

UNIVERSITY OF ARIZONA



39001033799936







# ECONOMIC THEORY AND MARKET SOCIALISM

Journal of Economic Theory, Vol. 1, No. 1, 1973  
© Cambridge University Press, 1973  
Printed in Great Britain

The following article contains the first of a series of papers on the theory of market socialism. The second paper in the series will be published in the next issue of the Journal. The first paper is devoted to the theory of the firm in a market socialist economy. It is shown that the firm is a profit-maximizing entity, and that the profit function is concave in the firm's output. The second paper is devoted to the theory of the market. It is shown that the market is a competitive equilibrium, and that the equilibrium is unique. The third paper is devoted to the theory of the distribution of income. It is shown that the distribution of income is determined by the market equilibrium, and that the distribution is efficient. The fourth paper is devoted to the theory of the distribution of capital. It is shown that the distribution of capital is determined by the market equilibrium, and that the distribution is efficient. The fifth paper is devoted to the theory of the distribution of labor. It is shown that the distribution of labor is determined by the market equilibrium, and that the distribution is efficient.

Professor of Economics  
University of Cambridge  
Cambridge, England

REPRINTED FROM THE JOURNAL OF ECONOMIC THEORY

## ECONOMISTS OF THE TWENTIETH CENTURY

**General Editors:** Mark Perlman, *University Professor of Economics, Emeritus, University of Pittsburgh* and Mark Blaug, *Professor Emeritus, University of London; Professor Emeritus, University of Buckingham; and Visiting Professor, University of Exeter*

This innovative series comprises specially invited collections of articles and papers by economists whose work has made an important contribution to economics in the late twentieth century.

The proliferation of new journals and the ever-increasing number of new articles make it difficult for even the most assiduous economist to keep track of all the important recent advances. By focusing on those economists whose work is generally recognized to be at the forefront of the discipline, the series will be an essential reference point for the different specialisms included.

A list of published and future titles in this series is printed at the end of this volume.

# Economic Theory and Market Socialism

Selected Essays of Oskar Lange

Edited by Tadeusz Kowalik

*Professor of Economics*

*Institute of Economics*

*Polish Academy of Sciences*

ECONOMISTS OF THE TWENTIETH CENTURY

Edward Elgar

© Tadeusz Kowalik 1994.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior permission of the publisher.

Published by  
Edward Elgar Publishing Limited  
Gower House  
Croft Road  
Aldershot  
Hants GU11 3HR  
England

Edward Elgar Publishing Company  
Old Post Road  
Brookfield  
Vermont 05036  
USA

**British Library Cataloguing in Publication Data**

Lange, Oskar

Economic Theory and Market Socialism:  
Selected Essays of Oskar Lange. —  
(Economists of the Twentieth Century  
Series)

I. Title II. Kowalik, Tadeusz III. Series  
330.1

**Library of Congress Cataloguing in Publication Data**

Lange, Oskar, 1904–1965.

Economic theory and market socialism : selected essays of Oskar  
Lange / with an introduction and edited by Tadeusz Kowalik.  
p. cm. — (Economists of the twentieth century)

Includes index.

1. Marxian economics. 2. Socialism. 3. Economics. I. Kowalik,  
Tadeusz. II. Title. III. Series.

HB97.5.L264 1993

330—dc20

93-22663  
CIP

ISBN 1 85278 707 4

Printed and Bound in Great Britain by  
Hartnolls Limited, Bodmin, Cornwall.



---

# Contents

---

Acknowledgements	vii
Introduction	ix

## PART I ECONOMICS – GENERAL PROBLEMS

1	‘Marxian Economics and Modern Economic Theory’, <i>Review of Economic Studies</i> , 2(3) (1935), pp. 189–201.	3
2	‘The Place of Interest in the Theory of Production’, <i>Review of Economic Studies</i> , 4(1) (1936), pp. 159–92.	16
3	Book Review of Joseph A. Schumpeter’s <i>Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process</i> , <i>Review of Economic Statistics</i> , XXIII(4) (November 1941), pp. 190–93.	50
4	‘The Foundations of Welfare Economics’, <i>Econometrica</i> , No. 3–4 (1942), pp. 215–28.	54
5	‘The Scope and Method of Economics’, <i>Review of Economic Studies</i> , 13(33) (1945), pp. 19–32.	68
6	‘The Principle of Economic Rationality: Political Economy and Praxiology’, <i>Political Economy, Vol. I: General Problems</i> , translated from Polish by A.H. Walker (New York: Macmillan, 1963), pp. 148–225.	82
7	‘Political Economy’, entry in <i>Encyklopedia Wspolczesna</i> (in Polish), appearing in <i>Papers in Economics and Sociology</i> , translation edited by P.F. Knightsfield (Warsaw: Państwowe Wydawnictwo Naukowe, 1970), pp. 191–217.	160

## PART II REFINING KEYNES’S GENERAL THEORY

8	‘The Rate of Interest and the Optimum Propensity to Consume’, <i>Readings in Business Cycle Theory</i> (London: George Allen and Unwin, 1954), pp. 169–92.	189
9	‘Say’s Law: A Restatement and Criticism’ in Oscar Lange, Francis McIntyre and Theodore O. Yntema (eds), <i>Studies in Mathematical Economics and Econometrics</i> (Chicago: University of Chicago Press, 1942), pp. 49–68.	213
10	‘The Theory of the Multiplier’, <i>Econometrica</i> , No. 3–4 (1943), pp. 227–45.	233

11	‘On the Economic Theory of Socialism’, <i>Review of Economic Studies</i> , Part I: 4(1) (1936), pp. 53–71; Part II: 4(2) (1937), pp. 123–42; Annexes: A.P. Lerner, ‘A Note on Socialist Economics’, <i>Review of Economic Studies</i> , 4(1) (1936), pp. 72–6; ‘Mr. Lerner’s Note on Socialist Economics’, <i>Review of Economic Studies</i> , 4(2) (1937), pp. 143–4; Oskar Lange’s letter to Hayek (31 July 1940).	252
12	‘The Economic Operation of a Socialist Society: I & II’, <i>Contributions to Political Economy</i> , 6 (1987), pp. 3–12, 13–24.	300
13	‘The Practice of Economic Planning and the Optimum Allocation of Resources’, <i>Proceedings of the International Statistical Conferences</i> , V (Washington, DC: The Econometric Society, 1947), pp. 166–70.	322
14	‘How I See the Polish Economic Model’, <i>Papers in Economics and Sociology</i> , translation edited by P.F. Knightsfield (Warsaw: Państwowe Wydawnictwo Naukowe, 1970), pp. 438–42.	327
15	‘Political Economy of Socialism’, an address delivered on 18 November 1957 at the Institute for International Politics and Economics, Belgrade, published as Chapter 1 of <i>Problems of Political Economy of Socialism</i> (The Hague: Institute of Social Studies, 1958), reset.	332
16	‘Role of Planning in Socialist Economy’, an address delivered on 19 November 1957 at the Institute for International Politics and Economics, Belgrade, published as Chapter 2 of <i>Problems of Political Economy of Socialism</i> (The Hague: Institute of Social Studies, 1958), reset.	342
17	‘From Accounting to Mathematics’, <i>Papers in Economics and Sociology</i> , translation edited by P.F. Knightsfield (Warsaw: Państwowe Wydawnictwo Naukowe, 1970), pp. 115–22.	353
18	‘The Computer and the Market’ in C.H. Feinstein (ed.), <i>Socialism, Capitalism and Economic Growth: Essays Presented to Maurice Dobb</i> (Cambridge: Cambridge University Press, 1967), pp. 158–61.	361
	Name index	365

---

## Acknowledgements

---

The publishers wish to thank the following who have kindly given permission for the use of copyright material.

Academic Press Ltd for article: 'The Economic Operation of a Socialist Society: I & II', *Contributions to Political Economy*, 6 (1987), pp. 3–12, 13–24.

Cambridge University Press for article: 'The Computer and the Market' in C.H. Feinstein (ed.), *Socialism, Capitalism and Economic Growth: Essays Presented to Maurice Dobb*, 1967, pp. 158–61.

The Econometric Society for articles: 'The Foundations of Welfare Economics', *Econometrica*, No. 3–4 (1942), pp. 215–28; 'The Theory of the Multiplier', *Econometrica*, No. 3–4 (1943), pp. 227–45; 'The Practice of Economic Planning and the Optimum Allocation of Resources', *Proceedings of the International Statistical Conferences*, V (1947), pp. 166–70.

Mrs F. Lange for articles: 'The Principle of Economic Rationality: Political Economy and Praxiology', *Political Economy*, Vol. I, translated from Polish by A.H. Walder, 1963, pp. 148–225; 'Political Economy of Socialism', *Problems of Political Economy of Socialism*, Institute of Social Studies, (1958); 'Role of Planning in Socialist Economy', *Problems of Political Economy of Socialism*, Institute of Social Studies, (1958), reset.

Pánstwowe Wydawnictwo Naukowe for articles: 'Political Economy' entry in *Encyklopedia Współczesna*, in *Papers in Economics and Sociology* (ed. P.F. Knightsfield), 1970, pp. 191–217; 'From Accounting to Mathematics', *Papers in Economics and Sociology* (ed. P.F. Knightsfield), 1970, pp. 115–22; 'How I See the Polish Economic Model', *Papers in Economics and Sociology* (ed. P.F. Knightsfield), 1970, pp. 438–42.

Review of Economic Statistics for article: Book Review of Joseph A. Schumpeter's *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, *Review of Economic Statistics*, XIII(4) (1941), pp. 190–93.

Routledge for article: 'The Rate of Interest and the Optimum Propensity to Consume', *Readings in Business Cycle Theory*, George Allen and Unwin, 1954, pp. 169–92.

Society for Economic Analysis for articles: 'Marxian Economics and Modern Economic Theory', *Review of Economic Studies*, 2(3) (1935), pp. 189–201;

'The Place of Interest in the Theory of Production', *Review of Economic Studies*, 4(1) (1936), pp. 159–92; 'The Scope and Method of Economics', *Review of Economic Studies*, 13(33) (1945), pp. 19–32; 'On the Economic Theory of Socialism', Part 1: 4(1) (1936), pp. 53–71; *ibid*, Part II: 4(2) (1937), pp. 123–42; Annexes: A.P. Lerner, 'A Note on Socialist Economics', *ibid*, pp. 72–6; 'Mr. Lerner's Note on Socialist Economics', *ibid*, pp. 143–4.

University of Chicago for article: with F. McIntyre and T. Yntema, 'Say's Law: A Restatement and Criticism', *Studies in Mathematical Economics and Econometrics*, 1942, pp. 49–68.

Every effort has been made to trace all the copyright holders but if any have been inadvertently overlooked the publishers will be pleased to make the necessary arrangement at the first opportunity.

---

## Introduction\*

---

Oskar Ryszard Lange: born 27 July 1904 in Tomaszow Mazowiecki; died 5 October 1965 in a London hospital. Studied law and economics at Poznan and Krakow (Jagiellonian) Universities, obtained a Ph.D. in economics and in 1931 became a docent. Spent the year 1928 in England (mostly in London and Cambridge) as a stipendist. In 1934 received a fellowship from the Rockefeller Foundation for studies in the US and England, but spent most of his time (extended to two years) at Harvard University studying under J. Schumpeter. For the next ten years taught at several American universities, mainly at Chicago. In 1945 became an ambassador of the Polish People's Republic in Washington DC and subsequently the representative of Poland at the UN Security Council. In 1948 finally returned to Warsaw, combining political activity with research and teaching, first at the Main School of Planning and Statistics and then at the University of Warsaw.

### **The Polish background**

Lange grew up in the western part of Polish territory occupied by Russia. His father was a German textile manufacturer, producing largely for distant eastern markets, but was bankrupted shortly before World War I. When Poland regained its independence in 1918, Lange manifested his Polish patriotism: as a 14-year-old boy he underwent his baptism of fire, joining a band of youths who seized weapons from German soldiers in the panic-stricken retreating army. Two years later, during the Polish-Russian war, he volunteered to join the Polish army, but as an invalid (hip-tuberculosis), was detailed to an alternative service.

These rather symbolic gestures typify the early road taken by many Poles who invested excessive hope in the newly independent Fatherland and became rapidly and sorely disillusioned. Lange's preoccupation with unresolved social questions and his turn to socialism – initially in its reformist and pacifist, and then its revolutionary version – reflected broader processes of radicalization in a country condemned to economic and social stagnation.

Prewar Poland was not simply a backward country. Its per capita income was lower than that of Spain, Hungary and Argentina, though higher than in Romania, Bulgaria, Yugoslavia and Greece. However, partly as a result of the Great Depression, Poland's many problems formed a trap or 'vicious circle' typical of backwardness. Its main social problems were the semi-feudal structure of agriculture, with its inefficient latyfundia on the one hand, and with still less efficient small farmholders suffering from pervasive but disguised unemployment on the other. Foreign capital played an important role, but was not involved in developing domestic industry; hence Polish exports consisted mainly of raw materials.

Trying to explain the stagnation of the Polish economy, Lange identified, as the main cause, the growing role of monopolies in the world economy. It was they who were responsible for precipitating the Great Depression, stiffening market mechanisms

and prolonging backwardness. A revolutionary overthrow of the capitalist system and the construction of socialism – this was what Lange envisaged at that time as the only viable solution to eliminating poverty and stimulating development.

Lange's most extended revolutionary message was presented in a book entitled *Gospodarka-Polityka-Taktyka-Organizacja Socjalizmu* (1934). This was a collective work organized and edited by Lange, then an intellectual leader of the left-wing socialist formation. The main chapter of the book, 'The Road to a Planned Socialist Economy' – written by him together with Marek Breit, another brilliant young economist later murdered by the Nazis – presents Lange's first outline of his vision of a socialist economy (cf. Chilosi, 1986). This was clearly meant as an alternative not only to capitalism, but to Soviet 'state socialism' as well (Lange et al., 1934).

This early work foreshadows in all main problems, such as the transition and principles of functioning, explored in Lange's classic work on socialism, published only two years later. Perhaps the most important characteristics of Lange's concept was his stress that socialism should not only be the *negation* of capitalism, but *continuity* as well. Lange's conviction was that, by introducing fascism (which Lange considered as genetically linked to monopolies and imperialism), the bourgeoisie was renouncing political democracy. Similarly, an expansion of economic monopolies had destroyed the market and free competition. Thus, the task of the socialist movement was to salvage and broaden the scope of democracy and competition. This conviction was at the heart of Lange's views, and that is why – not central planning – but markets and competition were to be the basis of the future system.

How did Lange envisage that such an economic system should function? At first, the Lange-Breit model seems similar to the Hungarian model of indirect planning with the aid of financial parameters, as operated till the end of the 1980s. The Polish economists wanted to empower the Central Bank with the task of steering the economy. The Bank was to determine the rate of accumulation and to appropriate and allocate investment resources between individual enterprises and their associations (called trusts). It was also to have the power to close inefficient firms and to transfer their assets to more efficient competitors as well as to check whether enterprises and trusts were employing 'strict cost accounting'.

The similarity with the Hungarian model is, however, of a purely formal nature, because the criteria governing the behaviour of the centres in the two systems were entirely different, if not antithetical. In the Hungarian model, the centre had the power to decide the scale and direction of investment and to determine most prices on the basis of its own preferences. On the other hand, the Central Bank in the Lange-Breit model had no price-setting powers whatsoever, not even in relation to capital goods. All prices were to be determined by the market. Similarly, investment resources were to be allocated, not according to the preferences of the centre, but according to market demand generated by the needs of consumers. The bank was simply designed to 'serve' the market.

Afraid that, in a monopolized economy, big corporations might cause a spiralling escalation of prices and wages, Lange and Breit proposed that the state should oblige enterprises to employ all those who applied for work. The ensuing growth in output would bring down prices and, as a result, wages. The Central Bank would be obliged to provide investment loans to enterprises if warranted by the growth of employment.

Lange-Breit believed that in this way any arbitrariness in investment policy would be avoided, for decisions would be based on an automatic indicator of intensity of demand for individual commodities.

The impracticability of this 'practical' proposal is so obvious that any detailed criticism seems to be superfluous. It is worth noting, however, the authors' intention – their effort to retain a commodity and labour market in the strict institutional sense so that the entire economy, including the investment process, would operate according to automatic, and thus objective, market mechanisms reflecting the intensity of consumers' needs.

The Lange-Breit model also differs from the Hungarian model in the postulate that the entire organizational structure of the economy be based on 'a system of workers' councils' from top to bottom. This was to constitute an effective antidote to the danger of bureaucratization, counteracting what was called in Hungary the 'illusion of regulation'. The absence of such a countervailing force to bureaucracy in Hungary led to the transformation of the New Economic Mechanism into a system of indirect centralization, in which spontaneous market mechanisms were destroyed by excessive intervention of bureaucrats and politicians at all levels.

Lange and Breit believed that their model would be superior not only to the capitalist economy (which, at the time of the Great Depression, did not seem difficult), but also to the Soviet model. They considered that the latter was based largely on popular enthusiasm and on appeals from revolutionary leaders which did not hold out the prospect of efficient functioning in the long run:

We view the cultural and moral might of the Russian peasant and worker revolution with great admiration ... We should remember, however, that in the long run socialism will take root only if it manages to transcend its moral achievements to show that its economy functions better than capitalism (Lange, *Dziela*, vol. 2, 1973).

They added that if the socialist economy does not fulfil this hope, then 'indeed it will not be worth the toil and sacrifice that the working masses have endured in the struggle to achieve it'.

### **Classic model of market socialism**

This most known and most frequently (albeit critically) quoted work of Oskar Lange, his *On the Economic Theory of Socialism*, was written (first published in 1936–37) in the United States only two years after he had left Poland (Chapter 11). One can assume that his general views on social issues were those that had been formed earlier. In all its major points, including his call for the sudden introduction of socialism by revolutionary measures, this study continues themes developed in the Lange-Breit book discussed above. Thus, ideas presented in it may be a good starting point for showing the evolution of Lange's economic and social views during the decade of his stay in the United States.

Let us start with recalling the main features of Lange's model. In terms of organization, the socialist economy was to be extremely straightforward. For simplicity of exposition and reasoning, Lange assumed that only the public sector existed and thus ignored private firms. The public sector would be organized on

three levels: enterprises; trusts, as branch associations of enterprises, and the centre, called by Lange the Central Planning Board (CPB). Economic management was to be separated from the political apparatus of the state. Enterprises and trusts were to be directed by public functionaries, subject to 'democratically organized control'. A Supreme Court would eventually supervise the whole economy in order to ensure that it operated in accordance with the public interest.

Equally simple and intelligible would be the principles by which the national economy operated, based on two distinct markets: a real market, as Lange says, 'in the institutional sense', and a market simulation by the CPB. Prices for consumer goods and wages were to be freely determined by market forces, while prices for capital goods were to be established by the CPB. Such a combination of the two markets was intended to provide free choice of consumption, of occupation and place of work and to make enterprises largely autonomous. The CPB was also to ensure that managers of plants and trusts acted in accordance with two rules: they were to choose such a combination of production factors so as to keep average costs at the lowest possible level. The second rule to be observed by managers was to set the volume of output of the industrial branch at such a level that marginal costs were equal to price. The first of these rules was designed to help eliminate less effective production alternatives, while the second was to serve as a substitute for the free-entry rule in a private market economy. Both were substitutes for the principle of profit maximization. The share of national income to be allocated to investment was to be determined by the CPB using interest rates arbitrarily fixed by the centre.

It is impossible to present here, even in summary, all the interpretations and criticisms that Lange's classic model engendered. It has been criticized most frequently for lack of realism, particularly for the assumption that managers of firms and trusts would act accordingly to the two chief rules outlined above unless the CPB had some means of forcing them to do so. Referring to the trial-and-error method of simulating a capital goods market, many socialists have interpreted Lange's model as leading to the abandonment of any real planning. Many liberal economists, on the other hand, have argued that the CPB would be bogged down in red tape and would be unable to react quickly enough to market signals; thus the economy would inevitably become too rigid and bureaucratized.

Oskar Lange had in a way anticipated some criticisms. In the second part of his study, he explicitly recognized that '*the real danger of socialism is that of the bureaucratization of economic life, and not the impossibility of coping with the problem of allocation of resources*' (reprinted in this volume as pp. 275-6). He considered his own model of market socialism also open to such danger, although less so than centralized models. Comparing this aspect of his blueprint with the capitalism exhibited by large corporations, he expressed his conviction that the latter were open to the same or even greater danger, adding in the book edition that 'officials subject to democratic control seem preferable to private corporation executives who practically are responsible to nobody' (Lange & Taylor (1964), p. 110). Thus Kornai clearly exaggerates when he writes that the Lange of the 1930s 'lived in a sterile world of Walrasian pure theory and did not consider the socio-political underpinning of his basic assumption' (Kornai (1986), p. 1727). It is true, however, that Lange, like many other theorists of socialism, underestimated the scale of the perceived



danger. It was precisely this danger that made the issue of rational allocation of resources very difficult, if not totally impossible. Thus, we may say that bureaucratization of economic life and allocation of resources are not two separate problems, but in many ways closely intertwined.

The above-mentioned characteristics of Oskar Lange's concept of socialism (as not only the negation of capitalism, but also as its continuation) did not prevent him from being radical in proposing measures to attain the new system. In the last chapter of his study *On the Policy of Transition*, he was arguing – contrary to the almost generally accepted view that the process of socialization must be as gradual as possible since it would otherwise bring economic catastrophe – for a 'policy of revolutionary courage'. In his opinion, a capitalist system can operate normally only when the security of private property is maintained, whereas the very existence of a government aiming at socialism must be perceived as a constant threat, causing financial panic and uncertainty in investment. That is why 'the socialist government must either guarantee the immunity of private property and private enterprise in order to enable the capitalist economy to function normally, in doing which it gives up its socialist aims, or it must go through resolutely with its socialization program at maximum speed. Any hesitation, any vacillation and indecision provokes the inevitable economic catastrophe' (reprinted in this volume as pp. 282–3).

The same conviction led him to postulate that, as a complement to speedy nationalization, a socialist government should guarantee absolute security to all private property and firms not included in the nationalization programme. In order to prove the seriousness of the government's intention, he advised that immediate deeds be issued in favour of such small entrepreneurs and property holders.

*On the Economic Theory...*, published finally in book form (together with a former article by Fred Taylor), represented the conclusion of his intensive studies in this field for many years. For at least a decade thereafter, a new environment and new duties focused his interest in different directions.

### **From Schumpeter to Keynes**

During more than ten years spent in the US (1934–47), including several breaks for travels to Poland and England, Lange maintained his reputation, above all as an econometrician and mathematical economist. These strengths were not evident at the beginning of his American sojourn. More obvious for the first few years were interests stemming from his socialist convictions and Marxist readings, his involvement in major socio-economic issues in what later became known as the comparative analysis of economic systems. After coming to the US, this interest grew more important, in part because Lange became fascinated with Joseph Schumpeter, his personality and style of practising economics, to say nothing of his theory of capitalism, a theory which Lange had already studied and quoted. Unexpectedly, Schumpeter became a mentor for the newcomer from Poland, causing Lange to change his original plan on how to use his two-year Rockefeller Foundation fellowship and instead spend most of his time under the former's wing at Harvard University.

The idea of studying with Schumpeter could have stemmed from Lange's wish to learn as much as possible from the universally recognized specialist in business cycles, a subject which Lange had long been interested in (both his doctoral

dissertation and his thesis presented for the 'docent' degree being largely devoted to it). Lange may have known that Schumpeter was preparing a detailed manuscript on the issue (it appeared in two volumes in 1939). He could readily appreciate that Schumpeter placed the problem of business cycles within the framework of a theory of the development of capitalism. In his new mentor Lange admired first of all his broad interests and outstanding erudition, and particularly his awareness that intellectual currents and social movements influence each other as well as economic and political institutions. In one of his first essays written in the US, an article entitled 'Marxian Economics and Modern Economic Theory' (1935), Lange described Schumpeter as 'the only economist outside the Marxist camp who has formulated a theory of economic evolution. However, the close connections of his theory with Marxian ideas is obvious' (see note 1 on p. 7 of Chapter 1 in this volume).

Lange also shared with Schumpeter an admiration for Leon Walras and his theory of general equilibrium. As we recall, towards the end of his life (in an unfinished book, *History of Economic Analysis* (1954)), Schumpeter recognized Walras as the greatest economist of all times. Lange would follow this path by devoting much effort to perfecting a modern economic theory based on the same concept. Schumpeter's admiration of Walras was to a large extent abstract, since his knowledge of mathematics was too limited to feel at ease in the field. In his new disciple he perhaps noticed the inception of ideas and work he felt unable to accomplish himself.<sup>1</sup>

Soon, however, Lange's fascination with Schumpeter was tempered by two other absorbing interests. From the very beginning, the newcomer from Poland had appreciated the grandeur of Keynes's work and the importance of the 'Keynesian Revolution'. Guided most probably by his desire to come into closer contact with the author of *The General Theory* and his school, he went to England in the autumn of 1937 and spent half a year there, thus reversing his initial idea of studying for a period in the US and then in England. Somewhat later, a book *Value and Capital* (1939) by J.R. Hicks appeared, providing, in Lange's opinion, 'the most up-to-date formulation of the theory of general economic equilibrium' (Lange (1945), p. 7). During the years spent in Chicago, Lange devoted himself mainly to the reception of Keynes's work, to the incorporation of his theory into the theory of general equilibrium and to its possible applications.

Schumpeter's approach to the 'New Gospel' was quite different; he was mistrustful of it and deprecated its author. Let us remember that although he wrote about Keynes's work as 'the greatest literary success of our epoch', Schumpeter explained this success in terms of psychological considerations rather than on its merits ('as in banking or insurance ... success engenders success. Literature produces literature'). Lange's name was one to appear within that context: 'it would be easy to compile a list of arguments (all of them valid) from the writings of, say, Hicks, Lange, Modigliani, and Samuelson that in hands less friendly than theirs would sum up to a very damaging criticism. But they had no intention to damage. In Keynes's case, merit and luck combined to blunt the edges of the criticism of some of those who were most competent to inflict injury' (Schumpeter (1954), p. 1182). One may wonder whether this trenchant remark hid any nostalgic regret that he himself was not as lucky as Keynes with respect to his disciples....

### **Professor at the University of Chicago**

The initiative to employ Lange at the University of Chicago probably came from Paul Douglas (known in the discipline mainly as the co-author of the Cobb-Douglas function) who as early as the autumn of 1937 informed Lange about a vacancy for the Chair of Statistics. Lange pursued the proposal, but at the beginning of 1938 a new problem surfaced. Frank Knight sent a letter to Lange warning that his political views might become an obstacle to the furtherance of his academic career. Even without the evidence of Knight's letter, some such warning can be deduced from the preserved correspondence of the then Dean, Chester Wright, and from Douglas's letters. The former wrote to Lange as follows:

Professor Knight kindly showed me the letter which he proposed to send you concerning the situation here at Chicago. ... The main point I wish to stress, and I think Professor Knight and Henry [Schultz] agree with me on this, is the relatively slight likelihood that your future advancement here would be affected by the conditions that Professor Knight outlines (C. Wright to O. Lange in his posthumous papers).

Douglas was even more categorical when assuring Lange that he did not know of any other academic campus which would extend more freedom than Chicago. He added that Chancellor Hutchins was clearly delighted with the prospect of appointing Lange. Those assurances proved to be sufficiently persuasive as, late in the summer of 1938, Lange accepted a position there as an associate professor.

That this came to pass is surprising, mainly because the warning Lange received came from one of his 'antagonists', opposed not only to his socialism but also to his style of practising economics which was diametrically different from his own. For that reason it is hard to believe that Knight's gesture was motivated by friendly concern. In his above-quoted letter, Wright added:

Obviously, you are the best judge as to whether your ideals of academic work and action would be likely to create a situation where these contingencies might become actualities. Without knowing you better, this is a point on which I can have no intelligent opinion. On the other hand, it is the opinion of both Professor Knight and Schultz who have had the chance to know you that such an outcome is unlikely. (*ibidem*).

Aware of the habits and Aesopian language of academia, those sentences could be interpreted in the following way: 'Dear Mr. Lange, We want to employ you regardless of your being a known socialist. And although our university is remarkably tolerant, any subsequent political activities on your part could not be undertaken with total freedom. Would you kindly take this into account. ...'

Such an interpretation might seem cynical or even sinister, but one must remember that this decision involved whether or not to employ a newcomer from Eastern Europe whose crusade had been to muster up 'revolutionary courage' while advocating, almost at one go, a system based upon public ownership.

Thus, taking into consideration the prevalent political climate in the US in that period and the social conditioning of academics on the one hand, and the extremity of Lange's views on the other, the University of Chicago authorities clearly made

a remarkable gesture of tolerance and trust, downplaying fears that they could not accommodate the 'Trojan horse of revolutionary socialism'.<sup>2</sup>

In concluding this topic, let us note that indeed Lange had no reason to complain about intolerance shown by the University authorities or its academic circles. On the contrary, a few years later evidence of their extraordinary friendliness occurred when, in the summer of 1945, Lange accepted an appointment as Ambassador of Poland in Washington (i.e., as a representative of its communist regime). Not only did the University authorities give him leave of absence for that whole period and even kept his Chair vacant, but they also repeatedly sent him invitations to return. They had to pay for that later, on the humiliating occasion of the hearing of the Chancellor by the notorious Commission for Investigating Anti-American Activities.<sup>3</sup>

### Mastering tools

Whether or not Lange ever became the Trojan horse in Chicago, the fact was that his socialist convictions figured less and less prominently even in his correspondence. Lange considered that his mission was to modernize economic science, which implied first of all its mathematization. The statutory formula of the Econometric Society (whose full name was *An International Society for the Advancement of Economic Theory in its Relation to Statistics and Mathematics*) expressed that mission in the fullest possible manner. Lange was active in that Society from the very start, especially during the war as the acting editor of the Society's journal, *Econometrica* whose aim was 'to promote studies that aim at a unification of the theoretical-quantitative and the empirical-quantitative approach to economic problems and that are penetrated by constructive and rigorous thinking similar to that which has come to dominate in the natural sciences' (published on the back page of *Econometrica*).

Thus, the Society's ambitions were not confined to the creation of another branch of economic science (econometrics has in actual fact become one), but rather they involved introducing a revolutionary change in the very foundations of the theory of economics. That in turn meant, among other things, the dethronement of such traditional economists as Frank Knight, a leading authority not only at Chicago but much further afield.

With this in mind, the first encounter between Lange and Knight was very symbolic indeed. If a much later account of a witness is to be believed, they met at a seminar in 1934. After Lange's lecture Knight reportedly said: 'I wouldn't like this if I could understand' (quoted from a letter of Carl Lienan to Lange, dated 21 August 1964; O.L.'s posthumous papers). Two aspects of this blunt statement are significant: the fact that Lange incorporated a new language which the traditionally-minded Knight could neither understand nor, as a consequence, dispute, and the fact that he could not admit the validity of such new concepts.

In 1934 the former factor was probably essential. Some years later the beginning of the 'Formalist Revolution' (Benjamin Ward's expression) coincided with the 'Keynesian' one, in the fields of theory and policy. Both would then thoroughly influence economic literature and, for a period of time, even dominate it. Both of them constituted a challenge to Frank Knight's economics and contributed to his marginalization. Only Knight's young disciples (here I mean Milton Friedman in the first place) have lived long enough to participate in 'the conservative-laisser-

faire-counter-revolution'. Chicago University was destined to pioneer both the former and the latter tides.

Oskar Lange's part in the first tide (the 'Formalist' plus the 'Keynesian' Revolutions) was certainly outstanding, both on the micro-scale, at Chicago University, and at the macro-level – that is, in the development of modern economics. It was mainly due to his contributions that Chicago came to the fore of several leading academic centres in which modern economics was developed. Let us note the most significant facts.

At the time when Lange began to work in Chicago, several different currents were being pursued within the discipline. Apart from the most influential economists originating from the classical school, including Knight, Jacob Viner and Henry Simon, there were some institutionalists. In addition, Melvin Reder (1982) identifies a small but quite influential group of mathematical economists and econometricians.

Amongst this third band were, first of all, Paul Douglas who initiated empirical quantitative research on the labour market, and Henry Schultz, a mathematical economist with formal and methodological interests. Lange joined that group. The circumstances were such, however, that he alone remained. Schultz died in a car accident soon after, while Douglas turned to politics and then left the university to join the navy. Thus, quite naturally, Lange became the most outstanding representative of the new trend in economic science and the main opponent of Frank Knight. This is how one of the then students, Don Patinkin, characterized the lectures of the two scholars:

The teachers of economic theory during my student days at Chicago included not only Frank Knight and Jacob Viner, but also Oskar Lange – who was the antithesis of Knight, and not only on political grounds. Where Knight devoted much attention to probing ... into the meaning of the basic definitions and assumptions of the analysis ... Lange (in his contrastingly clear and systematic manner) was primarily concerned with drawing the logical implications of these assumptions. So where Knight taught economic theory in a loose, 'literary', philosophical fashion – and was antipathetic to mathematical economics – Lange was formal, rigorous, complete, and frequently made use of mathematical tools (not to mention his invaluable course in Mathematical Economics). And where Knight was basically not sympathetic to the new developments in economic theory (read: Keynes and Hicks) – and even, I would say, instinctively critical of them – Lange was an early convert as well as an efficient expositor and refiner. ... From the implicit dialogue that thus took place between these two teachers, we students were the direct beneficiaries (Patinkin (1981), pp. 25–6).

A number of personal qualities, his tact and disarming manner in particular, made Lange 'persona grata to all' (Melvin Reder's expression) as well as a figure of natural authority whose goal was to rebuild and extend the Department of Economics. In 1945 the process of rebuilding was so advanced that a historian of 'Chicago economics', Melvin Reder, felt justified in wondering what the fate of the neo-liberal 'Chicago School' associated with Knight's disciples, Milton Friedman and George Stigler, would have been had Lange not just left Chicago.<sup>4</sup>

It would be hard to establish what constituted Lange's direct contribution, what was due to the efforts of others and what occurred as if spontaneously under the impact of new trends in economics. Let us simply note that, apart from the modern

economists brought up through the Department (such as Melvin Reder, Leonid Hurwicz and Bert Hoselitz, and to some degree also D. Gale Johnson, H. Gregg Lewis, Jacob Mosak and Martin Bronfenbrenner), such outstanding mathematical economists as Tjalling Koopmans and Jacob Marschak also came to be employed there.

The enhanced role in economics assumed by Chicago can be symbolized in part by the transferal there of the seat of the Cowles Commission for Research in Economics from Colorado Springs. That prestigious institution for economic research was affiliated to the Econometric Society and, since 1943, was headed by Jacob Marschak. Oskar Lange had earlier become the acting editor of the Society's journal *Econometrica* (replacing Ragnar Frisch who was cut off by war conditions).

These changes constituted only a partial realization of Lange's extraordinary ambitions. His aspirations for the institution also encompassed the recruitment of outstanding talent. In his suggestions to the University authorities (letters to S.E. Leland, 21 November and 6 December 1944; in O.L.'s posthumous papers), Lange listed the following candidates for permanent or semi-permanent appointments: J.R. Hicks, Abraham Bergson, Nicolas Kaldor, Aba. P. Lerner, Abraham Wald, Simon Kusnets, Franco Modigliani, Colin Clark, Tibor Scitowsky, Paul Samuelson, Norman Buchanan, Michal Kalecki and T. Haavelmo. Nearly all of them either already ranked among the world's leading economists and econometricians or became famous soon after.

Just after the war came to an end, however, Chicago rapidly began to lose its leading position as the hub of mathematical economics. That happened between 1945 (Lange left the University in that year) and 1953 when the Cowles Commission was transferred to Yale.

### **The market and rational allocation of resources**

It would be a gross oversimplification to explain the decline of Chicago University as the most vital nucleus of mathematical economics in terms of individual careers (Lange's return to Poland) or with organizational changes (the loss of the Cowles Commission). The phenomenon in fact reflected more universal (Lange would call them sociological) trends.

Of course, one could speculate about the first internal crisis within the 'Formalist Revolution', anticipating the Cambridge, UK vs. Cambridge, Mass. controversy two decades later. But this could not explain the demise of Chicago as the centre of mathematical economics after World War II, since mathematization was still vigorously invading not only economics, but social sciences generally. The crisis it suffered was rather a reflection of changes in the political climate which were to influence politics as well as economic policy and political economy. The University of Chicago appeared to be particularly sensitive to this new climate. Let us explain.

Lange himself and his circle were, as already said, advocates of the economics and social philosophy of J.M. Keynes and manifestly supported Roosevelt's New Deal. His coterie justified the need for state intervention in terms of 'market failures'. First of all it demanded public control over big corporations, an active full-employment policy and institutionalized arrangements for a welfare state. That, incidentally, constituted an answer which satisfied the 'social demand' generated by the Great Depression. Roosevelt's death, and particularly the end of the war,

were followed by a period of counter-revolution. This became evident, first in politics (Maccartism) and then in the counter-attack on Keynesianism. The US itself began to change from the 'arsenal of democracy' (Lange's expression) into a stronghold of the old order.

Confronted with the broad systemic problems put on the agenda by the Great Depression and then by the outbreak of World War II, Lange still seemed prepared to devote as much attention to great Schumpeterian problems as to the perfection of research methods in economics. As early as 1939 he articulated his intentions in the following manner:

[M]ost of the institutions devoted to economic and social research work on monographic problems, which, however interesting they may be, are not directly integrated towards an analysis of the most important social problems of our day. The more time I spend on studying economic theory, the more impatient I feel about the fuss over many details and the small attention which is given to problems of real importance. I always hoped to see some day a group of competent economists and sociologists coming together to analyse the basic problems of social change in the present period (Letter of O. Lange to J.H.G. Pierson, 2 November 1939; in O.L.'s posthumous papers).

The outbreak of war also induced him to focus his research on the problems of social systems. During the first months of the war Lange wrote a text of about a hundred pages, entitled *International Socialism and the War* (never published). Soon after, he edited a small book *Economic Mobilisation* (1940) with some systemic hints. Both these works might have pointed to the beginning of broader and more systematic research on the evolution of contemporary capitalism.

In his first research projections, the outlines of the several topics seem to indicate that this evolution would indeed constitute the line of his research interest. For instance, in a letter to Social Science Research Committee (1 March 1940), Lange informed it that he was working on 'the interaction of social institutions and economic activities' and expressed the hope that his book *Sociological Foundations of Economics* would be ready by the end of the year. As an auxiliary topic he intended to study, in collaboration with colleagues who were anthropologists, 'the economics of primitive people'. It is a pity this book was never written and that in his posthumous papers only several pages of synopsis survive. The project of publishing his systematic book on *Economic Theory*, bearing different names in his posthumous papers, had somewhat better fortune – its first chapter, entitled 'The Scope and Methods of Economics' being published in 1945. However, the table of contents of this book which was found amongst his papers suggests that it would probably have been devoted to what used to be called 'pure theory' rather than to political economy.

As a consequence, his potential contribution to the socio-economic theory of development, though never fully achieved, manifested itself best in two book reviews, both remarkable, first of the already mentioned work by Schumpeter on *Business Cycles* and, second, of the well-known book *Theory of Capitalist Development* (1942) by Paul Sweezy.

Abandoned publishing projects (including his textbook on mathematical economics, several times reconsidered) notwithstanding, the American period ranked among Lange's most fruitful years. Those studies already mentioned which developed some

aspects of the general theory of equilibrium and of Keynes's theory, especially those which indicate how the two theories are mutually compatible and integrated, remain valuable to the present day.

The most comprehensive work written by Lange in Chicago was *Price Flexibility and Employment* (1944). Its principal message is not hard to grasp: Lange questioned the view of traditional economics that employment is entirely due to the rigidity of factor prices. The main factor he had in mind was undoubtedly wages, which are usually identified as promoting rigidity due to the trade union action. Lange argued that a totally free market, and thus flexible prices, cannot guarantee the full utilization of resources. That is because many and complex conditions must be fulfilled to make such an equilibrium possible, and in the oligopoly period such conditions had long since disappeared.

Due to the peculiarity of the time at which the book appeared – towards the end of the war – it did not raise any special interest, although even opponents stressed its intellectual merits. Milton Friedman was alone in writing a general critique of the work, the essence of his judgement boiling down to the following uncourteous statement: 'Here is an obviously first-class intellect at work: yet the analysis seems unreal and artificial' (Friedman, 1946). Friedman's main contention was that Lange did not describe reality, but remained within the domain of deductive thinking: he drew conclusions about the real world from artificial, unrealistic and non-verifiable premises.

Although Friedman's criticism stemmed mainly from his different social philosophy – which was itself even less verifiable than Lange's reasoning – in methodological terms, it did highlight the weakest point of Lange's book. What it questioned was the utility of the general theory of economic equilibrium for a better understanding of reality. In fact, towards the end of his life, Lange himself admitted that line of critique to be justified. In his autobiographical conversations he specifically remarked that *Price Flexibility* had been conceived as a contest with neoclassical economics on its own ground.<sup>5</sup> It had been undertaken to prove that 'the theory of automatically obtained economic equilibrium is a conception dealing with highly improbable contingencies'.

### **Convergence?**

Oskar Lange's economic and social studies, as well as his involvement in social and political activity during the Chicago years, had a profound impact on his blueprints for the world's two competing systems. Lange's views on the capitalist economy began to change first of all under the impact of Keynes's *General Theory*, supplemented by the Kaleckian theory of business cycles and the Rooseveltian New Deal. He thus started to believe that an appropriate policy could successfully cope with the two most glaring deficiencies of capitalism – unemployment and crises. Of course, Lange was well acquainted with and many times analysed the fact that the great corporations, vested interests of other powerful social strata, as well as prejudices and simple political shortsightedness together sometimes created irresistible obstacles for reform.<sup>6</sup> He lost the conviction, however, that the development of capitalism inevitably leads to its collapse, the view he had preached in the 1930s. Such papers like *A Democratic Program of Full Employment* (1941), 'Economic



Control after the War' (1945) and particularly *The American Way of Business* (1944, written together with A.P. Lerner), may be seen as Lange's attempt to extend and refine New Deal policies. Financial tools in particular seemed to him very promising. That is why he regarded A.P. Lerner's book *The Economics of Control* as 'the only truly original and important event in pure theory' during the war years (O. Lange to W. Hagemeyer in a letter dated 19 April 1945; in Lange (1986) p. 334).

The feasibility of structurally reforming capitalist economies strengthened Lange's concept of the socialist economy as a continuation and improvement, rather than a negation, of capitalism. '[W]e do not need to abolish the market because capitalism distorts it, but rather have to readapt our system so that the market will actually perform the functions it can and should perform' (Lange (1987) p. 9).

In a similar way his writing about democracy was relevant not only with regard to the US, but also to Lange's native country. In his programmatic article on 'Economic Foundations of Democracy in Poland' (1943), he argued in favour of decentralization, freedom of association and for diversity of forms of ownership.

Postulating nationalization of banks, key industries and latyfundia, Lange simultaneously emphasized that the state sector should permanently coexist with a large private sector, including medium-sized enterprises. A large private sector was needed for two different reasons. Firstly, through the private sector 'the entire national economy acquires pliability and flexibility as well as an adaptive capability that private initiative alone can give'. Secondly, it is needed as a base for democracy. His idea was to ensure the broadest possible diffusion of property rights, in order to prevent the concentration of economic power not only in the hands of big businessmen and landlords, but also in the hands of state bureaucracy which could gain too much power through nationalization. This reasoning must have led Lange to reject his early vision of a socialist economy as dominated by public property.

Initially, Lange tried to introduce some minor corrections into his early model of a socialist economy. In a letter to Hayek, he said he would recommend free price-setting in the market wherever it was possible, only where the 'automatic process of competitive market did not function' would he recommend socialization of factories and trial-and-error procedures for fixing prices by CPB. In his review of H.D. Dickinson's book *Economics of Socialism* (1939), Lange dropped his old idea of an arbitrary and fixed rate of accumulation by the state in favour of temporary consumers' preferences determining personal savings.

As early as in 1942, however, he started to construe the rather new model of a socialist, or half-socialist, economy. In his two public lectures on this issue, held in May 1942, he outlined the blueprint for a mixed economy (called by him 'socialist'), which resembled an intermediary system between his early model of socialism and capitalism, or a left-Keynesian radically reformed capitalism. Not only was the state sector to be rather modest in size, but the main feature of his old model – using trial-and-error methods to fix prices by CPB – seemed, at least *implicitly*, to be abandoned.

It is not surprising, then, that shortly before Lange left Chicago, when forced to compare his present views with those expressed in the study *On the Economic Theory of Socialism*, he took a very far-reaching decision. This occurred when his publisher proposed that he prepare a new edition. Lange initially accepted this idea, but after

some effort and consideration changed his mind. His verdict was: 'The essay is so far removed from what I would write on the subject today that I am afraid that any revision would produce a very poor compromise, unrepresentative of my thoughts' (O. Lange to M. Harding, 25 May 1945; in O. Lange's posthumous papers).

### **Cold War instead of convergence**

According to the opinion of one of his Chicago students, Oskar Lange became 'a tragic figure' during the Cold War (Patinkin (1981), p. 9). On leaving Chicago in 1945, he still seemed to believe that the post-1945 world was entering an era of coexistence and that foundations for it were very firm. What would occur first of all was an evolution – accelerated by World War II – of both competing systems towards a democratic mixed economy. He believed that, in conditions of peaceful cooperation and democracy, the Soviet 'semi-war' economy, as well as Soviet society and its political system, would transform itself and adapt to this new situation. He seemed desperately to hope that the US, which was for him the world's 'arsenal of democracy', would move in a similar direction. Of course, other tendencies could predominate and Lange was aware of difficulties mounting after the war. Unsure of an entirely optimistic prospect and in case of a gloomy scenario, he tried not to break all his American links. We have already mentioned his arrangement at the University to be 'on leave' when serving as a diplomat. But even more surprising is that after deciding to be Polish ambassador in Washington, he tried to preserve his American citizenship (my personal conversation with Professor Theodore W. Schultz at Chicago University, in April 1988). Such mixed feelings must have been acute in 1948, on returning to Poland for good. He supposedly said to his friends that either there would be a revolution in Western Europe, or he would end his life in Siberia (my personal conversation with Professor Alec Erlich at Columbia University in 1982). And yet he rejected the repeated insistence of his Chicago friends to resume his job at the University. He convincingly and repeatedly stressed that, as a person who knew the West and the East intimately, he felt exceptionally qualified and thus obliged to build bridges of mutual understanding and promote economic cooperation between these two parts of the world (source: Professor T.W. Schultz, as above). We may add that, most probably, he was too polite to say to his interlocutors that there was no best option since in the meantime the US had ceased to be an 'arsenal of democracy'. As we now know, the world was entering a long period of Cold War, and even as Lange undertook his mission of building bridges between the East and West, he was doomed – as a prestigious intellectual – to be exploited and skilfully manipulated by the Communists.

Perhaps the most glaring event of this type was Lange's involvement (as a chief organizer) with the 1952 International Economic Conference of businessmen and politicians in Moscow. The political atmosphere was so thoroughly eroded by rivalry between the two superpowers that the gathering could produce no significant results apart from propaganda benefits for the Soviets.<sup>7</sup> Still more ambiguous were the results of his participation in the peace movement led by the Communists at that time.

Even in the years of Stalinism, however, Lange's hopes did not vanish. Faithfully following the Otto Bauer prognosis (Bauer, 1936), he firmly believed that industrialization would inevitably modernize the whole Soviet system. In this

way Stalin himself was to dig a grave for Stalinism. Hoisting Russia from barbarity by barbaric methods as he did, Stalin was creating a modern and culturally advanced society which would eventually burst the fetters of bureaucratic centralism as an anachronism hampering further growth. The Soviet semi-war economy would be replaced by one working according to objective economic laws, the argument contended.

Indeed, many events after Stalin's death, especially a liberalization wave in 1956, seemed to confirm this hope. Thus, Lange enthusiastically plunged into the job of preparing for economic reforms and a democratization process. After the Chicago years, this was undoubtedly the second most productive period in his life. In terms of economic proposals, he tried to reconcile market with plan: a regulated market for products and labour was to be combined with planning of investment. His watchword now was 'central planning with decentralization of management'. Thus, he did not want to go so far as to recommend as a practical solution his old concept of market socialism. In distancing himself from his classic work, he even refused his consent for it to be published in Polish as a separate booklet, since he did not want to lend his support to 'socialist free-marketeters'. There was at that time in Warsaw a 'market socialism' school, very close to the ideas of young Lange and Lerner, but paradoxically without Lange's personal participation.

### **Dying hopes**

Alas, many years of 'dying hopes' ensued. The reform programme prepared by the Economic Council (a government advisory body chaired by Lange) was, according to the well-known saying of the then Prime Minister Jozef Cyrankiewicz, 'neither implemented nor rejected'.

Similarly, popular demands for democratization were ignored or rejected as revisionist. In these conditions Lange directed his efforts to responding to the Western 'Formalist Revolution'. Econometrics, the theory of optimal decision-making, praxiology and economic cybernetics became his areas of work. All that was intended to pave the way for the transition *From material balances to the choice of optimal plan* – as he put it in the title of one of his publications (Lange, 1965). In this perspective, the market appeared to him as 'a computing device of the pre-electronic age' (from an article 'The Computer and the Market', p. 158).

A suddenly extended margin of freedom in 1956 encouraged Lange to undertake the realization of his life's dream: to write a treatise on political economy. He intended to base his 'great synthesis' on two pillars: on Marxian historical materialism and on praxiology (mainly on the principle of economic rationality). But, partly because his illness grew more acute, and probably first of all because of a deteriorating political atmosphere, he soon lost his commitment. Of the three projected volumes, he managed to write only the first one, which – according to many opinions – was overloaded with ideology.

Strange as it may seem, it was only in 1956 that Lange was given his first university chair – that of political economy at Warsaw University. Each subsequent year he delivered a different series of lectures (and, on their basis, wrote several books), none in political economy proper, but in econometrics and other above-mentioned areas. His preoccupation with the 'Formalist Revolution' left him too little time to

study systematically more general aspects of economic systems, though he was increasingly aware that sociological factors create fetters curtailing the dynamics of socialist economies.

During the last five years of his life the 'real socialism' surrounding him made him increasingly worried and disenchanted. The extent of his anxiety was perhaps as wide as the gap between the sophistication of computing and control devices produced by the human mind and their poor application in the actual practice. However, Lange's frustrations were mainly expressed in private conversations or letters. In a number of letters he predicted that the COMECON states would need some ten years to shed their bureaucratic straitjackets. But he was not even that optimistic with regard to his own country. A few months before his death he professed in a private letter that, in Poland 'the sociological factors generate an enduring stagnation, while an "explosive" solution of her problems stands no chance of success (nor does it seem really desirable). A change, if it comes, may be touched off by external developments, namely when Poland falls too far back behind both the capitalist world and the socialist world' (O. Lange's letter to this author, 19 February 1965, in my possession).

## Notes

- \* Some paragraphs have been taken from my 1991 article 'Oskar Lange's Market Socialism' in *Dissent*, Winter.
1. In private conversation, Michael Kalecki said that Schumpeter expressed regret that Lange had decided to go back to Poland in 1945. Apart from Samuelson, he recognized in him the most outstanding economist of the younger generation, and knew that in Poland he would not have equally favourable opportunities to develop. This was said towards the end of Schumpeter's life, at a time when each of them had taken his own path, in theory as well as in general *Weltanschauung*.
  2. In 1939 Lange still considered himself to be a revolutionary, at least with regard to his own country. The following recollection concerning Lange's stay in Warsaw in 1939, during his last visit there before the outbreak of World War II, may sound rather strange today. As a professor at Chicago University, Lange contemplated what his priority should be: science or revolution? During his lengthy discussions 'on the increasingly revolutionary situation in Poland and the role of the socialist left in it ... Oskar asked: "Wladek, tell me sincerely ... isn't my duty to stay here with all of you?" "Oskar," said Wladek, "go ... be sure I won't let you down. If we decide your presence here is necessary because the revolutionary situation has reached that point, then I'll send you a cable: come immediately"' (remembrance of Halina Malinowska, in Lange (1986), p. 110).
  3. These are some sections of the minutes from the hearing of Chancellor Hutchins.
 

Question (Q): 'You are quite definite ... that there are no subversive activities on the Campus. ...'

Chancellor Hutchins (H): I say that no professor is a Communist. ...

Q: In your current catalogue ... Professor Oscar Lange is carried as a Professor of Economics, with a footnote "On leave of absence". ... Do you have any doubts in your mind about Professor Lange being a Communist?

H: Oh, yes. ...

Q: You know he renounced his American citizenship in order to become the Ambassador of a Communist Government. ...'

H: Professor Lange was to perform an important dangerous public service. ... The Polish State had just been reconstituted. ... The choice that he had to make was extremely difficult and he made it because on both sides, both in the government at Washington and the government of Poland, it was felt he would make a great contribution to the relations between the United States and Poland.

Q: Professor Lange would be received back at the University if he asked ...?

H: ... If his views are now what they were before he went on leave. ...

Q: Do you recall he made a statement in the United Nations denouncing the United States?

H: [H]e was objecting to certain policies of the United States, to some of which many loyal Americans also objected.

Q: May I ask how long it is the practice to carry a professorship, as Professor Lange, on a leave of absence status?' ('The Great Investigation ...', n.d.).

4. 'Whether Lange's presence would have materially altered the course of departmental appointments during the rebuilding process after 1945 is moot. But it is not absurd to suppose that it might have done so, in which case the Chicago School might have died or, more likely, taken roots elsewhere' (Reder, (1982) p. 5).
5. In a biography authorized by him, we read: 'Lange sometimes compares this with the case of an ape writing the text of the *Encyclopedia Britannica* while pounding the keys of a typewriter. The calculus does not completely exclude the possibility of an ape composing *Encyclopedia Britannica* on a typewriter. But is it worthwhile to take account of such a highly unlikely contingency?' (Kowalik (1964), p. 6).
6. In one of his memoranda Lange recognized unemployment as the biggest unsolved problem in economics:

I doubt, however, whether this problem is suited as a subject of Department research because the major part of the problem is political rather than economic. The causes of and remedies for unemployment might be known by the economists and yet political conditions might make the suggestions offered by economists unacceptable to the political authorities. Therefore, I do not think that the problem can be investigated adequately from the economic angle alone' (Lange to Chester W. Wright, 22 January 1939; O.L.'s posthumous papers).

7. Even Lange's close friends from the University of Chicago, professors T.W. Schultz and Louis Wirth, refused to participate in this gathering (copies of their letters to O. Lange on this topic were kindly given to me in April 1988 by Professor Theodore W. Schultz).

## References

- Bauer, Otto (1936), *Zwischen zwei Weltkriegen?*, Prague.
- Chilosi, Alberto (1986), 'Self-Managed Socialism with "Free Mobility of Labor"', *Journal of Comparative Economics*, 10 (3), September.
- Friedman, Milton (1946), 'Lange on Price Flexibility and Employment. A Methodological Criticism', *American Economic Review*, No. 4, September.
- Kornai, Janos (1986), 'The Hungarian Reform Process: Visions, Hope and Reality', *Journal of Economic Literature*, XXIV, December.
- Lange, Oskar (1941), *A Democratic Program of Full Employment*, mimeo; published in Polish in O. Lange (1973), *Dziela*, vol. 1, Warszawa.
- Lange, Oskar (1944), *Price Flexibility and Employment*, Bloomington.
- Lange, Oskar (1945), 'Economic Control after the War', *Political Science Quarterly*, No. 1.
- Lange, Oskar (1965), 'Od Bilansowania do Wyboru Optymalnego Planu', (trans. as 'From Material Balances to the Choice of Optimal Plan') *Nowe Drogi*, No. 2, Warsaw.
- Lange, Oskar (1973), *Dziela*, vols 1 and 2, Warszawa.
- Lange, Oskar (1986), *Dziela*, vol. 8, Warszawa.
- Lange, Oskar (1987), 'The Economic Operation of a Socialist Society', *Contributions to Political Economy*, No. 6.
- Lange, Oskar *et al.* (1934), *Gospodarka-Polityka-Taktyka-Organizacja Socjalizmu*, Warszawa.
- Lange, Oskar and Lerner, Aba (1944), *The American Way of Business*, Washington D.C.
- Lange, Oskar and Taylor, Fred M. (1964), *On the Economic Theory of Socialism*, edited and with introduction by Benjamin E. Lippincott, University of Minnesota Press, McGraw-Hill Paperback (first published in 1938).
- Oskar Lange's posthumous papers have been collected at the Archive of the Polish Academy of Sciences.
- Patinkin, Don (1981), *Essays on and in the Chicago Tradition*, Durham, N.C.
- Reder, Melvin (1982), 'Chicago Economics: Permanence and Change', *Journal of Economic Literature*, XX, March.
- Schumpeter, Joseph (1954), *History of Economic Analysis*, London.
- 'The Great Investigation, An account of the Investigation of the University of Chicago by the State Seditious Activity Investigation Commission...', published by the All-Campus Committee Opposing the Broyles Bills and the Broyles Investigation (no date and no place of publication).



# PART I

## ECONOMICS – GENERAL PROBLEMS





# Marxian Economics and Modern Economic Theory

1. In a recent issue of the *Kyoto University Economic Review*<sup>1</sup> Professor Shibata brought up the question of the relative merits of Marxian economics and the modern theory of economic equilibrium. He contends that the theory of general economic equilibrium, which has received its most precise and complete formulation in the works of the School of Lausanne, "is ineffectual in making clear systematically either the organisation of present-day capitalistic society or the laws of its development"<sup>2</sup>, while the Marxian political economy, "though it is now shown to contain many defects, sets forth theories which are either intended to enunciate systematically the organisation of present-day capitalistic society and the laws governing its development, or have inseparable and necessary bearings on them."<sup>3</sup> And Professor Shibata asks what it is that makes Marxian economics so powerful a tool for understanding the basic phenomena of Capitalism while the mathematical theory of economic equilibrium is quite powerless.

This superiority of Marxian economics seems strange, indeed, in view of the fact that it works with concepts which are long since outdated and which ignore the whole development of economic theory since the time of Ricardo. Professor Shibata thinks that the sterility of the theory of general economic equilibrium is due to its complexity and the high degree of abstraction which make its application to actual problems impossible. Marxian economics instead, being concerned rather with aggregates and averages than with the mental structure of the individuals taking part in the organisation of capitalist production, is more amenable to direct practical application. Professor Shibata tries, therefore, to restate and simplify the Lausanne system of equations so as to make it possible to apply them practically. In this Professor Shibata has performed an exceedingly fine piece of analysis for which any serious economist should be grateful. It seems to me, however, that Professor Shibata has not touched the very essential point which accounts for the (real or alleged) superiority of Marxian over "bourgeois" economics. It is, therefore, my purpose to discuss: (1) in what the real or alleged superiority of Marxian economics consists, and (2) whether this superiority is due to the economic concepts used by Marx, or to an exact specification of the institutional (or, if the reader prefers the expression, sociological) data which form the framework in which the economic process works in Capitalist society.<sup>4</sup>

<sup>1</sup> Kei Shibata, *Marx's Analysis of Capitalism and the General Equilibrium Theory of the Lausanne School*, *The Kyoto University Economic Review*, July 1933.

<sup>2</sup> *loc. cit.* p. 107.

<sup>3</sup> *Ibidem* p. 108.

<sup>4</sup> As the word Capitalism is used frequently very ambiguously it should be mentioned here that it is used in this paper in its Marxian sense, i.e. Capitalism means an exchange-economy with private ownership of the means of production, to which the further sociological datum is added that the population is divided into two parts, one of which owns the means of production while the other part, owning no means of production, is compelled to work as wage-earners with the means of production belonging to the other part. Only because of this sociological datum do profit and interest appear as personal income separate from wages.

THE REVIEW OF ECONOMIC STUDIES

2. The Marxist's claim to superiority for his economics is that "bourgeois" economics has utterly failed to explain the fundamental tendencies of the development of the Capitalist system. These tendencies are: the constant increase of the scale of production which by substituting large-scale for small-scale production has led to the transition from the free-competitive Capitalism of the nineteenth century to the present monopolistic (or rather oligopolistic) Capitalism; the substitution of interventionism and "planning" for *laissez-faire*; the transition from free trade to high protectionism and economic nationalism in international relations; the constant expansion of the capitalist method of production in non-capitalist countries, which as long as competition was free led to a relatively peaceful permeation of capitalist economy and Western civilisation through the whole world, but which with oligopolistic and interventionist Capitalism leads to imperialist rivalry among the principal capitalist powers; the increase of economic instability in the capitalist system, which by destroying the economic and social security of the population of capitalist countries, causes them to rebel against the existing economic system, whatever the ideology and programme underlying this rebellion (Socialism or Fascism).

The claim that "bourgeois" economists have failed to explain these tendencies in the development of Capitalism, and to formulate them into a theory of economic evolution seems to be justified indeed. How utterly they failed to do so is conspicuous from the fact that many of them denied this development until the phenomena apparently became so overwhelming as to be familiar to anybody but the professional economist who was always the last to recognise their existence. Thus the tendency towards the concentration of production was denied, or, if admitted, was regarded as of minor significance for the nature of the economic system, until the monopolistic (or oligopolistic) character of the basic industries became so obvious that a special theory of limited competition had to be developed to supplement orthodox economic theory. The transition from free trade to protectionism was mainly interpreted as an act of economic folly; its close connection with the transition from free competition to monopolistic control has as yet scarcely been realised by "bourgeois" economists. The imperialist rivalry of capitalist powers has mainly been explained in purely political terms, the connection between imperialist rivalry and the fight for monopolistic control scarcely being realised. It was very generally held among "bourgeois" economists both at the beginning of the twentieth century and in the years preceding 1929, that the economic stability of Capitalism was increasing and that business fluctuations were becoming less and less intense. Thus the Marxian claim that "bourgeois" economists failed to grasp the fundamental tendencies of the evolution of the Capitalist system proves to be true. They either denied the existence of these tendencies or if they took account of them they never succeeded in explaining them by a consistent theory of economic evolution, but effectively offered no more than a historical description. On the other hand, Marxian economics must be admitted to have anticipated these tendencies correctly, and to have developed a theory which investigates the causal mechanism of this evolution and thus shows its inevitability.

## MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

It may be contended, however, that the lack of understanding of the basic phenomena of the evolution of Capitalism by the professional economists was not a failure of their science, but rather a personal failure due to their middle-class social allegiance. They certainly could not be expected to look with favour on a theory of evolution which draws the conclusion that the middle-class will be wiped out in the process of evolution. If this were the case, it would have been an "error artificis" rather than an "error artis", the psychological grounds of which are easily explained. There are, however, reasons which seem to suggest that the failure is more than a purely personal one and that some "error artis" is involved. In order to display this let us imagine two persons: one who has learned his economics only from the Austrian School, Pareto and Marshall, without ever having seen or even heard a sentence of Marx or his disciples; the other one who, on the contrary, knows his economics exclusively from Marx and the Marxists and does not even suspect that there may have been economists outside the Marxist School. Which of the two will be able to account better for the fundamental tendencies of the evolution of Capitalism? To put the question is to answer it.

But this superiority of Marxian economics is only a partial one. There are some problems before which Marxian economics is quite powerless, while "bourgeois" economics solves them easily. What can Marxian economics say about monopoly prices? What has it to say on the fundamental problems of monetary and credit theory? What apparatus has it to offer for analysing the incidence of a tax, or the effect of a certain technical innovation on wages? And (irony of Fate!) what can Marxian economics contribute to the problem of the optimum distribution of productive resources in a socialist economy?

Clearly the relative merits of Marxian economics and of modern "bourgeois" economic theory belong to different "ranges". Marxian economics can work the economic evolution of capitalist society into a consistent theory from which its necessity is deduced, while "bourgeois" economists get no further than mere historical description. On the other hand, "bourgeois" economics is able to grasp the phenomena of the every-day life of a capitalist economy in a manner that is far superior to anything the Marxists can produce.<sup>1</sup> Further, the anticipations which can be deduced from the two types of economic theory refer to a different range of time. If people want to anticipate the development of Capitalism over a long period a knowledge of Marx is a much more effective starting point than a knowledge of Wieser, Boehm-Bawerk, Pareto or even Marshall (though the last-named is in this respect much superior).

<sup>1</sup> This difference is connected, of course, with the respective social functions of "bourgeois" and Marxian economics. The first has to provide a scientific basis for rational measures to be taken in the current administration of the capitalist economy (monetary and credit policy, tariffs, localisation, monopoly prices, etc.), the social function of the latter has been to provide a scientific basis for long range anticipations guiding the rational activity of a revolutionary movement directed against the very institutional foundations of the capitalist system. But in providing a scientific basis for the current administration of the capitalist economy "bourgeois" economics has developed a theory of equilibrium which can also serve as a basis for the current administration of a socialist economy. It is obvious that Marshallian economics offers more for the current administration of the economic system of Soviet Russia than Marxian economics does, though the latter is surely the more effective basis for anticipating the future of Capitalism. In so far, modern economic theory, in spite of its undoubted "bourgeois" origin, has a universal significance.

## THE REVIEW OF ECONOMIC STUDIES

But Marxian economics would be a poor basis for running a central bank or anticipating the effects of a change in the rate of discount.

3. The difference between the explanatory value of Marxian and "bourgeois" economics respectively is easily accounted for if the essential features of modern economic theory are recalled. Economic theory as developed by the Austrian, Marshallian and Lausanne schools is essentially a *static* theory of economic equilibrium analysing the economic process under a system of constant *data* and the mechanism by which prices and quantities produced adjust themselves to changes in these data. The data themselves, which are psychological (the preference scales of the consumers), technical (the production functions), and institutional (the forms and distribution of property of the factors of production, the monetary and banking system, etc.) are regarded as outside the scope of economic theory. The study of the data is a matter of descriptive and statistical investigation, the study of changes in the data is the province of economic history. If there are any "laws" discoverable in the change of data, their study is outside the range of economic theory. Further, the institutional data of the theory are not specified. In so far as the theory of economic equilibrium is merely a theory of distribution of scarce resources between different uses it does not need any institutional data at all, for the relevant considerations can be deduced from the example of Robinson Crusoe. In so far economics is not even a social science. When economic theory is concerned with the pricing process, the specification of institutional data is very general. All that is assumed is the existence of the institutions necessary for the functioning of an exchange economy. But the consequences of the additional institutional<sup>1</sup> datum which distinguishes Capitalism from other forms of exchange economy, i.e. the existence of a class of people who do not possess any means of production, is scarcely examined.

Now, Marxian economics is distinguished by making the specification of this additional institutional datum the very corner-stone of its analysis, thus discovering the clue to the peculiarity of the Capitalist system by which it differs from other forms of exchange-economy. Another characteristic feature of Marxian economics (which will be shown to be closely connected with the former one), is that it provides not only a theory of economic equilibrium, but also a theory of economic evolution. For modern "bourgeois" economics the problem of economic evolution belongs not to economic theory but to economic history. The study of changes in the data of the economic system is regarded as being beyond the scope of economic theory: for these changes are considered to be from the economists' point of view accidental, not results of the economic process.<sup>2</sup> In opposition to this point

<sup>1</sup> By calling the fact of division of society into proletarians and owners of means of production an institutional datum I do not mean to imply that it is imposed by law. It might be better, perhaps, to distinguish between institutional data, resulting from legal institutions, and other types of sociological data which are not expressed in the form of legal institutions, but as the term "institutional" is used generally in a very broad sense there is no need to make such distinction for the purpose of this paper.

<sup>2</sup> Also H. L. Moore's theory of moving equilibrium explains only the reaction of the economic system to a given continuous change of data. The change of data itself is determined statistically but is not an object of theoretical analysis. The same is true of the "dynamic" theories which deduce the necessity of fluctuations from time lags in adjusting supply to changes in price.

## MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

of view, Marxian economics provides further a *theory* of economic evolution.<sup>1</sup>

The Marxian theory of economic evolution is based on the contention that it is possible, in certain circumstances, to deduce the necessity for, and also the direction of a certain change of economic data, and that such a change follows, in a particular sense, from the very mechanism of the economic process in capitalist society. What this mechanism is and what the term "necessity" means in this connection will be seen later; here it is sufficient to mention that the fundamental change in data occurs in production (a change of the production function) and that the "necessity" of such change can be deduced only under the institutional set-up specific to Capitalism. Thus a "law of development" of the Capitalist system is established. Hence the anticipation of the future course of events deduced from the Marxian theory is not a mechanical extrapolation of a purely empirical trend, but an anticipation based on the recognition of a law of development and is, with certain reservations, not less stringent than an anticipation based on the static theory of economic equilibrium such as, for instance, the anticipation that a rise in price leads, under certain circumstances, to a decline of the amount of a commodity demanded.

4. The economist whose horizon does not extend beyond the limits of a purely static theory of equilibrium usually denies the possibility of a theory of economic evolution. He is too much accustomed to see in the evolution of what he regards as the pure data of his science a certain kind of "accident" which may be described by the historian and statistician but which cannot be accounted for causally, at any rate not by economic theory. His argument is in general that the phenomena are too complicated to be capable of theoretical formulation, i.e. to be accounted for by one single principle (or a few principles). He contends that in the study of economic evolution so many factors must be taken into account that economic evolution can virtually only be described historically and cannot be forced into the pattern of an oversimplified (and therefore wrong) theory.<sup>2</sup> However, this argument is scarcely convincing, it is too much like that put forward by the historical school against the possibility of even static economic theory. The pricing problem, so the historical and purely institutional economist argues, is much too complicated to be explained by one single principle (marginal utility), but should rather be described historically and statistically so as to take due account of all the factors influencing the price of a commodity. And such factors are, besides utility, the cost of production, relative scarcity, the cost of transportation, the extent to which the commodity is imported or exported, its quality, the climate if the commodity is an article of clothing, etc., etc.<sup>3</sup> How crazy, one

These theories deduce the impossibility of an equilibrium in certain cases from the very nature of the adjustment mechanism, but they cannot deduce theoretically the changes of data responsible for the trend on which the fluctuations due to the process of adjustment are superimposed.

<sup>1</sup> The difference between a *theory* of economic evolution and a mere historical account of it is excellently explained in Chapter II of Schumpeter's *Theory of Economic Development* (English translation. Cambridge, Mass., 1934). Schumpeter is the only economist outside the Marxist camp who has formulated a theory of economic evolution. However, the close connection of his theory with Marxian ideas is obvious.

<sup>2</sup> The same type of argument is generally raised against the theory of historical materialism which explains social evolution in terms of a few definite principles.

<sup>3</sup> I know, for instance, of an institutionalist economist who actually maintained that the price level depends on exactly 12 factors. From his enumeration of these factors I happen

## THE REVIEW OF ECONOMIC STUDIES

might conclude on this type of argument, to explain the complicated result of so many causes by one single principle such as marginal utility.

Another argument is that even if a theory of economic evolution is in principle possible it does not belong to the field of economics. If by this it is meant that the theory of economic evolution requires *additional* assumptions beyond those contained in the theory of economic equilibrium this is obvious, for if the theory of economic equilibrium already contained these assumptions it would deduce a process of evolution instead of a state of equilibrium. Whether, however, the deduction of the necessity for a change of certain data from certain principles is called *economic* theory or not is merely a matter of terminology. It should be noted, however, that in Marxian theory this change of data is deduced from the principle of profit maximisation which is at the basis of the theory of economic equilibrium and that the phenomena connected with it were regarded by the classical economists as belonging to the traditionally established body of economic theory. Hence a theory of economic evolution explaining certain changes of data as resulting from "within" the economic process in capitalist society may duly be included in the science of economics.

5. I have pointed out that the real source of the superiority of Marxian economics is in the field of explaining and anticipating a process of economic evolution. It is not the specific economic concepts used by Marx, but the definite specification of the institutional framework in which the economic process goes on in capitalist society that makes it possible to establish a theory of economic evolution different from mere historical description. Most orthodox Marxists, however, believe that their superiority in understanding the evolution of Capitalism is due to the economic concepts with which Marx worked, i.e. to his using the labour theory of value. They think that the abandonment of the classical labour theory of value in favour of the theory of marginal utility is responsible for the failure of "bourgeois" economics to explain the fundamental phenomena of capitalist evolution. That they are wrong can be easily shown by considering the economic meaning of the labour theory of value. It is nothing but a static theory of general economic equilibrium. In an individualistic exchange economy, based on division of labour, in which there is no central authority to direct which commodities, and in what quantities, are to be produced, the problem is solved automatically by the fact that competition enforces such a distribution of productive resources between the various industries that prices are proportional to the amount of labour necessary for producing the respective commodities (these being the "natural prices" of classical economics). In essence this is as static as the modern theory of economic equilibrium, for it explains price and production equilibrium only under the assumption of certain data (i.e. a given amount of labour such as is necessary to produce a commodity—an amount determined by the technique of production). Nor is this theory based on more specialised institutional

to remember: the confidence people have in the national currency, whether the national budget is balanced or not, the balance of foreign trade, the size of agricultural crops (and thus indirectly rainfall). The ratio of the volume of monetary and credit circulation to the volume of trade he recognised as *one* of the factors, of course, but how wrong, he argued, to think of it as *the* principle explaining the price level.

## MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

assumptions than the modern theory of economic equilibrium; it holds not only in a capitalist economy, but in any exchange economy in which there is free competition.<sup>1</sup> To be exact, however, it really holds precisely only in a non-capitalistic exchange-economy of small producers each of whom owns his own means of production (an exchange economy composed of small self-working artisans and peasant farmers, for instance; Marx calls it "einfache Warenproduktion").<sup>2</sup> In a capitalist economy it requires, as Marx has shown himself in the third volume of *Das Kapital*, certain modifications due to differences in the organic composition of capital (i.e. the ratio of the capital invested in capital goods to the capital invested in payment of wages) in different industries. Thus the labour theory of value has no qualities which would make it, from the Marxist point of view, superior to the modern more elaborate theory of economic equilibrium.<sup>3</sup> It is only a more primitive form of the latter, restricted to the narrow field of pure competition and even not without its limitations in this field.<sup>4</sup> Further, its most relevant statement (i.e. the equality of price to average cost plus "normal" profit) is included in the modern theory of economic equilibrium. Thus the labour theory of value cannot possibly be the source of the superiority of Marxian over "bourgeois" economics in explaining the phenomena of economic evolution. In fact, the

<sup>1</sup> Cf. for instance, *Das Kapital*, vol. I, p. 132 (7th ed. Hamburg, Meissner, 1914).

<sup>2</sup> Cf. *Das Kapital*, vol. III, I, p. 154 seq. (4th ed. Hamburg, Meissner, 1919).

<sup>3</sup> In the Marxian system the labour theory of values serves also to demonstrate the exploitation of the working class under Capitalism, i.e. the difference between the personal distribution of income in a capitalist economy and in an "einfache Warenproduktion". It is this deduction from the labour theory of value which makes the orthodox Marxist stick to it. But the same fact of exploitation can also be deduced without the help of the labour theory of value. Also without it, it is obvious that the personal distribution of income in a capitalist economy is different from that in an "einfache Warenproduktion" (or in a socialist economy based on equalitarian principles, in which the distribution of income would be substantially the same as in an "einfache Warenproduktion"), for profit, interest and rent can obviously be the personal income of a separate class of people only in a capitalist economy. If interest is explained by the marginal productivity of capital, it is only because the workers do not own the capital they work with that interest is the personal income of a separate class of people. If interest is regarded as due to a higher valuation of present than future goods it is only because the workers do not possess the subsistence fund enabling them to wait until the commodities they produce are ready that the capitalist advancing it to the workers gets the interest as his personal income. Just as in Marx's case it is because the workers do not possess the means of production that the surplus value is pocketed by the capitalist. To make the Marxian concept of exploitation clearer by contrast it may be noticed that Pigou (*The Economics of Welfare*, 3rd ed., 1929, p. 556) and Mrs. Robinson (*The Economics of Imperfect Competition*, p. 281 seq.) define exploitation of the worker as occurring when he gets less than the value of the marginal physical product of his labour. This means that exploitation is defined by contrasting the distribution of income in monopolistic Capitalism and in competitive Capitalism. The middle-class character of this idea of social justice is obvious. For the Socialist the worker is exploited even if he gets the full value of the marginal product of his labour, for from the fact that interest or rent is determined by the marginal productivity of capital or land it does not follow, from the socialist point of view, that the capital- or land-owner ought to get it as his personal income. The Marxian definition of exploitation is derived from contrasting the personal distribution of income in a capitalist economy (irrespective of whether monopolistic or competitive) with that in an "einfache Warenproduktion" in which the worker owns his means of production.

<sup>4</sup> It is limited to the assumption that the ratio of capital goods to labour in each industry is determined by technical considerations alone, i.e. is a datum and not a variable depending on wages and the prices of capital goods. The very moment substitution between capital goods and labour is assumed to be possible the theory of marginal productivity must be introduced to determine the organic composition of capital, the knowledge of which is necessary in the Marxian system to determine the deviation of "production prices" from the respective labour values.

## THE REVIEW OF ECONOMIC STUDIES

adherence to an antiquated form of the theory of economic equilibrium is the cause of the inferiority of Marxian economics in many fields. The superiority of Marxian economics on the problem of the evolution of Capitalism is due to the exact specification of the institutional datum which distinguishes Capitalism from "einfache Warenproduktion". It was thus that Marx was able to discover the peculiarities of the capitalist system and to establish a theory of economic evolution.

6. The shortcomings of Marxian economics due to its antiquated theory of economic equilibrium and its merits due to its possession of a theory of economic evolution both become conspicuous if the contribution of Marxian and of "bourgeois" economics to the theory of the business cycle are considered. Neither of them can give a complete solution of the problem.

That Marxian economics fails is due to the labour theory of value, which can explain prices only as equilibrium prices (i.e. "natural prices" in the terminology of Ricardo). Deviations of actual from "natural prices" are more or less accidental and the labour theory has nothing definite to say about them. But the central problem of business cycle theory is one of deviation from equilibrium—of the causes, the course and the effect of such deviation. Here the labour theory of value inevitably fails. The inability of Marxian economics to solve the problem of the business cycle is demonstrated by the considerable Marxist literature concerned with the famous reproduction schemes of the second volume of *Das Kapital*. This whole literature tries to solve the fundamental problems of economic equilibrium and disequilibrium without even attempting to make use of the mathematical concept of functional relationship.

But on the other hand, "bourgeois" economics has also failed to establish a consistent theory of business cycles. It has done an exceedingly good job in working out a number of details of the greatest importance for a theory of business cycles, such as studying the effects of the different elasticities of the legamina in our economic system. And it has elucidated in a manner hitherto unprecedented the rôle of money and credit in the business cycle. But it has not been able to formulate a complete theory of business cycles. This inability is a direct consequence of its being only a static theory of equilibrium and of adjustment processes. Such a theory can analyse why, if a disturbance of equilibrium has occurred, certain adjustment processes necessarily follow. It can also analyse the nature of the adjustment processes following a given change of data. But it cannot explain why such disturbances recur regularly, for this is only possible with a theory of economic evolution. Thus the modern theory of economic equilibrium can show that a boom started by an inflationary credit expansion must lead to a breakdown and a process of liquidation. But the real problem is to explain why such credit inflations occur again and again, being inherent in the very nature of the capitalist system. Similarly with the case of technical innovations as a cause of the business cycle. In a theory of economic evolution the business cycle would prove to be the form in which economic evolution takes place in capitalist society.<sup>1</sup>

<sup>1</sup> This character of the business cycle as the specific form of economic development under Capitalism has been stated very clearly by Schumpeter.



MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

Only by a theory of economic evolution can the "necessary" recurrence of a constellation of data leading to a constantly recurring business cycle be explained. A mere theory of economic equilibrium which considers the problem of change of data to be outside its scope can tackle the problem of the business cycle only in two ways: (1) either by seeking the regularity of the recurrence of business cycles in a regularity of changes of data resulting from forces outside the economic process as, for instance, meteorological cycles or successive waves of optimism or pessimism, or (2) by denying the existence of a regularly recurrent business cycle and regarding business fluctuations as due to changes of data which are, from the economic theorist's point of view, "accidental" and hence the concern rather of the economic historian. In the latter case the scope of economic theory would be limited to explaining each business fluctuation separately, as a unique historical phenomenon, by applying the principles of the theory of economic equilibrium to the factual material collected by the economic historian.<sup>1</sup>

7. I have stressed the point that the distinguishing feature of Marxian economics is the precise specification of an institutional datum by which Marx defines Capitalism as opposed to an "einfache Warenproduktion", i.e. an exchange economy consisting of small independent producers each of whom possesses his own means of production. The institutional datum, which is the corner-stone of the Marxian analysis of Capitalism, is the division of the population into two parts, one of which owns the means of production while the other owns only labour power. It is obvious that only through this institutional datum can profit and interest appear as a form of income separate from wages. I believe that nobody denies the important sociological bearing of this institutional datum. However, the question arises whether this institutional datum which is the basis of the Marxian definition of Capitalism has any bearing on economic theory. Most of modern economic theory is based on the tacit assumption or even flat denial that any such bearing exists. It is generally assumed that, however important the concept of Capitalism (as distinct from a mere exchange economy), may be for sociology and economic history, it is unnecessary for economic theory, because the nature of the economic process in the capitalist system is not substantially different from the nature of the economic process in any type of exchange economy.

This argument is perfectly right in so far as the theory of economic equilibrium is concerned. The formal principles of the theory of economic equilibrium are the same for any type of exchange economy. The system of Walrasian equations is applicable indiscriminately to a capitalist economy or to an "einfache Warenproduktion". Whether the persons who own the productive services of labour and capital (labour power and the means of production in the Marxian terminology) are the same or not affects, of course, the concrete results of the economic equilibrium process, but not its formal theoretical aspect. But the same is true of the formulation of the theory of economic equilibrium which was used by Marx, i.e. of the labour theory of value. This theory, too, applies indiscriminately to any type of exchange

<sup>1</sup> This point of view has been argued very ably by Friedrich Lutz, *Das Konjunkturproblem in der Nationalökonomie*, Jena 1932.

## THE REVIEW OF ECONOMIC STUDIES

economy, provided only that there is pure competition. It was argued repeatedly by Marx himself that the "law of value" by which equilibrium asserts itself in an exchange economy based on the division of labour holds for any type of exchange economy, whether capitalistic or an "einfache Warenproduktion". Even more, Marx develops his theory of value first for an "einfache Warenproduktion" later showing the (unessential from his point of view) slight modification it must undergo if applied to a capitalist economy. Thus the institutional basis of capitalist society has no essential significance for the general theory of economic equilibrium. In so far, the prevailing opinion of economists is right. The whole significance of this datum is in terms of a sociological interpretation of the economic equilibrium process.

However, the institutional datum underlying the Marxian analysis of capitalism becomes of fundamental significance where the theory of economic evolution is concerned. A theory of economic evolution can be established only on very definite assumptions concerning the institutional framework in which the economic process goes on. The instability of the technique of production which is the basis of the Marxian<sup>1</sup> theory of economic evolution can be shown to be inevitable only under very specific institutional data. It is clear that it could not be shown to exist in a feudal society, or even in an "einfache Warenproduktion". Of course, a certain amount of technical progress exists in any type of human society, but only under Capitalism can it be shown to be the necessary condition for the maintenance of the system.

8. The necessity of technical progress<sup>2</sup> for the maintenance of the capitalist system is deduced in Marxian economics by showing that only in a progressive economy can capitalist profit and interest exist.

The profit of the capitalist entrepreneur, from which also interest on capital is derived, is explained by Marx to be due to the difference between the value of the worker's labour power and the value of the product created by the worker. Now, according to the labour theory of value, the value of labour power is determined by its cost of reproduction. As in any civilised society a worker is able to produce more than he needs for his subsistence he creates a surplus which is the basis of his employer's profit. However, the crucial point in the Marxian theory is the application of the labour theory of value to the determination of wages. If the market price of cotton cloth exceeds its "natural price" capital and labour flow into the cotton cloth industry until, through increase of the supply of cotton cloth, its market price conforms to the "natural price". But this equilibrating mechanism, which is the foundation of labour theory of value, cannot be applied to the labour market. If wages rise above the "natural price" of labour power so as to threaten to annihilate the employers' profits, there is no possibility of transferring capital and labour from other industries to the production of a larger supply of labour power. In this respect labour power differs fundamentally from other commodities. Therefore, in order to show that wages cannot exceed a certain maximum and thus annihilate profits a principle different from the ordinary

<sup>1</sup> And also of Schumpeter's.

<sup>2</sup> By technical progress I mean here not only technical improvements in the narrow meaning of the word, but also improvements in organisation, etc., i.e. any innovation increasing the efficiency of the optimum combination of factors of production.

MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

mechanism making market prices tend towards "natural prices" must be introduced.

The classical economists found such a principle in the theory of population. They taught that the pressure of the reproductive instincts of the population on the means of subsistence reacts on any increase of wages above the "natural price" of labour power to such an extent as to counteract effectively the increase of wages. Ricardo says explicitly<sup>1</sup>: "However much the market price of labour may deviate from its natural price, it has, like commodities, a tendency to conform to it. . . . When the market price of labour exceeds its natural price, . . . by the encouragement which high wages give to the increase of population, the number of labourers is increased, wages again fall to their natural price." Thus the working class is assumed to be in a vicious circle which it cannot transcend. Marx rejected the Malthusian theory of population<sup>2</sup>, contending that even without such reproductive facilities wages could not rise so as to annihilate profits. For Capitalism creates, according to Marx, its own surplus population (industrial reserve army) through technical progress, replacing workers by machines. The existence of the surplus population created by technical progress prevents wages from rising so as to swallow profits. Thus technical progress is necessary to maintain the capitalist system<sup>3</sup> and the dynamic nature of the capitalist system, which explains the constant increase of the organic composition of capital, is established.

That the labour theory of value is not necessary for this argument is easily seen, for its application to the labour market is a purely formal one, since the equilibrating mechanism which is at the basis of this theory does not work on the labour market. It is technical progress (or the "law of population" in the case of the classical economists) which prevents wages from swallowing profits.

We can now see in what sense Marxian economics deduces from theoretical considerations the "necessity" of economic evolution. Of course, the necessity of the fact that labour-saving technical innovations are always available at the right moment cannot be deduced by economic theory and in this sense the "necessity" of economic evolution cannot be proved. But Marxian economics does not attempt to prove this. All it establishes is that the capitalist system cannot maintain itself without such innovations. And this proof is given by an economic theory which shows that profit and interest on capital can exist only on account of the instability of a certain datum, i.e.

<sup>1</sup> *Principles*, Chap. V, p. 71 (of Gonner's ed. 1929).

<sup>2</sup> *Das Kapital*, I, chap. XXIII.

<sup>3</sup> Marx himself did not see clearly that in his theoretical system the virtual existence of a surplus population created by technical progress is necessary for the maintenance of the capitalist system. He applied the labour theory of value to the labour market without being aware that the equilibrating mechanism at the basis of this theory does not work in respect to labour power. But his theory of surplus population which he opposed to the Malthusian theory allows us to complete Marx's argument so as to bridge the gap in his system. It may be mentioned that a proletarian surplus population can also be created through driving out of small independent producers (for instance, artisans and peasants) from the market through the competition of capitalist industry. This source of surplus population was very important in the early history of Capitalism. So long as such a source of surplus population exists the capitalist system might exist, in theory, even without technical progress other than the dynamic process inherent in the destruction of pre-capitalist systems.

## THE REVIEW OF ECONOMIC STUDIES

the technique of production, and that it would necessarily disappear the moment further technical progress proved impossible. The economic theory presented here is, of course, but a mere sketch of how Marx explains the evolution of Capitalism and a suggestion as to how his theory can be completed so as to bridge over the gaps he left. The modern development of economic theory, however, makes it possible to construct a far more satisfactory theory of economic evolution.

It is obvious that the necessity of economic evolution under Capitalism is entirely due to the institutional datum distinguishing Capitalism from an "einfache Warenproduktion" and that it would not exist in the latter form of exchange economy. Therefore, "bourgeois" economics, omitting to specify exactly the institutional datum of Capitalism, is unable to establish a theory of economic evolution, for such a theory cannot be evolved from the very broad assumptions of exchange economy in general. From our account of the Marxian theory of economic evolution, it becomes evident that the necessity of economic evolution does not result from the exchange and pricing process as such, but from the special institutional set-up under which this process goes on in a Capitalist system.<sup>1</sup> The specification of institutional data by "bourgeois" economic theory is too broad, since it gives no more than the institutional data common to any type of exchange economy. But since this very broad specification gives results which are too general to be applicable to special problems, it usually superimposes a very narrow specification of institutional data concerning the monetary and banking system (e.g. the existence or non-existence of the gold standard, whether the banking system makes an inflationary credit expansion possible or not, etc.). But between the first specification of institutional data which is very broad and the second specification which is very narrow there is a gap: the institutional datum distinguishing Capitalism from an "einfache Warenproduktion". And this is precisely the datum which is of fundamental significance for the theory of economic evolution.

9. Through the exact specification of the institutional framework of capitalist economy, Marxian economics is able to establish a theory of economic evolution in which certain data evolve "from within" the economic system. But not all changes of data are explained in this way by the Marxian theory. The evolution of certain data resulting from the very mechanism of the economic system influences certain extra-economic factors such as the policy of the state, political and social ideas, etc., which, reacting back on the economic system, change other of its data. This consideration supplies the explanation of the transition from *laissez-faire* to state interventionism and from free trade to protectionism and economic nationalism, the emergence of imperialist rivalries, etc. The causal chain through which the evolution of certain economic data influences certain extra-economic factors and the reaction of these factors back on the data of the economic system is, however, not within the subject-matter of economics. It belongs to the theory of historical materialism the object of which is to elucidate the causal chains connecting economic

<sup>1</sup> Similarly Schumpeter's theory of economic evolution is based on very definite institutional data and does not hold for any type of exchange economy.

MARXIAN ECONOMICS AND MODERN ECONOMIC THEORY

evolution with social evolution as a whole. Therefore, the full evolution of Capitalism in all its concreteness cannot be explained by a theory of economic evolution alone. It can be explained only by a joint use of both economic theory and the theory of historical materialism. The latter is an inseparable part of the Marxian analysis of Capitalism.

10: Our results may be summarised as follows :

(1) The superiority of Marxian economics in analysing Capitalism is not due to the economic concepts used by Marx (the labour theory of value), but to the exact specification of the institutional datum distinguishing Capitalism from the concept of an exchange economy in general.

(2) The specification of this institutional datum allows of the establishment of a theory of economic evolution from which a " necessary " trend of certain data in the capitalist system can be deduced.

(3) Jointly with the theory of historical materialism this theory of economic evolution accounts for the actual changes occurring in the capitalist system and forms a basis for anticipating the future.

*Cambridge, Mass—Cracow.*

O. LANGE.

# The Place of Interest in the Theory of Production

## I. INTRODUCTORY REMARKS

IN view of the confused state in which the theory of interest is at present a thorough and systematic investigation of its foundations does not seem out of place. The aim of the present paper is to clarify the foundation of the theory of interest by attempting to restate some of its fundamental propositions with special reference to the general theory of production. The relation of the theory of interest to the general theory of production, i.e. the theory of pricing of factors of production, is rather obscure. Outside of a rather vague and, as we shall see later, doubtful statement that the relation of the theory of interest to the general theory of production consists in the first taking into account time while the other is "timeless," little positive has been achieved in this field. Also the discussion of the problem whether there exists a *net* productivity of capital is bound to be rather confused unless the problem of interest is brought into closer connection with the general theory of production. The present paper tries, therefore, to elucidate in a systematic way the place of interest in the general theory of production.

Reasons of exposition and of space require a certain simplification and a limitation of our subject. The simplification consists in the assumption that only one finished commodity is produced in the economic system studied and that only one original factor of production, i.e. labour, and only one real capital good is used. This assumption allows a considerable simplification of the exposition while a generalisation of the theory to the case of production of many commodities with many original factors and many real capital goods does not encounter any logical difficulty. More numerous are the limitations of our study. First of all our investigation is restricted to the case of circulating capital and the delay period at which factors are applied in production is regarded as fixed.<sup>1</sup> Further, our investigation is limited to free competition and to the case where all factors of production are substitutable (the case of limitational factors thus being disregarded). Also the special influence of money creation is ruled out. To do this we need not assume an actual barter economy. We may well assume that commodities are actually bought and sold for money. All we need to know is that money behaves only like a "numéraire," or in other words that it is "neutral." What the actual conditions for money to be "neutral" are, whether they mean a constant amount of money or a constant level of average prices, or even whether "neutral" money is possible at all, need not concern us here. The study of those conditions is a matter for monetary theory. As terms like "money capital" and "monetary saving" are used in this paper the reader ought to be warned

<sup>1</sup> As to the concept of the delay period cf. A. Smithies, "The Austrian Theory of Capital in Relation to Partial Equilibrium Theory," *Quarterly Journal of Economics*, October, 1935, p. 127 seq.

that they have nothing to do with money creation. By " money capital " in this paper the purchasing power at the disposal of entrepreneurs is meant and the only way to increase it is, according to our assumptions, through saving, i.e. through refraining from spending purchasing power for consumption and through transferring it to the disposal of entrepreneurs. Though the abstraction from the influence of money creation cripples the theory of interest substantially it is methodologically both perfectly legitimate and also indispensable. For only after the theory of interest has been established independently of the effects of money creation can a satisfactory elucidation of the influence of money creation on interest and production be achieved. Also the element of risk is ruled out from our study and the rate of interest treated here is the rate of net interest.

A fully developed theory of interest must include all the factors neglected here. However, the more fundamental aspects of the theory of interest can be established within the limitations of our study and all the great standard works on the theory of interest and discussions of the subject have also kept usually within these boundaries.

2. CONDITIONS OF MAXIMUM NET OUTPUT

Our first problem is to find the conditions maximising net output with a given amount of resources. We shall assume that only one commodity is produced in our economic system and let  $x$  be the output per unit of time. To produce this commodity a certain amount of labour and a certain amount of equipment (tools, machinery, or materials) is necessary. If  $l$  and  $m$  are the amounts of labour and equipment used per unit of time the production function of our commodity is :

$$x = F(m, l) \dots\dots\dots (1)$$

As an illustration, let us think of an economic system as consisting of a Robinson Crusoe, or, to make it more realistic, of a communistic settlement of pioneers in a forest. Let wood be the commodity produced and axes be the equipment. The equipment is assumed in our case to be produced with the aid of labour and of a certain amount of equipment of the same kind. Thus it takes both labour and other axes to produce axes. We may express this by saying that equipment is, in this case, a *circular* factor. If  $l'$  and  $m'$  be the amount of labour and equipment (axes) respectively used per unit of time to produce equipment, the amount of equipment produced per unit of time is a function of  $l'$  and  $m'$ . Let this function be  $\phi(m', l')$ . However, the amount of equipment produced per unit of time consists of two parts. One part  $m$  is used for producing the finished commodity (wood in our example), while another part is used to reproduce the worn-out equipment. If the equipment is to be maintained, the worn-out pieces have to be replaced by new ones and the amount of equipment used to produce new equipment is exactly equal to the amounts used in producing the equipment in hand, i.e. equals  $m'$ . We have, therefore :

$$m + m' = \phi(m', l') \dots\dots\dots (2)$$

We have thus two production functions.<sup>1</sup> The amounts figuring in the formulae (1) and (2) are all understood as per unit of time. We assume also that the equipment is worn out completely during a unit of time. If a year is chosen as the unit of time this means that each axe has to be replaced after a year. There is also a certain delay of time from the application of labour and equipment to the receipt of the product. However, as a first approximation, we assume that this delay period is fixed by technical considerations alone and that it equals exactly one unit of time. We assume also that the production of the finished commodity and of the equipment is perfectly synchronised, so that we have a constant flow of commodities produced and of equipment to replace the worn-out one. During each unit of time exactly the amount of equipment is reproduced which is wearing out.

To our two production functions we add another equation expressing that the sum of labour used in producing the finished commodity (wood) and used in producing the equipment (axes) is a constant. Thus :

$$l + l' = L \dots\dots\dots (3)$$

where  $L$  is a constant. Equation (3) expresses the condition that the amount of original factors<sup>2</sup> at disposal in our economic system is fixed.<sup>3</sup>

We shall call  $x$  the *net output* of our economic system. Our problem is to find the method of production which maximises net output, i.e. to determine  $m, l, m'$  and  $l'$  so as to maximise the production function (1) subjected to the two supplementary conditions expressed by equations (2) and (3). The solution is found immediately by the method of Lagrange multipliers. Let us form the expression :

$$F(m, l) + \lambda_1 [\phi(m', l') - m - m'] + \lambda_2 (l + l' - L)$$

where  $\lambda_1$  and  $\lambda_2$  are Lagrange multipliers. Differentiating this expression with respect to  $m, l, m'$  and  $l'$  and putting the partial derivatives equal to zero we get :

$$\begin{aligned} F_m - \lambda_1 &= 0 \\ F_l - \lambda_2 &= 0 \\ \lambda_1 (\phi_{m'} - 1) &= 0 \\ \lambda_1 \phi_{l'} + \lambda_2 &= 0 \end{aligned}$$

and eliminating  $\lambda_1$  and  $\lambda_2$  we arrive at the two equations :

$$\phi_{m'} = 1 \dots\dots\dots (4)$$

$$\text{and } F_m \phi_{l'} = F_l \dots\dots\dots (5)$$

<sup>1</sup> The analogy of these two production functions to the famous reproduction schemes of Marx in the second volume of *Das Kapital* may be noticed.

<sup>2</sup> By original factors we mean factors which are not produced, i.e. which enter as variables into production functions but have no production function of their own. In our simplified case labour is the only original factor of production. It ought to be noticed that this definition of original factors does *not* imply that equipment (axes) is produced by original factors (labour in our instance) alone.

<sup>3</sup> Instead of assuming the amount of labour resources in our economic system to be fixed, we might also assume that it depends on the net output  $x$ , for instance our settlers may be willing to work more if the reward expected is greater. In such case equation (3) would be replaced by the equation :

$$l + l' = \psi(x) \dots\dots\dots (3a)$$

where  $\psi(x)$  is the supply function of labour.



which, together with equations (2) and (3), serve to determine the four unknowns  $l$ ,  $l'$ ,  $m$  and  $m'$ .<sup>1</sup> By substitution of  $l$  and  $m$  into equation (1) we can determine the maximum output  $x$ .<sup>2</sup>

Equations (4) and (5) require an economic interpretation. Equation (4) says that the marginal productivity of equipment used in the production of equipment is a constant. This can be interpreted in the following way. Write the production function (2) in the form :

$$m = \phi(m', l') - m'$$

Then

$$\frac{\partial m}{\partial m'} = \phi_{m'} - 1$$

and equation (4) can be written :

$$\frac{\partial m}{\partial m'} = 0$$

which means that the marginal *net* productivity of the circular factor is zero. This is obvious. The amount of a circular factor engaged in reproducing itself is not a genuine cost factor. Its use will be extended as long as there is any positive marginal *net* productivity.

Even more simple is the economic interpretation of equation (5). The expression  $F_m \phi_{l'}$  is the marginal productivity of labour used in producing equipment (axes) in terms of the finished commodity (wood). Indeed, from (1) and (2) we have :

$$\frac{\partial x}{\partial l'} = F_m \phi_{l'}$$

Let us use the terms direct labour and indirect labour to designate the labour used in the production of the finished commodity and of equipment respectively. Thus  $F_m \phi_{l'}$  is the marginal productivity of *indirect* labour while  $F_l$  is the marginal productivity of *direct* labour, both marginal productivities being conceived in terms of the finished product (wood, in our instance). Equation (5) states that the *maximum net output is obtained when the marginal productivity of indirect labour is equal to the marginal productivity of direct labour*.

### 3. THE MARGINAL NET PRODUCTIVITY OF INDIRECT LABOUR

We have seen, so far, that the maximum net output is obtained when the marginal productivity of indirect labour equals the marginal productivity of direct labour. This condition implies, of course, an appropriate division

<sup>1</sup> Equations (4) and (5) are obtained also if instead of (3) the equation (3a)—cf. the preceding footnote—is used as a supplementary condition. Thus the replacement of the assumption that the amount of labour resources is fixed by the assumption that their supply depends on the "reward" they get in the magnitude of the net output does not change the conclusions obtained. We use, therefore, in the text only the first assumption as the more simple to handle mathematically.

<sup>2</sup> The problem of maximising net output from a given amount of resources has been treated and equations (4) and (5) have been obtained by Griffith C. Evans, "Maximum Production Studied in a Simplified Economic System," *Econometrica*, January, 1934, pp. 37-41.

of the total labour resources between labour used in producing the finished commodity and labour used in producing equipment. If this appropriate division of the labour resources of the economic system is reached there is no motive to change it in either direction, for any change would result in diminishing net output. Together with equation (4), the equality of the marginal productivity of indirect and of direct labour determines the optimum amount of equipment to be used both in the production of the finished commodity and in the production of equipment. Any decrease of this amount, and also any *increase* of it, would diminish the net output of the economic system.

Now let us imagine a situation in which the amount of equipment is less than the optimum amount. Such a situation may have arisen due to a change in data which makes it advantageous to use more equipment than has been used under the old conditions. For instance, the production functions or the amount of labour available in our economic system may have changed. Or it may be due to an unforeseen destruction of a part of the equipment. For example, a part of the axes may have been destroyed by a fire. If the amount of equipment is smaller than the optimum amount this means that not enough labour is used in producing equipment and too much is used in co-operation with the equipment engaged in the production of the finished commodity. The net output of our economic system may be increased by transferring labour from its direct to its indirect use.

In the situation considered, the marginal productivity of indirect labour is greater than the marginal productivity of direct labour. Indeed, let  $l_0$  be the amount of labour initially engaged in the production of the finished commodity and  $l'_0$  the amount of labour initially engaged in the production of equipment. Let  $s$  be the amount of labour transferred from the direct to the indirect use. By putting  $l = l_0 - s$  and  $l' = l'_0 + s$  production function (1) can be written :

$$x = F(m, l_0 - s) \dots\dots\dots (1a)$$

and production function (2) becomes correspondingly :

$$m + m' = \phi(m', l'_0 + s) \dots\dots\dots (2a)$$

The marginal increase of net output  $x$  due to the transfer of the amount  $s$  of labour from its direct to its indirect use is  $\frac{\partial x}{\partial s}$ .

We have from (1a) :

$$\frac{\partial x}{\partial s} = F_m \frac{\partial m}{\partial s} - F_l \dots\dots\dots (6)$$

and from (2a) :

$$\frac{\partial m}{\partial s} = \phi_{l'} \dots\dots\dots (7)$$

Hence, by substitution of (7) into (6) :

$$\frac{\partial x}{\partial s} = F_m \phi_{l'} - F_l \dots\dots\dots (8)$$

and  $F_m\phi_l' > F_l$  if  $\frac{\partial x}{\partial s} > 0$ , i.e. if the amount of indirect labour is less than the optimum amount.

If a unit of labour is transferred from the direct to the indirect use there is a decrease of net output due to the withdrawal of a unit of direct labour and an increase due to the addition of a unit of indirect labour. This decrease, which is equal to the marginal product of a unit of direct labour, is the *cost* involved in adding a unit of indirect labour. Therefore, *the marginal productivity of direct labour may be conceived as being the marginal cost of indirect labour*. If the labour resources are distributed so as to maximise net output the marginal productivity of indirect labour equals its marginal cost. We arrive, then, at the same result whether we evaluate the marginal significance of indirect labour by its marginal productivity (in terms of the finished product) or by its marginal cost (conceived as an opportunity lost). But not so if the amount of indirect labour employed differs from the optimum amount. In such case the evaluation by the marginal productivity and by the marginal cost lead to different results. We shall call the difference between the marginal productivity of indirect labour and its marginal cost the *marginal net productivity of indirect labour*. The marginal cost of indirect labour (in terms of lost opportunities) being equal to the marginal productivity of direct labour, *the marginal net productivity of indirect labour is equal to the difference between the marginal productivity of indirect and of direct labour*.<sup>1</sup>

From (8) it follows immediately that the marginal *net* productivity of indirect labour is positive, zero, or negative according to whether the amount of indirect labour employed is less, equal, or more than the optimum amount. From the second order conditions that the net output be a maximum it follows that  $\frac{\partial^2 x}{\partial s^2} < 0$  in the neighbourhood of the maximum point.<sup>2</sup> As according to our definition  $\frac{\partial x}{\partial s}$  is the marginal *net* productivity of indirect labour this

<sup>1</sup> The marginal *net* productivity of indirect labour corresponds to what is the substitutive marginal productivity of indirect labour, if we follow Pigou in distinguishing between additive and substitutive marginal productivity (cf. *The Economics of Welfare*, Fourth edition, pp. 131-2).

We have from (1) and (2)  $\frac{\partial x}{\partial l'} = F_m\phi_l'$  if  $l$  is regarded as independent of  $l'$ , and  $\frac{\partial x}{\partial l'} = F_m\phi_l' - F_l$  if the relation  $l + l' = \text{const.}$  is imposed while differentiating. The first is the additive and the second is the substitutive marginal productivity of indirect labour. I prefer, however, to use here the term *marginal net* productivity of indirect labour.

<sup>2</sup> The second order condition that the function (1) subjected to the supplementary conditions (2) and (3) be a maximum is :

$$F_{mm}dm^2 + 2F_{ml}dmdl + F_{ll}dl^2 + F_m d^2m < 0 \dots\dots\dots (I)$$

Differentiating (8) with respect to  $s$  and remembering that  $m$  is a function of  $s$  we have :

$$\frac{\partial^2 x}{\partial s^2} = F_{ms}\phi_l' + F_m\phi_l's - F_{ls} \dots\dots\dots (II)$$

However :

$$F_{ms} = F_{mm} \frac{\partial m}{\partial s} + F_{ml} \frac{dl}{ds} = F_{mm}\phi_l' - F_{ml}$$

means that in the neighbourhood of the equilibrium point the marginal *net* productivity of indirect labour must decrease as the amount of indirect labour increases.

Strictly, the condition  $\frac{\partial^2 x}{\partial s^2} < 0$  holds only in the neighbourhood of the maximum position. However, generally we may expect the production functions to be shaped so that there is a rather large interval in which the condition  $\frac{\partial^2 x}{\partial s^2} < 0$  holds.

The discussion of the properties of the marginal *net* productivity of indirect labour is done most conveniently by means of graphs. In Figs. 1, 2, and 3 the line  $II'$  represents the marginal productivity of indirect labour and the line  $DD'$  represents the marginal productivity of direct labour, both marginal productivities being understood in terms of the finished commodity. The units of

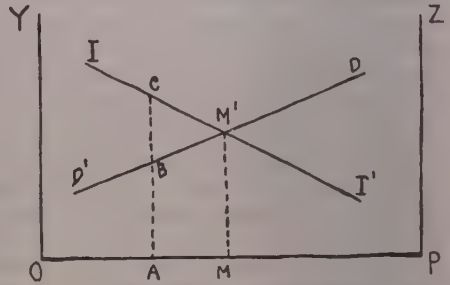


FIGURE 1

$$\phi'_s = \phi'_{i'} \frac{dl'}{ds} + \phi'_{m'} \frac{\partial m'}{\partial s} = \phi'_{i'}$$

$$F_{ls} = F_{im} \frac{\partial m}{\partial s} + F_{ll} \frac{dl}{ds} = F_{mi} \phi'_{i'} - F_{ll}$$

Substituting these expressions into (II) we get :

$$\frac{\partial^2 x}{\partial s^2} = F_{mm} \phi_{i'}^2 - 2F_{mi} \phi'_{i'} + F_{ll} + F_m \phi'_{i'} \dots \dots \dots (III)$$

From production function (2) we have :

$$dm = (\phi_{m'} - 1) dm' + \phi'_{i'} dl'$$

Taking into account that in the maximum position  $\phi_{m'} = 1$  (cf. equation (4) ) this reduces to :

$$dm = \phi'_{i'} dl'$$

or :

$$dm = -\phi'_{i'} dl$$

because  $dl' = -dl$ , resulting from equation (3). Hence :

$$\phi'_{i'} = -\frac{dm}{dl}$$

and

$$\phi'_{i'} = \frac{d^2 m}{dl^2}$$

Substituting these relations into (III) and multiplying by  $dl^2$  we arrive at :

$$\frac{\partial^2 x}{\partial s^2} dl^2 = F_{mm} dm^2 + 2F_{mi} dm dl + F_{ll} dl^2 + F_m d^2 m \dots \dots \dots (IV)$$

The right hand side of (IV) is identical with (I) which is negative by the second order maximum condition. Hence :

$$\frac{\partial^2 x}{\partial s^2} < 0 \dots \dots \dots (V)$$

in the neighbourhood of the maximum position.

indirect labour are measured from the origin  $O$  to the right and the units of direct labour are measured from the origin  $P$  to the left. The segment  $OP$ , which is constant, represents the total amount of labour, direct and indirect. Thus if  $OA$  is the amount of indirect labour the corresponding amount of direct labour is  $PA$  and  $OA + PA = OP$  is the total amount of labour resources available.<sup>1</sup>

The lines  $II'$  and  $DD'$  need some further explanation. If the marginal productivity of direct and of indirect labour is each a function of one variable (i.e. of the amount of the respective type of labour) alone the lines  $II'$  and  $DD'$  represent simply the marginal productivity of the two types of labour. But if the marginal productivity of direct and of indirect labour is each a function of two variables (i.e. if it depends on the amount of both types of labour employed), the interpretation of the lines  $II'$  and  $DD'$  needs some qualification. In such case it is understood that, for instance, the ordinate  $AC$  represents the marginal productivity of the amount  $OA$  of indirect labour when the amount of direct labour employed is  $PA$ . Similarly, the ordinate  $AB$  is understood to represent the marginal productivity of the amount  $PA$  of direct labour when the amount of indirect labour employed is  $OA$ .

If both marginal productivities are functions of one variable alone, the curves  $II'$  and  $DD'$  are both declining, at least in a certain neighbourhood of the maximum position which is determined by their point of intersection. This is obvious as to the marginal productivity of direct labour (as a consequence of the law of diminishing returns). The marginal productivity of indirect labour is the product of the marginal productivity of indirect labour in terms of equipment and of the marginal productivity of equipment in terms of the finished commodity (cf. p. 162). This product diminishes from the point on the two marginal productivities just mentioned diminish both. In this case both curves have, at least in a certain neighbourhood of the maximum position, the shape indicated in Fig. 1. However, if the marginal productivity of direct and of indirect labour is each a function of two variables, one of them may rise while the other declines, but the absolute value of the slope of the rising curve must be smaller than that of the declining curve. This follows from the condition of existence of a maximum position. These conditions are: (i) there must be a point where both curves intersect, i.e. where the marginal productivity of indirect and of direct labour is equal, and (ii) the marginal productivity of indirect labour must be greater than the marginal productivity of direct labour to the left, and smaller to the right of the maximum position.<sup>2</sup> Thus in the neighbourhood of the maximum position

<sup>1</sup> If, instead of assuming the total amount of labour resources to be fixed, we assume it to depend on the amount of net output, the segment  $OP$  stretches (or shrinks) as net output increases with the amount of indirect labour approaching its optimum size. However, according to the second order maximum conditions in the neighbourhood of the maximum position the supply of labour resources must increase or decrease at a diminishing rate as net output increases. This prevents the segment  $OP$  from stretching (or shrinking) indefinitely and assures a final equilibrium.

<sup>2</sup> This follows from the condition that  $\frac{\partial x}{\partial s} = 0$  in the maximum position and  $\frac{\partial^2 x}{\partial s^2} < 0$  in the neighbourhood of this position. Recalling that  $\frac{\partial x}{\partial s} = F_m \phi_1' - F_l$  we have  $F_m \phi_1' - F_l > 0$  to the left and  $F_m \phi_1' - F_l < 0$  to the right of the maximum position. The second condition could not be

the two marginal productivity curves must have either the shape indicated in Fig. 1 or one of the shapes indicated in Fig. 2 and Fig. 3.<sup>1</sup>

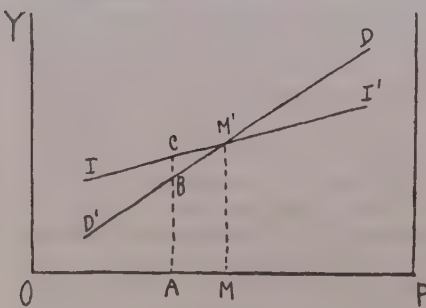


FIGURE 2

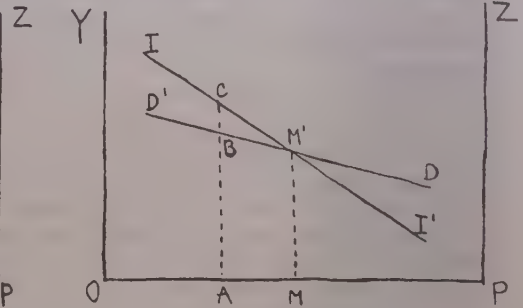


FIGURE 3

If  $OA$  is the amount of indirect labour and  $PA$  the amount of direct labour actually employed the marginal productivity of indirect and of direct labour is  $AC$  and  $AB$  respectively. The difference  $BC$  between those two marginal productivities is the marginal *net* productivity of indirect labour. By plotting the differences between the ordinates of the curves  $II'$  and  $DD'$  as ordinates on a separate graph we obtain a curve  $NN'$  representing the marginal *net* productivity of indirect labour (cf. Fig. 4). The curve  $NN'$  is declining. The marginal *net* productivity of indirect labour is positive to the left of the maximum point  $M$ , zero at this point, and negative to the right of it.

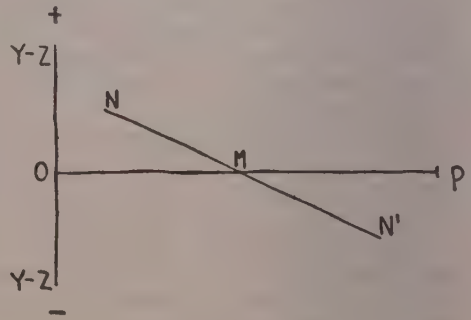


FIGURE 4

#### 4. THE MARGINAL NET PRODUCTIVITY OF REAL CAPITAL

We shall use the term *real capital* to designate the equipment (in our example, the axes) employed in production. For certain purposes it is more satisfied if both marginal productivity curves were rising and neither the first nor the second condition would be satisfied, if one of the curves being rising and the other declining, the absolute slope of the rising curve were greater than that of the declining curve.

<sup>1</sup> It may be noticed that the marginal productivity curves in Figs. 1, 2, and 3 are drawn only for a certain interval around the maximum position. Outside of this interval their shape may be different; eventually they may intersect again. However, the intersection points next to the maximum position represent unstable equilibria. In any case, the marginal productivity of either direct or indirect labour must be zero in the neighbourhood of the origins  $O$  and  $P$ , for generally no product can be obtained by using only direct or indirect labour. The transition of the marginal

convenient to consider the marginal *net* productivity of real capital instead of the marginal *net* productivity of indirect labour. The first is derived from the latter in a simple way. The marginal gross productivity of real capital employed in the production of the finished commodity is  $F_m$ . To increase the amount of real capital a certain amount of labour must be withdrawn from the production of the finished commodity and transferred to the production of equipment (real capital). This withdrawal leads to a diminution of the output of the finished commodity which constitutes the *cost* of adding an additional amount of real capital. The amount of labour which must be with-

drawn to create the additional amount  $\Delta m$  of real capital equals  $\frac{\partial l'}{\partial m} \Delta m = \frac{\Delta m}{\phi_l'}$ .

Thus the loss of net output involved in withdrawing the amount of labour  $\frac{\Delta m}{\phi_l'}$  from its direct use is  $\frac{F_l}{\phi_l'} \Delta m$ . This loss is compensated by an increase of net output equal to  $F_m \Delta m$ . The difference

$$F_m \Delta m - \frac{F_l}{\phi_l'} \Delta m$$

is the *net* increment of net output due to an increase  $\Delta m$  of the real capital. The rate of increase is then :

$$F_m - \frac{F_l}{\phi_l'} \dots\dots\dots (9)$$

and is the marginal *net* productivity of real capital. The marginal *net* productivity of real capital is thus the marginal *net* productivity of indirect labour in terms of the finished commodity divided by the marginal gross productivity of indirect labour in terms of equipment (real capital). As the latter is assumed to be always positive the marginal *net* productivity of real capital has always the same sign as the marginal *net* productivity of indirect labour and may be represented by a curve similar in shape to that indicated in Fig. 4.

The increase of the amount of real capital requires a transfer of labour from the production of the finished commodity to the production of equipment. However, such transfer involves a temporary interruption of the synchronisation of production. Immediately after the transfer takes place there is a decrease of the production of the finished commodity and an increase of the amount of labour employed in the production of equipment. Only when the additional equipment is ready and is installed in the production of the finished commodity the synchronisation of production is restored. When this will happen depends on the length of the delay periods in both productions. But from the moment the synchronisation is restored there is an increased perpetual flow of the finished commodity (provided, of course, that the amount of equipment was less than the optimum amount, for otherwise the flow of the finished commodity would be decreased). Thus the transfer of labour from the production of the finished commodity to the production of real capital (equipment) is equivalent to a temporary reduction of the output of the finished productivity from zero to a positive value can be effected either through a rising branch of the respective marginal productivity curve or through a discontinuous jump. Similarly the transition from a positive value to zero at the other end of the curve may be either continuous or discontinuous.

product recompensated by an increase of the perpetual flow of this product. The said act of transfer of labour is an act of *real saving*.<sup>1</sup> "Real saving" means thus a transfer of labour from its direct use to its indirect use resulting in an increase of real capital.

5. THE RATE OF REAL INTEREST

Following the terminology generally accepted we define the *rate of real interest* as the ratio of the marginal net productivity of real capital to its marginal cost. The marginal cost of real capital being  $\frac{F_l}{\phi_l}$  (cf. p. 168), the rate of real interest is :

$$i = \frac{F_m - F_l/\phi_l}{F_l/\phi_l} \dots\dots\dots (10)$$

This is J. B. Clark's well-known definition of the rate of interest.<sup>2</sup> Formula (10) can also be written in the form :

$$i = \frac{F_m\phi_l - F_l}{F_l} \dots\dots\dots (11)$$

which expresses the rate of real interest as the ratio of the marginal net productivity of indirect labour to its marginal cost. This is the well-known formula of Wicksell.<sup>3</sup> Both formulae are, of course, equivalent. The first formula refers interest to the marginal net productivity of real capital, while the other refers it to the marginal net productivity of indirect labour, i.e. to the difference between the marginal productivity of indirect and of direct labour.<sup>4</sup>

The rate of real interest is zero when net output is a maximum. This follows immediately from equation (5) which states a maximum condition. The denominator of formula (10) and (11) being always positive, the rate of real interest is positive or negative according as to whether the amount of real capital (or, what is equivalent, the amount of indirect labour employed) is less or more than the optimum amount, i.e. the amount needed to maximise net output. Writing formula (10) or (11) in the form :

$$i = \frac{F_m\phi_l}{F_l} - 1$$

we observe that the rate of real interest is the nearer zero the nearer the

<sup>1</sup> The term "real" is used here, as in the word "real capital," in distinction to "monetary." The word "saving" means creation of *additional* real capital. It does not include the mere maintenance of the existing real capital.

<sup>2</sup> *The Distribution of Wealth*, New York, 1899, pp. 184-6.

<sup>3</sup> *Lectures on Political Economy*, vol. I, London, 1935, p. 156.

<sup>4</sup> Wicksell gives the definition : "Interest is the difference between the marginal productivity of saved-up labour and land and of current labour and land" (*Lectures*, vol. I, p. 154). We use the expression indirect labour, instead of Wicksell's term "saved-up labour," in order to avoid the appearance as if it were necessary that real capital is produced by labour alone without the co-operation of some quantity of real capital (equipment), too. Production function (2) shows clearly that no such assumption is involved in our analysis.



expression  $\frac{F_m\phi_l'}{F_l}$  is to unity. Now, this expression approaches unity the more the expression  $F_m\phi_l' - F_l$ , which is the marginal *net* productivity of indirect labour, approaches zero. We have seen that, in a certain neighbourhood of the maximum position, the marginal *net* productivity of indirect labour decreases as the distribution of labour resources between direct and indirect labour approaches the distribution maximising net output. The rate of real interest, or still better the discount factor  $1+i$ , may thus serve as an index of the distance of the actual allocation of the labour resources from the allocation producing maximum net output.<sup>1</sup>

## 6. CONDITIONS OF MAXIMUM PROFIT

Having studied the conditions of maximum net output, which are independent of the institutional framework in which production goes on, we now pass to the study of a capitalist enterprise economy.<sup>2</sup> A capitalist enterprise economy works with prices and the producers, who are here called entrepreneurs, do not aim at a maximum net output but at a maximum profit in terms of money instead. By the word profit net profit is understood, of course. If net output is maximised in a capitalist enterprise economy, this is but an incidental result of the profit pursuing activities of the entrepreneurs. We shall restrict our study here to the case where free competition subsists among entrepreneurs. By free competition we mean the fulfilment of the following two conditions: First, the number of entrepreneurs must be large enough, so that no one separately can affect prices appreciably by varying the quantity of his output. Thus the prices given in the market are regarded by each entrepreneur as parameters independent of his behaviour. Second, there must be free entry of new entrepreneurs into the industry, which leads to prices being equal to average cost in long-period equilibrium. It is chiefly the first condition of free competition we shall make use of. The second condition will be needed only for one special purpose.

Let us imagine our enterprise economy as consisting, like the economic system considered, of the production of wood which is carried out with the aid of equipment (axes) and of labour. Further, the equipment is produced with labour and other equipment of the same kind (as axes are produced with labour co-operating with other axes). Finally, the total amount of labour

<sup>1</sup> It may serve as such index, however, only in the interval in which the marginal *net* productivity curve of indirect labour declines monotonously. But as has been already pointed out, the production functions may be generally expected to be shaped so that the marginal productivity curve satisfies this condition for a rather large interval. Outside of this interval, the marginal *net* productivity curve of indirect labour may have a rising branch, and it might be misleading to use the rate of interest as such index.

<sup>2</sup> Strictly speaking, most of our conclusions hold for any economic system working with a price system, and thus hold also for a socialist economy. Only in a socialist economy the price of labour (i.e. the wage rate) appearing in our equations would have to be interpreted as the imputed wages used for purposes of accounting and would not necessarily correspond to an actual share in the personal distribution of income. Therefore, our conclusions concerning the relations between monetary saving and real saving (cf p. 183) would need some modification if applied to a socialist economy.

resources is assumed to be either constant or to be a function of wages. The system being now an enterprise economy, wood and axes are produced by entrepreneurs whose aim is to obtain a maximum profit. We assume that the finished commodity (wood) and equipment (axes) are produced by different entrepreneurs, the producers of equipment selling the part of their output not needed in their own industry to the producers of the finished commodity. To secure free competition, the number of entrepreneurs must be large, both in the industry producing the finished commodity and in the industry producing equipment. However, in order to simplify the exposition we assume that each of the two industries consists of but one firm which works exactly *as if* under free competition. Thus we have only one firm producing the finished commodity and only one firm producing equipment. We shall call them briefly firm I and firm II. This assumption, though admittedly extremely unrealistic, simplifies the exposition considerably, and a transition to the more realistic case of many firms engaged in each of the two industries presents no difficulty whatever.<sup>1</sup>

We have a production function for firm I which is :

$$x = F(m, l) \dots\dots\dots (1)$$

and a production function for firm II :

$$m+m' = \phi(m', l') \dots\dots\dots (2)$$

all the symbols having the same meaning as before. All the physical quantities involved are understood as per unit of time. The equipment is assumed to wear out completely in a unit of time and the delay period in both firms is assumed to be fixed and equal to one unit of time, too. The production of the finished commodity and of equipment is assumed to be perfectly synchronised.

We have further, either the equation :

$$l+l' = L \dots\dots\dots (3)$$

where  $L$  is a constant, or, if the labour resources are not fixed but their supply depends on wages, we have the equation :

$$l+l' = \psi(p_l) \dots\dots\dots (3a)$$

instead, where  $p_l$  is the wage rate per unit of time and  $\psi$  is the supply function of labour.

As further data we have the price  $p_x$  of the finished commodity (wood), the price  $p_m$  of equipment (axes), and the price  $p_l$  of labour (i.e. the wage rate per unit of time). Free competition being assumed, the price of equipment and the price of labour are the same for the finished commodity producing and for the equipment producing industry. All prices are considered by the entrepreneurs as independent of their individual behaviour.

Our problem is to find for each of our two firms the method of production

<sup>1</sup> We might also do without this assumption by interpreting the production functions (1) and (2) as referring each to a whole industry, instead of to a single firm. These production functions would then have to be interpreted as the sums of the production functions of all the firms in a given industry. But in such case we would have, to avoid unnecessary technical complication, to maximise profit for a whole industry, instead of for a single firm. Though under free competition this leads to the same result, it is equally unrealistic. The reader is free to choose whichever interpretation of our equations he prefers.

which maximises its profit, i.e. we have to determine  $m$  and  $l$  so as to maximise the profit of firm I and to determine  $m'$  and  $l'$  so as to maximise the profit of firm II.

The profit  $\pi$  of firm I is :

$$\pi = x p_x - m p_m - l p_l \dots\dots\dots (4)$$

and similarly the profit  $\pi'$ , of firm II is :<sup>1</sup>

$$\pi' = (m + m') p_m - m' p_m - l' p_l \dots\dots\dots (5)$$

We find the method of production yielding the maximum profit for firm I from the equations :

$$\frac{\partial \pi}{\partial m} = F_m p_x - p_m = 0$$

$$\frac{\partial \pi}{\partial l} = F_l p_x - p_l = 0$$

and similarly for firm II :

$$\frac{\partial \pi'}{\partial m'} = \phi_{m'} p_m - p_m = 0$$

$$\frac{\partial \pi'}{\partial l'} = \phi_{l'} p_m - p_l = 0$$

These equations can be also written in the following form :

$$p_m = F_m p_x \dots\dots\dots (6)$$

$$p_l = F_l p_x \dots\dots\dots (7)$$

$$1 = \phi_{m'} \dots\dots\dots (8)$$

$$p_l = \phi_{l'} p_m \dots\dots\dots (9)$$

The economic interpretation of equation (8) has been already discussed (cf. p. 162 above). The other equations express the well-known proposition that the price of each factor of production is equal to the value of its marginal product.<sup>2</sup>

We have seven independent equations, i.e. (1), (2), (3) or (3a), (6), (7), (8) and (9), which serve to determine the seven unknowns  $m$ ,  $l$ ,  $m'$ ,  $l'$ ,  $x$ ,  $p_m$  and  $p_l$ . The price  $p_x$  of the finished commodity is determined from outside of the system, for which it is a datum. To determine  $p_x$  we need an additional equation, for instance, a demand function connecting  $p_x$  and  $x$ , or an equation stating that for firm I marginal cost equals average cost.

From equations (6)-(9) the prices  $p_m$  and  $p_l$  can be eliminated. We have from (7) and (9) :

$$\phi_{l'} p_m = F_l p_x$$

Substituting (6) into this expression and dividing both sides by  $p_x$  we arrive at :

$$F_m \phi_{l'} = F_l \dots\dots\dots (10)$$

<sup>1</sup> The profit of firm II may also be written in the form :

$$\pi' = m p_m - l' p_l$$

However, the more explicit cost account indicated in (5) will prove to be of importance later.

<sup>2</sup> Unless explicitly stated otherwise, by marginal product the marginal *physical* product is meant throughout this paper.

If prices are eliminated, the equations (6)–(9) reduce to the two equations (8) and (10) which are identical with the two equations expressing the conditions of maximum net output (cf. equations (4) and (5) on p. 161). Thus the production of the finished commodity is a maximum with the methods of production which maximise the profit of firm I and of firm II simultaneously. It follows especially from (10) that firm I and firm II *obtain simultaneously their maximum profit when the marginal productivity of indirect labour is equal to the maximum productivity of direct labour.*

## 7. THE FUNCTION OF MONEY CAPITAL

The equations obtained in the preceding paragraph determine the methods of production which maximise the profit of each of our two firms. These methods of production impose on each of the firms to produce a certain optimum output with an optimum combination of the factors of production. To do this each firm must employ a certain optimum amount of factors of production, namely, such amount of each factor as makes the value of its marginal product equal to its price. However, in order to employ such amount of each factor a firm needs a certain amount of money (or, rather, purchasing power). Thus if the optimum method of production imposes the employment of 100 axes and 100 workers per annum, and if the price of an axe is £10 and the yearly wages of a worker are £100, the firm needs a total sum of £11,000 per annum to buy factors of production. Supposing that the wood is sold at the end of the year, the sum of £11,000 is returned, but must be reinvested again. If production is to go on continuously the sum of £11,000 must be kept constantly invested. The fulfilment of the equations of the preceding paragraph presupposes then that the firms are able to procure the sum of money (purchasing power) necessary to purchase the optimum amount of factors of production.

If a firm would not be able to procure the sum of money necessary to purchase the optimum amount of factors of production it could not pursue the best method of production. We shall call the sum of money (i.e. purchasing power) available to a firm for constant investment in (i.e. for the recurrent purchase of) factors of production its *money capital*.<sup>1</sup> The function of money capital is to enable entrepreneurs to purchase factors of production. Money capital is, so to speak, a general "command over means of production."<sup>2</sup> A firm can pursue the best method of production, consisting in employing the amounts of factors of production which equalise the value of the marginal product of a factor and its price, only if it has a sufficient quantity of money capital. If the amount of money capital at the disposal of a firm is not sufficient

<sup>1</sup> It might be better to use the term "numéraire capital" since the specific problems imposed by money creation are ruled out from this investigation. Our term "money capital" corresponds exactly to what is meant by "capital disposal" in the terminology of Cassel, or what might also be called the accumulated savings at the disposal of the entrepreneurs, i.e. the *purchasing power* of which the entrepreneurs dispose to buy factors of production. However, the term "money capital" ought to be more appropriate on account of its direct connotation of the corresponding phenomenon in business practice. It ought only be kept in mind that money is assumed to behave here like a "numéraire," i.e. to be "neutral."

<sup>2</sup> Cf. Schumpeter, *The Theory of Economic Evolution*, Cambridge, Mass., 1934, pp. 116–7.

for this purpose we shall say that the firm suffers from a shortage of money capital.

Our next problem is to investigate the effect of a shortage of money capital on the method of production employed by a firm. For this purpose let us consider firm I and let us assume that the money capital at the disposal of this firm is  $\kappa$ . Thus the firm is not quite free to choose its method of production, for methods of production requiring a money capital larger than  $\kappa$  are not accessible to the firm. Making the best choice it can, the firm will choose the method of production which yields the maximum profit under the provision that the quantity of money invested in the purchase of factors of production is equal to  $\kappa$ , i.e. under the provision :

$$m\phi_m + l\phi_l = \kappa \dots\dots\dots (11)$$

where  $\kappa$  is a constant. Our problem is thus to determine the conditions of maximum profit subjected to the supplementary condition (11). Using the method of Lagrange multipliers this reduces to determining the conditions maximising the expression :

$$\pi - \lambda\kappa = x\phi_x - m\phi_m - l\phi_l - \lambda(m\phi_m + l\phi_l) \dots\dots\dots (12)$$

where  $\lambda$  is a Lagrange multiplier.

The expression (12) may be written in the more convenient form :

$$\pi - \lambda\kappa = x\phi_x - m\phi_m(1 + \lambda) - l\phi_l(1 + \lambda) \dots\dots\dots (12a)$$

The method of production maximising the expression (12a) is found from the equations :

$$\frac{\partial(\pi - \lambda\kappa)}{\partial m} = F_m\phi_x - \phi_m(1 + \lambda) = 0$$

$$\frac{\partial(\pi - \lambda\kappa)}{\partial l} = F_l\phi_x - \phi_l(1 + \lambda) = 0$$

Similarly, assuming that firm II has but a limited amount  $\kappa'$ , of money capital at its disposal the maximisation of its profit is subjected to the supplementary condition :

$$m'\phi_m + l'\phi_l = \kappa' \dots\dots\dots (13)$$

where  $\kappa'$  is a constant, and our problem becomes to maximise the expression :

$$\pi' - \lambda'\kappa' = (m + m')\phi_m - m'\phi_m(1 + \lambda') - l'\phi_l(1 + \lambda') \dots\dots\dots (14)$$

which leads to the equations :

$$\frac{\partial(\pi' - \lambda'\kappa')}{\partial m'} = \phi_{m'}\phi_m - \phi_m(1 + \lambda') = 0$$

$$\frac{\partial(\pi' - \lambda'\kappa')}{\partial l'} = \phi_{l'}\phi_m - \phi_l(1 + \lambda') = 0$$

where  $\lambda'$  is a Lagrange multiplier.

The equations expressing the maximum conditions may be written in the following form :

$$\phi_m = \frac{F_m\phi_x}{1 + \lambda} \dots\dots\dots (15)$$

$$p_l = \frac{F_l \phi_x}{1 + \lambda} \dots \dots \dots (16)$$

$$1 = \frac{\phi_m'}{1 + \lambda'} \dots \dots \dots (17)$$

$$p_l = \frac{\phi_l' \phi_m}{1 + \lambda'} \dots \dots \dots (18)$$

The equations (15)–(18), together with the equations (1), (2), (3) or (3a), and with the equations (11) and (13), are nine in number. The number of unknowns is seven, viz.  $m, l, m', l', x, p_m$  and  $p_l$ . There are thus two equations in excess of the number of unknowns which serve to determine the Lagrange multipliers  $\lambda$  and  $\lambda'$ .

Thus if the choice of the best method of production is restricted by a shortage of money capital the equations (6)–(9) of the preceding paragraph have to be replaced by the equations (15)–(18).

8. THE INTEREST ON MONEY CAPITAL.

The last equations obtained need an economic interpretation. For that purpose the economic meaning of the Lagrange multipliers  $\lambda$  and  $\lambda'$ , which are until now mere mathematical symbols, must be found out. To do this we must investigate the effect of a change of the quantity of money capital at the disposal of a firm on the profit obtained by the firm.

Let us first consider firm I. We have from (4) :

$$d\pi = p_x dx - p_m dm - p_l dl \dots \dots \dots (19)$$

We have also from (1) :

$$dx = F_m dm + F_l dl$$

Substituting this relation into (19) we get :

$$d\pi = (F_m p_x - p_m) dm + (F_l p_x - p_l) dl$$

Equations (15) and 16) yield :

$$F_m p_x = (1 + \lambda) p_m$$

$$F_l p_x = (1 + \lambda) p_l$$

Taking this into account we arrive at :

$$d\pi = [(1 + \lambda) p_m - p_m] dm - [(1 + \lambda) p_l - p_l] dl$$

or :

$$d\pi = \lambda (p_m dm + p_l dl)$$

But we have from (11),  $\kappa$  being now assumed as variable :

$$p_m dm + p_l dl = d\kappa \dots \dots \dots (20)$$

and, therefore :

$$\lambda = \frac{d\pi}{d\kappa} \dots \dots \dots (21)$$

The right-hand side of this expression is the marginal rate of increase of profit due to an increase of the quantity of money capital at the disposal of the firm. An increase of the amount of money capital available to the firm enables the firm to choose a better method of production and  $\frac{d\pi}{d\kappa}$  is the rate of increase of profit, it might be called the *marginal profitableness of money capital*. If the firm could borrow an additional amount  $\Delta\kappa$  of money capital it would be ready to pay for it any sum up to  $\frac{d\pi}{d\kappa}\Delta\kappa$  as interest, for so much is the increase of profit obtained due to an increase  $\Delta\kappa$  of the firm's money capital. And if the firm is but one of many competing for the borrowing of additional money capital it must pay as much;  $\frac{d\pi}{d\kappa}$  is then the rate of interest paid for money capital. The Lagrange multiplier  $\lambda$  is thus *the rate of interest on the money capital employed by firm I*.

In a quite similar way it is shown that :

$$\lambda' = \frac{d\pi'}{d\kappa'} \dots\dots\dots (22)$$

i.e. the marginal profitableness of the money capital invested by firm II. Or in other words : the Lagrange multiplier  $\lambda'$  is the rate of interest on the money capital employed by firm II.

In view of this economic interpretation of the Lagrange multipliers we are going to modify somewhat our assumption concerning the quantity of money capital. Instead of assuming that each firm has a fixed amount of money capital at its disposal we assume now that it is not the quantity of money capital available to each firm separately, but the total amount of money capital in the whole economic system which is fixed and constant. We have, then, in our case the equation :

$$\kappa + \kappa' = K \dots\dots\dots (23)$$

where  $K$  is a constant. Each firm may draw from this total fund of money capital as much as it wants, provided it pays the interest. If free competition subsists both among the firms and among the lenders of money capital the total fund of money capital is distributed among the firms so that each firm pays the same rate of interest and, therefore, the marginal profitableness of money capital is the same for each firm. Thus we have in our case :

$$\lambda = \lambda' \dots\dots\dots (24)$$

i.e. the rate of interest on money capital is the same for firm I and for firm II. By adding the equations (23) and (24) to our former set of nine equations we can determine the two additional unknowns  $\kappa$  and  $\kappa'$ .

Thus the Lagrange multipliers  $\lambda$  and  $\lambda'$  are equal. The economic interpretation of the formulae (15), (16) and (18) is now obvious. They state the well-known proposition that *the prices of the factors of production are equal to the discounted value of their marginal product*.<sup>1</sup> From formula (17) it will be

<sup>1</sup> Cf. Taussig, *Principles of Economics*, third edition, New York, 1921, Vol. II, p. 217.

observed that the marginal productivity of the circular factor  $m'$  is no more constant but depends on the rate of interest. This is explained by the fact that because of the shortage of money capital firm II might, instead of reinvesting the full amount of  $m'$ , which makes its marginal *net* productivity zero, sell a part of it and by doing so increase its money capital and its profit. This possibility changes the circular factor  $m'$  into a genuine cost element with respect to the rate of interest.

We have deduced the interest on money capital from a shortage of money capital which does not permit all firms to engage simultaneously in the best method of production, i.e. in the method which equalises the value of the marginal product of each factor and its price. This way of treating the problem of interest shows clearly the place of interest in the equations of the theory of production. It shows that the equations of the traditional theory of production are based on the tacit assumption that there is always available the money capital necessary to enable all firms to choose the best method of production. If this assumption is replaced by the assumption that the amount of money capital available to a firm, or available in the whole economic system, is short of this requirement, the maximisation of profit is subjected to a restriction and the rate of interest on money capital is a result of this restriction. Our treatment of the problem has the merit of *deducing* the rate of interest on money capital from the equations of the theory of production, instead of introducing it into these equations from outside, as is done by all mathematical economists.

#### 9. INTEREST ON MONEY CAPITAL AND REAL INTEREST.

We have now to analyse the relation between the marginal profitableness of money capital and the marginal *net* productivity of real capital, i.e. the relation between interest on money capital and real interest. There is an obvious analogy between them: as the rate of real interest is an index of the distance of the allocation of the original resources from the allocation maximising net output of the economic system, so the rate of interest on money capital is an index of the distance of the methods of production actually employed from the methods of production which maximise profit for all firms simultaneously. However, this analogy requires some further investigation.

Remembering that  $\lambda' = \lambda$ , let us eliminate from equations (15), (16) and (18), the prices  $p_m$  and  $p_l$ . We have from (16) and (18):

$$\frac{F_l p_x}{1 + \lambda} = \frac{\phi_l' p_m}{1 + \lambda}$$

and substituting (15) into this expression, dividing both sides by  $p_x$  and multiplying them both by  $1 + \lambda$  we get:

$$F_l = \frac{F_m \phi_l'}{1 + \lambda} \dots \dots \dots (25)$$

This equation corresponds to equation (10), which holds when there is no shortage of money capital. Equation (25) states that *the marginal productivity*



of direct labour is equal to the discounted marginal productivity of indirect labour. From (25) we deduce directly :

$$\lambda = \frac{F_m \phi_l' - F_l}{F_l} \dots\dots\dots (26)$$

Now, the right-hand side of this expression is nothing else but the rate of real interest (cf. formula (11) on p. 169). We arrive thus to the result that *the rate of interest on money capital is equal to the rate of real interest*. In other words : the marginal profitableness of money capital is equal to the ratio of the marginal net productivity of indirect labour (or of real capital) to its marginal cost.

This rather surprising result shows that a shortage of money capital affects the allocation of labour resources so as to allocate less of them to the indirect use than is required to maximise net output, and more of them into the direct use.

10. MONEY CAPITAL AND REAL CAPITAL.

The equality of the rate of interest on money capital and of the rate of real interest, which in the preceding paragraph has merely been deduced mathematically, needs some further explanation in economic terms. For that purpose we need a more detailed investigation into the mutual relationship between money capital and real capital. The word real capital is used as an alternative name for the equipment co-operating with labour. In our case  $m+m'$  is the amount of real capital employed in the economic system. Money capital is the amount of money invested in the purchase of *both* equipment *and* labour. The quantity of money capital is thus larger than the value of real capital employed in production. If  $\kappa = m\phi_m + l\phi_l$  is the money capital invested by firm I and  $\kappa' = m'\phi_m + l'\phi_l$  is the money capital invested by firm II the total money capital in our economic system is :

$$K = (m+m')\phi_m + (l+l')\phi_l \dots\dots\dots (27)$$

while the value of the real capital employed in production is only  $(m+m')\phi_m$ .

The distinction between money capital and real capital corresponds to the familiar distinction between capital in terms of "advances" or of "subsistence fund" on one side and capital in terms of "tools and materials" (Marshall's "instrumental capital"<sup>1</sup>) or "intermediate products" on the other side. However, as these terms are somewhat nebulous we prefer to speak simply of money capital as a sum of money invested in the purchase of factors of production and of real capital as a mere alternative term to denote equipment co-operating with labour in production.<sup>2</sup>

Money capital, providing for the entrepreneurs a general "command over means of production," is invested in the purchase of both real capital and

<sup>1</sup> Cf. Marshall, *Principles of Economics*, Eighth edition, London, 1920, p. 75.

<sup>2</sup> For our part we should like to reserve the word capital entirely for the designation of money capital and use for the designation of real capital only a word like equipment, means of production, etc. This would avoid much confusion. However, we keep here the term real capital because it is our purpose to study the relationship of two approaches to the interest problem, one of which uses generally the term real capital, while the other uses the term money capital, "advances," etc.

labour. In view of this it seems, at first glance, rather astonishing that a shortage of money capital ought to be accompanied always by a reduction of the employment of real capital which makes the marginal productivity of indirect labour to exceed the marginal productivity of direct labour, and thus to create a positive marginal *net* productivity for real capital. Money capital being used to purchase both real capital and labour it seems strange, indeed, why especially the employment of real capital should be reduced because of a shortage of money capital.<sup>1</sup> And it seems even more astonishing that the rate of interest on money capital should be exactly equal to the rate of real interest, as has been deduced from our equations. However, this coincidence between a shortage of money capital and the reduction of employment of real capital becomes clear upon closer analysis.

In the pricing process of factors of production the marginal productivity of direct labour is discounted only once. We have the equation :

$$p_l = \frac{F_l p_x}{1+\lambda} \dots\dots\dots (16)$$

But the marginal productivity of indirect labour (in terms of the finished commodity) is discounted twice : once when the labour is used in the production of equipment and another time when equipment is used in the production of the finished commodity. We have :

$$p_l = \frac{\phi_l' p_m}{1+\lambda} \dots\dots\dots (18)$$

and because of :

$$p_m = \frac{F_m p_x}{1+\lambda} \dots\dots\dots (15)$$

we get finally :

$$p_l = \frac{F_m \phi_l' p_x}{(1+\lambda)^2} \dots\dots\dots (18a)$$

From (16) and (18a) we get :

$$F_l = \frac{F_m \phi_l'}{1+\lambda} \dots\dots\dots (25)$$

i.e. the statement that the marginal productivity of direct labour is equal to the discounted marginal productivity of indirect labour.

What is the economic meaning of the double discounting of the marginal productivity of indirect labour ? It is assumed in our study that the production of equipment and the production of the finished commodity take one unit of time each. Thus a shortage of money capital affects the "command over means of production" twice through the production of equipment, while it affects it only once through the production of the finished commodity, for the production of the finished commodity and of equipment, though synchronised,

<sup>1</sup> It may be noted that under our assumption of the real capital wearing out completely in a unit of time this consists entirely of circulating capital. If the real capital were fixed capital it would be clear immediately that a shortage of money capital affects real fixed capital differently than direct labour.

are, so to speak, one on the top of the other in so far as the circular flow of money capital is concerned. A shortage of money capital at the disposal of the firms producing equipment increases the cost (and consequently the prices of equipment) by preventing the firms from using the best method of production. Thus, the firms producing the finished commodity are affected not only by their own shortage of money capital, but also by the shortage of money capital in the equipment producing industry which raises the price of equipment. In our example, the money capital invested in the production of axes bears interest during one year. But the axes used in the production of wood accumulate interest on their value during the year they are used in producing wood. Thus the money capital invested in the production of axes bears interest during two years while the money capital invested in the payment of wages bears interest only during one year. This explains why a shortage in money capital causes a shift of the labour resources towards their direct use and why any decrease of the marginal profitableness of money capital results in a shift of labour resources towards the indirect use, causing a corresponding diminution of the marginal *net* productivity of indirect labour. The equations (16) and (18a) explain the price mechanism through which this shift is effected. At any given moment the amounts of factors, and hence, their marginal productivities, are constant, since it takes some time to change them. Regarding  $F_l$ ,  $F_m$  and  $\phi_l$  as constant for the moment, the immediate effect of a change in the rate of interest on money capital is to change the wage-rate paid by the equipment producing industry more than the wage-rate paid by the industry producing the finished commodity. This leads to a shift of labour from one industry to the other, until the wage-rate is the same in both, and causes also a change of the relative prices of equipment and labour.

Let us see what the ultimate effect of a change in the rate of interest on the relative prices of equipment and of labour is. From (15) and (16) we have :

$$\frac{\dot{p}_l}{\dot{p}_m} = \frac{F_l}{F_m} \dots\dots\dots (28)$$

An increase in the rate of interest leads to less labour being invested indirectly and more being invested directly. It follows from (28) :

$$\frac{\partial}{\partial i} \left( \frac{\dot{p}_l}{\dot{p}_m} \right) = \frac{F_{ll}F_m - F_{ml}F_l}{F_m^2} \dots\dots\dots (29)$$

which expression is always negative when  $F_{ml} \geq 0$  and may be positive, in a certain case, when  $F_{ml} < 0$ , i.e. when both factors are competing. By putting  $\dot{p}_m = \text{constant}$  we see that this case is the same as that in which the demand for direct labour is an increasing function of its price. This case being disregarded, *wages fall when the rate of interest increases*, and vice versa. An increase of the rate of interest, by diminishing the demand for indirect labour invested, leads to a decrease of the equipment available. Thus, by a similar procedure, and excluding the case where the demand for equipment is an increasing function of its price, we arrive at the result that *the price of equipment (real capital) varies in the opposite direction from wages*.

Because of  $\lambda = \lambda'$  we have :

$$\lambda = \frac{d\pi}{d\kappa} = \frac{d\pi'}{d\kappa'} \dots\dots\dots (30)$$

From the second order maximum conditions for profit it follows that in a certain neighbourhood of the maximum profit point we have :

$$d^2\pi < 0 \text{ and } d^2\pi' < 0 \dots\dots\dots (31)$$

and hence :

$$\frac{d\lambda}{d\kappa} = \frac{d^2\pi}{d\kappa^2} < 0 \dots\dots\dots$$

and

$$\frac{d\lambda}{d\kappa'} = \frac{d^2\pi'}{d\kappa'^2} < 0 \dots\dots\dots \left. \vphantom{\frac{d\lambda}{d\kappa}} \right\} (31a)$$

From (31a) and from :

$$K = \kappa + \kappa' \dots\dots\dots (23)$$

we arrive at :

$$\frac{d\lambda}{dK} = \frac{I}{\frac{d\kappa}{d\lambda} + \frac{d\kappa'}{d\lambda}} < 0 \dots\dots\dots (32)$$

*i.e. the rate of interest decreases as the total amount of money capital increases.<sup>1</sup> Therefore, in general, wages increase and the price of equipment decreases when money capital becomes more abundant.*

II. MONEY CAPITAL AND THE SCALE OF OUTPUT

To investigate the function of money capital with respect to the scale of output of a firm we need to make use of the second condition of free competition consisting in the possibility of free entry of new firms into an industry. This possibility leads in the long run to the equality of marginal and average cost. However, as a shortage of money capital brings it about that interest is paid on money capital, it is the *accumulated* marginal and average cost which is to be equal.

The accumulated marginal cost of firm I is :

$$\frac{(\hat{p}_m dm + \hat{p}_l dl)(I + \lambda)}{dx} \dots\dots\dots (33)$$

From (1) we have :

$$dx = F_m dm + F_l dl$$

and from equations (15) and (16) :

$$F_m = \frac{\hat{p}_m (I + \lambda)}{\hat{p}_x}$$

<sup>1</sup> Generally we may expect the production functions to be shaped so that the relation (31) holds for some larger interval and therefore relation (32) must hold for some larger interval, too.

$$F_l = \frac{p_l (1+\lambda)}{p_x}$$

Substituting these two relations into the preceding one we get :

$$dx = \frac{1+\lambda}{p_x} (p_m dm + p_l dl)$$

and by substitution of this into (33) the accumulated marginal cost becomes :

$$\frac{(p_m dm + p_l dl)(1+\lambda)}{dx} = p_x \dots\dots\dots (34)$$

The equation stating the equality of marginal and of average cost is thus :

$$\frac{(p_m dm + p_l dl)(1+\lambda)}{dx} = \frac{(m p_m + l p_l)(1+\lambda)}{x} = p_x \dots\dots\dots (35)$$

i.e. *accumulated marginal cost and (in long period equilibrium) average cost are equal to the price of the commodity.*<sup>1</sup>

Similarly the equation stating the equality of (accumulated) marginal and average cost for firm II is obtained :

$$\frac{(p_m dm' + p_l dl')(1+\lambda)}{dm + dm'} = \frac{(m' p_m + l' p_l)(1+\lambda)}{m + m'} = p_m \dots\dots\dots (36)$$

Remembering that :

$$p_m = \frac{F_m p_x}{1+\lambda} \dots\dots\dots (15)$$

$$p_l = \frac{F_l p_x}{1+\lambda} \dots\dots\dots (16)$$

and substituting this into (35) we get for firm I :

$$p_x = \frac{p_x (F_m m + F_l l)}{x}$$

whence the well-known equation :

$$x = F_m m + F_l l \dots\dots\dots (35a)$$

Similarly, by substitution of (17) and (18) into (36) we get for firm II :

$$m + m' = \phi_m m' + \phi_l l' \dots\dots\dots (36a)$$

Equations (35) and (36) show that the scale of output does not depend directly on the rate of interest, since the factor  $1+\lambda$  on both sides of the equations cancels. However, the scale of output does depend on the rate of interest indirectly. We have seen that the relative shortage or abundance of money capital, of which the rate of interest is an index, affects the price of labour and of equipment, and by doing so it affects the scale of output.

<sup>1</sup> By writing (34) and (35) in the form :

$$\frac{p_m dm + p_l dl}{dx} = \frac{m p_m + l p_l}{x} = \frac{p_x}{1+\lambda}$$

we may also say that simple (not accumulated) marginal and average cost is equal to the *discounted* price of the commodity.

We have from equations (35) and (36) :

$$m\phi_m + l\phi_l = \frac{x\phi_x}{1+\lambda}$$

$$m'\phi_m + l'\phi_l = \frac{(m+m')\phi_m}{1+\lambda}$$

Adding these two expressions and taking into account that

$$(m+m')\phi_m + (l+l')\phi_l = K \dots\dots\dots (27)$$

i.e. the total money capital in our economic system, we arrive at :

$$K = \frac{x\phi_x + (m+m')\phi_m}{1+\lambda} \dots\dots\dots (37)$$

The formula obtained states that *the total money capital is equal to the discounted value of the gross product of the economic system.*

From (27) we have :

$$(m+m')\phi_m = K - (l+l')\phi_l$$

Taking this into account we can write (37) :

$$(1+\lambda)K = x\phi_x + K - (l+l')\phi_l$$

whence :

$$(l+l')\phi_l + \lambda K = x\phi_x \dots\dots\dots (38)$$

i.e. *the value of the net product of the economic system is distributed wholly between wage and interest payments.*

## 12. MONETARY SAVING AND REAL SAVING.

Our discussion of the relation of money capital and real capital showed that an increase of the quantity of money capital is always accompanied by an increase of the amount of real capital employed in production. It was shown that the rate of interest on money capital decreases as money capital becomes more abundant. But as the rate of interest on money capital is equal to the rate of real interest the marginal productivity of indirect labour decreases relatively to the marginal productivity of direct labour, which means an increase of real capital. Money creation being ruled out from our study, the only way to increase the quantity of money capital is through saving. Thus *any monetary saving is accompanied by real saving*, i.e. by an increase in the amount of real capital employed in production. The latter leads to an increase of the net output of the economic system.

It might seem, at first glance, that the amount of monetary saving must be equal to the money value of the real saving performed and that the rate of interest is equal to the value of the marginal increase of the net output due to the increase of money capital. However, this is not so, if we consider the whole economic system. An increase of money capital in the whole economic system changes the prices of real capital goods (equipment) and of labour. As the marginal productivity of direct labour increases relatively to the

marginal productivity of indirect labour wages rise.<sup>1</sup> This rise of wages absorbs a part of the monetary saving.

Assuming that wages and the price of equipment change because of the increase of money capital, we have from (27) :

$$dK = p_m(dm + dm') + (m + m')d\phi_m + \rho_i(dl + dl') + (l + l')d\phi_l \dots\dots (39)$$

Our economic system is subjected to the condition :

$$l + l' = L \dots\dots\dots (3)$$

i.e. the total amount of labour resources is constant, or :

$$l + l' = \psi(\rho_i) \dots\dots\dots (3a)$$

i.e. the total amount of labour resources is a function of wages. In the first instance we have :

$$dl + dl' = 0$$

and in the second instance :

$$dl + dl' = \psi'(\rho_i)d\rho_i \dots\dots\dots (40)$$

where  $\psi'$  is the first derivative of the function  $\psi$ . The first instance is a particular case of the second when  $\psi'(\rho_i) = 0$ . Hence we shall consider the second instance as the more general case.

Substituting (40) into (39) we get :

$$dK = p_m(dm + dm') + (m + m')d\phi_m + [\rho_i\psi'(\rho_i) + (l + l')]d\rho_i \dots\dots (39a)$$

whence :

$$p_m(dm + dm') + (m + m')d\phi_m = dK - [\rho_i\psi'(\rho_i) + (l + l')]d\rho_i \dots\dots (39b)$$

The left-hand side of this formula is the money value of the real saving performed and is equal to the amount of monetary saving minus the part absorbed by an increase of the total wage bill.

From the fact that monetary saving results in an increase of wages and in a decrease of the rate of interest it follows that the rate of interest is *different* from (generally *less* than) the value of the marginal net product of money capital. Indeed, we have from (38) :

$$\lambda K = x p_x - (l + l')\rho_i$$

whence :

$$\lambda dK + Kd\lambda = p_x dx - [\rho_i\psi'(\rho_i) + (l + l')]d\rho_i$$

and finally :

$$\lambda = \frac{dx}{dK} p_x - \frac{[\rho_i\psi'(\rho_i) + (l + l')]d\rho_i}{dK} - \frac{Kd\lambda}{dK} \dots\dots\dots (41)$$

According to (32) it is :  $\frac{d\lambda}{dK} < 0$ . Thus the formula obtained states that the rate of interest is equal to the value of the marginal net product of money capital minus the marginal increase in the sum of wages plus the marginal decrease in the sum of interest payments.

<sup>1</sup> As can be seen from formula (29), there may be an exception to this rule. However, the formulae (39) and (41) hold generally,  $d\rho_i$  being the *change* in the wage-rate, whatever the sign of this change is.

The result that the rate of interest is smaller than the value of the marginal net product of money capital has been obtained substantially already by Wicksell.<sup>1</sup> This result throws some light on the relation of money capital to real capital. The rate of interest was found to be equal to the marginal *net* productivity of *real* capital, which is equal to the marginal *profitableness* of money capital. Both these quantities differ, however, from the value of the marginal net *product* of *money* capital.<sup>2</sup> The explanation of this divergence is simple. An increase of money capital increases the net product of the economic system only in so far as it leads to an increase of real capital. However, money capital is used to purchase not only real capital goods (equipment) but also labour. The increase in wages resulting from a transfer of labour from the direct to the indirect use absorbs a part of the money capital saved and causes real saving to be smaller than monetary saving. This effect is counteracted by the fall in the rate of interest releasing some money capital which has been hitherto used for interest payments and which can be now invested in the purchase of real capital.

### 13. THE PERIOD OF TURNOVER OF MONEY CAPITAL.

Up to now it has been assumed that the production of both the finished commodity and of equipment takes one unit of time each. Thus the money capital invested by each entrepreneur is returned after a unit of time and must be reinvested again. After a unit of time (a year, for instance) the commodity produced by the firm is ready and sold and the money capital invested is returned to the entrepreneur. We call the period after which the money capital is returned its *period of turnover*. Hitherto the period of turnover was assumed to be equal to one unit of time. This can be achieved always by a proper choice of the unit in which time is measured. However, in view of the fact that different industries may have periods of turnover of money capital of different duration, it will prove important to generalise our formulas so as to be valid for any choice of time units.

Let the period of turnover of the money capital invested by firm I be  $\Delta t$  units of time ( $\Delta t$  may also be a proper fraction), and let  $m$  and  $l$  be the amount of equipment and labour used *per unit of time* and  $p_m$  and  $p_l$  the prices of equipment and labour. The firm needs now a money capital equal to  $\Delta t(m p_m + l p_l)$  to be able to use the quantities mentioned of the factors of production, for a sum of money equal to  $m p_m + l p_l$  must be spent during each

<sup>1</sup> Cf. *Über Wert, Kapital und Rente*, reprinted London, 1933, p. 111 seq., and *Lectures*, vol. I, pp. 148, 150 and 180. Formula (41) corresponds to the formula given by Wicksell on p. 180. Cf. also Wicksell's paper on *Real Capital and Interest* (reprinted as an appendix to *Lectures*, Vol. I) p. 268 and pp. 291-93, and Gustaf Åkerman, *Realkapital und Kapitalzins*, fasc. I, Stockholm, 1923, pp. 152-3.

<sup>2</sup> Thus Wicksell's criticism of Thünen's statement that the rate of interest is equal to the marginal net product of a unit of capital (cf. the places quoted in the preceding note) suffers from some confusion. Thünen seems to have meant real capital (cf. *Der isolierte Staat*, Part II, Rostock, 1850, pp. 79 and 97-102) and the rate of interest, as we have seen, equals exactly the marginal *net* productivity of real capital. However, it does not equal the value of the marginal product of *money* capital, and Wicksell was the first to see this discrepancy, though his explanation is somewhat obscure.



unit of time to purchase factors of production, and as this sum will be returned only after a period of  $\Delta t$  units of time,  $\Delta t$  times that sum must be at the disposal of the firm in order to enable it to carry on production. Let  $x$  be the output per unit of time and  $\kappa$  be the money capital available to the firm. Firm I maximises its profit (per unit of time) now subject to the supplementary condition :

$$\Delta t(m\dot{p}_m + l\dot{p}_l) = \kappa \dots\dots\dots (42)$$

where  $\kappa$  is a constant.

Using the method of Lagrange multipliers this is equivalent to maximising the expression :

$$\pi - \lambda\kappa = x\dot{p}_x - m\dot{p}_m - l\dot{p}_l - \lambda\Delta t(m\dot{p}_m + l\dot{p}_l)$$

where  $\lambda$  is the Lagrange multiplier. Hence the equations :

$$\dot{p}_m = \frac{F_m\dot{p}_x}{1 + \lambda\Delta t} \dots\dots\dots (43)$$

$$\dot{p}_l = \frac{F_l\dot{p}_x}{1 + \lambda\Delta t} \dots\dots\dots (44)$$

Similarly for firm II, if  $\Delta t'$  is its period of turnover of money capital, we get the equations :

$$\phi_{m'} = 1 + \lambda'\Delta t' \dots\dots\dots (45)$$

$$\dot{p}_l = \frac{\phi_{l'}\dot{p}_m}{1 + \lambda'\Delta t'} \dots\dots\dots (46)$$

From (43) and (44), together with equations (1) and (42) we derive :

$$\lambda = \frac{d\pi}{d\kappa} \dots\dots\dots (47)$$

and similarly the relationship :

$$\lambda' = \frac{d\pi'}{d\kappa'} \dots\dots\dots (48)$$

is obtained. Thus  $\lambda$  and  $\lambda'$  is the rate of interest *per unit of time* on the money capital invested by firm I and firm II respectively. Free competition being assumed as well among the lenders as among the borrowers of money capital we have  $\lambda = \lambda'$ . Remembering this, we have from (43), (44) and (46) :

$$F_l = \frac{F_m\phi_{l'}}{1 + \lambda\Delta t'}$$

whence :

$$\lambda\Delta t' = \frac{F_m\phi_{l'} - F_l}{F_l} \dots\dots\dots (49)$$

Taking into account formulae (43)-(46) the formulas of the preceding paragraphs can be adjusted so as to make them independent of the unit of time chosen. In consequence of equation (42) and of a similar equation for firm II, equation (37) turns into :

$$\frac{K}{\Delta t} + \frac{K'}{\Delta t'} = \frac{x\dot{p}_x}{1 + \lambda\Delta t} + \frac{(m+m')\dot{p}_m}{1 + \lambda\Delta t'} \dots\dots\dots (37a)$$

The left-hand side of this equation can be interpreted as the amortisation quota per unit of time of the total money capital. Thus the discounted value of the gross output per unit of time is equal to the amortisation quota per unit of time of the total money capital. For  $\Delta t = \Delta t'$  equations (38) and (41) are deduced from (37a). If  $\Delta t = \Delta t'$  equations (38) and (41) have to be replaced by some more complicated ones.

#### 14. THE TIME DIMENSION OF INTEREST

The treatment of the problem of interest given here may seem rather paradoxical. We have deduced all the fundamental propositions of the theory of interest from the ordinary equations of the theory of production which are generally regarded as being "timeless" or "instantaneous."<sup>1</sup> It is, however, a commonplace that interest has a time dimension. How, then, could a quantity having a time dimension be deduced from equations which are timeless in character? The solution of the apparent paradox is simple. Our result simply shows that it is fallacious to consider the ordinary equations of the theory of production as timeless. The equations of the theory of production, as well as the other equations of the theory of economic equilibrium, are by no means timeless as a widespread opinion wants to have it. They all include time, though only implicitly, for all the physical quantities, and also profit and utility, entering into those equations are understood to be *per unit of time*. This has been shown already by Jevons' dimensional analysis<sup>2</sup> and has been repeated explicitly by Pareto.<sup>3</sup> The possibility of obtaining the fundamental propositions of the theory of interest from these equations shows clearly that they cannot be timeless.

Let  $T$  be the dimension of time and  $M$  be the dimension of a quantity of money. It can be shown immediately that the dimension of  $\lambda$  as deduced from our equations is  $T^{-1}$  which is the proper dimension of the rate of interest as already established by Jevons.<sup>4</sup> The definition of  $\lambda$  as the rate of interest on money capital is:

$$\lambda = \frac{d\pi}{d\kappa} \dots\dots\dots (21)$$

i.e. the marginal profitableness of money capital. The dimension of  $d\pi$  is the same as the dimension of profit  $\pi$ , i.e. a quantity of money per a certain period of time. The dimension of  $d\pi$  is thus  $MT^{-1}$ . The dimension of  $d\kappa$  is the same as the dimension of money capital  $\kappa$ , i.e.  $M$ , money capital being simply an amount of money.<sup>5</sup> The dimension of  $\frac{d\pi}{d\kappa}$  is, therefore,  $MT^{-1}M^{-1} = T^{-1}$ .

<sup>1</sup> Cf. for instance, Schneider, *Theorie der Produktion*, Wien, 1934, p. III and p. 2.

<sup>2</sup> Cf. *The Theory of Political Economy*, fourth edition, London, 1924, pp. 61-9. Cf. also Wicksteed's article on dimensions in *Palgrave's Dictionary of Political Economy*, vol. I, and a paper by the same writer: "On Certain Passages in Jevons' Theory of Political Economy," *Quarterly Journal of Economics*, Vol. III, 1889, p. 307 seq. Both papers of Wicksteed are reprinted in the second edition of *The Commonsense of Political Economy*, Vol. II, London, 1933.

<sup>3</sup> *Manuel d'économie politique*, second edition, Paris, 1927, p. 148.

<sup>4</sup> Loc. cit. p. 247-53.

<sup>5</sup> See Jevons, loc. cit. p. 233-5.

Similarly we obtain  $T^{-1}$  as the dimension of the rate of real interest. The definition of the rate of real interest is :

$$\lambda = \frac{F_m \phi' - F_l}{F_l} \dots \dots \dots (26)$$

and by transforming our equations so as to make them independent of the unit of time chosen we get, according to (49) :

$$\lambda = \frac{1}{\Delta t'} \cdot \frac{F_m \phi' - F_l}{F_l} \dots \dots \dots (49a)$$

where  $\Delta t'$  is the period turnover of the money capital. Let  $Q$  be the dimension of the finished commodity and  $R$  the dimension of labour. The marginal productivity of labour (direct or indirect) in terms of the finished commodity has the dimension  $QR^{-1}$ . Therefore, the expression  $\frac{F_m \phi' - F_l}{F_l}$  has the dimension  $QR^{-1} Q^{-1} R = 1$ . And from (49a) we deduce that the dimension of  $\lambda$ , i.e. the rate of interest per unit of time, is  $T^{-1}$ . This proper time dimension of the rate of interest is obscured in formula (26) in which time does not appear explicitly. However, recalling that formula (26) is but a particular case of formula (49a) if the unit of time is chosen so that  $\Delta t' = 1$ , it becomes clear that  $T^{-1}$  is the dimension of the rate of interest also according to formula (26).

The fact that the equations of the theory of production enable us to deduce a rate of interest of the dimension  $T^{-1}$  and all the fundamental propositions concerning interest, proves that those equations cannot possibly be timeless in the literal sense of the word. However, the general equations of the theory of production may justly be called "timeless" in another sense. Though time certainly enters implicitly into those equations<sup>1</sup> it does not enter into them as a variable. The delay period from the application of the factors of production to the receipt of the product, which is the technological basis determining the period of turnover of money capital, has been assumed as fixed and determined by technological considerations alone and the equipment used in production has been assumed to wear out completely during this delay period. Therefore, time, although it enters implicitly into our equations, does not enter into them as a variable, and in this sense, but only in this sense, they may be regarded as "timeless."<sup>2</sup>

<sup>1</sup> While discussing the period of turnover of money capital time was also introduced explicitly into our equations. However, this might have been avoided by choosing a unit of time equal to the period of turnover of money capital. Thus all the propositions deduced in this paper may be stated so as not to make time appear explicitly in the equations.

<sup>2</sup> This is true, however, only as far as the theory of interest is limited to the consideration of circulating capital. When fixed capital is considered time must be introduced explicitly as a variable into the equations of the theory of production. Similarly by assuming the delay period between the application of factors and the receipt of the product to be variable a generalisation of the equations of the theory of interest can be obtained. (Cf. the paper of Smithies quoted above on p. 159). But this does not change the fact that all the fundamental propositions of the theory of interest can be obtained without introducing time as a variable into our theory. Therefore, it is not possible to develop the whole theory of interest (with fixed capital and variable delay periods) without introducing time explicitly as a variable. But the fundamental propositions of the theory of interest with respect to circulating capital and the very concept of interest can be obtained without doing so.

The fundamental propositions of the theory of interest being obtained from a theory of production into which time does not enter *as a variable*, it follows that interest is not connected with time in any different way from the way in which the general theory of production is connected with time. Our deduction of the fundamental propositions of the theory of interest has shown that those propositions can be established without introducing time explicitly *as a variable* into our equations.<sup>1</sup> Not the introduction of time as a variable into the equations of the theory of production, but a *shortage of capital*, which affects the distribution of original resources (of labour in our case) between their direct and their indirect uses, is at the basis of the theory of interest. In a capitalist enterprise economy the shortage of capital is a shortage of money capital which is, as we have seen, always associated with a shortage of real capital. A shortage of money capital prevents entrepreneurs from carrying through the optimum scale and the optimum combination of factors of production and the shortage of real capital (equipment), which accompanies the former, prevents the marginal productivity of indirect labour from becoming equal to the marginal productivity of direct labour (or in other words: the marginal *net* productivity of real capital from being zero). The problem of interest is thus essentially a problem of allocation of resources between different uses. The maldistribution of resources consequent upon a shortage of capital arises also, as we have seen, when time does not enter *as a variable* into our problem. Time enters into the dimension of the rate of interest through the fact that the quantities entering into the production functions are conceived as per unit of time and that a delay period is supposed to exist between the application of factors of production and the receipt of the product. Thus time, though associated inseparably with the theory of interest, as with the whole theory of production, is not its outstanding feature. This rôle is reserved to the shortage of capital. When the shortage of capital disappears, so that the marginal productivity of indirect labour becomes equal to the marginal productivity of direct labour, interest vanishes, however much time the production process may take.

#### 15. SHORT PERIOD AND LONG PERIOD EQUILIBRIUM IN THE THEORY OF INTEREST

Our treatment of the interest problem in connection with a shortage of capital shows the real relationship between the theory of interest and the general theory of production. The general theory of production (called also, rather strangely, the theory of "non-capitalistic" production) presupposes that there is always available the amount of capital necessary to choose the

<sup>1</sup> Professor Robbins in his preface to the English translation of Wicksell's *Lectures on Political Economy*, vol. I, p. xiv, says: "The work of Pareto, valuable as it is in other respects . . . it would certainly be correct to say that there is no *time*. Now time is the essence of capital theory." That this sentence overlooks the time dimension contained implicitly in Pareto's theory of economic equilibrium follows not only from what has been said above, but can also be shown from quotations of Pareto himself. Cf. his *Manuel*, p. 148. That interest is not due to introducing time *as a variable* into the equations of the theory of production is established by the results obtained in this paper.

best method of production, i.e. the method which equalises the value of the marginal product of a factor and its price, and consequently equalises also the marginal productivity of indirect and of direct labour. It is a theory of production in a state of perfect *saturation* with capital. The theory of interest, on the other side, is a theory of production subject to a shortage of capital.

The existence of a possibility of saturation of production with capital follows from the maximum conditions. If the production functions are shaped so that a maximum of net output, or of profit, is possible at all, and only under such circumstances equilibrium is possible, the possibility of a saturation of production with capital follows directly. It follows from the existence of a position in which the marginal productivity of indirect labour is equal to the marginal productivity of direct labour. In this position the marginal *net* productivity of real capital is zero. It has been shown that in an enterprise economy a saturation with real capital is equivalent to a saturation with money capital. In such a situation all entrepreneurs use the best method of production possible at all, and have no use for further money capital. As the method of production cannot be improved (i.e. average unit costs cannot be lowered) by investing more money capital the only use entrepreneurs could make of it would be to build parallel establishments. But this would lead to an over-expansion of the industry. Since no reduction of costs can be obtained any more<sup>1</sup> and the industry is confronted with a given demand function, building new establishments would involve the industry in losses. These considerations expose the fallacy of the superstitious belief current among many economists, that there would be an infinite demand for money capital if the rate of interest were zero, or that a saturation with capital could be attained only when all commodities were to become free goods. It follows clearly from the theory of production that a saturation with capital is attained when the marginal productivity of indirect labour becomes equal to the marginal productivity of direct labour.

The relation between the general theory of production, which presupposes a saturation with capital, and the theory of interest, which is based on the assumption of a shortage of capital, is that between a theory of long-period equilibrium and a theory of short-period equilibrium. In the latter the amount of capital is assumed as fixed and interest is deduced from the assumption that this amount is less than the amount required to saturate production with capital. In the former the amount of capital is itself a variable to be determined by all the equations of economic equilibrium. In long-period equilibrium all adjustments are accomplished and the economic system becomes stationary. The rate of interest, being an index of the shortage of capital, is also an index of the distance of the actual state from a long-period equilibrium. There must be certainly always a tendency to approach that long-period equilibrium, for as long as the marginal productivity of indirect labour is greater than the marginal

<sup>1</sup> However, a reduction of average unit costs might be possible if external economies dependent on the total output of the industry existed. The existence of external economies would not move private entrepreneurs to enlarge their output, unless as a result of State intervention. But an appropriate State intervention might create, in such case, additional opportunities for profitable investment of capital. Then, at the point at which external economies cease, investment opportunities reach their definite limit.

productivity of direct labour an advantage is gained from a transfer of labour resources from the direct to the indirect use. In a capitalist enterprise economy this advantage consists in the possibility of increasing profit by investment of additional money capital. But an increase of capital, whether money capital or real capital, involves capital accumulation. *The accumulation of capital provides the bridge between short-period equilibrium and long-period equilibrium in the theory of interest.*<sup>1</sup>

The way towards a long-period equilibrium with regard to interest is necessarily a slow one. For capital accumulation adds per annum but a small fraction to the existing stock of capital. In a monetary system consisting of actual gold circulation any fall in the general price level is counteracted by the inducement it gives to an increase of gold production. But as the annual output of gold is but a small fraction of the existing stock of gold, any adjustment movements working through the mechanism just mentioned must be of a secular character. Similarly with capital accumulation. As the annual accumulation is but a small fraction of the existing stock of capital the movements towards a long-period equilibrium in interest must be of a secular character, too.<sup>2</sup> There may be also some checks (a positive time preference, e.g.) preventing capital accumulation from going on till a perfect equality of the marginal productivity of indirect and of direct labour (and thus a zero rate of interest) is attained. The study of the course of adaptation of interest to a long-period equilibrium is the subject of the theory of capital accumulation. Of the forces governing the accumulation of capital it depends whether the rate of interest reduces in long-period equilibrium actually to zero. However, the tendency towards saturation of production with capital is slowed down by the possibility of extending the durability of fixed real capital (equipment) used in production and of affecting output by varying the delay period between the application of factors of production and the receipt of the product.

<sup>1</sup> In order to avoid the possibility of terminological confusion the possible different significance of the distinction between short-period and long-period equilibrium ought to be kept in mind. (i) First, we have the original Marshallian distinction between short-period and long-period equilibrium with respect to the existence or non-existence of fixed cost items. This is the distinction at the basis of the difference of short-period and long-period cost curves (and supply curves) of a single firm. (ii) The second distinction between short-period and long-period equilibrium refers to whether the number of firms in an industry is regarded as fixed or whether it may be varied by the entry (or exodus) of firms into (or from) the industry. It is this type of long-period equilibrium we have in mind when maintaining that marginal cost must be equal to average cost. With this connotation the term long-period equilibrium was used above, where the equality of marginal and average cost was discussed. The cost curves we had then in mind were long-period cost curves in the meaning of the term as defined sub. (i). Mrs. Robinson proposes to use the words quasi-long-period and long-period equilibrium in the case sub. (ii). Cf. *The Economics of Imperfect Competition*, London, 1933, p. 47 and p. 85. (iii) Finally, we may distinguish between short-period and long-period equilibrium according to whether the amount of capital (money capital and real capital) is regarded as fixed or dependent on all the equations of economic equilibrium. We may call this type of long-period equilibrium, which is the long-period equilibrium fundamental for the theory of interest, the Ricardian long-period equilibrium. It is obvious that it is the Ricardian long-period equilibrium the adjustment to which takes the longest time. Though it is probable that generally the long-period equilibrium sub. (ii) requires a longer adjustment time than the long-period equilibrium sub. (i) it does not seem that such statement would hold always.

<sup>2</sup> It seems to us that the adjustment movements towards a long-period equilibrium with respect to capital accumulation and interest are closely related to the secular wavelike movements in the evolution of the capitalist system known under the name of Kondratief cycles, or "trend" cycles. However, an investigation of this relationship is a topic for a separate study.

If the extension of the durability of fixed real capital (i.e. durable equipment) follows a law of diminishing returns, as is only natural to assume, the point of saturation of production with capital is only farther removed, but still existent. For at a certain point the marginal advantage gained by extending the durability of the equipment must become equal to that gained by increasing the quantity of equipment while keeping its lifetime constant. This is the final saturation point, because a further extension of the durability of equipment does not pay. A saturation of production with capital might never be reached only if output could be increased indefinitely by lengthening the delay period, but this does not seem very probable. It is in the study of the effects of fixed capital and of the variability of the delay period that time has to be introduced explicitly as a variable into the equations of the theory of production.

*Ann Arbor, Michigan.*

OSKAR LANGE.

## BOOK REVIEWS

*Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, by Joseph A. Schumpeter. 2 vols. New York: McGraw-Hill Book Co. 1939. Vol. I: xvi, 448 pp.; vol. II: ix, 647 pp. \$10 for two volumes.

The scope of this book is indicated most clearly by its subtitle. It is intended to be a thorough-going and comprehensive study of economic evolution under capitalism. This evolution appears to the author as progressing in the form of successive business cycles; hence the main title of the book. By itself, however, the main title fails to do justice to the wide field covered. In intention and horizon Professor Schumpeter's book can be compared with *Das Kapital* of Karl Marx which set out to investigate the "law of motion" of capitalism (cf. vol. 1. Preface to the first edition) and found that "crises" play the pivotal role. This comparison is intended by the reviewer as highest praise. The difference between the two books is one of time of conception as well as of sociological emphasis.

More than seventy years have passed between the two books, years heavily loaded with developments in economic science and with historical experience. Marx wrote during the heyday of a vigorous and expansive capitalism. Although he admired its vigor and its revolutionizing effect upon the process of production, his main emphasis was upon its exploitative social aspects with which he was utterly out of sympathy. Professor Schumpeter writes at a time when capitalism (according to his own opinion) is in eclipse. His main emphasis is upon the creative genius of the innovating entrepreneur who appears as the motor force of the capitalist system. For this genius he betrays profound sympathy, and he submits rather melancholically to the recognition that its days of glory are fading into the historical past. The causes making for an eclipse of capitalism are also different in the two books. According to Marx, the end was to come about through a breakdown of the economic mechanism of capitalism (not all Marxists, however, shared this view and many were much nearer to the views expressed by Professor Schumpeter than to those of Marx). According to Professor Schumpeter, the eclipse is due to the fact that capitalism has developed social attitudes uncongenial to the functioning of its economic mechanism. Such attitudes result in policies which undermine the function of the creative entrepreneur and thus destroy the whole system. This point is only hinted at in the present book (vol. II, pp. 695 seq. and 1038 seq.), but it has been treated explicitly in other writings of Professor Schumpeter.<sup>1</sup>

The contents of the book can be classified into three parts: theoretical (chapters II-IV and parts of chapters VIII-XIII), statistical (chapter V and parts of chapters VIII-XIII), and historical (chapters VI, VII, XIV, XV). The theoretical chapters present a model of the process of capitalist evolution. This model is to serve as a working hypothesis. In the statistical chapters, the model is confronted with the reality of the most important economic time series and is amplified and expanded

with reference to the behavior of prices, physical quantities, national income and wages, deposits, loans, interest rates, and stock prices. In chapter XIII the role of banks in the business cycle is discussed at length. The historical chapters are, in the reviewer's opinion, the climax of the work. Here the course of the economic history of capitalism and of its social and political background unfolds into a panoramic picture and is interpreted by means of the working hypothesis developed in the theoretical part. The picture is fascinating and has all the qualities of a real work of art. This, however, should not be understood as disparaging its scientific value. In fact, Professor Schumpeter's treatment of the history of business cycles ranks beside the great treatments of Juglar, Tugan-Boranzowski, Spiethoff, etc. It is the only modern treatment of the history of business cycles available in English. The major part of it has a value quite independent of the correctness of Professor Schumpeter's theoretical model. Thus even should the theory of business cycles presented prove a complete failure (which it is not, in the reviewer's opinion), the book would retain its value as an outstanding contribution to the historical study of business cycles. Unfortunately, the wealth of material contained in Professor Schumpeter's book prohibits a discussion of its whole content. We have to overcome the temptation of drawing the historical chapters into the orbit of our discussion and shall confine ourselves to the theoretical model. The statistical part will be taken account of only in so far as it has an immediate bearing upon the theory.

The economic history of capitalism is dominated, according to Professor Schumpeter, by two factors: innovation, i.e., changes in production functions, and credit creation. So great is their importance that Professor Schumpeter makes them the basis of his definition of capitalism. He defines capitalism as "that form of private property economy in which innovations are carried out by means of borrowed money, which in general, though not by logical necessity, implies credit creation" (vol. 1, p. 223). Whereas Marx, chiefly interested in the exploitative social relations of capitalism, defined it in terms of concentration of property and of wage labor, Professor Schumpeter's definition draws attention to the innovating entrepreneur and to the fact that innovations are carried out with borrowed money. The interplay of innovation and credit creation creates the business cycle.

The fundamental facts about innovations are, besides their being financed as a rule by credit creation, as follows: (1) Most of them require the construction of new plant and equipment, or the rebuilding of the old. (2) They are associated with the rise to leadership of new men, which under competitive capitalism (as distinguished from what the author calls "trified capitalism") usually implies the rise of new firms. (3) Innovating entrepreneurs (Professor Schumpeter even reserves the term "entrepreneur" to designate only innovators) are scarce, but once an innovation is success-

<sup>1</sup> See in particular, "The Instability of Capitalism," *Economic Journal*, XXXVIII (1928), pp. 361-86.



fully introduced there appears a wave of imitators (who may be hampered but not held back indefinitely by the establishment of monopoloid situations) who spread the innovation through the relevant sector of the economy; in consequence, innovations are concentrated in certain sectors of the economy (e.g., in certain industries). (4) Although the development of technical, organizational, etc. knowledge (including the flow of inventions) is gradual, innovations are introduced only at certain junctures of economic history, namely, when the risk of failure is not excessive; the risk of failure is the smaller the more a given actual situation approaches economic equilibrium. Because of the last point, and of (2) and (3), the innovations tend to appear in clusters. Conditions approximating economic equilibrium are favorable for innovations, but as the innovations spread over important sectors of the economy the economy gets disequibrated, the risk of failure increases (it becomes increasingly difficult to anticipate correctly costs and receipts), and the rate of innovation slackens. After a time the economy gets back into equilibrium, the risk of failure diminishes, and the rate of innovation gains in intensity. Thus the rate of innovation tends to fluctuate in a regular manner (but without constant periodicity or amplitude; these two depend entirely on "accident").

The fluctuation of the rate of innovation gives rise to the business cycle. As indicated above, sub(1), this fluctuation implies a fluctuation in the demand for factors of production. The increase of the demand for factors during an intensification of the rate of innovation is financed by credit creation. The credit creation is not due to an "active" expansive policy of the banks but appears rather as an automatic result of the profits caused by the process of innovation; these profits cause an increase in the demand for funds which only the most restrictive banking policy could stop (at this point the reader should also refer to chapter XIII which belongs to the best that has been written on the role of the banks in the business cycle). The credit creation allows the innovating entrepreneurs to bid away factors of production from other uses (it is assumed that there is no unemployment in equilibrium, except such as is due to frictions and imperfection of competition; this unemployment is not reduced substantially by the credit creation). Here Professor Schumpeter develops an argument that runs along the lines of the familiar "forced saving" doctrine, with one important difference. The creation of credit reduces the real purchasing power not only of consumers but also of the non-innovating firms. Thus the innovating entrepreneurs bid away factors from all the non-innovating firms, irrespective of whether these produce consumers' goods or producers' goods. This leads to a rise of prices, first of factors and then, because of the increase in money incomes, of all commodities.

However, when the innovating firms begin to throw their products on the market, the prices of these products (and of their substitutes produced by the old firms) fall. The fall in prices is further accentuated by the fact that the innovators now repay their loans to the banks. Professor Schumpeter calls this "autodeflation" (this process again occurs without any initiative of the banks). The innovating firms are not affected adversely

by the fall in prices. But the old (i.e., non-innovating) firms which face the competition of the products of the innovators have not reduced their costs. They were in equilibrium before; now, in consequence of the fall of prices of their products, they suffer losses. This disequilibrates the whole economy. The risk of failure increases and the rate of innovation slackens. To the observer this appears as an "exhaustion of investment opportunities"; however, it is not the objective material for innovations (e.g., inventions) which has vanished; innovations are not introduced because the risk of failure is too great. After a period of readjustment, the economy returns to a new equilibrium with a lower price level than before but with a higher real income. When the new equilibrium is approached, the rate of innovation rises again. Thus we obtain a two phase cycle: prosperity and recession. Professor Schumpeter calls this the Pure Model, or the First Approximation.

This theory is brought into closer correspondence with reality by means of a Second Approximation. The increase of demand for factors of production by the innovators produces a "multiplier effect" (this phrase is not Professor Schumpeter's). Old firms, too, increase their demand for factors and finance it by borrowing from banks. This stimulates further credit creation. In addition, the expectation of a further rise in demand and in prices causes speculative expansion. The multiplier effect and speculation produce what is called the Secondary Wave which is superimposed upon the developments described in the Pure Model. When the rate of innovation slackens because of the rising risk of failure, the Secondary Wave not only superimposes itself upon the recession but carries the liquidation much further than described in the Pure Model. The multiplier effect and speculation cause "abnormal liquidations" and thus carry the economy past the new equilibrium point. This is the depression. Professor Schumpeter admits that it cannot be proved that the cumulative process of depression must come to an automatic halt. If this has happened, notwithstanding, in our historical experience, it is due, in addition to possible external factors, to the special empirical fact that the cumulative multipliers are finite<sup>2</sup> (this again is not Professor Schumpeter's terminology, but it seems to express correctly and briefly the train of his argument; see vol. 1, p. 153). But when the depression has "petered out," the economy returns to a new equilibrium. This return to a new equilibrium is the essence of recovery. Thus the Second Approximation leads to a four-phase cycle: prosperity, recession, de-

<sup>2</sup> The multiplier is the ratio of the increment of one variable to the increment of another variable which is a component of the first (e.g., total income and total investment, total employment and primary employment). In order that a cumulative process does not go on indefinitely, it is not sufficient that the multiplier thus defined be finite. For example, when an increase of investment increases income, the greater income stimulates further investment which increases income in turn, etc. The multiplier which must be finite is the ratio of all the cumulative increment of one variable to the increment of the other variable. This ratio will be finite when the sum of increments of the first variable is convergent.

pression, and recovery. Between recession and prosperity and between recovery and prosperity the economy passes through "neighborhoods of equilibrium." At the last of these "neighborhoods of equilibrium," the motor force of capitalist evolution—i.e. the innovating entrepreneurs—come into action.

Finally, the theory is carried to a Third Approximation by noticing that there are good reasons to believe that the rate of innovation may fluctuate in such a way as to produce not one but several cycles. This is due to the following considerations: (1) The period of gestation and of absorption of their effects differs for different innovations. (2) Because of the increasing risk of failure, a single large-scale innovation may be carried out in successive steps (as, for instance, the introduction of railroads, or electrification), each step giving cause to a cycle. (3) A given set of innovations may produce a number of effects, each of which appears at a different time. Professor Schumpeter thinks that the empirical material available justifies the distinction of three cycles: the Juglar cycle which is the ordinary business cycle treated in the literature of the subject and which has an average duration of less than ten years, the Kondratief cycle corresponding to the well-known "long-waves" associated with that name and with a duration of less than 60 years, the Kitchin cycle (discovered by Mr. Kitchin and Professor Crum) of about 40 months' duration. The three Kondratief upswings known to us correspond to the three great waves of innovation in the history of capitalism: (1) the industrial revolution, (2) railroadization, (3) electrification, motorization, and the development of chemical industries. On theoretical grounds each longer cycle must contain an integral number of shorter cycles. Professor Schumpeter thinks that historical and statistical evidence establishes in each case six Juglars to a Kondratief and three Kitchins to a Juglar.

Professor Schumpeter's three cycle scheme is open to serious criticism, largely on empirical grounds. There is, of course, no doubt about the Juglar. But the Kitchin cycle is based on rather meager evidence. The empirical material on which it has been observed refers almost exclusively to the monetary sector of the economy. No investigation has been made as to whether the short "cycles" are not simply cumulative random effects (the Slutsky effect which Professor Schumpeter rightfully rejects as an explanation of major cycles may be applicable here). How far Kitchins extend into the past is not known. But even if the evidence be accepted, it seems doubtful that such short cycles should result from fluctuations in the rate of innovation. More probably, they are fluctuations of the "adaptive" type (a possibility which Professor Schumpeter mentions himself; vol. 1, p. 171) due to the accumulation and liquidation of inventories. The Kondratiefs are much better established empirically; the evidence of historians is here even more convincing to the reviewer than that of statisticians whose cycles may be "manufactured" by the statistical procedures they use.<sup>8</sup> But there is serious doubt whether the Kondratiefs can properly be called

cycles. Professor Schumpeter's explanation in terms of the three great waves of innovation in the history of capitalism seems quite correct. But these three waves of innovation appear to be more of the nature of historical "accidents" due to discoveries in technology than regular fluctuations of the rate of innovation connected with fluctuations in the risk of failure, as Professor Schumpeter's theory would require. The reviewer is under the impression that Professor Schumpeter has extended his theory of business cycles, worked out originally with reference to Juglars, rather mechanically to Kondratiefs and Kitchins. Such extension requires much more careful empirical and also theoretical analysis. Thus, for instance, it is doubtful whether a Kondratief cycle, even if Professor Schumpeter's theory were totally accepted, would lead to a Secondary Wave of the same type as a Juglar; the same holds for Kitchins.

The standard criticism which has been raised against Professor Schumpeter's theory of the business cycle is concerned with the "clustering" of innovations at certain periods of time. The explanation sought by the critics was either in terms of the social psychology of innovations, i.e., that one successful innovation encourages others (a point which Professor Schumpeter himself makes, cf. vol. 1, p. 100, which, however, is not of decisive importance for the theory), or in terms of a clustering in time of technological inventions. These explanations being refuted, the theory was easily rejected. But all this is quite irrelevant. Professor Schumpeter's theory does not rest upon either of these points. The clustering is a consequence of the changing risk of failure. Whatever the time shape of the supply of new inventions, new plans of organization, etc., or of entrepreneurial skill, the actual introduction of innovations will be "bunched" at periods of neighborhood of equilibrium when the risk of failure is the smallest; and as an intensification of the rate of innovation disequilibrates the economy and increases the risk of failure, this rate must slacken again. Thus we can dismiss the standard criticism; the clustering is explained quite satisfactorily in Professor Schumpeter's theory. The real weakness of his theory appears to be elsewhere. It is the lack of an adequate theory of employment (in the sense of Mr. Keynes) to serve as a basis for the theory of the business cycle.

For the unsophisticated observer the business cycle is primarily an employment cycle, a cycle in the degree of utilization of resources. It is also a cycle in total output, but the fluctuations in production are strictly connected with fluctuations in the level of employment. It is very difficult to locate the fluctuations of employment in Professor Schumpeter's theory. In the Pure Model we encounter only an output cycle and a price cycle. The price cycle follows the usual pattern, i.e., prices rise in prosperity and decline in recession. But the output cycle follows the opposite of the usual pattern. Total output remains unchanged during prosperity and increases (as a result of the innovations) during recession. The output of consumers' goods even decreases during prosperity (because the innovators bid away the factors). Thus we curves to two branches of the Kondratief superimposed on a rising trend.

<sup>8</sup> The reviewer suspects that the 25-year cycles of Professor Kuznets are of this nature: a result of fitting logistic

obtain a fall of real income consumed during prosperity and an increase during recession. Except for the entrepreneurs and capitalists (who benefit from the rise of interest rates), the community is worse off during prosperity than during recession. A queer picture, indeed. Even Marx in all his belief that the ideas of an epoch are those which correspond to the interest of the ruling class would not have thought that the capitalist entrepreneurs have such amazing semantic power, i.e., the power to make people call "prosperity" the period in which they are worse off merely because it is one of prosperity for the entrepreneurs and capitalists. Professor Schumpeter tries to make this plausible by reference to a socialist economy (vol. 1, pp. 142-43). In such an economy, he argues (invoking the Soviet Five-Year Plans as witness), it is clear that the period of innovations is paid for by sacrifices of consumption and that the benefit is reaped when the products of the innovations appear. As an explanation he adds that in a socialist economy it would be also clear that the benefits of international trade are derived from imports whereas exports are a sacrifice. It is astonishing to find such statements coming from an author so conscious of the historical specificity of capitalism as Professor Schumpeter.

The explanation is, of course, in the fluctuation of the level of employment. The real consumable income of those who are employed does fluctuate in the way indicated in the Pure Model. But the fluctuation of the level of employment makes the aggregate real income and the aggregate real consumption fluctuate in the opposite direction, i.e., rise during prosperity and fall during recession. At best they remain stationary during recession, part of the fruits of innovations being always wasted through unemployment (vide the empirical evidence in vol. II, p. 563). It is not at all clear how the employment cycle can be tied up with Professor Schumpeter's theory: most probably in connection with the Secondary Wave, but Professor Schumpeter fails to do so explicitly. The only time unemployment is even mentioned in the exposition of the theory is a parenthetical reference to "unemployment series" in the discussion of the Secondary Wave (vol. I, p. 156). The fluctuation of the level of employment (and of the degree of utilization of resources) is our primary empirical datum about the business cycle. As long as it is not explicitly connected with the theory and assigned in it its due role, Professor Schumpeter's theory must be regarded, at least, as incomplete.

With the qualification just mentioned, and disregarding the problems raised by his Third Approximation, Professor Schumpeter presents us with a consistent and workable theory of the business cycle. The trouble is that it is not the only theory that satisfies these requirements. The theories explaining the business cycle by means of "adaptive" fluctuations of the rate of investment present equally acceptable alternatives (the purely monetary theories are excellently refuted in chapter

xiii and need not bother us here). Among these the theories of Mr. Kalecki and Mr. Kaldor are the most outstanding (those of Mr. Harrod and Professor Tinbergen follow essentially the same pattern but are more complicated). In the absence of empirical evidence to the contrary, Mr. Kalecki's theory seems preferable to that of Mr. Kaldor because it does not need to assume inherently unstable equilibria. This theory explains the business cycle in terms of fluctuations of the marginal return on investment resulting from the accumulation and decumulation of capital and from the effect of investment on income. It leads also to a four-phase cycle and has the advantage of great simplicity. Professor Schumpeter's criticism that flexibility of interest rates must stop the Kalecki mechanism (vol. 1, p. 188) is not justified. Such a flexibility presupposes a monetary system different from the actual one, and even if that be granted, uncertainty and elastic expectations may foil the effect.

The choice between Mr. Kalecki's (or Mr. Kaldor's, or any other) theory and that of Professor Schumpeter can be made only on the basis of empirical investigation. It is necessary to find the concrete functions involved and their parameters, then to investigate what periods, amplitudes, damping, etc. are to be expected from the different theories, and to confront these expected values with empirical data. Only in this way is it possible to choose the "true" theory from among those theoretically admissible. It is possible, even likely, that the "true" theory will prove more complex and will have to combine elements of the different *a priori* theories developed (this is suggested by Professor Tinbergen's work and has also been made clear by Professor Haberler). Among these elements there will be certainly the dominant role of innovations and their effects very much as described by Professor Schumpeter. This is seen immediately by confronting some implications of the theories of Mr. Kalecki or Mr. Kaldor with the facts. Both theories imply net disinvestment of capital during the depression. As far as our statistical knowledge goes such disinvestment does not happen as a rule (an exception: the U.S.A. in 1931-35). Thus some other factor than net disinvestment of capital must raise the marginal return on investment and turn the downswing into an upswing. Most likely this is the higher productivity due to innovations. This raises the question of a possible synthesis between the "adaptive fluctuations of investment" theories and that of Professor Schumpeter. The cycle in investment activity may prove to be a consequence of both adaptive fluctuations and fluctuations in the rate of innovation resulting from changes in the risk of failure. Substantially, this would amount to a different way of combining the Pure Model and the Secondary Wave of Professor Schumpeter, with a more explicit role assigned to fluctuations in the level of employment.

Professor Schumpeter's theory is not the final theory of the business cycle, but it provides us with a decisive element of any realistic explanation of the phenomenon.

OSCAR LANGE

## THE FOUNDATIONS OF WELFARE ECONOMICS

By OSCAR LANGE

1. WELFARE ECONOMICS is concerned with the conditions which determine the total economic welfare of a community. In the traditional theory the total welfare of a community was conceived as the *sum* of the welfares (utilities) of all constituent individuals. The problem of maximization of total welfare thus involved the weighing against each other the losses of utility and gains of utility of different individuals. This implies *interpersonal* comparability of utility, as is seen in the dictum about the marginal utility of a dollar for the poor man and for the rich man. Such implication, however, is open to epistemological criticism on the ground of lack of operational significance. In consequence a restatement of the principles of welfare economics is in progress<sup>1</sup> which tries to dispense with the interpersonal comparability of utility. Such restatement, however, implies a restriction of the field of welfare economics. This paper intends to give a precise statement of the basic assumptions and propositions of welfare economics and to discuss their operational significance.

2. In order to dispense with interpersonal comparability of utility the total welfare of a community has to be defined not as the sum of the utilities of the individuals (a scalar quantity) but as a *vector*. The utilities of the individuals are the components of this vector. Let there be  $\theta$  individuals in the community and let  $u^{(i)}$  be the utility of the  $i$ th individual. Total welfare is then the vector

$$(2.1) \quad u = (u^{(1)}, u^{(2)}, \dots, u^{(\theta)}).$$

It is convenient for our purpose to order vectors on the basis of the following definition: a vector is said to be greater than another vector when at least one of its components is greater than the corresponding component of the other vector, and none is less.<sup>2</sup> Thus a vector in-

<sup>1</sup> Some of the recent literature: A. P. Lerner, "The Concept of Monopoly and the Measurement of Monopoly Power," *Review of Economic Studies*, June, 1934; A. Burk, "A Reformulation of Certain Aspects of Welfare Economics," *Quarterly Journal of Economics*, February, 1938; H. Hotelling, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates," *ECONOMETRICA*, July, 1938; L. Robbins, "Interpersonal Comparisons of Utility," *Economic Journal*, December, 1938; N. Kaldor, "Welfare Propositions and Interpersonal Comparison of Utility," *Economic Journal*, September, 1939; J. R. Hicks, "The Foundations of Welfare Economics," *Economic Journal*, December, 1939; T. de Seitovszky, "A Note on Welfare Propositions in Economics," *Review of Economic Studies*, November, 1941.

<sup>2</sup> The ordering of vectors according to this definition must be distinguished from the ordering of vectors according to their length (defined as usual). When

creases when at least one of its components increases and none decreases. According to the definition adopted, a *maximum* of total welfare occurs when conditions cannot be changed so as to increase the vector  $u$ , i.e., when it is impossible to increase the utility of any person without decreasing that of others.<sup>3</sup> We have, therefore,  $u = \max$  when

$$(2.2) \quad u^{(i)} = \max \quad (i = 1, 2, \dots, \theta)$$

subject to

$$(2.3) \quad u^{(j)} = \text{const} \quad (j = 1, 2, \dots, i-1, i+1, \dots, \theta).$$

3. Let the utility of each individual be a function of the commodities in his possession. Denoting by  $x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)}$  the quantities of  $n$  commodities in the possession of the  $i$ th individual, his utility is  $u^{(i)} = u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)})$ . Denote further by  $X_r = \sum_{i=1}^{\theta} x_r^{(i)}$  the total amount of the  $r$ th commodity in the community. These amounts are not constant but subject to technological transformation the possibilities of which are circumscribed by a transformation function  $F(X_1, X_2, \dots, X_n) = 0$ . Our problem is to maximize total welfare subject to the constraint of the transformation function.

We thus have the following maximum problem:

$$u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)}) = \max \quad (i = 1, 2, \dots, \theta)$$

subject to the side relations

$$(3.1) \quad u^{(j)}(x_1^{(j)}, x_2^{(j)}, \dots, x_n^{(j)}) = \text{const} \\ (j = 1, 2, \dots, i-1, i+1, \dots, \theta),$$

$$(3.2) \quad X_r = \sum_{i=1}^{\theta} x_r^{(i)} \quad (r = 1, 2, \dots, n),$$

$$(3.3) \quad F(X_1, X_2, \dots, X_n) = 0.$$

This is equivalent to maximizing the expression

$$(3.4) \quad \sum_{i=1}^{\theta} \lambda_i u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)}) + \sum_{r=1}^n \nu_r \left( \sum_{i=1}^{\theta} x_r^{(i)} - X_r \right) \\ + \nu F(X_1, X_2, \dots, X_n),$$

a vector is greater than another in the above sense then its length is also greater than the length of the other vector, but the reverse does not hold true. According to our definition the vectors form a partially ordered system which does not have the "chain" property: given  $u$  and  $v$ , either  $u \geq v$  or  $v \geq u$ .

<sup>3</sup> In the language of the theory of partially ordered systems a maximum of total welfare is a "maximal" element of the set of admissible vectors  $u$ . Cf. Garrett Birkhoff, *Lattice Theory*, American Mathematical Society, Colloquium Publications, Vol. XXV, 1940, p. 8. The set of admissible vectors is given by the conditions (3.2) and (3.3) in the text.

where the  $\lambda$ 's and the  $\nu$ 's are Lagrange multipliers and  $\lambda_i \equiv 1$  successively for  $i=1, 2, \dots, \theta$ . The result obtained is the same for each  $i$ .

The first-order maximum conditions yield, after elimination of the Lagrange multipliers, the  $(n-1)\theta$  equations<sup>4</sup>

$$(3.5) \quad \frac{u_r^{(i)}}{u_s^{(i)}} = \frac{F_r}{F_s} \quad (r \text{ and } s = 1, 2, \dots, n; i = 1, 2, \dots, \theta),$$

which together with the equations (3.1) and (3.3) serve to determine the  $n\theta$  quantities  $x_r^{(i)}$ . The equations (3.5) can also be written in the form

$$(3.6) \quad \frac{\partial x_s^{(i)}}{\partial x_r^{(i)}} = \frac{\partial X_s}{\partial X_r} \quad (r \text{ and } s = 1, 2, \dots, n; i = 1, 2, \dots, \theta).$$

The latter form shows clearly the economic interpretation and the operational significance of our maximum conditions. The left-hand side of (3.6) is the marginal rate of substitution of two commodities (the amounts of the remaining commodities being kept constant) which leaves the individual's utility unaffected. The right-hand side is the marginal rate of technological transformation of the two commodities. Thus each individual's marginal rate of substitution of any two commodities must be equal to the marginal rate of transformation of these commodities. Both rates can be determined empirically, the second from the technological conditions of transformation, the first by offering each individual choices between different "bundles" of commodities and adjusting the "bundles" so as to make his choice indifferent.

The derivation of (3.5) or (3.6) does not imply interpersonal comparability of utility. This can be seen also in the following way. From (3.5) we have

$$(3.7) \quad \frac{u_r^{(i)}}{u_r^{(j)}} = \frac{u_s^{(i)}}{u_s^{(j)}} \quad (r \text{ and } s = 1, 2, \dots, n; i \text{ and } j = 1, 2, \dots, \theta; j \neq i).$$

Each side is the ratio of the marginal utilities of different individuals. The numerical value of these ratios is *indeterminate*.

This treatment of the maximum total welfare problem does not imply the measurability of the individuals' utility either. The equations

<sup>4</sup> The subscripts stand for partial derivatives. Thus, e.g.,

$$u_r^{(i)} = \frac{\partial u^{(i)}}{\partial x_r^{(i)}} \quad \text{and} \quad F_r = \frac{\partial F}{\partial X_r}.$$

(3.5)–(3.7) are invariant with regard to any positive transformation  $\phi^{(i)}(u^{(i)})$  (where  $\phi^{(i)} > 0$ )<sup>5</sup> of the utility functions of the individuals. Only the *projective* properties of these functions are used. This implies only ordering, not measurement, of each individual's utility.

The equations (3.5) or (3.6) contain *in nuce* most theorems of welfare economics,<sup>6</sup> e.g., all the propositions in Pigou's *Economics of Welfare*. The only theorems not contained in these equations are those which relate to the optimum distribution of incomes. This limitation and the problem how it can be overcome in a way which is operationally significant will be the subject of the remaining part of this paper.

4. The solution given by (3.5) or (3.6) contains arbitrary parameters, namely the constants of the right-hand side of (3.1). These parameters express the level at which the utilities of all the other individuals are held constant while the utility of the *i*th individual is being maximized. Thus our solution is *relative* to the values chosen for these parameters. It gives, for instance, the conditions under which the poor man's utility cannot be increased any more without diminishing the rich man's utility (or vice versa), but the level at which the rich man's utility is held constant is arbitrary. Obviously, the poor man's utility corresponding to a situation of maximum total welfare will be different when the level of the rich man's utility is chosen differently.

In an exchange economy the constants on the right-hand side of (3.1) are uniquely related to the money incomes of the respective individuals. This follows from the maximization of the individuals' utility. Let  $u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)}) = \max$  subject to  $\sum_{r=1}^n p_r x_r^{(i)} = M^{(i)}$  where  $M^{(i)}$  is the individual's income and the *p*'s are the prices of the commodities. The value of  $u_{\max}^{(i)}$  depends on  $M^{(i)}$  and on the *p*'s as parameters. The *p*'s can be determined from equations which express the equality of demand and supply of each commodity, but  $M^{(i)}$  remains arbitrary.<sup>7</sup> Thus the problem of determining the constants on the right-hand side of (3.1) reduces, in an exchange economy, to that of determining the distribution of incomes. The conditions of maximum total welfare expressed in (3.5) or (3.6) leave this distribution arbitrary.

5. In order to arrive at the optimum determination of the constants on the right-hand side of (3.1) it does not suffice to maximize the vector *u*. We must be able to choose between different vectors *u* which cannot

<sup>5</sup> In fact, they are invariant with respect to any transformation such that  $\phi^{(i)'} \neq 0$ . But the second-order maximum conditions admit only positive transformations. Negative transformations would change the maximum into a minimum.

<sup>6</sup> For a somewhat fuller treatment of this point see the Appendix.

<sup>7</sup> The  $M^{(i)}$  must, however, satisfy the relation  $\sum_{i=1}^g M^{(i)} = \sum_{r=1}^n p_r X_r$ , which follows from (3.2) and from the budget equations  $\sum_{r=1}^n p_r x_r^{(i)} = M^{(i)}$ .

be ordered in the way defined above.<sup>8</sup> This can be done in two ways. One is to weigh against each other the gains of utility and the losses of utility of different individuals. This need not, however, imply the acceptance of the traditional definition of total welfare as the sum of the utilities of the individuals. The weighting can be based, instead, upon a *social valuation* of the importance of the individuals, the subject exercising the valuation being an agency of the organized community (e.g., Congress).<sup>9</sup> The other way is to establish *directly* a social valuation of the distribution of commodities or incomes between the individuals, without reference to the individuals' utilities. In the first case the optimum distribution of incomes (and of commodities) is determined by a social valuation of the individuals' utilities. In the second case the utilities of the individuals appear as a more or less accidental by-product of the direct social valuation of the distribution of incomes (or of commodities).

In both cases the social valuation can be expressed in the form of a *scalar function of the vector*  $u$ , i.e.,  $W(u)$ , except that in one case the community (or rather its agency) chooses the most preferred vector  $u$  and adjusts the distribution of incomes and of commodities among the individuals so as to obtain the desired vector, while in the other case it chooses the most preferred distribution of incomes (or commodities) directly and the vector  $u$  adjusts itself to this choice. We shall call the function  $W$  the *social value function*.

It is convenient to give names to the different derivatives of this function. We shall call them *marginal social significances*. Let  $W_i = \partial W / \partial u^{(i)}$  and call it the marginal social significance of the  $i$ th individual. As  $u^{(i)} = u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)})$ , we can form the derivative  $\partial W / \partial x_r^{(i)}$ . It will be called the marginal social significance of the  $r$ th commodity in the hands of the  $i$ th individual. In the preceding section it was shown that in an exchange economy a unique relation exists between  $u^{(i)}$  and the individual's money income  $M^{(i)}$ . Hence we can form  $\partial W / \partial M^{(i)}$  which will be called the marginal social significance of the  $i$ th individual's income.

Between these derivatives there are the relations

$$(5.1) \quad \frac{\partial W}{\partial x_r^{(i)}} = W_i u_r^{(i)},$$

$$(5.2) \quad \frac{\partial W}{\partial M^{(i)}} = W_i \mu_i \quad \text{where} \quad \mu_i = \frac{\partial u^{(i)}}{\partial M^{(i)}};$$

<sup>8</sup> I.e., we need now the "chain" property mentioned in footnote 2 above.

<sup>9</sup> In a democratically organized community these agencies will have to reflect the valuations of the majority.



$\mu_i$  is called the marginal utility of income.<sup>10</sup> We have also

$$\frac{\partial W}{\partial x_r^{(i)}} = \frac{\partial W}{\partial M^{(i)}} \frac{\partial M^{(i)}}{\partial x_r^{(i)}}.$$

But  $M^{(i)} = \sum_{r=1}^n p_r x_r^{(i)}$  (vide Section 4) and  $\partial M^{(i)} / \partial x_r^{(i)} = p_r$ . Consequently, we have the relation

$$(5.3) \quad \frac{\partial W}{\partial x_r^{(i)}} = \frac{\partial W}{\partial M^{(i)}} p_r.$$

Our problem is now to maximize  $W$  subject to the side relations (3.2) and (3.3). This leads to the maximizing of the following expression

$$(5.4) \quad W(u^{(1)}, u^{(2)}, \dots, u^{(\theta)}) + \sum_{r=1}^n \nu_r \left( \sum_{i=1}^{\theta} x_r^{(i)} - X_r \right) + \nu F(X_1, X_2, \dots, X_n)$$

where the  $\nu$ 's are Lagrange multipliers.

Eliminating the Lagrange multipliers, we obtain the first-order maximum conditions

$$(5.5) \quad \frac{\partial W}{\partial x_r^{(i)}} \div \frac{\partial W}{\partial x_s^{(j)}} = \frac{F_r}{F_s}$$

( $r$  and  $s = 1, 2, \dots, n; i$  and  $j = 1, 2, \dots, \theta$ ).

For  $j=i$  and  $s \neq r$  these equations become, taking account of (5.1),

$$(5.6) \quad \frac{u_r^{(i)}}{u_s^{(i)}} = \frac{F_r}{F_s};$$

<sup>10</sup>  $\mu_i$  is also the Lagrange multiplier used in maximizing  $u^{(i)}$  subject to  $M^{(i)} = \text{const}$ . The first-order maximum conditions are in this case (omitting the superscript  $i$  in order to simplify the notation)  $u_r = \mu p_r$  ( $r = 1, 2, \dots, n$ ). Write  $\partial u / \partial M = \sum_{r=1}^n u_r \partial x_r / \partial M$ . It can be shown (cf. J. R. Hicks, *Value and Capital*, Oxford University Press, 1939, p. 308) that

$$\frac{\partial x_r}{\partial M} = \frac{\mu U_r}{U},$$

where

$$U = \begin{vmatrix} 0 & u_1 & \dots & u_n \\ u_1 & u_{11} & \dots & u_{1n} \\ \dots & \dots & \dots & \dots \\ u_n & u_{n1} & \dots & u_{nn} \end{vmatrix}$$

and  $U_r$  is the cofactor of the element  $u_r$  in the first row. Thus we get

$$\frac{\partial u}{\partial M} = \mu \sum_{r=1}^n \frac{u_r U_r}{U} = \mu.$$

for  $j \neq i$  and  $s = r$  they turn into

$$(5.7) \quad \frac{\partial W}{\partial x_r^{(i)}} = \frac{\partial W}{\partial x_r^{(j)}}.$$

The conditions (5.6) are identical with (3.5) and have the same economic interpretation. Their operational significance has already been established. The equations (5.7) state that each commodity must have the same marginal social significance in the hands of each individual. The operational significance of this condition requires further inquiry.

6. In virtue of (5.1)–(5.3) the equation (5.7) can be written in the following alternative forms

$$(6.1) \quad \frac{\partial W}{\partial M^{(i)}} = \frac{\partial W}{\partial M^{(j)}},$$

$$(6.2) \quad W_i u_r^{(i)} = W_j u_r^{(j)},$$

$$(6.3) \quad W_i \mu_i = W_j \mu_j.$$

(6.1) states that the marginal social significance of each individual's income must be the same. According to (6.2) the weighted marginal utility of each commodity, and according to (6.3) the weighted marginal utility of income, must be the same for each individual, the marginal social significance of the individual serving as weight.

The operational significance of the maximum conditions obtained depends on which of the two types of social valuation is used. When the communal agency makes its valuation directly in terms of the distribution of commodities or incomes among the individuals, the equations (5.7) and (6.1) can be used. They have, in this case, an immediate operational significance. The communal agency need not bother about the individuals' utilities and it considers  $W$  as a direct function of the  $x$ 's or of the  $M$ 's, i.e., as being in the form  $W(x_1^{(1)}, \dots, x_n^{(1)}; \dots; x_1^{(j)}, \dots, x_n^{(j)})$  or  $W(M^{(1)}, \dots, M^{(j)})$ . A direct valuation in terms of the distribution of commodities is in practice a very complicated affair. It requires a separate evaluation of the marginal social significance of each commodity in the hands of each individual. Therefore, it is rarely fully practiced, except in times of emergency, e.g., during war, when practice comes pretty close to it. A direct valuation in terms of the distribution of incomes does not present the same technical obstacles. It requires only an evaluation of the marginal social significance of each individual's income. This can be done by means of one or a few simple principles and is actually practiced, for instance, in framing income-tax legislation.

When the social valuation is made in terms of weighting the individuals' utilities the equations (6.2) and (6.3) have to be used. This required a knowledge of the marginal utilities of the different individuals. There exists no operational procedure by which such a knowledge can be gained. To that extent (6.2) and (6.3) lack operational significance. This, however, does not make them completely meaningless. It is possible to form certain a priori hypotheses about the relationships between individuals' marginal utilities and to investigate what consequences in terms of the distribution of incomes or of commodities follow. Thus it is possible to control the valuations made directly in terms of incomes or commodities in the light of these hypotheses.

The most interesting of such hypotheses is the hypothesis that the function  $\mu_i(M^{(i)})$  which expresses the marginal utility of income is the same for each individual. In this case (6.3) becomes

$$(6.4) \quad W_i \mu(M^{(i)}) = W_j \mu(M^{(j)}) \quad (i \text{ and } j = 1, 2, \dots, \theta),$$

where  $\mu$  is written without subscript because the function is the same for all individuals. Let us also assume that the community adopts an equalitarian social ideal, i.e., the marginal social significance of each individual is the same. Then  $W_i = W_j$  for all  $i$ 's and  $j$ 's and we obtain from (6.4)

$$(6.5) \quad M^{(i)} = M^{(j)} \quad (i \text{ and } j = 1, 2, \dots, \theta).$$

Each individual has to get the same income.<sup>11</sup>

In this way it is possible to check up the consistency of the social valuation with the professed ideal of an economic society which, like ours, claims to attach to each individual the same marginal social significance. Upon the hypothesis that the marginal-utility-of-income function is the same for all individuals the inequalities in the distribution of incomes are inconsistent with the equalitarian ideal professed. In a similar way the actual distribution of incomes (or of commodities)

<sup>11</sup> This does not imply that each individual's *money earnings* must be the same. Among the goods  $x_r^{(i)}$  there are included leisure, safety and attractiveness of the different occupations, social prestige, etc., and prices have to be assigned to them. If an individual prefers, for the reasons indicated, an occupation in which he earns less money than he could earn in some other one, he can be considered as purchasing certain goods associated with the occupation he chooses and as paying a price for them. Thus differences in money earnings which correspond to the individuals' preferences for the various occupations are not in contradiction with the equality of incomes discussed in the text. This takes care of the question of incentives. Cf. on this subject the present writer's essay, *On the Economic Theory of Socialism*, Minneapolis, University of Minnesota Press, 1938, pp. 101-102.

can be checked up with regard to other hypotheses made and with regard to other social valuations of the individuals' utilities.

7. It is seen from (5.5) that the maximum conditions are invariant under a transformation  $\phi(W)$  of the social-value function, where  $\phi' > 0$ .<sup>12</sup> Thus only the projective properties of  $W$  are used. Only the ordering, not the measurement, of the social valuations is involved.

The utilities of the individuals need not be measurable either. Let us subject the utility functions of the individuals to the transformation  $\phi^{(i)}(u^{(i)})$ , where  $\phi^{(i)} > 0$ <sup>13</sup> and  $i = 1, 2, \dots, \theta$ . We obtain, instead of (6.2),

$$(7.1) \quad \frac{\partial W}{\partial \phi^{(i)}} \phi_r^{(i)} = \frac{\partial W}{\partial \phi^{(j)}} \phi_r^{(j)}.$$

This can be written

$$(7.2) \quad \frac{\partial W}{\partial \phi^{(i)}} \phi^{(i)'} u_r^{(i)} = \frac{\partial W}{\partial \phi^{(j)}} \phi^{(j)'} u_r^{(j)},$$

whence

$$(7.3) \quad \frac{\partial W}{\partial u^{(i)}} u_r^{(i)} = \frac{\partial W}{\partial u^{(j)}} u_r^{(j)},$$

which is identical with (6.2). In a similar way it can be shown that (6.3) is invariant under the transformation  $\phi^{(i)}$ .

8. Let us restate our conclusions. The propositions of welfare economics can be divided into two parts. One part is based on maximizing the vector  $u$  and is concerned with conditions which permit increasing the utility of one individual without diminishing the utility of anybody else. It comprises all propositions of welfare economics except those which relate to the optimum distribution of incomes. These propositions are all operationally significant. The other part requires the setting up of a social value function  $W(u)$  which is maximized. The maximum conditions thus obtained may be expressed either directly in terms of the commodities and incomes allowed to different individuals or in terms of the marginal utilities of the individuals. In the first case propositions of immediate operational significance are obtained but each individual's utility is determined quasi-accidentally as a by-product of the valuations made in terms of commodities or incomes. In the other case the optimum distribution of incomes must be derived from certain a priori hypotheses concerning the functions expressing the marginal utility of incomes of the different individuals.

<sup>12</sup> Cf. footnote 5 above.

<sup>13</sup> Cf. footnote 5 above.

Although these hypotheses have no direct operational significance they lead to definite conclusions as to the appropriate distribution of incomes. They may, therefore, be used as check-ups of a distribution of incomes established by direct valuation.

Neither the social valuations nor the utilities of the individuals need be measurable; it is sufficient that they can be ordered.

## APPENDIX

In order to simplify the exposition the transformation function introduced at the beginning of Section 3 is assumed to refer to the whole economy. This is a strong oversimplification of reality admissible only under special circumstances. Actually the technological transformation of commodities is performed by individuals ("firms"; even in a socialist society there would be separate productive establishments) and each individual is confronted with a transformation function of his own. Only when the transformation functions of the individuals are all the same can they be combined in a unique way into a transformation function for the economy as a whole. Otherwise the conditions of transformation in the economy as a whole depend on how the transformation of commodities is distributed among the individuals (i.e., the relation between total "outputs" and total "inputs" depends on how much "output" and "input" is done by each individual). Thus in order to give a better picture of an actual economic system we must assume each individual to be confronted with a separate transformation function.

Denote by  $f^{(i)}(y_1^{(i)}, y_2^{(i)}, \dots, y_n^{(i)}) = 0$  the transformation function of the  $i$ th individual, where  $y_r^{(i)}$  is the quantity of the  $r$ th commodity he transforms. Denote, as before, by  $x_r^{(i)}$  the quantity of the  $r$ th commodity which the  $i$ th individual possesses. The amount of a commodity which an individual possesses need not be equal to the amount he obtains or gives up through transformation, for he may acquire commodities or get rid of them by means other than technological transformation (e.g., by exchange or gift). But for the economy as a whole these amounts are equal. We have, therefore,  $\sum_{i=1}^{\theta} x_r^{(i)} = \sum_{i=1}^{\theta} y_r^{(i)}$  for  $r = 1, 2, \dots, n$ .

In place of the maximum problem in Section 3 we now have

$$u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)}) = \max \quad (i = 1, 2, \dots, \theta),$$

subject to the side relations

$$(1) \quad u^{(j)}(x_1^{(j)}, x_2^{(j)}, \dots, x_n^{(j)}) = \text{const} \\ (j = 1, 2, \dots, i - 1, i + 1, \dots, \theta),$$

$$(2) \quad f^{(i)}(y_1^{(i)}, y_2^{(i)}, \dots, y_n^{(i)}) = 0 \quad (i = 1, 2, \dots, \theta),$$

$$(3) \quad \sum_{i=1}^{\theta} x_r^{(i)} = \sum_{i=1}^{\theta} y_r^{(i)} \quad (r = 1, 2, \dots, n).$$

This leads to the expression

$$(4) \quad \sum_{i=1}^{\theta} \lambda_i u^{(i)} + \sum_{i=1}^{\theta} \gamma_i f^{(i)} + \sum_{r=1}^{\theta} \nu_r \left( \sum_{i=1}^{\theta} x_r^{(i)} - \sum_{i=1}^{\theta} y_r^{(i)} \right),$$

where the Greek letters stand for Lagrange multipliers and  $\lambda_i \equiv 1$  successively for  $i = 1, 2, \dots, \theta$ .

Eliminating the Lagrange multipliers, we arrive at the first-order maximum conditions

$$(5) \quad \frac{u_r^{(i)}}{u_s^{(i)}} = \frac{f_r^{(j)}}{f_s^{(j)}} \quad (r \text{ and } s = 1, 2, \dots, n; i \text{ and } j = 1, 2, \dots, \theta),$$

which take the place of (3.5) in the text.

The propositions usually found in the literature on welfare economics are special cases of the conditions (5). We obtain from (5)

$$(6) \quad \frac{f_r^{(i)}}{f_s^{(i)}} = \frac{f_r^{(j)}}{f_s^{(j)}} \quad (i \neq j).$$

$$(7) \quad \frac{u_r^{(i)}}{u_s^{(i)}} = \frac{u_r^{(j)}}{u_s^{(j)}}$$

The relation (6) states that the marginal rate of transformation of any two commodities must be the same for each individual (i.e., "firm").<sup>14</sup>

<sup>14</sup> The relation (6) can be interpreted as the condition of maximum total physical output. In a similar way as total welfare was defined as the vector  $u$ , total physical output can be defined as the vector  $X = (X_1, X_2, \dots, X_n)$ , where  $X_s = \sum_{i=1}^{\theta} x_s^{(i)} = \sum_{i=1}^{\theta} y_s^{(i)}$ . We have then the problem

$$X_r = \max \quad (r = 1, 2, \dots, n)$$

subject to the side relations

$$(i) \quad X_s = \text{const} \quad (s = 1, 2, \dots, r-1, r+1, \dots, n),$$

$$(ii) \quad X_s = \sum_{i=1}^{\theta} y_s^{(i)} \quad (s = 1, 2, \dots, n),$$

$$(iii) \quad f^{(i)}(y_1^{(i)}, y_2^{(i)}, \dots, y_n^{(i)}) = 0 \quad (i = 1, 2, \dots, \theta),$$

which leads to the conditions (6). The maximum total output is determined purely by the technological transformation possibilities without any reference to utility. Since the relation (6) is part of any maximum-welfare conditions, whether involving the social-value function  $W$  or only the vector  $u$ , the maximization of total physical output may be considered as the most narrow type of a concept of maximum total welfare. It is concerned only with the possibility of increasing the output of some commodities without diminishing the output of any other commodity, regardless of who is to get the commodities (cf. Lerner,

If the commodities are both factors this means that the ratio of their marginal productivities (in terms of any given product) must be the same in each firm of the economy. If they are both products the ratio of their marginal factor cost (in terms of any given factor) must be the same in all firms. If one is a factor and the other a product the marginal productivity of the factor in terms of that product must be the same in each firm.<sup>15</sup> These are all theorems well known in welfare economics. The relation (7) indicates the well-known theorem that the marginal rate of substitution of any two commodities must be the same for each individual. With these relations in mind, we see that, according to (5), any individual's marginal rate of substitution of two commodities has to be equal to the ratio of the marginal factor costs of these commodities in any firm of the economy. The last is the most widely known theorem of welfare economics.

It was assumed here that each commodity appears as a variable both in the utility functions and in the transformation functions. This need not be the case, however. It may appear only in the utility functions as, for instance, a "gift of nature" which is not produced. Then the relation (7) still applies to it, but the other relations do not. Or, what is of greater practical importance, it may appear in the transformation functions without appearing in the utility functions, i.e., it is a factor of production which has no direct utility. In this case the relation (6) alone applies to it.

Through proper interpretation the relation (5), or (6) and (7) which are derived from it, can be taken as giving the dynamic conditions of maximum total welfare over a period of time. For this purpose we consider the period over which total welfare is maximized as being divided into a finite number of discrete intervals (e.g., "days" or "weeks"); the first of these intervals constitutes the "present," the other ones are in

---

*op. cit.*, p. 57). We may thus consider the problem of maximum total welfare in three stages (instead of in two, as in the text): (1) maximizing the vector  $X$ , (2) maximizing the vector  $u$ , (3) maximizing the scalar function  $W$ . The maximum conditions in each stage include the maximum conditions of the preceding one.

<sup>15</sup> This condition implies the absence of unemployment. An unemployed factor can be considered as being employed by an "industry" or "firm" where its marginal productivity is nil. Any shift of the factor to an industry or firm where its marginal productivity is positive increases total physical output (as defined in the preceding footnote). The distinction between two types of propositions of welfare economics, one dealing with the allocation of resources and the other dealing with the degree of utilization of resources, which has been recently proposed by Mr. Scitovszky (*op. cit.*, p. 77), while useful pedagogically, is unnecessary from the analytic point of view. All propositions of welfare economics concerned with the degree of utilization of resources can be treated as allocational propositions.

the future.<sup>16</sup> The same physical good in different time intervals is considered to constitute different commodities. The utility functions  $u^{(i)}(x_1^{(i)}, x_2^{(i)}, \dots, x_n^{(i)})$  and the transformation functions  $f^{(i)}(y_1^{(i)}, y_2^{(i)}, \dots, y_n^{(i)}) = 0$  are taken as covering the whole period of time over which total welfare is maximized. These functions thus contain among their variables commodities in different future time intervals as well as commodities in the "present." The relations (5)–(7) refer then to intertemporal as well as intratemporal substitution and transformation. Condition (5) states, among other things, that the intertemporal marginal rates of substitution must be equal to the corresponding intertemporal marginal rates of transformation.

Thus the condition (5) implicitly determines the rate of capital accumulation which maximizes total welfare over time. The result is pretty much along the lines of the traditional theory. The intertemporal marginal rate of substitution is the marginal rate of time preference [which, according to (7), for any given commodity must be the same for each individual] and the intertemporal marginal rate of transformation is the marginal productivity of waiting [which, according to (6), for any given commodity must be the same for each firm] of the traditional theory.<sup>17</sup> The two must be equal when total welfare is maximized over time. It should be noticed, however, that though for any given commodity and any given two time intervals these rates are the same for each individual (and firm), they need not be the same for different commodities or different pairs of time intervals. We have a separate rate of time preference and of (equal to the former) marginal productivity of waiting for each commodity<sup>18</sup> and for each pair of time intervals. Nor need the time preference and the marginal productivity of waiting be necessarily positive.<sup>19</sup>

<sup>16</sup> Cf., for instance, Hicks, *Value and Capital*, Oxford University Press, 1939, pp. 122–127.

<sup>17</sup> Speaking more precisely, the marginal rate of time preference and the marginal productivity of waiting differ by unity from the marginal rate of intertemporal substitution or transformation, respectively. The marginal rate of time preference is usually defined as  $u_r^{(i)}/u_s^{(i)} - 1$ . Cf. R. G. D. Allen, *Mathematical Analysis for Economists*, London, Macmillan and Co., 1938, p. 344. Correspondingly, the marginal productivity of waiting may be defined as  $f_r^{(i)}/f_s^{(i)} - 1$ . The subscripts  $r$  and  $s$  refer here to different time intervals.

<sup>18</sup> Using the terminology of Mr. Keynes, *The General Theory of Employment, Money and Interest*, New York: Harcourt Brace Co., 1937, p. 223, we obtain a system of optimum (from the social point of view) "own rates" of interest.

<sup>19</sup> The proposition made in the traditional treatment of the theory of interest that under conditions of zero capital accumulation these rates are positive rests on empirical assumption, not on theoretical deduction. The empirical assumption is either that the marginal rate of time preference is positive under these conditions and determines a positive value of the marginal productivity of wait-



Our treatment can be generalized further by assuming that the transformation function of each individual (or firm) depends also on the quantities transformed by other individuals (or firms) in the economy. Taking the most general case, the transformation functions are then of the form  $f^{(i)}(y_1^{(1)}, \dots, y_n^{(1)}; \dots; y_1^{(\theta)}, \dots, y_n^{(\theta)}) = 0$ . The maximum conditions (5) become

$$(8) \quad \frac{u_r^{(i)}}{u_s^{(i)}} = \frac{f_r^{(j)} + \sum_{k \neq j} f_r^{(k)}}{f_s^{(j)} + \sum_{k \neq j} f_s^{(k)}}.$$

The terms under the summation signs represent "external economies" and "external diseconomies" which play such a distinguished role in the analysis of Professor Pigou.

*Cowles Commission for Research in Economics*  
*The University of Chicago*

---

ing (time-preference theory of interest, or, conversely, that the latter is positive and determines a positive value of the first (marginal-productivity theory of interest). Whether any of these assumptions (and which one) is true is an empirical, not a theoretical question.

# The Scope and Method of Economics

## I. THE SUBJECT MATTER OF ECONOMICS.

Economics is the science of administration of scarce resources in human society. Human beings, living within the framework of a given historical civilisation, experience various wants, such as of food, shelter, clothing, education, social prestige, entertainment, expression of religious, national, or political attitudes, and others. Some of the wants result from biological needs which must be satisfied for the very preservation of life. Most of them, however, are products of life in civilized society, frequently of the very existence of the means to satisfy them, and even the wants which result from biological needs assume forms determined by the standards of the particular civilization under which the human beings live. The wants can be satisfied by means of appropriate objects called *goods*, e.g. land, coal, cattle, buildings, ships, railroads, machinery, stocks of raw materials and the uses of such objects or of persons called *services*, like of transportation, of housing, of workmen, of teachers, of managers, and of artists, etc. The goods and services are the *resources* which serve to satisfy human wants. Some of the resources, air, for instance, are so plentiful that all wants dependent upon them can be fully satisfied. Others, however, e.g. oil or the services of human beings, exist only in quantities which are not sufficient to satisfy all wants dependent upon these resources. In this case, we say that the resources are *scarce*. When resources are scarce, certain wants must go unsatisfied. Men make decisions which, given the organisation and institutions of society, determine the distribution of the scarce resources among the different persons as well as the uses to which the scarce resources are put. In other words: the resources are administered. The study of the ways in which scarce resources are administered is the task of the science of economics.

The administration of scarce resources is influenced by the standards of civilisation and by the organisation and institutions of the society in which men live. The influence is a two-fold one. The wants which the resources serve to satisfy are products of standards of civilisation historically developed in society. The ways in which scarce resources are procured, adapted to various purposes, distributed among different persons are all results of social organisation and social institutions. Forms of ownership, institutions like corporations and banks, technical knowledge acquired in institutes of research and transmitted by schools, regulation by government agencies, habits and moral standards all influence the ways of administering scarce resources. Economics is thus a *social science*, i.e. it deals with a subject which depends on the standards and forms of life in human society. It differs from sociology, the science of social actions and relations (patterns of repeated social actions) between men, by being interested in the actions of men toward the scarce resources which serve to satisfy their wants. These actions are dependent upon social actions but are distinct from them. We shall call them *economic actions*. While dependent on social actions, economic actions, in turn, influence and even create social actions and relations. The last mentioned influence provides subject-matter for a special field of study. We might name it *economic sociology*, the science of the effect of economic actions upon social actions and relations. Subjects such as the sociology of industrial relations, bureaucracy in corporations, trade-unionism, belong to this field. The present essay is limited to economics, i.e. the study of economic actions. This includes a study of the influence of social organisation and institutions upon the ways and methods of administration of scarce resources.

Like any other science, economics is not content with merely descriptive knowledge. It tries to discern general patterns of uniformity in the administration of scarce resources. The possibility of establishing such patterns of uniformity is based on two observed facts. Human actions with regard to scarce resources are subject to uniform patterns of repetition. For instance, most people react to an increase in their income by spending more money on goods and services. Within the framework of given social organisation and institutions, the uniformities in economic action of individuals or groups of individuals produce certain uniformities in the distribution and use of scarce resources. Thus, an increase in the quantity of bank loans to businessmen or corporations makes them increase their demand for resources with a consequent rise in employment and/or prices. The branch of economics which deals with such patterns of uniformity and combines them in a coherent system is called *theoretical economics* or *economic theory* (also economic analysis). Statements enunciating the patterns of uniformity are referred to as *economic laws*. Economic laws are, like all other scientific laws, conditional statements. They assert that such and such happens regularly whenever such and such conditions are satisfied (i.e. whenever such and such other observations take place). No scientific law applies when its prerequisite conditions do not occur. Since the administration of scarce resources is influenced by social organisation and institutions, such organisation and institutions are among the conditions implied in economic laws. Consequently, economic laws which hold under one type of social organisation may fail to do so under another type. Most economic laws are thus "limited historically" to certain given types of social organisation and institutions. This, however, does not imply any basic difference between the laws of economics (or of other social sciences) and the laws of the natural sciences. The latter, too, are contingent upon conditions which are subject to change. Different laws of the natural sciences have different degrees of historic permanence, usually a much higher one than the laws of economics, though even this is not always the case (some laws of meteorology are less permanent than some laws of economics). The difference is but one of degree. Like all scientific laws, economic laws are established in order to make successful prediction of the outcome of human actions. In economics the laws serve to predict the result of policies, i.e. of actions of public or private agencies with regard to the administration of scarce resources. Such predictions, however, are difficult. This is due to the fact that the number of conditions circumscribing the validity of economic laws is very great, and it is difficult to ascertain whether they are all satisfied in any particular situation. Notwithstanding, some successful predictions are being made with the aid of economic science.

Theoretical economics does not exhaust the field of economic inquiry. Economics also studies and describes the particular ways and methods of administering scarce resources as they occur in the history of human society, past and present. Observations are made and classified and interpreted with the aid of the uniformities established by economic theory. This pursuit provides the subject-matter of *applied economics*. Applied economics is subdivided into several parts. The most important are economic history—the study of administration of scarce resources in the human societies of the past—and institutional economics, the study of the influence of particular social institutions upon the administration of scarce resources. The effect of trade-associations upon prices, quality and output of goods, or the effect of collective farming in agriculture on the efficiency of production are examples of problems which fall in the last-mentioned field.

Theoretical economics puts the patterns of uniformity in a coherent system. This is done by presenting the laws of economics as a deductive set of propositions derived by the rules of logic (and of mathematics) from a few basic propositions. The

basic propositions are called assumptions or postulates, the derived propositions are called theorems. Theoretical economics thus appears (like all other theoretical sciences) as a deductive science. This, however, does not make it a branch of pure mathematics or logic. Like the rest of economics, economic theory is an empirical science. Its assumptions or postulates are approximative generalisations of empirical observations; e.g. the assumption that business enterprises act so as to maximise their money profit. Some inaccuracy of approximation (e.g. some considerations, like safety, may keep enterprises from maximising money profit) is accepted for the sake of greater simplicity. The theorems, in turn, are subjected to test by empirical observation. A deductive set of theorems to be subjected to empirical test is also called a *theory*, *hypothesis*, or a *model*. We can thus say that theoretical economics provides hypotheses or models based on generalisation of observations and subject to empirical test.

Since the assumptions (postulates) underlying a model are only approximative, the theorems do not correspond directly to results of empirical observations. In order to establish such a correspondence, special procedures must be provided. First, the concept used in theoretical models are not adequate representations of empirical observation. For instance, a theoretical model speaks of "the price" of a specified good, but experience fails to produce anything like the specified "good" and its "price." There are hundreds of quality-grades and thousands of sellers each charging a different price. Experience is much richer than the language of science can make allowance for. In order to bridge the gap between theoretical concepts and empirical observations, it is necessary to have a procedure of *identification*, which contains rules establishing a correspondence between the two. Such procedures have to be provided by the different branches of applied economics. Furthermore, the theorems of theoretical economics are never borne out exactly by empirical observation. At best, they do so only "approximately." This raises the question as to what is to be considered as an acceptable degree of approximation inducing us to accept a hypothesis as "true" and what degree of approximation is to be judged as insufficient, making us reject the hypothesis as "incompatible with the facts." The question can be answered only in terms of a procedure of *verification* (testing) which establishes rules according to which hypotheses are accepted as "empirically verified" or rejected as "empirically unverified" or "empirically refuted." A recently developed special branch of economics deals with such procedures of verification. It is called *econometrics* and is based on the principles of mathematical statistics.

The administration of scarce resources empirically observed can be evaluated in terms of certain social objectives. Such objectives may consist in the best satisfaction of the wants of private persons according to their own preferences or in marshalling scarce resources for certain collective enterprises—e.g. industrialisation of a country according to time-table, as in the Soviet Union, or successful prosecution of war, or enactment of certain ideas of social justice—or, finally, of a combination of all. The social objectives being given, rules of use of scarce resources can be found which are most conducive to the attainment of these objectives. The use of resources which follows these rules is referred to as the "ideal" use. The rules of "ideal" use of resources provide a standard by which the actual use can be evaluated as to its social desirability. The use of resources empirically observed may be compared with the "ideal" use and measures may be recommended to bring the actual use into closer correspondence with the "ideal" one. This provides subject-matter for another branch of economic science, usually called *welfare economics* (also normative economics or social economics). The rules of "ideal" use of resources are general statements; they express uniform patterns of economic action which, if adopted, are most conducive to the social objectives aimed at. They are conditional statements because they are

## THE REVIEW OF ECONOMIC STUDIES

valid only under given social objectives and given empirical conditions ; they require empirical verification. (A rule of "ideal" use of resources may prove in practice not to be conducive to the social aims desired). The rules of "ideal" use of resources can thus be considered as a special kind of economic laws. This makes it convenient to include welfare economics in theoretical economics as a supplementary branch of the latter.

## 2. THE OBJECTIVITY OF ECONOMIC SCIENCE.

The statements of economic science have objective validity. This means that two or more persons who agree to abide by the rules of scientific procedure are bound to reach the same conclusions. If they start with the same assumptions, they are bound, by the rules of logic, to derive the same theorems. If they apply the same rules of identification and verification, they are bound to reach agreement as to whether the theorems should be accepted as "true" or rejected as "unverified" or "false." The test of verification decides whether the assumptions are adequate or not. In the latter case, they have to be replaced by new ones which lead to theorems able to stand the test of verification. The final verdict with regard to any statement of economic science is thus based upon an appeal to facts, i.e. to empirical observations. "The proof of the pudding is in the eating." This verdict has interpersonal validity because facts are interpersonal, i.e. can be observed by everyone.

The interpersonal validity of statements holds also for welfare economics. There is no necessary interpersonal agreement about the social objectives which provide the standard of evaluation for welfare economics. Different persons, social groups and classes may, and frequently do desire different social objectives. Once, however, the objectives are stated and certain assumptions are made about empirical conditions, the rules of "ideal" use of resources are derived by the rules of logic and verified by the rules of verification. This procedure is interpersonally objective, i.e. everyone who applies it is bound to reach the same conclusions. The situation may be compared with that of two physicians treating a patient. There is no necessity of interpersonal agreement about the objective of the treatment. One physician may want to heal the patient, the other may want to kill him (e.g. the patient may be a Jew in a Nazi concentration camp ; one physician may be a fellow prisoner who wants to help him, the other physician may be a Nazi acting under orders to exterminate Jews). But once the objective is set for the purpose under discussion (either of the two physicians may, of course, refuse to act upon it), their statements as to whether a given treatment is conducive to the end under consideration have interpersonal validity. Any disagreement between them can be settled by appeal to fact and to the rules of scientific procedure.

Our conclusion about the objectivity of economic science may seem startling. Economists are rather notorious for being unable to reach agreement and for being divided into opposing "schools of thought," "orthodox" and "unorthodox," "bourgeois" and "socialist," and many others. The existence of profound disagreement among economists, however, does not refute our thesis about the objectivity of economics as a science. The disagreements can all be traced to one or more of the following sources :

(1) Disagreement about social objectives. This is the most frequent source of disagreement, but acts as such only as long as it is implicit and unrecognised. If the social objectives are stated explicitly, the disagreement disappears. For any given set of social objectives and with given assumptions as to empirical conditions, conclusions are drawn with interpersonal validity by the rules of logic and of verification.

(2) Disagreement about facts. Such disagreement can always be resolved by further observation and study of the empirical material. Frequently, however, the empirical data necessary to resolve the disagreement are unavailable. In such cases the issue remains unsettled. The conclusion that the issue cannot be settled with the data available has interpersonal validity. Agreement is reached to withhold judgment.

(3) Failure to abide by the rules of logic, of identification and of verification. The disagreement can be removed by correct application of these rules.

The disagreements are thus all due to failure to abide by the rules of scientific procedure and can be resolved by strict application of these rules. Economists, as well as other scientists, however, are not automatons acting on the basis of the rules of scientific procedure. As human beings they are subject to a great multiplicity of influences, some conscious, most of them subconscious, which determine their conclusions as laid down in the literature of economics. There are influences, sociological and psychological, which sometimes are unfavourable and sometimes favourable to the application of scientific procedure. The persistence of disagreements indicates that the harmful influences are very strong. It is desirable to have a picture of these influences, harmful as well as helpful.

Economists, like other human beings, live under the institutions of a historic society and under the standards of its civilisation. They share in its beliefs and values, prejudices and interests, horizons and limitations. They depend for their living, advancement, and recognition on the institutions of the society in which they live, e.g. on universities, research institutes, publishers, press, government, and business establishments. Most of these institutions have other, more important, objectives than the "untrammelled pursuit of truth," and even those which have this objective are dependent on the rest of society and must make their adjustments and compromises. Furthermore, economists are brought up as members of a particular nation, social class, religious or philosophical group, and political tradition, etc. All this exposes economists, and also other scientists, to a multiplicity of influences other than the rules of scientific procedure. Those influences which are conscious are easily recognised and overcome if they interfere with honest application of scientific procedure. Though even in this case, many may choose to limit their scientific inquiry to "safe" fields where there is little danger of conflict with powerful and dominant interests and prejudices. The really important influences, however, are those which are subconscious. The economist subject to them is unaware of their existence; the influences operate through processes of rationalisation of subconscious motivations. The result is the production of *ideologies*, i.e. systems of beliefs which are held not on grounds of their conformity to scientific procedure but as rationalisations of subconscious, non-logical, motives. Ideologies have no interpersonal validity. They convince only those who share the same subconscious motivations and undergo the same processes of rationalisation.

The study of ideologies, of the conditions of their origins and influences, has become the subject-matter of a special discipline, the *sociology of knowledge*. This discipline has established valuable insights into the sociological and psychological conditions of scientific inquiry. Its most important contribution is the recognition of the fact that all scientific production contains an ideological element. This holds for the natural sciences as well as for the social sciences. The history of the Copernican theory in astronomy and of the theory of evolution in biology provides an example. For a long time the attitude of astronomers and of biologists to these theories was influenced by their general attitude, friendly or hostile, to dominant ecclesiastic doctrines and by their personal dependence or lack of dependence on ecclesiastic institutions. The history of economics is full of instances of the ideological element in

economic science. The most important stepping-stones in the development of economics were not merely scientific but also ideological with far-reaching social consequences.

The existence of an ideological element in each science has caused some representatives of the sociology of knowledge to deny the objective validity of scientific statements, particularly in the domain of the social sciences. Such a conclusion is unwarranted. The validity of scientific statements can be ascertained with impersonal objectivity through an appeal to facts. Predictions derived from scientific statements are or are not borne out under the test of verification. The outcome is entirely independent of human motivations, conscious or subconscious; it depends entirely on the correctness of the scientific procedure applied in establishing the statements. Eclipses predicted do or do not occur, bridges stand the stress of traffic or break down, patients get healed or die, whatever the personal motivations of the astronomer, the engineering scientist or the medical man. Certain economic situations lead to unemployment or to inflation, whatever the economist's personal liking or disliking of the capitalist system. The validity of scientific statements does not depend on human motivations; it depends entirely on the observations of the rule of scientific procedure and is, therefore, interpersonal.

The ideological element in scientific inquiry need not always be a handicap in reaching interpersonally valid results. If this was not the case, little scientific progress would have been made. Ideological motivation may also stimulate the development of science. Discoveries have been made in physics and chemistry as a consequence of the desire to make profits or to promote national defence (indeed, the very development of these sciences is closely related to modern industry and warfare). Biological science has been stimulated by motivations of human sympathy for the sick and the suffering. Most important contributions of the social sciences are due to passion for social justice and betterment. The discoveries of classical economics were thus ideologically motivated by passion for freedom and justice as well as by the interests of the industrial middle class. The progress of institutional economics was substantially motivated ideologically by the desire for justice and for the improvement of the lot of the industrial working class. Some relation seems to exist between the nature of the motivations and their favourable or unfavourable influence upon the development of economics and other social sciences. "Conservative" motivations, i.e. motivations resulting from the desire to maintain established social institutions and standards of civilisation tend to disfavour, while "progressive" motivations which result from the desire to change and improve social institutions and standards of civilisation tend to favour the attainment of scientifically valid results in the domain of the social sciences. For it is the desire for change and betterment, whether conscious or subconscious which creates the inquisitiveness of mind resulting in scientific investigation of human society.

### 3. THE UNITS OF ECONOMIC DECISION AND THEIR CO-ORDINATION.

Administration of scarce resources, or economic activity, is carried on by various units such as individual persons, families, business corporations, or agencies of the government. Each of these units has disposal over certain resources and makes decisions as to their use. We shall call them *units of economic decision* (or of economic activity). Three kinds of use of resources are ordinarily distinguished: (1) *consumption* or the use of resources for direct satisfaction of wants; (2) *production* or the preparation and adaption of resources for the satisfaction of wants through actions such as changing physical, chemical, and biological qualities, changing location in space,

and storing for future use ; (3) *exchange* or the use of resources for procurement of resources from other units of economic decision. Accordingly, the units of economic decision are frequently classified as consumers and producers, respectively. These classes, however, are not mutually exclusive. For the same unit is frequently a consumer and producer at the same time (a farm, for instance) ; almost all units in modern society engage in exchange. There are practically no units engaging in exchange alone ; e.g. commerce involves always some change in location or some storage of resources.

A more important classification is one according to the objectives which guide the decisions of the units. On this basis three types of units can be distinguished :

(1) *Households*. The objective of the decisions of these units is consumption, i.e. satisfaction of wants. Households may engage in exchange and in production, but these activities are undertaken with the purpose of providing for the satisfaction of wants of members of the unit. Households appear in different forms, namely, as individual persons, families, corporations, and even public agencies (e.g. a municipal orphanage). In our society, the family is the dominant form of a household.

(2) *Firms or Business Enterprises*. These are units which engage in exchange with the purpose of making a money profit, i.e. a difference between the money value of the resources sold and the money value of the resources bought. Firms are practically always producers ; they are distinguished from other producers by the objective of their activity, namely the acquisition of money profit. Firms assume diverse forms : individual enterprises, business corporations, and also government agencies. In our present society, the corporate form is dominant.

(3) *Public Services*. These are agencies operated with the purpose of contributing to the attainment of certain social objectives (usually called public welfare). Instances of public services are schools, hospitals, research institutes, publicly owned and operated utilities, the post-office, the army and navy, etc. In most cases, public services are operated by some branch of government, national, state or local. But this is not always the case, e.g. privately endowed universities or hospitals. Certain public services are also operated jointly by two or several governments or by governments and private institutions.

The three objectives which serve as a basis for this classification can always be conceptually distinguished. Accordingly, each unit of economic decision will be considered as being either a household, a firm, or a public service. Under certain circumstances, the pursuit of one of these objectives may imply exactly the same actions as the pursuit of another one. Thus, a public service may, according to the social objective chosen, act exactly like a business enterprise. In such cases, it is necessary to ascertain the real objective of the decisions (e.g. attainment of a social objective or pursuit of money profit). This can be done by varying the circumstances hypothetically in such a way that the different objectives imply different actions and by inquiring into the actions which will be followed. It should also be noticed that individual persons may be members of several units of economic decision. For instance, a person can be a member of a household, and at the same time a member of several business firms.

The decisions of a unit may be independent of the decisions of other units and exert no influence on them. The unit is then said to be an isolated unit. Isolated units of economic decision are by necessity, households. In modern society, however, decisions of the various units influence each other ; they are interdependent. The totality of interdependent units of economic decision is called an *economy* or an *economic system*. If the decisions of the different units in an economy are to be carried out, they must be consistent with each other. Thus, the quantity of resources which units wish to consume must be equal to the quantity which the same or other units wish to produce ; the quantity of resources which units wish to acquire by exchange



must be equal to the quantity which other units wish to give up in the exchange ; the total quantity of a resource desired by the units must be equal to the quantity available in the economy. When the decisions of the various units in the economy are consistent with each other, the economy is said to be in *equilibrium*. Unless the economy is in equilibrium, the decisions of the units cannot all be translated into actions. In order for action to become possible, the decisions must be co-ordinated, i.e. brought into consistency with each other.

There are two principal methods by which decisions of the various units are co-ordinated. One is *planning*, i.e. co-ordination by a central authority with power to influence the decisions of the units. The means used by the planning authority to influence the decisions of the units are many. The planning authority can prescribe quotas, i.e. quantities of resources to be produced or consumed, bought or sold by each unit. It can also use more indirect means as, for instance, subsidies and taxes to encourage or discourage certain decisions. Another means of planning is regulation, the setting of rules which the units must observe in their decisions and actions. The planning authority may extend over the whole economy or over a part of it. It may be public, e.g. an agency of government, or private, as, for instance, a trade association or a cartel. We may, accordingly, distinguish between private and public planning.

The other method of co-ordination is the *market*. A market is a pattern of regular, recurrent exchange relations between units of economic decision. Regular exchange between a large number of units presupposes the use of a generally accepted medium of exchange, namely of money. The units thus transact their exchange in two stages, sale and purchase ; they sell their resources for money and buy with the money the resources desired. The ratio at which money and resources are exchanged in the market is called the price. Meeting in the market, the various units match their offers and bids, their supplies and demands, against each other. They adjust and readjust their quantities offered and demanded and their prices, until co-ordination of their decisions is reached. Thus, through an interplay of the units in the market, equilibrium of the economy is attained. This happens quite unintentionally, as a by-product of the pursuit by each unit of its own individual goals (consumption, money profit, or public service). The market thus automatically produces a result equivalent to that of planning. Its operation has, therefore, been compared (by Adam Smith and others) to that of an invisible hand which produces co-ordination out of the autonomous decisions of many separate units. Not all markets, however, are able to produce such co-ordination, nor is the co-ordination obtained always consistent with accepted social objectives. In such cases, planning is used either to reach the co-ordination otherwise unobtainable or to correct the co-ordination produced by the "invisible hand" of the market.

Planning and the market do not exclude each other. Planning may utilise the uniformity of behaviour patterns of units operating in the market as one of the means of influencing their decisions. This happens, for instance, when the planning authority imposes tariffs or pays subsidies in order to influence the quantities bought or sold. Sometimes regulation—a special method of planning—is necessary in order to enable the market to achieve co-ordination of the units' decisions. The two methods of co-ordination co-exist with each other. However, in different historic societies, one or the other of these methods plays the preponderant role and appears as the chief means of co-ordinating all the units in the economy. The development of economics as a science is closely connected with the growing preponderance of the market in modern times. The co-ordinating operation of the market and, at times, the failure of the market to achieve co-ordination of decisions have posed the intellectual problems which have led to the emergence and growth of economic science.

## 4. CAPITALISM AND OTHER FORMS OF ECONOMIC ORGANISATION.

The history of human society confronts us with different ways in which administration of scarce resources is organised. Of all types of economic activity, production is the one to which men devote their major time and attention. We, therefore, classify the forms of economic organisation according to the units of economic decision which are dominant in the performance of production. In older times, almost all producers were households; administration of resources was carried on in isolated units. Such a form of economic organisation is usually called a domestic economy. The growing interdependence of households through exchange of goods and services had led to the emergence of the firm or business enterprise as the dominant producing unit in the economy. At present, in most of the advanced countries, production is done by firms.

Firms or business enterprises have as their objective one single magnitude, namely, money profit. In this they differ from households and public services. A household, for instance, desires to satisfy several wants, not to pursue merely one magnitude as an objective. Similar considerations hold for public services. Having one single magnitude for an objective, the firm attains the objective the better the greater the value of the magnitude attained. In other words: pursuing money profit for its objective, a firm wants to *maximise* it. It uses the resources at its disposal—its capital—in such a way as to obtain the greatest possible money profit. An economy in which all or most of production is done by firms is called a *capitalist economy*; the economic organisation which leaves production to firms is called *capitalism*. In our present economy, most of the firms or business enterprises are privately owned (most frequently they are private corporations). It is, however, possible to envisage an economic organisation in which production is assigned to publicly owned profit-maximising enterprises. We shall use the term *state capitalism* to denote such an economic organisation. For the sake of distinction, we may describe our present economic organisation as *private capitalism*. Since a publicly owned profit-maximising enterprise operates exactly like a private firm, this distinction is of no importance for economic theory, however significant it may be from the point of view of sociology or political science.

Pursuit of money profit implies participation in exchange. Firms regularly buy and sell resources. The market is, therefore, an integral part of the capitalist economy. It is, indeed, the chief method by which various units of decision in the capitalist economy are co-ordinated. Planning, however, is not excluded as a method of co-ordination under capitalism. It played an important part in early capitalism (mercantilist policy, e.g.) and increases steadily in importance in the present capitalist economy. The existence of the market is not sufficient for the economy to be capitalist; a market, for instance, exists in an economic organisation in which production is done by households which regularly exchange part of their products. For the economy to be capitalist, according to our definition, money profit must be the sole objective of the units engaged in production. This excludes an economy in which the satisfaction of wants competes with the profit-making objective. A craftsman may refuse to use an opportunity of making an additional money profit because it is not worth the effort involved or because he prefers to devote his time to the satisfaction of specific wants, such as company, entertainment, etc. A farmer may fail to maximise money profit because he prefers to consume some of his products instead of selling them. In order that the producing unit pursue money profit as its sole objective, it must be entirely separated from the owner's (or owners') household and, in addition, all services of persons employed by the unit must be purchased in the market.

The condition that all services of persons employed by the producing unit be

purchased in the market implies that these persons do not own the enterprise. They must be either pure labourers paid wages or salaries or slaves purchased by the enterprise. In antiquity business enterprises operated with slave labour played a considerable role. Some authors, therefore, speak of capitalism in ancient Greece and Rome. In modern times, however, business enterprises employ the services of free wage and salary earners. The existence of a class of labourers working for wages and salaries endows capitalism with specific sociological features. Capitalism as a form of economic organisation is, therefore, a subject of study of economic sociology as well as of economics.

Firms, as defined by us, are but approximative representations of certain units of economic decision found in experience. Although in the present economy, money profit is the chief objective of most units engaged in production, some other objectives are always co-existent. Among these other objectives are, for instance, prestige, social standing, desire for a "quiet life," social responsibilities, and, most important of all, desire for safety, i.e. dislike of decisions involving risk. Strictly speaking, the empirical units called "firms" or "business enterprises" are households which desire to satisfy these specific wants alongside with making money profit; they are ready to sacrifice some money profit to attain the other objectives. The pursuit of money profit, however, dominates the other objectives to such an extent that the units mentioned conform approximately to our theoretical concept of a firm. The extent of approximation between the theoretical concept and its empirical counterpart justifies the assumption that the units engaged in production pursue the single objective of money profit as a useful simplification of analysis. The consequences of the other objectives being present can be introduced at a later stage, whenever necessary. However, the desire for safety may be of such prominence that it sometimes becomes necessary to introduce it from the very beginning in the analysis of the firm. This can be done by redefining the firm as pursuing profit "discounted for risk" as a single objective. The presence of a desire for safety among firms will be considered as compatible with the capitalist character of the economy.

Another form of economic organisation to consider is *socialism*. This is an economic organisation where production is done by public services operated for the satisfaction of the wants of the community. Socialism is the objective of important social and political movements in many countries, e.g. the Labour Party in Great Britain, and in some of the Dominions, the Co-operative Commonwealth Federation in Canada, the socialist and communist movements in the various countries of Europe. One country, the Union of Soviet Socialist Republics, has established a socialist economy. In a socialist economy production is a public, not private, responsibility. All the units of economic decision charged with production need not be owned and operated by the central government. They may be owned and operated by branches of provincial and local government, by citizens' associations like co-operatives, unions, or collective farms, by special public service corporations, or foundations. There may be substantial decentralisation of units of decision in a socialist economy. All these units, however, must be public services, i.e. they must be operated for the satisfaction of the wants of the whole community and not merely of members of the unit. In principle, the co-ordination of the decisions of the various units may be effected by either planning or the market. In practice, both methods prove necessary, as is similar under capitalism. Most socialists, however, assign planning a much greater role under socialism than it has under capitalism. In the U.S.S.R. planning serves as the basic method of co-ordination between producing units, the market playing an important subsidiary role in co-ordinating the decisions of households with the decisions of the producing units. If socialism is adopted by more countries, the socialist economies in different countries

will probably differ substantially as to types of producing units, their degree of centralisation, and as to the relative importance of planning and the market as methods of co-ordination, just as the capitalist economy differs from country to country and in different historical periods.

History seldom confronts us with an economic organisation corresponding exactly to our theoretical classifications. In most cases, production is carried on by all three types of units of economic decision, by households, by firms, and by public services. Thus, in the United States at present, households like small farms or craftsmen and public services like publicly owned power plants or transportation services engage in production alongside with business enterprises. Elements of a domestic economy and of a socialist economy co-exist with those of a capitalist economy. But one of the three types (for instance, business enterprises in the United States) may be so dominant (in terms of the amount of resources at the disposal of units of this type) that the economy may be described as approximately domestic, capitalist, or socialist. For purposes of theoretical analysis, we then disregard the other elements and introduce them, if necessary, at a later stage. Such a procedure is sometimes called construction of "ideal types" of economic organisation. Economic theories can then be developed which describe the operation of such "typical" economies, e.g. the economics of capitalism or the economics of socialism. In some cases, however, this proves impossible because several types of units of economic decision are equally important in production, or although one type is dominant, some other type is too important to be disregarded even in a first approximation. For instance, in many countries of Europe big industry and finance are operated as public services, while medium-sized and small industry are operated by business enterprises; in addition, farming is frequently operated by households exchanging but a small part of their products in the market. In such case we speak of a *mixed economy*.

An instance of mixed economy occurs when the government chooses to leave production to private firms (or sometimes to households) or to conduct it through public services, depending upon, in each case, which course promises to contribute more to the satisfaction of the wants of the community. This may be called a *service economy* because production is assigned to the unit which best serves the social purpose. But it can be considered as a special kind of socialist economy. The purpose of production here is always satisfaction of the wants of the community; the operation of production is merely delegated to private firms if they do it better than, or at least, just as well as, public agencies. In such an economy private firms can be considered as a special kind of public service in which the managers are remunerated by being allowed to make whatever money profit they can. Furthermore, in a service economy the government must have the power to decide in each case whether a private firm or a public agency is to be charged with production. This presupposes an alignment of political power similar to that in a socialist society. The service economy type of socialism, rather than the "ideal type" excluding all forms of private business enterprise, is the objective of contemporary socialist movements; the political programmes of the socialist and communist parties are explicit in stating that private enterprise shall continue to operate under socialism in small farming, small trade, and small industry. It is, therefore, an important subject of study for economic science.

##### 5. THE POSTULATE OF RATIONALITY.

We have seen that the pursuit by firms of a single magnitude for an objective implies the desire to maximise it. A unit in pursuit of money profit but not desirous of maximising it obviously must be striving for additional objectives. It is ready to

sacrifice some money profit for the attainment of some other objective or objectives. Thus, there appears to be an essential difference between firms and households. Firms pursue a single objective, a magnitude which they want to maximise; households, instead, are concerned with the satisfaction of many different wants, theirs being a multiplicity of objectives. However, since resources are scarce, wants must be weighed against each other and decisions must be made as to which wants to satisfy and to what extent; resources must be allocated accordingly. This implies the existence of given preferences which guide the household in choosing one allocation rather than another. We may now ask whether these preferences can be ordered along a scale. When this is possible, the household can be interpreted as pursuing a single objective, namely, the most preferred allocation of the resources among its different wants. The household appears then as maximising a magnitude. We call this magnitude *utility*. The decisions of the household are interpreted, in this case, in a way similar to those of firms, i.e. as resulting from the pursuit of a single objective.

The possibility of interpreting decisions of households in a way similar to decisions of firms suggests the adoption of a general postulate covering both cases. We call it the *postulate of rationality*. A unit of economic decision is said to act rationally when its objective is the maximisation of a magnitude. Firms thus act rationally, by definition, while households do so only when their preferred allocations of resources among different wants can be ordered along a scale. The postulate of rationality is the assumption that all units of economic decision act rationally. This assumption provides us with a most powerful tool for simplification of theoretical analysis. For, if a unit of decision acts rationally, its decisions in any given situation can be predicted by mere application of the rules of logic (and of mathematics). In absence of rational action such prediction could be made only after painstaking empirical study of the uniformities in the decision patterns of the unit. For a unit which acts rationally, these uniformities or laws can be deduced immediately by logic and the decisions predicted, accordingly. Thus, the postulate of rationality is a short-cut to the discovery of laws governing the decisions of units and to the prediction of their actions under given circumstances.

Though a short-cut designed to save elaborate empirical investigation, the postulate of rationality is, nevertheless, but an empirical assumption. It is a hypothesis which, in each case, must be verified by confronting the logical deductions obtained from the postulate with the observations of experience. The use of the postulate is justified only when the logical deductions agree with the results of empirical observation with an acceptable degree of approximation. Otherwise, the postulate would lead us to make predictions which fail to be borne out by observed facts. This needs to be stressed because some economists believe that the postulate of rationality can be used as an *a priori* principle, not subject to empirical verification. In such case, however, the conclusions derived from the postulate of rationality could not have any empirical relevance, either. Theoretical economics would become a branch of pure logic or mathematics without empirical implications, whatsoever. If the laws deduced from the postulate of rationality are to serve as a basis of making predictions about the decisions of units encountered in experience, this postulate must be treated as an empirical hypothesis.

The hypothesis that producing units act rationally, i.e. with the objective of maximising money profit, is verified with satisfactory approximation in the capitalist economy. It serves, therefore, as a useful tool of simplification in the study of that economy. The situation is more doubtful with regard to households. Here the verification of the hypothesis is much more precarious, and we must expect much larger discrepancies between results of empirical observation and conclusions derived from

the postulate of rationality. There seems, however, to be some difference between households operating in the capitalist economy and households of the domestic economy of pre-capitalist societies. The dominance of business enterprises with a tangible and quantified magnitude (money profit) as their objective has created a mental habit of considering all kinds of decisions as a pursuit of a single objective, expressed as a magnitude. Some authors call this mental habit the "capitalist spirit." It spreads beyond the specific decisions of business enterprises and affects the mode of operation of other units, including households. Under the influence of the mental habit mentioned, households are encouraged to order their preferences along a scale, i.e. to maximise utility. In capitalist society, therefore, the decisions of households are more likely to conform to the deductions derived from the postulate of rationality than in societies which preceded the rise of modern capitalism.

Public services act rationally when the social objective they aim at can be expressed as a single magnitude to be maximised. The magnitude is then called *public welfare*. Public welfare exists as a magnitude when the community, or more exactly the agencies of the community responsible for the judgment, have preferences as to the distribution of resources among members of the community as well as to the allocation of resources among the various wants of each member, and when, furthermore, these preferences can be ordered along a scale. In this case, the decisions of public services in any given situation can be derived by the rules of logic from the postulate of rationality. But the community seldom has such definite and ordered preferences. Because of this, the study of the operation of public services has to be based on the observations of institutional economics and economic history rather than on logical deductions from the postulate of rationality. However, there is a different way in which the postulate of rationality is useful in the study of public services. Instead of accepting it as an empirical hypotheses, we can consider conformity of public services with the postulate of rationality as a social objective. In other words: we can set up a chosen set of ordered preferences, i.e. some concept of public welfare, as our own (i.e. the student's) social objective and require that all public services be guided by this objective as a norm. This leads to rules of "ideal" use of resources and provides a basis for critical evaluation of the actual administration of resources by public services as well as by firms and households. The postulate of rationality becomes then the basis of a theory of welfare economics.

There is a difference between the rationality of households and firms and the rationality, whether (approximately) actual or normative (as in welfare economics) of public services. The first involves the pursuit of a private objective—utility or profit, respectively; the latter involves pursuit of a social objective, namely, public welfare. We can speak of *private* and *social rationality*, accordingly. Private rationality need not necessarily exclude social rationality. If the community's preferences as to allocation of resources among the various wants of each member coincide with the individual preferences of the members, then each member, by maximising his private utility, contributes to the attainment of maximum public welfare. Under certain conditions the maximisation of money profit by firms implies maximisation of public welfare too. In such cases, their own private rationality makes the members of the community act as if they were public services; private rationality then implies social rationality. The existence of such situations underlies the idea of the service economy. If all firms were always subject to these conditions, the capitalist economy could be considered as a special case of a service economy in which it is found expedient to delegate all production to private firms. This, indeed, is the famous doctrine of *laissez faire* which maintains that the capitalist economy, provided it is not hampered by government planning, spontaneously operates in such a way that it secures the maximum

of public welfare. Accordingly, non-interference in the spontaneous operation of the capitalist economy is considered to be the best way of assuring the "ideal" use of resources. Most contemporary students of welfare economics consider this claim to be false and point out many conflicts between the private rationality of business enterprises and social rationality as postulated by welfare economics. The private rationality of business enterprises is also in conflict with the social objectives accepted by most citizens of modern democratic society. This accounts for the increasing tendency toward planning under contemporary capitalism and also for the socialist movements present in most capitalist countries.

A final observation has to be made about the procedure of verification of the postulate of rationality. There is some difference in procedure between firms, on the one hand, and households and public services on the other. Money profit is a quantity which can be observed empirically (like, for instance, velocity in physics). The theoretical concept of money profit, therefore, can be easily identified with corresponding empirical observations (the procedure of identification involves an interpretation of book-keeping categories). Direct observation tells, then, whether firms do or do not maximise money profit. Utility and public welfare, instead, are purely theoretical constructs; there are no empirical observations which would serve as their counterparts (just like in the case of the concept of potential in physics). But this does not preclude verification by indirect devices. The uniformities of decision patterns are different when utility or public welfare, respectively, are maximised than when they are not. This difference in the uniformities mentioned makes it possible to verify empirically the hypothesis of rationality of acts of households and of public services.

*Washington, D.C.*

O. LANGE.

THE PRINCIPLE OF ECONOMIC  
RATIONALITY  
POLITICAL ECONOMY AND PRAXIOLOGY

*Economic activity and technique*

HUMAN economic activity is conscious and purposive activity. In the general economic conditions determined by production and distribution relations, certain economic stimuli together with certain ways of reacting to these stimuli make their appearance. This finds expression in the economic laws of human behaviour which we have discussed above. Economic stimuli determine the aims of economic activity, i.e. economic incentives. The reaction to these stimuli consists in the application of certain means in order to realize these ends. Economic activity consists in the realization of given ends by the use of certain means.

The set of means serving to realize the end together with the mode of application is the *technique* of a given economic activity. We thus talk about the technique of production and the technique of distribution, and, more specifically we distinguish between agricultural technique (agrotechnics, zootechnics), mining technique, the technique of steel production, the technique of chemical production, transport (land and water) techniques, trade technique, the technique of financial operations and many others. In the broad sense of the word the term "technique" is synonymous with the term "method", which, as we know, denotes a systematic mode of behaviour directed to the achievement of a given aim<sup>1</sup>.

---

<sup>1</sup> See above p. 100 n. 15 on the meaning of the term "method". The term "technique" is often used in a similar sense. Max Weber for example,



The technique of economic activity has, however, a special feature in that the means which it uses are material objects and the ends which it achieves are connected with material objects. Production consists in the manufacture of material objects i.e., goods, by the use of the means of production (the means of labour and the objects of labour) which are also material objects. Distribution is the division of goods among men, and hence the division of material objects; its performance requires the existence of material objects which we call the means of distribution (e.g. warehouses, shop buildings, and fittings like shelves, counters, scales etc.). Even the performance of services which directly satisfy the needs of man requires as a rule material means (e.g., the instruments of the hair-dresser, of the doctor, of the musician, of the teacher, the premises on which services are carried out, and the fittings of these premises); moreover, normally the service has a material effect (hair-cutting, medical treatment, the showing of a film). The technique of economic activity is thus a *material technique* and consists in the use of material means in order to achieve material ends<sup>2</sup>. Such technique is frequently called *technics*.

---

writes that each purposeful human activity has its own technique and gives as examples the technique of prayer, the technique of thought, the technique of scientific research, the technique of mnemonics (i.e., the technique of remembering), the technique of education, the technique of administration, the technique of love-making, the technique of war, musical technique, painting technique etc. (*Wirtschaft und Gesellschaft*, ed. cit., p. 32). The expression "technique" comes from the Greek τέχνη meaning "art". We often speak of the art of medicine, the art of engineering, the art of sailing etc.

<sup>2</sup> The fact that the technique of economic activity is a material technique was noted by W. Sombart: *Der moderne Kapitalismus*, 3rd ed., Munich and Leipzig 1919, vol. 1, pt. 1, p. 5. He also uses the term "instrumental technique" to denote the technique of economic activity. He defines this as follows: "By this I understand behaviour of a kind which, in order to achieve a technical end, applies real objects, instruments". F. von Gottl-Ottilienfeld, in a book dealing with technique and economy, uses the term "Realtechnik" to mean the technique of "intervention in the external sensual world". He distinguishes between individual technique (mnemonic technique, the technique of physical exercise), social technique (the technique of fighting, the technique of government and

Technique realizes the goal of an activity by evoking causes which have the effect of realizing the end. The means employed by a technique are causes having the desired end as their effect. The achievement of this end, or the *effectiveness* of the technique, consequently depends on the employment of such means which, as causes, in accordance with the causal laws existing in that particular field of activity, have the intended effect. A knowledge of these laws and the ability to make use of this knowledge constitute the conditions for the effectiveness of technique; the degree of effectiveness of a technique depends on the extent of the knowledge of the appropriate causal laws and on the ability to make use of them. In the material technique applied in economic activity it is the knowledge and ability to make use of the appropriate physical, chemical, biological and also (in the process of labour) psychological laws which determine its effectiveness. The study of the various types of material technique used in economic activity is called *technology*. Thus we have, for example, the technology of ship construction, the technology of land and water transport, the technology of storing meat products, the technology of showing films, etc.

Technology is thus the study of the means used to realize the various aims of economic activity, dealing with a vast assortment of material techniques. The aims which are actually realized in the course of economic activity, and the means which are applied, depend on the economic conditions in which economic activity takes place, and also on certain properties of the economic activity connected with these conditions.

*Traditional character of economic activity in natural economy*

Before the development of commodity production and commodity-money exchange, or when such production and exchange

---

administration), and intellectual technique (the technique of computation, the technique of playing chess). Gottl-Ottliensfeld comes to the conclusion that the peculiar technique of economic activity is "Realtechnik". See *Wirtschaft und Technik, Grundriss der Sozialoekonomik*, pt. 2, Tuebingen 1923, p. 9. It seems that the term, "material technique" best denotes the technique of economic activity.

have not yet developed fully, production and distribution are devoted to the direct satisfaction of needs. This is what is called *natural economy*. The stimuli determining the aims of economic activity are concrete needs. A great variety of needs results in correspondingly diverse aims of economic activity. Thus there are various aims like the acquisition of different kinds of food, clothing, housing, weapons, artistic objects, amusements, etc. These needs are, as we know, the product of that set of conditions of social life, which we call the culture of a given society. In a given culture, then, human economic activity has particular aims. These aims are established by custom and morality, approved by religion, and sometimes also sanctioned by legislation. The means employed to realize these aims, the technique of economic activity, are discovered and established by collective experience, and are moulded in the social process of labour by, as it were, "trial and error". Collective experience, moulded in the process of labour, discovers new means, evaluates their effectiveness in practice, retains those which are effective and discards those which are not. In this way a spontaneous "natural selection" of means takes place and the technique of economic activity is developed.

The aims of economic activity thus established together with their corresponding technique are carried over by tradition. Each new generation of society takes over aims and techniques of economic activity which have arisen from a particular culture. Economic activity realizes goals established by tradition with the help of means established by tradition without carrying out a reasoned analysis of either. This kind of economic activity is called *customary* and *traditional* activity. It is true that slow changes do take place in the aims and means of economic activity, for in every society the law of the progressive development of productive forces is at work in greater or less degree<sup>3</sup>. This, as we know, is the result of the mutual interaction on each other of man and the artificial environment which he creates in the social process of

---

<sup>3</sup> See Chapter Two.

production. These changes take place spontaneously and as a rule so slowly that they do not affect the traditional character of economic activity; in the life of the individual these changes are too minute to affect the traditional aims and means of his economic activity<sup>4</sup>. Only in periods of sharp contradiction between production relations and the nature of productive forces sudden and great changes do take place in the aims and means of economic activity. Once agreement has been re-established between the relations of production and the character of the productive forces a new set of aims and means of economic activity is established, becomes customary, and is passed down by tradition. Economic activity again becomes a customary, traditional activity.

Thus, within the framework of social formations in which natural economy prevails, economic activity is customary and traditional. This is a fact familiar to anthropologists, ethnologists, and economic historians. The American anthropologist Herskovits states: "The element of tradition is thus of great importance in determining the forms of technological and economic aspects of culture no less than of any other aspects"<sup>5</sup>. Sombart, the historian of capitalism, in describing the traditionalism of economic activity in pre-capitalist social formations, wrote: "Empirical, traditional economy means economy as it has been taught and handed down, and to which people have become accustomed. In deciding on some undertaking or activity, a man does not look in front of him, to his

---

<sup>4</sup> Krzywicki called these minor almost imperceptible changes "social differentials": "In the heart of society, that is of civilized society, minor differentials accumulate in the material substratum which finally result in a revolution in all fields of social life... Minor changes in the shaping of the productive forces, *social differentials*, slowly accumulate and just as a small annual subsidence of the land after hundreds of years gives it an altogether different form so 'after a time these minor social changes give birth to the *integral*, i.e., the framework of completely new relations". *Social Development among Animals and Human Beings. Sociological Studies* (in Polish), ed. cit., pp. 207-8 and 210.

<sup>5</sup> M. J. Herskovits, *Economic Anthropology*, Alfred A. Knopf, New York 1932, p. 80.

goal, he does not exclusively consider the purpose of his decision, but he looks back to the examples and experiences of the past"<sup>6</sup>. He goes on to explain: "From our birth onwards, and maybe even before, our environment imposes itself upon us and obliges us to follow a particular path of ability and volition: our knowledge, study, activities, feelings, views of our parents and teachers are all handed down to us... To the power of tradition, later in life, a second equally strong force is added: force of habit, which makes a man inclined always to do what he has done before so that as a result he is still more firmly held into the groove into which he has slid... Moreover a particular member of a group in trying to show that he is a worthy member of this group particularly esteems the cultural values which characterize his group... In this way primitive man is set on the track of an existing culture by various forces... The internal unity of all these individual features of pre-capitalist economy, as of the whole of pre-capitalist cultural life, find their expression in a basic concept of life as perpetuation..."<sup>7</sup>.

Economic activity in pre-capitalist societies was similarly described by Max Weber who, however, emphasized two other elements in his explanation of the problem. These two elements were the interest of certain social classes or groups in the preservation of traditional forms of activity, and magico-religious sanctions. Weber writes: "At the beginning we find *traditionalism* and the sanctity of tradition everywhere, which will only allow activity and economy of the kind which has been practised by previous generations... An inability and general reluctance to leave accustomed paths is the main reason for adhering to tradition. This primitive traditionalism may, however, become much stronger in two circumstances. In the first place *material interests* may be involved with the maintenance of tradition... Even stronger is the effect of the *magical stereotypization* of activity, the fear of altering a traditional way of life for fear of supernatural harm. This

---

<sup>6</sup> W. Sombart, *Der Moderne Kapitalismus*, ed. cit., vol. 1, pp. 37-8.

<sup>7</sup> *Ibid.*, pp. 38-39.

generally corresponds with the interests of priests, but its basis is a general belief in supernatural dangers"<sup>8</sup>.

Marx drew attention to the importance of class interest as a factor in maintaining the traditionalism of economic activity in pre-capitalist formations. Writing about the feudal mode of production he says: "It is thus obvious that in the primitive and undeveloped conditions on which this social production relation and its corresponding mode of production are based, tradition must play an all-powerful part. It is equally obvious that, as always, it is in the interest of the governing section of society to sanction the existing state of things as the legal one and to consolidate as legal the framework created by custom and tradition"<sup>9</sup>.

*Separation of gainful activity from household activity in a commodity-money economy. Change in structure of ends of economic activity*

Since natural economy prevails in pre-capitalist formations, economic activity in these formations is mainly traditional and customary. This has survived right up to the present day wherever considerable elements of peasant economy have survived. The development of commodity production and commodity-money exchange, however, which begin in pre-capitalist social formations, undermines the traditionalism of economic activity. This occurs with peculiar force when the capitalist mode of production is developed and the whole of production becomes commodity production, and not only products but labour power is the object of commodity-money exchange. The whole process of production and distribution then takes place in the conditions of commodity and monetary economic relations.

---

<sup>8</sup> M. Weber, *Wirtschaftsgeschichte*, Munich and Leipzig 1924, pp. 302-3. As an example of magical stereotyping Weber tells how when railway construction was started in China the inhabitants objected to the disturbance of certain mountains, forests and rivers on the grounds that it would disquiet the spirits of their ancestors.

<sup>9</sup> K. Marx, *Das Kapital*, Berlin 1951, vol. 3, p. 844.

Commodity production and commodity-money exchange lead to the severance of the direct connection between economic activity and the satisfaction of needs. Human economic activity falls into two separate kinds of activity: *gainful activity* and *household activity*. Gainful activity consists in the production, sale and re-sale of goods (including labour power), in order to obtain a certain amount of money, or *money income*. Money income is spent on the purchase of goods which in the household are adapted and used to satisfy various needs (most frequently in the family, but also, for example, in an orphanage, a hospital, in military barracks etc.). All these are household activities.

The division of economic activity into two distinct kinds of activity leads to a new system of economic aims. In the household the aims of activity are still directly dictated by needs. These aims are multiple, corresponding to a variety of needs—for food, for clothing, housing, entertainment etc. Gainful activity on the other hand has only one aim: to obtain money income. This aim is always and everywhere the same, independent of the form which gainful activity may take. Whether it is agricultural production or industrial production, marine transport or trade in timber or textiles, financial operations or the performance of wage labour, medical or artistic services, or other concrete kinds of gainful activity—their aim is always the same: to obtain money income. This aim is also independent of the concrete needs to be satisfied by the proceeds of gainful activity. Whether it is a matter of supporting a family (providing them with food, housing and clothing), of medical treatment, of tourist travel, of amusements, of philanthropic activity, or of other concrete needs—gainful activity, which is to ensure the possibility of satisfying these needs, has always one and the same aim: money income.

The division of economic activity into gainful activity and household activity thus produces a general end, the realization of which is the condition for the realization of all other aims of economic activity. The aims connected with household activity and determined by various needs can only be realized

insofar as the end of gainful activity i.e., the obtaining of money income, is realized. In these conditions the end of gainful activity is the *key end* since on its realization depends the realization of all other aims. This gives rise to a specific *structure of ends*: one end, that of obtaining money income, becomes the means of realizing all other ends, or aims. The aims of economic activity are connected with each other by the fact that there is a common means for their realization, which means is in turn the end of gainful activity. Instead of parallel aims existing side by side, as in natural economy, there is a system of ends with a definite structure. The key end of this system, the obtaining of money income, becomes the focus of all human economic activity; gainful activity becomes the foundation of all economic activity.

The development of a structure of ends in economic activity makes it impossible to preserve the traditional character of this activity in its entirety. The aims of domestic economic activity can and, as a rule, do preserve their traditional and customary character because they are determined by traditional cultural conditions, social status and its corresponding "way of life". The end of gainful activity, on the other hand, is imposed ineluctably by the economic relations of commodity production and commodity-money exchange. Money income in a commodity-money economy is an *economic necessity*, independent of a society's cultural traditions. This necessity acquires the nature of an economic law of commodity-money economic relations. Without money income all other economic activity is impossible. This undermines the traditional and customary set of aims of economic activity, whatever they may be, introduces gainful activity as the key end and transforms the set into the structure referred to above, composed of mutually connected aims with the key end as its focus. Thus the end of gainful activity is independent of the cultural setting of society and the traditional aims of the economic and other activities connected with it.

Since in gainful activity there is one end only and not—as in natural economy—a multiplicity of aims, all the means



and operations of this activity, the whole of its technique, are subordinated to this one common end. We express this by saying that *an integration of means by a common end* takes place. This integration combines the means into a purposive system of applying them. By comparison with natural economy this creates quite new conditions for economic activity. In natural economy there are a great variety of parallel ends and an equally great variety of means; some means are specifically applied to particular ends (e.g., bread for food), others may serve various ends (e.g., wood for building houses, making carts, building bridges or for fuel). This complicated system of ends and means is established by tradition and becomes the object of traditional and customary economic activity. On the other hand, the fact that in gainful activity there is only one end, that this end is unconditionally necessary and that all means are subordinated to this one end, simplifies activity, making it easy to analyze. The integration of means through the end of gainful activity wrenches them from their traditional and customary paths. For integration requires at all times the evaluation of the usefulness of a given means from the point of view of the end of gainful activity, i.e., money income. Unsuitable means are discarded, without regard to the tradition on which they are based and the choice of means is made on the basis of a calculation of their relation to the money income that can be attained.

*Rationality—the characteristic of gainful activity*

Thus, in a commodity-money economy, both the end and the means of gainful activity break with tradition. Gainful activity becomes an activity based on reasoning, a *rational activity*<sup>10</sup>. The end of gainful activity emerges with logical

<sup>10</sup> The concept of rational activity applies to all kinds of activity besides economic activity. Max Weber, whose classification of types of behaviour gained wide acceptance, uses the term *zweckrationales Handeln* in distinction from another kind of rational behaviour, *wertrationales Handeln*. See *Wirtschaft und Gesellschaft*, vol. 1, p. 12. But it seems that this second type can be reduced to the first, and that one category of rational activity is sufficient. Kotarbiński distinguishes only one category:

necessity in the process of reasoning as the indispensable condition for the realization of any other aim of economic activity, while the means are evaluated by applying logical inference to the known laws of nature, economic relations and concrete facts.

In this connection we distinguish two kinds of rationality of action: factual rationality and methodological rationality<sup>11</sup>. The first occurs when the choice of means corresponds to the true objectively existing situation, i.e., to the actually existing facts, laws and relations. Factual rationality of action

---

*Treatise on Good Work*, ed. cit., p. 137. Weber further distinguishes traditional activity and emotional activity (p. 12). Emotionality of behaviour, however, is connected with a different principle of classification: both rational and traditional behaviour can be positively or negatively coloured by emotion, they can have pleasant or unpleasant associations. The division into rational and traditional behaviour is sufficient. It is significant, moreover, that Weber only uses two of these categories in his books on economic history; see for example *Wirtschaftsgeschichte*, pp. 15 and 302-3. Ludwig von Mises' assertion that human action is necessarily always rational and that the term "rational action" is therefore pleonastic and must be rejected as such, is completely mistaken. (Ludwig von Mises, *Human Action—A Treatise on Economics*, London 1949, p. 18). Mises states that "the opposite of action is not irrational behaviour, but a reactive response to stimuli on the part of the bodily organs and instincts which cannot be controlled by the volition of the person concerned" (p. 20). This leaves no room for traditional behaviour which is also conscious and purposeful activity but is distinguished by the fact that the aim and the means of this activity are established by tradition and are not the result of reasoning. Both in traditional activity and in rational activity there is a consciousness of aim and means; the difference between these two kinds of activity consists in the fact that in one case the aim and the means adopted are traditional and in the second case they are arrived at by reasoning. Gerd Alschner gives a penetrating criticism of Mises' view in *Rationalität und Irrationalität in den wirtschaftlichen Handlungen und ihre Erfassung durch die Wirtschaftstheorie*. *Schmollers Jahrbuch für Gesetzgebung, Verwaltung und Volkswirtschaft*, 1957, pp. 5-12.

<sup>11</sup> Kotarbiński makes this distinction in *Treatise on Good Work* (in Polish), ed. cit., pp. 137-9. He gives the following example of activity which is methodologically but not factually rational: "Someone bases his plan of travel on the official time-table but fails to reach his destination, because contrary to the information given the train does not stop there".

is thus synonymous with its effectiveness. The second, methodological rationality means that the activity is rational from the point of view of the knowledge possessed by the agent, or, in other words, that the logical inference determining the choice of means is correct within the framework of the knowledge possessed, without going into the question of whether this knowledge is in agreement with the actual state of things. It is obvious that the rationality of gainful activity is methodological rationality, because the inference involved in this activity is based on the knowledge possessed by the individual carrying out this activity. At all events only methodological rationality is a property of activity as a mode of behaviour; factual rationality is a matter of the adequacy of the knowledge on which the activity is based.

The transition from customary and traditional economic activity to rational gainful activity, i.e., the *rationalization* of economic activity, is made gradually, in keeping with the development of commodity and monetary relations. This transition is hampered by the fact that apart from gainful activity there are alternative methods of obtaining the means of satisfying needs, in the form of direct production and distribution. The feudal lord and peasant, and even the handworker as yet not completely severed from the cultivation of land, the rearing of animals and other forms of labour for his own needs, still have available means of satisfying their needs other than gainful activity. Money income is still not an absolute economic necessity. It is only with the development of the capitalist mode of production that commodity and monetary relations become general, even labour power becomes a commodity, and gainful activity becomes a universal economic necessity. The whole process of production and distribution becomes a rational economic activity, and traditionalism in economic activity is restricted to domestic economy (although even here advertising and other methods of capitalist enterprise break through). In production and distribution the traditional activities linger on only in peasant economy, where even under capitalism natural economy persists on a considerable scale.

The factor which is the turning point in the transition from traditional and customary activity in production and distribution to rational gainful activity is the emergence and activity of the capitalist enterprise.

An enterprise is a group of people systematically engaged in gainful activity. Capitalist enterprise is distinguished by the fact that the material means of gainful activity (means of production, of distribution or of rendering services) are the private property of one person or group of people (capitalists), who employ hired workers; these workers are rewarded with wages.

In a capitalist enterprise economic activity is for the first time concentrated on money income as its sole and exclusive end. The large scale activity of the class of owners of such enterprises—the bourgeoisie—results in the spreading of commodity and monetary relations. The *Communist Manifesto*, written in 1847 at a time when the capitalist mode of production was spreading throughout Western Europe, sums up the changes brought about by the capitalist mode of production in the following words: “The bourgeoisie, wherever it has got the upper hand, has put an end to all feudal, patriarchal, idyllic relations... and has left remaining no other nexus between man and man than naked self-interest, than callous ‘cash payment’ ”<sup>12</sup>. And further on: “All that is solid melts into air, all that is holy is profaned, and man is at last compelled to face with sober senses his real conditions of life and his relations with his kind”<sup>13</sup>. Rational economic activity spreads from the capitalist enterprise to all classes and social strata. All are drawn into the economic necessity of gainful activity.

*Quantification (measurability and commensurability) of the end and means of gainful activity. Category of profit*

The development of commodity and monetary relations, and especially the capitalist mode of production, by singling out and making gainful activity general and by turning it into

<sup>12</sup> K. Marx and F. Engels, *Selected Works*, ed. cit., vol. 1, p. 36.

<sup>13</sup> *Ibid.*, p. 37.

a rational activity based on reasoning, leads to the quantitative measurability and commensurability of the end and means of this activity. A *quantification* of the end and means takes place and is expressed in *uniform units of measurement*, in monetary units. The end of gainful activity is from the very beginning a quantitative category expressed in monetary units. Quantitative categories are also formed by the outlay of means, but they are at first expressed in different physical units like pounds, yards, quarts and pieces. Commodity-money exchange leads to the expression of this outlay in uniform monetary units so that various outlays may be compared as constituent parts of *cost*, expressed in money. At the same time they become commensurable with the end of gainful activity—money income.

It is then possible quantitatively to compare the end achieved and the means used and to express the result of this comparison in monetary units. In pre-capitalist forms of production and commodity exchange this commensurability is still incomplete since it does not include the outlay of labour. The capitalist mode of production, by transforming labour power into a commodity and thus into an element of cost expressed in monetary units, achieves the full commensurability of the means and end of economic activity in a capitalist enterprise. The quantitative comparison of money income with the cost incurred finds its expression in the economic category of *profit*. Profit becomes the uniform, quantitatively measurable end of the activity of capitalist enterprise.

#### *Calculation and book-keeping in capitalist enterprises*

The quantification of end and means in uniform units of measurement and the emergence of the economic category of profit means that the rationality of the operation of an enterprise finds expression in *calculation*, the monetary reckoning of all the components of income and cost. Book-keeping is developed. This at first appears in capitalist enterprises engaged in trade where the quantification of the end and the means appears earliest, and then gradually spreads

to all kinds of enterprise. The complete calculation of all the elements, together with the results of the activity of an enterprise, was made possible by the invention of double-entry book-keeping, which consists in connecting all accounts dealing with individual operations of the enterprise with one main account synthesizing the whole activity of the enterprise. The next step was the introduction of a separate account called the capital account which, together with the account of income and expenditure, makes it possible to evaluate the value of the property of the enterprise in terms of money (in the form of a balance of assets and liabilities).<sup>14</sup>

<sup>14</sup> The beginnings of systematic commercial book-keeping are to be found in the 13th century. Merchants in Italian cities, especially Florence, began to keep systematic accounts (in Italian "conto", hence "account") of their more important commercial operations. In the 14th century accounting is to be found in France as well. Double-entry book-keeping appeared at the end of the 14th century in northern Italian cities, probably first in Genoa, and then developed especially in Venice (so that it was called Venetian book-keeping). From there it spread to all the major trading centres in Western Europe and especially Holland. The first systematic exposition of double-entry book-keeping was given by Luca Paccioli in *Summa di arithmetica, geometria, proportioni et proportionalita*, published in Venice in 1494. An important part was also played by decimal notation and the method of calculation connected with it, which was taken from the Arabs, having first appeared in India. The turning point in this field was marked by the appearance of Leonardo Pisano's *Liber abaci* published in Florence in 1202. The transition to the decimal system is closely connected with the development of accounting and commercial book-keeping. In northern Italian cities, and later in other countries as well, special schools were set up to train youths in accounting and book-keeping in order to prepare them to be merchants. These schools already existed in Florence in the 14th century. Capital accounting appeared later, in the sixteenth century. The Dutch author, Simon Stevin (who contributed a great deal to the practical application of decimal fractions) demanded in 1608 that a balance sheet for an enterprise should be drawn up every year as well as when a merchant died or a firm was dissolved. It is worth noting that in Italian the term "ragione" was adopted to denote an enterprise and in French the term "raison" (both come from the Latin "ratio"), which originally meant both "reason" and "calculation". Thus the rationality of capitalist enterprise and its connection with commercial calculation shows itself even in etymology. Sombart writes about the development of book-keeping in capitalist enterprise and its significance

Calculation is the expression of fully developed rationality in the activity of an enterprise, since it consists in the quantitative comparison of all the constituents of income and cost, together with changes in the value of the property (capital), thus employing logical and mathematical inference. Calculation is also an instrument which serves to make that rationality more precise, and is especially a means of fully integrating the means through the end—within the framework of an enterprise. By the use of calculation the means employed by an enterprise are evaluated from the point of view of their profitability. The material technique of production and distribution, like all other operations, is strictly subordinated to the unique end of the enterprise—profit.

as a factor in the rationalization of economic activity in *Der moderne Kapitalismus*, ed. cit., vol. 2, pt. 1, pp. 110–138. Sombart also draws attention to the indirect influence which the rationalization of economic activity, in the form of calculation, exerts on the development of the natural sciences; he also emphasizes the influence of this rationalization on the development of scientific economic categories: “Double-entry book-keeping is based on the consistent application of a conception which treats all phenomena as quantities—quantification, an idea which has brought to light all the marvels of nature and which here, for the first time in history, has become quite clearly the basic idea of a particular system. It requires no great mental effort to see in double-entry book-keeping the germ of the ideas of gravitation, the circulation of the blood, the conservation of energy and other ideas which have proved so fruitful in natural science” (p. 119). Further on, discussing balance accounts, he writes: “This approach determined the creation of the concept of capital. One can also say that before double-entry book-keeping the category of capital did not exist” (p. 120). Sombart also points out that the categories of fixed and circulating capital, the categories of changes in the form of capital, of commercial turnover, capital turnover, production costs, and other categories of political economy arose out of the practical activity of capitalist enterprise. Max Weber notes that in contrast to capitalist enterprise, merchants, usurers and bankers in non-capitalist societies do not keep books and money accounts. (*Wirtschaftsgeschichte*, ed. cit., pp. 198–203). Marx drew attention to the significance for the development of book-keeping of the development of enterprise trading in money, especially of cash enterprises and associations in Venice and Holland. This resulted in a division of labour in which cashiers took upon themselves the responsibility of book-keeping. (*Capital*, Saraswaty Library, Calcutta 1946, vol. II, pt. 4, p. 251.

*Maximization of profit—an economic necessity for a capitalist enterprise*

The quantification of the aim of gainful activity results in a tendency to its *maximization*, i.e., to the realization of the end to the greatest extent possible in the circumstances. This happens because this end is the means of realizing all other aims of economic activity; if it is realized in a greater degree, then the greater the number of other aims which may be realized and the greater the number of needs which can be satisfied. The tendency to the maximization of money income develops together with the development of commodity and monetary relations. It appears in pre-capitalist social formations, frequently threatening to undermine the traditional way of life established there; this arouses counteraction, especially on the part of the ruling class and the strata connected with them, living in a natural economy.

Aristotle drew attention to this, noting that the desire for riches in the form of objects of use is limited, "for the quantity of possessions of this kind capable of making life pleasant is not unlimited", while the desire for money is unbounded, to such an extent that the quest for riches in the form of money "knows no limits to its aim, but is an end in itself"<sup>15</sup>. In the middle ages the tendency to the maximization of money income was denounced by the teaching of the church which declared that man's possession of worldly goods ought to be such as made possible a life "appropriate to his station"<sup>16</sup>. Life according to one's station was enforced in the middle ages by numerous sumptuary laws which attempted to limit

<sup>15</sup> K. Marx, *Capital*, Dent, London 1930, vol. 1, pp. 137-138.

<sup>16</sup> The great systematizer of medieval philosophy and theology Thomas Aquinas wrote: "... dum scilicet homo secundum aliquam mensuram quaerit habere exteriores divitias, prout sunt necessariae ad vitam eius secundum suam conditionem. Et ideo in excessu huius mensurae consistit peccatum: dum scilicet aliquis supra debitum modum vult acquirere vel retinere. Quod pertinet ad rationem avaritiae quae definitur esse immoderatus amor habendi" (It is understood then that man desires a certain amount of external riches to the extent to which they are necessary



the expenditure of burghers growing rich on commodity-money exchange<sup>17</sup>.

However, the growth of commodity production and commodity-money exchange, the development of capitalism in commerce and shipping, and the subsequent development of capitalist industrial production—gradually broke down this resistance. The expression of this process is the mental and moral revolution in the period of the Renaissance, Humanism, and Reformation. The tendency to maximize money income was finally recognized and later even approved. The immediate result of the penetration of feudal agricultural production by commodity exchange was the attempt to increase money income from land rent and a growth in peasant exploitation<sup>18</sup>.

---

for him to live in accordance with his station. It is in exceeding this amount that sin consists: if someone wishes to obtain or retain more than is his due, this is reckoned as avarice, which is defined as an excessive desire of possession). *Summa theologica*, secunda secundae, quaestio 118, articulus 1.

<sup>17</sup> In Poland sumptuary laws of this kind were introduced in the 14th century. In the 17th century they were used in order to prohibit burghers to wear furs, silk robes and girdles, and morocco leather shoes. In the 18th century this feudal measure was again used on a large scale but for a purpose different from the former one; the measure was designed to prevent imports—above all the import of luxury goods, and at the same time to promote national industry and the accumulation of capital. Sumptuary laws first affected the burghers but later embraced the gentry as well. These laws were backed by heavy fines and the confiscation of the luxury goods in question. (See Z. Kaczmarczyk and B. Leśnodorski, *Historia państwa i prawa polskiego*, [A History of the Polish State and Law], Warsaw 1957, pt. 2, pp. 261, 365, 483).

<sup>18</sup> This gave rise to the phenomenon which Marx called the greed for surplus labour (Heisshunger nach Mehrarbeit). This appears wherever the product of surplus labour becomes a commodity. "It is obvious, however", writes Marx, "that when a society is so constructed that, from the economic standpoint, the use-value of products predominates over their exchange-value, surplus labour is restricted within a smaller or larger circle of wants, and that, in such a society, an unquenchable thirst for surplus value cannot arise as the direct outcome of the very nature of the method of production... As soon, however, as peoples among which production still takes the lower form of slave labour, serf labour, and the like, are attracted within

The tendency to the maximization of money income is the inevitable consequence of the break-down of economic activity into gainful activity and domestic economic activity. Like calculation, it is the expression of the rationality of gainful activity. Rational activity directed to one single quantified end must tend to the realization of this end to the maximum quantitative extent possible in given conditions. A failure to desire the realization of this end in the greatest measure would indicate that apart from this end there existed other aims, that this end is not the only one.

The tendency to the maximization of money income cannot be fully developed in conditions in which there exist other possibilities for obtaining the means of satisfying needs beside gainful activity. A peasant, for example, may give up the maximization of his money income in favour of the employment of part of his own products in his own domestic economy (e.g., consume butter instead of selling it on the market), a wage labourer may give up the maximization of his money income in favour of working in his own garden (e.g., devoting less days in the week to wage labour) or in order to conserve his health (e.g., working less intensively when on piece-work). In a capitalist enterprise, on the other hand, there can be no alternative to the drive for profit: everything is quantified and calculated in monetary units, everything is bought or sold for money, and profit is the only end of the enterprise's activity. In a capitalist enterprise the *maximization of profit* is an economic necessity.

---

the domain of the world market which is dominated by the capitalist method of production, so that the sale of products made for export becomes their leading interest, the civilized horrors of overwork are grafted on to the barbaric horrors of slavery, serfdom, etc." (*Capital*, ed. cit., vol. 1, pp. 235-236.) In Poland, the growth in the production of marketable grain, especially for export, which began in the 16th century, led to the development of an economy of large holdings and an increase in the labour dues demanded from the peasants. See *Historia Polski*, (History of Poland), ed. Tadeusz Manteuffel, Warsaw 1958, vol. 1, pt. 2, pp. 91-9 and 429-432.

*The principle of economic rationality and its two variants: the principle of the greatest efficiency and the principle of the economy of means*

The maximization of profit in capitalist enterprise is accomplished by the application of a general rule of procedure which is called the *economic principle* or the *principle of economic rationality*. This is a general principle of procedure when the end and means of activity are quantified. This principle asserts that the maximum degree of realization of the end is achieved by proceeding in such a way that either for a given outlay of means the maximum degree of realization of the end is achieved, or that for a given degree of realization of the end the outlay of the means is minimal<sup>19</sup>. The first variant of this

<sup>19</sup> Strictly speaking, the full quantification of the end of activity is not necessary for the application of the economic principle. It is sufficient if the degrees of realization of the end form an ordered set so that it is possible to say whether the end is achieved in a greater or lesser degree. It is not necessary that the end should be measurable i.e., that the degrees of realization should form a set which can be brought into a one-to-one correspondence with the set of real numbers or with a sub-set of it (e.g., with the set of rational numbers or the set of natural numbers). In this case it would be possible to say that a certain degree of the realization of the end is a given number of times (e.g., 3 times, 5 times) larger than another. This would be full quantification. In order to maximize the degree of realization of the end it is, however, sufficient to know whether the degree of realization is greater or smaller; measurability is unnecessary here. If the degrees of the realization of the end are measurable they, of course, form an ordered set but not *vice versa*. The reader will find a more detailed discussion of this problem in the appendix at the end of the chapter. Some use the term "magnitude" to denote any phenomenon whose different degrees of realization form an ordered set, and the term "quantity" to denote the case where different degrees of realization form a set which can be brought into a one-to-one correspondence with the set of real numbers or with a sub-set of it. Every quantity is a magnitude, because the set of real numbers is ordered; but not every magnitude is a quantity. The scale of hardness of minerals is an example of a magnitude which is not a quantity. Minerals are ordered according to their hardness but there is no meaning in the assertion that one mineral is three times harder than another. Using this terminology, we can say that in order to apply the economic principle it is sufficient if the end of economic activity is a magnitude, it may (but need not) be a quantity. The profit of an

procedure is called *the principle of greatest effect* or *the principle of greatest efficiency*. The second variant is called *the principle of the minimum outlay of means*, or *the principle of economy of means*<sup>20</sup>. When applied to an enterprise where all outlays of means are part of a uniform category of cost, the second variant may also be termed the principle of minimum cost.

Both variants lead to the same result. Proceeding according to the first variant we take as a starting point the outlay of all the means at our disposal and immediately obtain the maximum degree of the realization of the end which is possible with the means at our disposal. Proceeding according to the second variant we take as a starting point a certain degree of realization of the end which we obtain with a minimum outlay of means, while we use the economized means in order to raise the degree of realization of the end; this leads to the maximum realization of the end possible with the means at our disposal. These are thus two equivalent variants of the principle of economic rationality<sup>21</sup>.

enterprise is a quantity and so the quantification of the aim of activity in capitalist enterprise is more than is necessary for the application of the economic principle.

<sup>20</sup> Kotarbiński clearly distinguishes between these two variants. Kotarbiński talks about the "economic quality" of behaviour and distinguishes two kinds of it: "productivity" and "economy". He defines them in the following way: "The more valuable the product for a given expenditure the more productive is behaviour, and on the other hand, the less the outlay in the achievement of a given aim, the more economical is behaviour" (*Treatise on Good Work* [in Polish] ed. cit., p. 124). Kotarbiński draws attention to the vagueness of terms like "value of the product" and "quantity of outlay" and states (*ibid.*, p. 126) that "as far as productivity is concerned, a particularly happy situation is when all the values of the product can be given commercial exchange values, measurable in terms of money, and if the same can be done for all outlays". (*Ibid.* See also *A Logic Course for Lawyers*, (in Polish), ed. cit., pp. 159-160). Some also use the expression "the principle of the least effort" to describe the second variant. This is a rather narrow definition since effort is only one of the means alongside with physical resources. Moreover, in capitalist enterprise, effort is only reckoned with in so far as it appears as the expenditure of money, i.e., in so far as it is embodied in material objects.

<sup>21</sup> Sometimes both these variants are joined together in the form:

The use of means in accordance with the principle of rational economy is called the *optimum use of means*. The use of means other than optimum is called *waste*. Waste is a symptom of irrational action; it means that the aim of activity to the maximum degree possible for the means possessed is not attained. It can thus be said that the application of the principle of economic rationality consists in the optimum use of means, in the elimination of waste.

*Principle of economic rationality as historical product of capitalist enterprise*

The most important case of the application of the principle of economic rationality is that of the capitalist enterprise. This principle shows itself here in full for the first time in the history of the development of human economic activity. It could not show itself earlier, i.e., in natural economy. For in natural economy there is a multiplicity of aims of economic activity, quantified in various degrees and not commensurable with each other, nor are the means commensurable either. In these conditions activity follows the customary and traditional paths, traditionally established aims are realized with the aid of traditional means. The development of commodity production and

---

the attainment of the maximum effect for the minimum outlay of means. This, however, leads to a contradiction. Let us suppose that the first variant is satisfied, i.e., the maximum degree of realization of the aim for a given outlay of means is reached. Then the outlay of means cannot be reduced because this would lead to a reduction in the degree of the realization of the end. Or vice versa: let us suppose that the second variant is satisfied, i.e., a particular degree of realization of the end is obtained for the minimum outlay of means. It is then impossible to increase the degree of realization of the end because this would demand an increase in the outlay of the means. The variants are alternatives: their combination leads to a logical absurdity. Here, as in all reasoning dealing with the economic principle, it is assumed that the connection between the outlay of means and the degree of realization of the end is positive, i.e., the greater the amount of means employed the greater the degree of realization of the aim, and vice versa: a greater degree of realization of the end requires a greater amount of means. A more detailed explanation will be found in the appendix to this chapter.

commodity-money exchange gives birth to gainful activity with its uniform quantified end. The development of capitalist trade and the capitalist mode of production produces the capitalist enterprise where all elements of activity are quantified and subject to calculation, and where there is one single end—the maximization of profit. In the activity of the enterprise the principle of economic rationality is evolved together with the two variants of this principle—the principle of greatest efficiency and the principle of economy of means. This takes place gradually in the course of the development of the capitalist mode of production.

In the earlier period of capitalism, the enterprise is still connected with household activity or with other forms of natural economy. Apart from money profit the owner of the enterprise has other aims which he can realize within the framework of natural economy; this hampers his striving for the maximization of profit<sup>22</sup>.

However, as the elements of natural economy disappear and the enterprise is completely separated from the household and from all elements of natural economy<sup>23</sup>, the maximization

---

<sup>22</sup> Sombart gives examples of this kind of connection between an enterprise and either natural economy or household under early capitalism. In Silesia, as late as the beginning of the 19th century, iron ore mines belonging to land owners were worked in conjunction with agriculture. The amount of ore smelted was determined by the amount of timber the estate could spare for non-agricultural purposes. In Bolzano the great merchants closed their businesses in the summer and went on holiday. Even Benjamin Franklin devoted only six hours daily to his business. Other aims competed with the maximization of profits. (See *Der moderne Kapitalismus*, ed. cit., vol. 2, pt. 1, pp. 53–58).

<sup>23</sup> A pioneer role in the separation of enterprise from the household of the owner was played by trading companies and later by joint stock companies. Trading companies developed in Western Europe in the 16th and 17th centuries mainly in connection with foreign trade and exploitation of colonies. It was against this same background that joint stock companies appeared, at first sporadically, in the 16th and 17th centuries. Capitalist industrial production developed, however, in the form of family enterprise or of company (the latter often being only a family enterprise legally registered). Such were, for example,

of profit together with the application of the principle of economic rationality begin to rule the enterprise undividedly. This is most clearly seen in the application by the enterprise of the second variant of the principle we have discussed, the principle of economy of means; this principle is an obvious and characteristic feature of capitalist enterprise. Marx drew attention to this when he wrote: "The economies realized in the application of constant capital, this method of getting a certain result out of the means of production with the smallest possible expense is regarded more than any other power inherent in labour as a peculiar gift of capital and as a method characteristic of the capitalistic mode of production"<sup>24</sup>.

The principle of economic rationality is an economic necessity for capitalist enterprise not only because it is the only way to realize the end of the enterprise but also because competition between enterprises ensures its application, threatening bankruptcy to enterprises which do not use it. The race between enterprises to lower costs throws out of the market those which get left behind and are unable to keep up; it forces them into bankruptcy and liquidation. The natural selection carried out by competition allows only those enterprises to survive which have shown themselves able to apply the principles of economic rationality. Thus, for a capitalist enterprise, rationality in economic activity is not only the result of economic stimuli peculiar to capitalist relations of productions and exchange, but is quite simply a vital necessity. There is no room for sentiment, for traditional values not

---

the typical "firms" of Victorian England, the "firm" about which Alfred Marshall writes, recalling with obvious satisfaction the frequent careers of young men who, in return for good work in the firm, were rewarded with the owner's daughter for a wife. (See *Principles of Economics*, 9th ed., London 1936, p. 301). In spite of the family character of the enterprise, its size and function as a factory formed a barrier separating it from the household of the owner's family. In the second half of the 19th century there was an enormous growth in the number of limited liability companies and joint stock companies—the classical form of contemporary capitalist enterprise.

<sup>24</sup> See K. Marx, *Capital*, Calcutta 1946, vol. III, p. 62.

quantified in money, nor for traditional slackness in gainful activity. Everything gives way to the iron necessity of maximizing profits<sup>25</sup>.

Behaviour guided by the economic principle, the principle of economic rationality, is thus the product of historical development, a feature of a certain historical stage in the development of economic relations. It is not, as is sometimes falsely stated, a universal property of human economic activity (this will be dealt with later). On the contrary, as we have seen, throughout the long period of previous history human economic activity has been customary and traditional. The aims and means of this activity slowly change, and in some periods even change suddenly, but the activity remains traditional in character. Only the development of commodity and monetary relations and the capitalist mode of production created conditions in which part of economic activity, gainful activity, is rationalized and the end of activity is unified and quantified. Complete commensurability of end and means, the calculation of all elements of activity, the maximization of profit as the only end—all these are finally realized in capitalist enterprise. The principle of economic rationality is then applied in its entirety. Its application is enforced by competition which penalizes with bankruptcy any deviation from this principle. Thus in the course of a long process of historical development the practice of proceeding according to the principle of economic rationality has been formed, and with practice has come its conscious realization in human thought<sup>26</sup>.

<sup>25</sup> The problem of the transformations which this economic necessity undergoes in monopoly capitalism demands separate consideration. This will be given later in this book.

<sup>26</sup> Quesnay, the founder of the physiocratic school, arrived at a formulation of the economic principle, although it was an imperfect one, i.e., he combined the principle of the greatest effect with the principle of economy of means which, as we know, is contradictory. His formulation is as follows: "When the greatest possible increase in pleasure for the greatest possible economy in expenses has been achieved, then economic behaviour has reached perfection". *Sur les Travaux des Artisans, second dialogue. Ouvres économique et philosophiques de Quesnay*, Frankfurt and Paris 1888, p. 535.



*Operation of the principle of economic rationality under capitalism restricted to private activity and antagonistic in character*

The first historical triumph of the principle of economic rationality thus takes place in the capitalist enterprise, but it is a limited and distorted triumph. It is limited because it covers each enterprise individually and does not embrace the whole of the economic activity of society, the whole social process of production and distribution. The rationality of the activity of a capitalist enterprise is confined to *private economic rationality* and does not mean *social economic rationality*. The rationality of the activity of a capitalist enterprise consists in the application of the economic principle in the realization of a private end, for the maximization of private profit; it does not serve any end embracing the whole of the economic activity of society. It is a result of the private ownership of the means of production and of its consequence—the anarchic character of the capitalist mode of production.

The private ownership of the means of production will admit private economic ends for individual enterprises only; each of them struggles for the maximization of its own profit. There is no common end covering the whole of the social process of production and distribution—an end to which the activity of all enterprises would be subordinated. In other words, within a capitalist enterprise all means are integrated by the end of the enterprise. On the other hand, when the means of production are privately owned, there is and can be no integration of the economic activity of society. For this the social ownership of the means of production is indispensable.

The distortion of the principle of economic rationality is the result of the antagonistic character of capitalist production relations. Within the framework of capitalist production relations, the maximization of profit by an enterprise is effected by the exploitation of the class of wage-labourers; for profit is part of surplus value. The application of the economic principle by capitalist enterprises is the source of a continual pressure by the owners of the enterprises to increase the amount

of surplus value, often at the price of the health, safety—and even the lives of the workers. This is most easily seen when a capitalist enterprise applies the second variant of the economic principle—the principle of the economy of means. The economy of means for a capitalist enterprise is economy in the costs of production, that is, economy in material outlay and economy in expenditure on labour power, that is, economies in wages. The first leads to conditions of labour which neglect the health and safety of workers and their personal needs as workers. The latter results in a constant pressure on wages and a reduction in the number of employees, often leading to mass unemployment.

Discussing the application of the principle of economy to the means of production, Marx states: “In conformity with its contradictory and antagonistic nature, capitalist production proceeds to add to the economies in the use of constant capital<sup>27</sup>, and thus to the means of increasing the rate of profit, a prodigality in the use of the life and health of the laborer himself... Such economies are: the overcrowding of narrow and unsanitary rooms with laborers, or, in the language of the capitalist, a saving in buildings; a crowding of dangerous machinery into one and the same room without means of protection against this danger; a neglect of precautions in productive processes which are dangerous to health or life, such as mining—etc.; not to mention the absence of all provisions to render the process of production human, agreeable, or even bearable, for the laborer. From the capitalist point of view, such measures would be quite useless and senseless. No matter how economical capitalist production may be in other respects, it is utterly prodigal with human life<sup>28</sup>.”

---

<sup>27</sup> By constant capital Marx understood the value of the means of production employed.

<sup>28</sup> K. Marx, *Capital*, Calcutta 1946, vol. II, pp. 63–64. Kautsky very clearly exposes the antagonistic operation of the principle of economic rationality within the framework of the capitalist mode of production: “To economize is certainly not only a technical but also an economic virtue. There

The effort to keep wages at a minimum needs neither illustration nor commentary. If disregard for the health, safety and lives of workers in the leading capitalist countries has to-day decreased—and if to some extent the effort to keep wages at a minimum has lessened—this is not a result of the principle of economic rationality applied in capitalist enterprises. All this happens in spite of this principle, as a result of the strength of the working class, its trade union and political organization and its ability to use this strength. This is shown by the fact that the phenomena described by Marx still exist in the countries in which the working class is weak, unorganized, and deprived of opportunities for political activity as, for example, in colonies, underdeveloped countries, and in countries under foreign rule or with an undemocratic political system.

Thus, within the capitalist mode of production the principle of economic rationality operates antagonistically.

The restricted, private character and the antagonistic mode of operation of the principle of economic rationality within the framework of the capitalist mode of production means that its application by capitalist enterprises does not guarantee the optimum use of means from the point of view of society as a whole, i.e., the optimum use of the social productive forces. Maximum economy in the use of means in an enterprise is connected with a social waste of means. This shows itself in the waste of human productive forces (of which we have already spoken) as well as in the waste of material produc-

---

are however economic relations, in which the mighty ones are prodigal with the labour power of those dependent on them—slaves or hired labourers—and who regard this as economy. This prodigality is typical of certain economic relations... In a world of opposed class interests not every economy can be held to be an economy from the point of view of everybody concerned. The capitalist economizes in costs but not in the labour time of his workers. There where no resistance is encountered thoughtless prodigality is allowed—for very economic reasons. Not in economy but only in technique is 'the economic principle' always unequivocal, since there are no opposed interests or classes in technique". (*Die materialistische Geschichtsauffassung*, ed. cit., vol. 1, pp. 726-7).

tive forces. This applies particularly to natural resources, which are often recklessly exploited by capitalist enterprises as is the case, for example, with forests, sea fishing, or the exploitation of land. The tendency to reckless exploitation of the labour force and natural resources is a result of the fact that because of the peculiar nature of capitalist relations of production a capitalist enterprise takes no account of the social need for the reproduction of the labour force and natural resources.

Another symptom of the waste of productive forces is economic crisis—a joint result of the limited, private character and antagonistic operation of the principle of economic rationality when applied in capitalist enterprise. Mention should be made of the waste of productive forces which results from the activities of monopolies and oligopolies<sup>29</sup> which limit production in order to maintain a monopolistic structure of prices and capital values as well as the waste connected with the fact that monopoly capitalism is economically incapable of developing the productive forces of backward countries. Thus the principle of economic rationality, applied within the framework of the capitalist mode of production, gives a distorted result and from a general social point of view a result contradictory to its own logic of the optimum use of means. This is a result which, as Marx put it; “loses for society what it gains for the individual capitalist”<sup>30</sup>.

In spite of these distortions, the rationalization of economic activity within the capitalist enterprise, the practice of proceeding according to the principle of economic rationality, and especially the consciousness of this principle in human thought, all constitute an achievement of historic significance. This is an achievement on a par with the imposing advance in material technique made within the capitalist mode of production, an advance which is itself closely connected with the application of the principle of economic rationality in enterprise. The rationalization of economic activity and the applica-

<sup>29</sup> For the meaning of the term oligopoly see below page 305, note 28.

<sup>30</sup> K. Marx, *Capital*, ed. cit., vol. II, p. 64.

tion of the principle of economic rationality in order to maximize an enterprise's profit stimulates the development of productive forces. At present, when as a result of the maturity of the productive forces it is possible and at the same time necessary to pass to new production relations based on the social ownership of the means of production—it is at the same time possible and necessary to pass from private rationality to rationality on a social scale, to social economic rationality. This opens a new phase in the history of the application of the principle of economic rationality.

*Planning of social economy—realization of social economic rationality*

As we have pointed out, social rationality of economic activity demands that the aims of individual enterprises be subordinated to an end which embraces the whole of the social process of production and distribution; in other words, it requires the coordination of the activities of individual enterprises, the integration of their aims by a common end directing the economic activity of society. This coordination is called the *planning of the social economy*. The need to go beyond the bounds of private rationality and the need to coordinate the activities of individual enterprises—a need for planning—appears to a certain extent even under capitalism. It appears within the framework of capitalist industrial organizations like the trusts and cartels which are formed in the period of monopoly capitalism and as a result of the taking over of various fields of economic activity by the state. Since, however, the means of production are still privately owned such plans cannot cover the whole of the social economy. It thus extends the reach of private economic rationality but does not change its limited character or its antagonistic mode of operation. Moreover, since the means of production are privately owned, plans of this kind covering a group of capitalist enterprises have a limited effect on individual enterprises. For reasons which will be discussed later in this book even plans laid down by the state have only a limited effectiveness.

especially with respect to large monopolistic or oligopolistic enterprises, unless these plans form part of their common private economic aims. But even then the rationality of these plans is distorted by the antagonistic character of capitalist relations of production.

Social economic planning, that is, the realization of social rationality in production and distribution, is only possible in the socialist mode of production.

The social ownership of the means of production changes the character of the enterprise, it becomes—a *socialist enterprise*. Maximization of profit is no longer the ultimate end. The activity of a socialist enterprise is subordinated to the general social end, expressed in the plan for the social economy. The social economic plan sets the end in the form of a quantitative measurable target; normally in the shape of national income. The plan also normally determines the more important means serving to realize this end, e.g. the volume and composition of investment, production in various branches of industry and agriculture, employment, distribution, etc., and sets targets for enterprises.

The category of profit is retained in socialist enterprise but ceases to be the ultimate end of its activity and becomes the means of subordination to the general social end of the plan. Profit serves as a stimulus to the completion of the planned targets and as a test of how far the economic principle is observed. Thus in the socialist mode of production the aims of the activity of individual enterprises are integrated in a common social end determined in the social economic plan. The scope of this integration can vary and corresponds to the extension of society<sup>31</sup>. At the moment, in countries in which the socialist mode of production prevails or is developing, this scope coincides with the state organization of society and hence covers the national economy. At a later stage in the development of the socialist mode of production the

---

<sup>31</sup> As explained above, by society we mean all people connected with each other by co-operation and the division of labour, that is, people who work together and for one another. See Chapter Two.

scope of social economic planning will undoubtedly become international; to-day the nuclei of this process are already appearing<sup>32</sup>.

*Hierarchic structure of ends as a feature of socialist planning*

The subordination of the activity of a socialist enterprise to the end established in the social economic plan may be either direct or indirect. Within the framework of the national economic plan, for example, there may be plans at various lower levels. There may be provincial plans, district plans, etc., as well as plans for particular groups of enterprises, e.g., a plan for the machine industry or a plan for lignite. The activity of enterprises may be subordinated to a plan at a lower level rather than directly to the general social economic plan. All the plans at a lower level, however, are subordinated to the general social economic plan; the aims set in them are means for the realization of the end set in the general social economic plan. Moreover, some socialist enterprises may have no general targets set for them in the plan, and operate according to the principle of the maximization of profit. By laying down the conditions under which the maximization of profit takes place, the plan at the same time determines the result of the activity of such enterprises. This is also a way of indirectly subordinating the activity of an enterprise to the end of the social economic plan.

The integration of the aims of the activity of socialist enterprises by a common end established in the social economic plan leads to a hierarchic structure of ends. At the top of this structure stands the main end, i.e. the end of the social economic plan which we shall call the first order end. The means serving directly to implement that end are second order ends. The means serving directly to the realization of aims of the second order are third order ends, and so on. The aims of the activity

---

<sup>32</sup> A nucleus of this kind is to be found in the Council of Mutual Economic Aid whose members are the Soviet Union and the European People's Democracies; the Chinese People's Republic and other Asiatic socialist states are also taking part in its work.

of various enterprises occupy different levels in this hierarchy of ends. Railways and steel foundries, for example, realize second order ends while a local forge or button factory realizes ends at a lower level in the hierarchy. The place occupied by the aim of the activity of a given enterprise in this hierarchy of ends normally determines whether that enterprise is directly or indirectly connected with the national plan; it also determines the level and character of an indirect connection.

A hierarchic structure of ends is a peculiarity of the socialist mode of production just as a peculiarity of the capitalist mode of production is the existence of independent parallel aims of individual enterprises: their attempts to obtain the maximization of their profits. For the hierarchic structure of ends is the expression of the social economic plan and the integration of the aims of individual socialist enterprises by a chief end laid down in the social economic plan. It is at the same time the expression of the social rationality of the socialist mode of production. This rationality, finding its expression in the hierarchic structure of ends does not appear fully-fledged together with socialist relations of production. It develops slowly and laboriously together with the socialist mode of production.

From the capitalist mode of production the socialist mode of production, apart from productive forces, inherits only the methodology of the private rationality of capitalist enterprises, in particular, calculation and book-keeping, together with the idea of the principle of economic rationality itself. This is a great historical inheritance but it is not sufficient to realize the social rationality of production and distribution. It makes it possible to apply the economic principle in individual enterprises but provides no way of uniting the activity of enterprises with a hierarchic structure of ends subordinated to the realization of the main end. Socialist society has to work out such a way in the course of its own development.

#### *Basic problems in social economic planning*

In the initial period of the development of the socialist mode of production the coordination of the various aims of economic



activity and their arrangement in a hierarchic structure of ends, which is the expression of the application on a social scale of the principle of economic rationality, is carried out with difficulty. In the first place, elements left over from earlier modes of production, like the capitalist sector, and sometimes also feudal elements, yield only with difficulty to social economic planning. It is also difficult to plan the activity of small commodity production. There are, moreover, two other difficulties. One consists in the fact that the aims of the social economic plan are not coordinated and are often not quantified and that there is more than one end to which the remaining aims might be subordinated in a hierarchy. Only gradually as practice in planning is acquired is the main end crystallized and all other aims integrated in a hierarchic structure of ends. The second difficulty lies in the fact that methods of carrying out such an integration are not yet developed. These difficulties are overcome by the development of the methodology of social economic planning.

The methodology of social economic planning plays a role in the socialist mode of production analogous to that played by calculation and book-keeping in an enterprise. Calculation and book-keeping also form the historical point of departure for the methodology of social economic planning. Marx noted that under socialism book-keeping, which is a product of capitalist development, will find its application in social economic planning. Marx writes: "After the abolition of the capitalist mode of production but with the preservation of social production... the regulation of the hours of work and the division of social labour among different productive groups, and finally *the book-keeping involved with all this* (my italics, O. L.) will become more essential than they have ever been before"<sup>33</sup>. Still earlier, in this connection Marx noted the neces-

<sup>33</sup> K. Marx, *Das Kapital*, ed. cit., vol. 3, p. 907, See also *Capital*, ed. cit., vol. II, p. 100: "Book-keeping, as a method of controlling and understanding this process becomes increasingly necessary the more the process reaches a social scale and loses its individuality—it is thus more necessary in capitalist production than in handworkers' and peasant production, more necessary in collective than in capitalist production"

sity of applying the principle of economic rationality: "Economy of time together with the planned division of labour time among various branches of production thus remain the first economic law of common social production (*gemeinschaftliche Produktion*). It becomes a law of even greater importance than before"<sup>34</sup>. Lenin wrote with especial emphasis of the need to apply book-keeping and economic statistics in the socialist economy. He considered book-keeping, applied on the scale of the whole national economy, to be the essential feature of the socialist mode of production. "Book-keeping at state level, the *recording* of the production and distribution of products at state level is, so to speak, something like the *skeleton* of socialist society"<sup>35</sup>. Lenin frequently emphasized in his writings and speeches the need for a general national accountancy covering the whole social process of production and distribution.

*The method of social economic balances*

Social economic planning is developed by appropriating the categories and methods of the book-keeping employed in capitalist enterprise and applying them to the whole social process of production and distribution. The chief methodological device has become the *balance accounting*. The drawing up of a balance for the whole of the social process of production and distribution was first carried out in the Soviet Union, the first country in which the socialist mode of production appeared. The practice of planning the national economy in the Soviet Union requires a whole series of annual balance sheets covering the most important aspects of the national economy. The first balance sheet, covering the whole of the national economy of the USSR for 1923/1924, was published in 1926. At present a balance of output and utilization of materials (material balances), of the requirement and resources available for the various branches of production and distribution, of

---

<sup>34</sup> K. Marx, *Grundrisse der Kritik der politischen Oekonomie*, Berlin 1953, p. 89.

<sup>35</sup> V. I. Lenin, *Will the Bolsheviks retain the power of the State?* *Sochineniya* (Works), vol. 26, p. 89.

industrial machinery, of foreign trade, of the incomes and expenditure of the population etc., are drawn up each year. Individual balance sheets are combined to form a general balance sheet for the whole of the national economy, which gives a synthetic picture of the social process of production and distribution showing the production and division of the national income and the direction of the appropriate parts for consumption and investment. In the USSR specific balance sheets and the balance sheet for the national economy have become a part of economic statistics which has been adjusted to the needs of national economic planning<sup>36</sup>.

Balance accounting is an instrument for coordinating the various tasks of the national economic plan, an instrument for integrating all the aims contained in the plan in a hierarchic structure of ends. It is also a method of checking the plan for its agreement with the principle of rational economy, since it makes it possible to ascertain whether and to what degree the various means at the disposal of society are used up. Social economic balance sheets thus play a role in socialist economy similar to that played by calculation in a capitalist enterprise

<sup>36</sup> For the history of balance accounting in the Soviet Union see T. Riabushkin, *Iz istorii balansa narodnovo khoziastva SSSR* (History of Balance of National Economy in the USSR). *Doklady soviet-skikh uchenykh na XXXI sesyu Mezhdunarodovo Statisticheskovo Instituta*, Academy of Sciences of the USSR, Moscow 1958. Every Soviet textbook of economic statistics now contains a list of all the more important kinds of social-economic balances and an account of their preparation. See, for example, *Kurs ekonomicheskoy statistiki* (Course of Economic Statistics), ed. A. Petrov, Moscow 1961, chapter VIII, and A. Gozulov, *Ekonomicheskaya statistika* (Economic Statistics), Moscow 1953, chapter VII. On the balance of national economy see S. Strumilin, *Balans narodnovo khoziastva kak orudiye sotsialisticheskovo planirovaniya* (Balance of National Economy as an Instrument of Socialist Planning) "Voprosy Ekonomiki", 1954, no. 11, and V. Niemchinov, *Statisticheskyye i ekonomicheskyye voprosy postroyeniya balansa narodnovo khoziastva. Uchenyye zapiski po statistike*, (Statistical and Economic Problems of Drawing up a National Economic Balance. Scientific Notes on Statistics), Vol. III, Academy of Sciences of the USSR, Moscow 1957. For Polish literature on the subject see *Statystyka spoleczno-gospodarcza*, (Socio-economic Statistics) ed. Kazimierz Romaniuk, Warsaw 1954, chapter XIII.

with, however, one difference, namely that these balance sheets are instruments for controlling social economic rationality and not private economic rationality like calculation in a capitalist enterprise.

The use of social economic balances has spread to all countries in which the socialist mode of production has appeared and in which planning of the national economy has consequently been introduced. Recently the practice of drawing up balances covering various aspects of the national economy has been introduced in a number of capitalist countries as a result of the evergrowing need to go beyond the bounds of private economic rationality which we have already mentioned, and the consequent increased intervention of the state in economic relations together with the direct economic activity of the state. The second world war especially, together with the post-war needs of economic reconstruction, helped to bring this about. The successes of the national economy of the USSR also played a great part in this as did the desire to make use of the planning methods developed in the USSR in order to rationalize and stabilize capitalist economy<sup>37</sup>.

The use of balance accounting for the whole of the national economy in capitalist countries is called "*social accounting*" or "*national accounting*"<sup>38</sup>. A method using balances combined with the mathematical formulation of the conditions necessary for the consistency of the aims of a production plan has acquired especial importance. This method, input-output analysis, arose under direct influence of Marx's analysis

---

<sup>37</sup> On the effect of the successes of planned economy in the USSR on the economic policy of capitalist countries and attempts to adopt certain elements of the Soviet method of planning the national economy see E.H. Carr, *The Soviet Impact on the Western World*, London 1947, pp. 20-42.

<sup>38</sup> See R. Stone, *Function and Criteria of Social Accounting, Income and Wealth*, Cambridge 1951; F. Perroux, *Les comptes de la Nation*, Paris 1949, J. Ohlson, *On National Accounting*, Stockholm 1955. See also Erich Schneider, *Einführung in die Wirtschaftstheorie*, I, 6th ed., Tuebingen 1955, part 1, chapter VI. In capitalist countries national economic balances are sometimes called "national economic budgets".

of the social process of reproduction and the development of the use of social economic balance-sheets in the Soviet Union during the period when the first five-year plan was being prepared<sup>39</sup>.

Within the framework of the capitalist mode of production the significance of "social accounting" is limited; social rationality in economic activity is, as we have seen, impossible under these conditions. The significance of "social accounting" in capitalist countries consists rather in that it produces an awareness of the necessity of crossing the bounds of the private

---

<sup>39</sup> Input-output analysis was introduced by the American economist Vassily Leontief in his book *The Structure of American Economy, 1919-1930*, New York 1941 (earlier, in 1937, he published an article on the subject in the "Review of Economic Statistics"). This analysis is now employed in many countries and there is a great deal of literature on the subject. Oskar Lange gives an introduction to input-output analysis in *Introduction to Econometrics*, second edition, Warsaw-London 1962, pp. 259-338, as does Paweł Sulmicki in *Przepływy międzygaleziowe* (Inter-industry Flows), Warsaw 1959. The first outline of the basic concepts of his analysis was published by Leontief in 1925, *Balans narodowo khoziaistva SSSR* (Balance of the National Economy of the USSR), "Planovoye Khoziaistvo" no. 12. This article was written in connection with the discussion on the preparation of the first Soviet five-year plan. At the time Leontief was an employee in the State Economic Planning Commission of the USSR (Gosplan); he continued his work on balances of national economy in the United States. Interest in his work was roused during and after the second world war, when his methods found important practical application. A comparative analysis of input-output analysis and the Soviet method of national economic balances has been made by W.S. Niemchinov, *Balansovyyi metod v statistikye*. Doklady sovietskikh uchenykh na XXX sesy Mezhdunarodnovo Statisticheskovo Instituta (Balance Method in Statistics. Reports of Soviet Scientists for XXX Session of the International Statistical Institute), Academy of Sciences of the USSR, Moscow 1957. Niemchinov comments favourably on Leontief's contribution to the study of national economic balances. See *Nyekotorye voprosy ispolzovanya balansovovo metoda v statistikye vzaimnosviazannykh ekonomicheskikh system*. Doklady sovietskikh uchenykh na XXXI zjezd Mezhdunarodnovo Statisticheskovo Instituta. (Some Problems of Using the Balance Method in the Statistics of Interrelated Economic Systems. Reports of Soviet Scientists for the XXXI Congress of International Statistical Institute), Moscow 1958, pp. 17-18.

rationality of individual enterprises and ensuring the social rationality of the process of production and distribution. The methods of "social accounting", especially input-output analyses, find their full application only in the planning of a national economy, and hence only within the framework of the socialist mode of production. The scientific procedure of investigation connected with these methods are now employed in national economic planning in socialist countries<sup>40</sup>.

After the adoption by capitalist enterprises of double entry book-keeping and balance accounting, the social economic balance accounting constitutes the second great historic step in the development of methods of rational economic activity. Book-keeping (together with balance accounting) appeared in the initial stages of the development of capitalism as an instrument of commercial calculation—the original basis of the application of the economic principle in capitalist enterprise. The social economic balance or "social accounting", appeared in the initial stages of the development of the socialist mode of production as the instrument of socialist calculation in applying the principle of economic rationality at the level of the national economy.

#### *Different spheres of application of the economic principle*

The economic principle, or the principle of economic rationality, evolved with man's economic activity. Hence its name. Its application is not, however, limited to economic activity. The economic principle is applied in many other spheres of human activity, above all in technology. The amount of work done by an engine may vary for a given amount of fuel or, what is the same thing, the amount of fuel used by an engine may vary for the performance of a given amount of work. We speak of a greater or lesser technical efficiency of the engine.

---

<sup>40</sup> Input-output analysis is now being employed in the Soviet Union, Poland, Yugoslavia, Hungary and Czechoslovakia. Socialist countries have also started to use linear programming, a point which will be discussed later.

When designing an engine we design one of the greatest possible technical efficiency for a particular cost of construction. Similarly, in planning a power station, we endeavour to obtain the greatest technical efficiency, measured, say, in terms of the number of kilowatts of electric energy produced per ton of coal used, for particular costs of construction. This is procedure according to the economic principle.

Another field in which the economic principle is applied is that of military strategy and tactics. Rational strategy or tactics consists in obtaining the maximum strategic or tactical effect with a given number of forces, or—putting the same thing in the form of the second variant—in obtaining a particular strategic or tactical effect with the minimum number of forces. We find similar examples in all fields of rational activity: the rational method of teaching the piano is that method by which the pupil makes the most progress in a given time (or by which a particular amount of progress is made in the minimum amount of time); the rational method of transporting loads is that by which a given load is transported with the minimum of effort or by which the maximum load is transported for a given effort. The economic principle also finds application in scientific research. It appears most clearly in mathematical statistics when a certain parameter is to be estimated or a statistical hypothesis has to be verified on the basis of the smallest possible number of observations; well-known in this connection is the concept of the efficiency of various statistical methods.

Thus it can be seen that the economic principle is the principle of all rational human behaviour directed to the maximum realization of a given end. Wherever activity is rational and the end is quantitatively measurable, or at least can be expressed in the form of a greater or lesser degree of realization, there the economic principle is at work. Economic activity is the widest field for the application of the economic principle and is the sphere in which the principle first appeared, although not the only one. Moreover, the economic principle has entered and is continually taking over new fields for its application.

In the capitalist mode of production, as we know, quantification of aims and rationalization permeates all fields of economic activity which became the domain of gainful activity and especially of capitalist enterprise. This induces the rationalization and quantification of aims in many other fields of human activity, since these fields are directly connected with gainful activity (e.g., in technology), or indirectly—as a result of the “mental climate” prevailing in the capitalist social formation. Individual and social life, together with culture, are rationalized and in part become a field for the quantification of aims (e.g., the quantitative measurability of results in modern sport). In this way more and more fields of human activity are submitted to the application of the economic principle.

The socialist mode of production makes possible further progress of rationalization—and most likely also of quantification of aims—of various fields of human activity. Social rationality is introduced by the inclusion of the whole social process of production and distribution in a social economic plan thus necessarily strengthening the trend toward rational behaviour in all fields of human activity. Moreover, the superstructure of the socialist social formation has no need of those numerous irrational and even anti-rational constituents which are necessary in social formations based on antagonistic relations of production. On the contrary, in a socialist society these constituents are an obvious hindrance to social development and active attempts are made to get rid of them. Consequently it is to be expected that the economic principle, that is, the principle of economic rationality, will embrace an ever greater area of human activity.

*Praxiology—the science of rational activity*

In view of the fact that rationality of action is now a feature of many fields of human activity, there arises the problem of discovering what it is that is common to all fields of rational activity. This has led to the general study of rational activity,



*praxiology*. This is still a very young science; so far the most systematic exposition of its foundations has been made by Tadeusz Kotarbiński<sup>41</sup>. Praxiology may be described as the "logic of rational activity". For it deals with the methods of inference employed in rational activity. It formulates the general concepts which arise from rational activity. These are concepts

---

<sup>41</sup> The first systematic treatment of praxiology is Kotarbiński's book *Traktat o dobrej robocie* (Treatise on Good Work) published in 1955. Kotarbiński however began his work on praxiology much earlier. See *Szkice praktyczne* (Essays on Practice) (1913), *Czyn* (Action) (1934), and *O stosunku sprawstwa* (Causal Action) (1925). All these papers are in *Pisma Wybrane* (Selected Works) vol. 1, Warsaw 1958. A brief outline of the basic concepts of praxiology is contained in *Logic Course for Lawyers* (in Polish) pp. 156-164 and in *Sprawność i błąd* (Efficiency and Error), Warsaw 1957 (especially the last chapter). For the separation of praxiology from the technique of activity see Kotarbiński, *Zdania prakseologiczne* (Praxiological Sentences), "Studia Filozoficzne", no. 4, Warsaw 1960, and *Rodzaje zdań prakseologicznych oraz sposoby ich uzasadniania*, (Types of Praxiological Sentences and their Justification) "Kultura i społeczeństwo", no. 4, Warsaw 1960. According to Mises (*Human Action*, p. 3), the term *praxiology* was first used by the French sociologist Espinas in 1890, in an article on the origins of technology. It appears that the first work on praxiology—using this term—was published in 1926 by the famous Soviet mathematician Eugene Slutsky with the title *Ein Beitrag zur formal-praxeologischen Grundlegung der Oekonomie* in *Academie Oukrainienne des Sciences, Annales de la classe des sciences sociales-economiques*, vol. 4, Kiev 1926 (in German and Ukrainian). Kotarbiński is responsible for the fact that the term has now become more widely known and used. Mises also uses the term in the book which we have already cited (first published in Geneva in 1940 with the title *Nationaloeconomic. Theorie des Handelns und Wirtschaftens*). As we shall see in due course, Mises falsely identifies praxiology with political economy. Kotarbiński's definition also raises some doubts. He describes praxiology as the science of effective activity (*A Logic Course for Lawyers* [in Polish], ed. cit. p. 6; *Efficiency and Error* [in Polish], ed. cit., p. 104); in *Treatise on Good Work* [in Polish], ed. cit., p. 7, he is talking about a general theory of efficient activity, which is not the same thing. It seems to us that praxiology should be defined as the science of *rational* activity, using the word rational in the methodological sense; the effectiveness of an activity is connected with its factual rationality which, however, is not an attribute of activity as a mode of behaviour and is therefore not a question of praxiology but of technology.

like end and means, method, action, plan, effectiveness, efficiency, economy and so on. These concepts are called *praxiological categories*. Praxiology establishes relations between praxiological categories which are called *praxiological principles of behaviour*; principles of this kind appear in every field of rational human activity<sup>42</sup>. The economic principle, or principle of economic rationality, is precisely one of these praxiological principles of behaviour.

*Branches of scientific research belonging to praxiology: operations research and the science of programming. Cybernetics—a science auxiliary to praxiology*

Kotarbiński's work on praxiology was the result of purely academic interest and derived from the author's studies in the field of logic and the general methodology of science. Parallel to and independent of Kotarbiński's work, two kindred branches

---

<sup>42</sup> Formerly praxiological categories and principles of behaviour appeared in only two sciences, in ethics and in political economy. These disciplines were often called *moral sciences* especially in England and France, that is, the study of human behaviour. Treatises on ethics contain a great number of praxiological categories, and in political economy many praxiological principles of behaviour have been developed. As we shall see in due course there is even a tendency in political economy to identify economic science with praxiology. Since science is a field of human activity praxiological principles of behaviour are to be found here as well. For instance, the foundation of mathematical statistics (i.e., the science of the estimation of certain magnitudes and the verification of hypotheses on the basis of statistical observation) consists not only of the calculus of probability but also of certain praxiological principles of behaviour. In statistical estimation there are two rival principles of procedure: R. A. Fisher's principle of the maximum likelihood, and Markov's principle of the least variance (used earlier by Gauss). Recently a general theory of statistical decisions has been developed which derives all the principles of procedure employed in mathematical statistics from the economic principle. See A. Wald, *Statistical Decision Functions*, New York 1960, pp. 8–10. Praxiological principles of procedure in science are dealt with by the general methodology of science. Dialectical materialism treats all cognition as the result of human social activity and bases its theory of cognition on the praxiological principle of proceeding according to "the criterion of practice".

of scientific research have recently developed in direct response to practical requirements. They are *operations research* and the *science of programming*. Both developed from military problems during and immediately after the second world war and very quickly found their application in economic activity in problems like the organization of supplies and transport, the co-ordination of production, the planning of investment and so on<sup>43</sup>. The science of programming soon absorbed input-output

---

<sup>43</sup> At the beginning of World War II operations research groups were set up in the British armed forces in order to analyze scientifically the methods used in military operations. A notable part was played in this by two physicists, P.M.S. Blackett and J.D. Bernal. These groups, made up of scientists, dealt with problems like the optimum number of ships in a convoy, the optimum size of a bomber squadron, the optimum depth of explosion of depth charges. After the United States' entry into the war, operational research groups were also set up in the American armed forces. They dealt with problems like the optimum route of a ship during an air attack, the optimum disposition of mines at the entrance to an enemy port etc. A brief history of these groups is given by J.F. Closkey and F.N. Treethen in *Operations Research for Management*, 1954; and by J.D. Bernal in *Science in History*, London 1954, pp. 580-581. See also C.W. Churchman, R.L. Ackoff, E.L. Arnoff, *Introduction to Operations Research*, New York 1958, pp. 9-12. Bernal thinks that operations research was an important factor in the superiority of the armed forces of Great Britain and the United States over Nazi Germany's armed forces which employed more intuitive methods. In the United States there currently exist six or seven firms which specialize in operations research for industrial and trading enterprises and some big companies have their own operations research department. In Great Britain operations research institutes have been set up by business organizations and deal with industry, rail and municipal transport, road construction etc. The "Operational Research Quarterly" is published in England, "Operations Research" in America, and "Revue de Recherche Operationelle" in France. The theory of programming was developed in the United States after the Second World War as a continuation of operations research. At first it was used to establish the optimum co-ordination of activities like recruiting, training, equipment, the maintenance and renewal of stores, the construction of airfields etc. Later it found a wide application in economic activity. A brief historical sketch is given by R. Dorfman, P.A. Samuelson and R.M. Solov in *Linear Programming and Economic Analysis*, New York 1958, pp. 1-5. The fundamental concepts of programming had, however, been developed earlier in the Soviet Union in connection with the problems of the organ-

analysis as one of its constituent parts. To-day, operations research and the science of programming are applied in various fields of human activity where a great number of actions intended to achieve a particular aim must be co-ordinated and where the optimum arrangement of these actions must be found, i.e., a system which will ensure the realization of the end in the maximum degree must be worked out. For this reason these fields of enquiry form part of praxiology<sup>44</sup>.

Finally, the third discipline which has developed in recent years, cybernetics, is also linked with praxiology—especially that part of it called the theory of information. Cybernetics is the abstract study of systems composed of elements which mutually interact upon each other<sup>45</sup>. Cybernetics dissects these relations into chains of causes and effects, formulates the mathematical connections between them and studies the causal

---

ization and planning of production. See L.V. Kantorovich, *Matyematicheskiye metody organizatsii i proizvodstva* (Mathematical Methods of Organization and Production), Leningrad 1939. Kantorovich also published two other papers on the application of programming, *On the Translocation of Masses*, *Doklady Akademii Nauk SSSR*, 1942, nos 7 and 8; *Prinyenyeniye matyematicheskikh myetodov v voprosakh analiza gruzopotokov* (Use of Mathematical Methods of Analysis of Transport), in the book *Problemy povisheniya efektivnosti raboty transporta* (Problems of Improving the Efficiency of Transport), Academy of Sciences of the USSR, [Moscow-Leningrad 1949. Kantorovich has published a systematic exposition of programming with the title *The Economic Reckoning of the Optimum Use of Resources* (in Russian), Moscow 1959. A good introduction to programming is given by Wiesław Sadowski in *Teoria podejmowania decyzji* (The Theory of Decision), Warsaw 1960.

<sup>44</sup> An outline of the most important problems and methods of operations research is given in the books listed in note 43. As far as Polish literature is concerned mention should be made of Oskar Lange's *Introduction to Econometrics* (chapter three contains an introduction to programming).

<sup>45</sup> The term "cybernetics" comes from the Greek "κυβερνήτης", meaning helmsman. The word *gubernator* (governor) is etymologically related to it. Since the first use of this term applied to self-governing machines and devices, and then to self-governing biological processes, cybernetics was called the "science of control". The founder of cybernetics is Norbert Wiener. See his book *Cybernetics. Control and Communication in the Animal and the Machine* first published in Paris and New York in 1948.

chain processes taking place in these systems. Cybernetics has two applications in praxiology. Firstly, when human activity is indirectly aimed at a goal through setting in motion a long chain of interconnected causes and effects. Cybernetics then makes an exact analysis of the processes at work in this chain. Secondly, when external conditions alter in the course of an activity and especially when this alteration is a result of the very activity. In this case, if we want to reach the desired end it is necessary to change the means of action. This gives rise to the sequence: end—means of action—alteration in conditions—new means—new alteration in conditions etc. The basic element in the effectiveness of the activity is rapid, accurate, and sufficient information about the alteration in conditions which takes place in the course of activity and the rapid adjustment of the means to the altering conditions. This can be interpreted as a process “of learning” in the course of activity which takes place in conditions subject to change. Cybernetics analyses the process.

It can be seen that the rationalization of various fields of human activity gives rise to a series of new disciplines dealing with rational activity. These disciplines form constituent parts of praxiology—the general study of rational activity. Furthermore, cybernetics has appeared: a science dealing abstractly with a broad class of very general problems and concerning itself with certain aspects of human behaviour as a special case. The significance of cybernetics for praxiology lies in the fact that praxiology uses the results of cybernetics, applying them in the investigation of particular problems of human activity. Cybernetics is a science auxiliary to praxiology.

### *The principles of programming*

Praxiology is important in political economy chiefly because it deals with the study of programming. The study of programming is concerned with the question of the choice of appropriate means for the realization of a particular end when the means are quantitatively measurable and the end may be real-

ized in Varying degrees. The selection of these means is called programming, and the set of means chosen for the realization of an end is called a programme. Programming is made up of two parts.

The first consists in determining the available means and their possible applications and in establishing the consistency of these various applications. The possible applications are limited by the nature and quantity of the means; not all applications can be carried out. Nor are all applications consistent with each other. Some applications may be contradictory, and may disagree with each other. This is the case when there are insufficient means for all the applications or when one application for some reason renders another application impossible. Thus the various applications must be harmonized, or, as we say, the *internal consistency of the programme* must be established. The instrument by which the internal consistency of the programme is established is balance accounting. It is for this reason that the study of programming has absorbed various kinds of balance analysis, e.g., input-output analysis.

The establishment of the internal consistency of a programme is especially important where the structure of the means is complicated and takes the form of the hierarchy of ends which we have already discussed, where second order ends are the means for the realization of the first order end (chief end), third order ends are the means for the realization of second order ends, etc. The internal consistency of a programme requires that the structure of ends, in which each end is the means for the realization of a higher order end, should itself be internally consistent. The inner consistency of a programme is then a complicated matter and requires the application of special mathematical methods worked out by the science of programming.

The second part of programming consists in the establishment of the optimum set of means to be used, i.e., a set of means leading to the maximum realization of the end. This is called the *choice of the optimum programme*. The optimum programme is chosen only from internally consistent programmes since internally inconsistent programmes cannot be carried out in prac-

tice. As a rule there is a large (most frequently an infinite) number of internally consistent programmes from which the choice of the optimum programme is made. The choice of the optimum programme is quite simply the application of the economic principle to programming. As always, this principle may be applied here in two variants: either as the choice of the maximum realization of the end for a given outlay of means, or else as the choice of the minimum outlay of means for the realization of the end to a given degree.

Programming problems are solved mathematically<sup>46</sup>. The degree of realization of the aim is considered as a mathematical function of the amounts of the various means applied. This is called the *objective function*. The conditions for the internal consistency of a programme are formulated as equations or inequalities, in which the unknowns are the amounts of the means applied. The equations (or inequalities) are called *balance relationships* because they express connections between the amounts of various means which are in fact balance relations. A set of particular amounts of the means is called a programme. An internally consistent programme is a set of amounts of means fulfilling the balance relationships; an optimum programme is a set of amounts of means for which the objective function reaches its maximum. By solving the balance relationships we obtain internally consistent programmes. Since we normally assume that the number of balance relations expressed as equations is less than the number of unknowns (there may be a greater number of inequalities), there are consequently many solutions (usually an infinite number) i.e. there are many internally consistent programmes. The set of internally consistent programmes is called *the domain of feasible solutions* of the programming problem. In the domain of the feasible solutions we pick out the optimum solution (or several such solutions, if there is more than one), i.e., the solution for which the objective function reaches its maximum. This gives us

---

<sup>46</sup> The reader will find an introduction to the mathematical methods of programming in the appendix at the end of this Chapter.

optimum programmes of which there may be one or more than one (even an infinite number). This depends on the properties of the objective function and the balance relationships.

It is worth noting that a programming problem can be solved in two ways. One is the method described here of finding the maximum of the objective function for given balance relationships. A second method consists in the construction, on the basis of the balance relationships, of an *outlay function*, in adopting as a balance relation an equation expressing a particular degree of the realization of the end and then in finding the minimum of the outlay function. The solution obtained by the second method is identical with the solution obtained by the first method. The existence of two methods of solving a programming problem is called in the terminology of the science of programming the *duality* of the problem of the selection of the optimum programme. This duality corresponds to the two variants of the application of the economic principle.

The method of determining the maximum of the objective function or the minimum of the outlay function depends on the properties of these functions. In practice we distinguish between two fundamental cases. One of them occurs when either the increment in the objective function caused by the use of an additional unit of a particular means or the decrement in the outlay function caused by a diminution in the use of a particular means by one unit is a variable quantity (or when both are variable quantities). Mathematically, this means that the value of the first derivatives of at least one of these two functions is variable. In this case maximum and minimum values are found in the usual way by the use of differential calculus. The application of differential calculus in programming is called *marginal calculus*. The second case occurs when the increment and decrement mentioned has a constant value, i.e., mathematically speaking, when the values of the first derivatives of both functions are constant. A method called *linear programming* is then used.



*Marginal calculus*

Marginal calculus consists in comparing the increments in the objective function caused by the use of an additional unit of various means (it is here assumed that all means are commensurable and measured in the same units; the conditions of commensurability are determined by the balance relationships). If an additional unit of one means causes an increment in the objective function smaller than an additional unit of another means, we may then obtain a net increase in the objective function by substituting a unit of one means for a unit of another. As long as we can go on doing this, the objective function has not yet reached its maximum. The maximum is reached when the increments resulting from an additional unit of a means (so-called marginal increments) are the same for all means. It is then impossible to increase the value of the objective function by substituting a unit of one means for a unit of another, i.e., by changing the programme. The programme is optimum. Similarly, the minimum of the outlay function is obtained when decrements in the value of this function resulting from the diminution by one unit of the means used (so-called marginal decrements) are the same for all means. As long as this is not so it is possible to decrease the value of the outlay function by substituting a unit of one means for a unit of another means.

As can be seen, the application of marginal calculus requires that the marginal increments of the objective function or the marginal decrements of the outlay function should change in such a way as to allow marginal increments or decrements to equalize in the process of replacing one means by another. For this purpose the marginal increments or decrements must be variable and must, moreover, vary in a particular way, so as to lead to their equalization. It is sufficient if this occurs either for marginal increments of the objective function or for marginal decrements of the outlay function. For in view of the duality of the problem of selecting the optimum programme, this may be solved by applying marginal

calculus either to the objective function or to the outlay function. Marginal calculus may not be applied, however, when both the marginal increments of the objective function and marginal decrements of the outlay function have constant values. In this case the procedure applied above leading to the equalization of the marginal increments or decrements is not possible. When marginal increments are constant quantities they are either always equal, independent of the amounts of the means applied, or they are never equal and the substitution of one means for another cannot lead to their equalization. The same is true of marginal decrement. In this case linear programming is used. Its name is due to the fact that in this case both the objective function and the outlay function are linear functions, that is, there is a simple proportionality between the additional amount of a means and the increment in the degree of the realization of the end. In this case the balance relationships, on the basis of which the outlay function is defined, are also linear equations or inequalities.

#### *Linear programming*

To determine the maximum of the objective function (or the minimum of the outlay function) linear programming uses linear algebra and the geometry of linear manifolds (i.e., geometrical objects formed by the intersection of planes in multi-dimensional space). The praxiological meaning of the procedure employed can be explained as follows. Since the marginal increments (first derivatives) of the objective function are constant they are therefore always all equal or all unequal. In the first case the replacement of a particular amount of one means by a particular amount of another does not alter the value of the objective function. All programmes are then optimum since all give the same value for the objective function. This is the trivial case. If, on the other hand, the marginal increments are not equal, the value of the objective function may be increased by replacing a unit of a means giving a smaller marginal increment by a unit of a means giving a greater marginal increment. Because the marginal increment does

not vary (it is a constant quantity) it is possible to proceed in this way as long as the balance relationships allow. Hence the limits of this procedure are determined by the balance relationships.

Thus, the maximum of the objective function is determined as follows. First, other means are replaced by the means giving the greatest marginal increment. This is done as long as the balance relationships permit. When the possibilities of such a procedure are exhausted, other means are replaced by the means giving the second greatest marginal increment of the objective function. When the balance relationships no longer allow this then the remaining means are replaced by the means giving the third greatest marginal increment, etc. This procedure is carried out as long as the balance relationships allow, or until the available means are exhausted. The objective function then reaches its maximum within the limits of the possibilities determined by the balance relationships.

As a result it can be seen that the optimum programme provides for the application of just as many means as there are effective limitations of the outlay of means in the balance relationships. For individual means are applied successively—in order of the size of the marginal increment of the objective function which they cause—each up to the limit determined by the balance relationships. It is not possible to use a smaller number of means than the number of limiting balance relationships since in that case not all the possibilities of increasing the value of the objective function would be taken advantage of. Nor is it possible to use a greater number since that would mean the partial application of means giving a smaller marginal increment of the objective function in the place of means giving a greater marginal increment.

Since in linear programming the value of the objective function increases in stages of which each (in contrast to marginal calculus) leads to the limit imposed by the balance relationships, therefore the optimum programme is found, as we say, "on the border" of the domain of feasible solutions, that is, the set of internally consistent programmes. This can

be illustrated by certain geometrical analogies<sup>47</sup>. Similarly, the minimum of the outlay function is also determined in stages. First, other means are replaced by the means giving the greatest marginal decrement of the outlay function, etc., carrying each stage as far as the balance relationships will allow. As a result, the optimum programme is also found "on the border" of the domain of internally consistent programmes.

*Methodological links between political economy and praxiology*

Praxiology, and especially that part of it formed by the study of programming, is a science auxiliary to political economy like logic and mathematics, economic statistics and mathematical statistics, econometrics, economic history, economic geography and so on. It has a methodological significance for political economy since, wherever economic activity is rational, praxiological principles of behaviour form part of economic laws. When economic activity is rational the economic laws of human behaviour are a concretization of the praxiological principles of behaviour adapted to particular conditions. This is especially so where the end and the means of economic activity are expressed quantitatively as in a money economy and particularly in a capitalist enterprise. Then the economic laws of human behaviour express the application in given conditions of the economic principle, that is, the principle of economic rationality. Knowing the conditions in which economic activity takes place it is possible by means of the economic principle to *infer deductively* what laws of economic behaviour operate in these conditions. Knowing the conditions in which the activities of different people are connected and inter-operate, it is equally possible to infer deductively the economic laws of interplay of human activities.

From the fact, for example, that the owner of capital behaves rationally and that the aim of his activity is the maximization of profit, it follows that he places his capital in that

---

<sup>47</sup> See the appendix to this Chapter. These geometrical analogies are also set out in Oskar Lange's *Introduction to Econometrics*, pp. 333-7.

field of economic activity in which the rate of profit is the highest. From the fact that the owners of capital have a free choice of the fields in which they wish to place their capital and that competition exists among them it follows that the rates of profit in various branches of economic activity tend toward a common level. From the fact that in a particular field the owners of the capital invested there have a monopoly and do not permit the investment of other capital it follows that in this field the rate of profit is higher than in fields to which there is a free flow of capital.

*Certain laws of political economy are conclusions deduced from praxiological principles of behaviour*

The significance of praxiology and especially of the science of programming thus lies in the fact that certain laws of political economy can be deduced from praxiological principles of behaviour and especially from the economic principle. In this way the scope of the section of political economy which uses deductive inference, i.e., economic theory, is considerably widened. It also makes the construction and use of theoretic economic models easier. Inductive generalization of the results of comparative observation of the economic process which we referred to above<sup>48</sup>, together with certain praxiological principles of behaviour, form the basis of the axiomatization of the model<sup>49</sup>. The logical and mathematical consequences of praxiological principles as, for instance, the calculi employed in the science of programming, serve as directives of inference in the model<sup>19</sup>. In this way a considerable part of political economy is in fact a system of deductive inference.

This "deductivization" of inference constitutes a considerable methodological simplification in political economy.

<sup>48</sup> See Chapter Four.

<sup>49</sup> As we know, a deductive system of inference contains the definitions of terms, axioms (also called postulates), i.e., statements forming the premisses of inference which are not proved in the system, and directives of inference, i.e., rules for the deduction of conclusions from premisses. See, for example, Kotarbiński, *A Logic Course for Lawyers* (in Polish), ed. cit., pp. 128-129.

Many laws of political economy can be easily deduced from the praxiological principles of behaviour, while to arrive at them by inductive generalization would demand a laborious examination of numerous aspects of the economic process and complicated historical and statistical analysis. Moreover, it would be considerably more difficult on the basis of inductive generalization to separate essential from incidental relationships and there would thus remain considerably greater doubt as to whether this isolation had been done well or not. Also the laws of political economy established on this basis would not have the same force of logical necessity as laws which are deductions from the praxiological principles of behaviour. It is for precisely this reason (as well as for the reason that a greater interest exists in this field) that political economy has, up till now, chiefly concerned itself with the economic laws of social formations in which the predominant part of economic activity is rational activity and, hence, with the laws of the capitalist and socialist formations. For in these two social formations it is possible by deduction to understand economic laws to a large extent on the basis of praxiological principles of behaviour, especially the economic principle. Therefore, the economic principle, (often incorrectly formulated—a point which will be discussed later) played a large part in the formation of political economy as a science.

*Study of economic laws by deduction dependent on the rationality of economic activity*

Thus, deduction from the praxiological principles of behaviour is a short cut to the comprehension of economic laws. Whether or not it may be used as a means of studying economic laws, however, depends on the truth of the assumption that economic activity is rational activity. As we know, not all the economic activity under consideration is rational activity (as some have thought and still think wrongly). In pre-capitalist social formations where natural economy prevailed, economic activity was customary and traditional. Customary and traditional activity still prevails in household

activity in the capitalist and socialist modes of production. Therefore, before a "short cut" to the study of economic laws is taken by deduction from the praxiological principles of behaviour, it is necessary to check whether the economic activity under investigation is rational activity or customary and traditional activity. This is ascertained by reductive inference using historical and statistical verification. It consists in drawing logical and mathematical conclusions from the praxiological principles adopted and in the confrontation of these consequences with actual human economic activity.

If the check gives a negative result it is not possible to use the "short cut" to the study of economic laws. In this case the investigation must be made by induction. As an example of the inductive investigation of economic laws we might note the study—using statistical and monographic analyses—of the laws of human behaviour in individual peasant holdings where, on account of the partly natural character of this kind of economy, economic activity is not directed to the maximization of profit and is largely traditional and customary activity. Another example is provided by the study of the laws of activity in the household on the basis of an analysis of family budgets. This has led, for example, to the discovery of Engel's law which states that the percentage of income spent on food diminishes with an increase of the average income per head of the family.

Inductive methods of this kind are mainly used in the examination of the economic laws of pre-capitalist social formations. This does not mean that deduction plays no part at all in the examination of economic laws where economic activity is customary and traditional. Deductions can be made from this activity as well. Knowing, for example, the forms and customary levels of feudal rent and the productivity of peasant labour, it is possible to draw various conclusions about the standard of living of the peasants, the incomes of land-owners, the rate of surplus labour etc. It is not, however, possible to use the "short cut" referred to above in studying economic laws. The political economy of

pre-capitalist social formations therefore uses deduction to a much lesser degree than the political economy of social formations in which the major part of economic activity is rational activity.

*The need to establish empirically the scope of the methodological knowledge applied in practice*

For deducing of economic laws from the praxiological principles of behaviour it is not sufficient to be sure that the economic activity under investigation is rational activity. It is also necessary to establish by comparative observation what methodological means are used in a given activity. As we have pointed out, when we speak of rational activity we have methodological rationality of action in mind. Modes of behaviour in methodologically rational activity depend on the methodological knowledge possessed by those engaged in the activity and on the external conditions which decide how much of this methodological knowledge is useful. For example, mathematical methods of programming are not always used in activity directed towards the maximization of a quantified end and employing quantified means. A small business man cannot use them, for example, if he does not possess the necessary mathematical knowledge and has never heard of programming. A large firm, for example, which has a special programming department or employs special consultants, certainly uses them. A small business man, even if he knows about the possibilities of programming, does not take advantage of them because the cost of expert consultants is too high. Furthermore, economic relations may make it impossible to utilize the methodological knowledge available. A considerable proportion of our knowledge of programming is not used in capitalist enterprises or capitalist states because its application demands a co-ordination of the activities of individual enterprises, which is only possible when the means of production are socially owned. In this case the methodological knowledge of rational activity exceeds the possibilities of its application in the capitalist mode of production.



Thus, when applying deduction in political economy on the basis of the praxiological principles of behaviour, it is necessary to take into account the actual methodological knowledge, possessed by people involved in economic activity, and the possibilities of applying this knowledge. This requires comparative observation of the actual economic process and drawing conclusions from this observation by means of induction. The deduction of economic laws from praxiological principles of behaviour must contain an inductive element if it is to lead to correct results conforming with objective reality. This element consists in empirically establishing the extent of the methodological knowledge applied in actual economic activity. Without this the results of the application of the praxiological principles of behaviour might prove to be false.

Many economists, for example, starting from the assumption that a capitalist enterprise maximizes its profit, draw from this the conclusion that it always makes use of marginal calculus. There have even been attempts, as we shall see further on, to make marginal calculus the methodological foundation of the whole of political economy. It has been found, however, that marginal calculus has a limited application in the activity of enterprises<sup>50</sup>. In the first place the book-keeping and balancing methods used in practice are not adapted to the needs of marginal calculus; furthermore, capitalist enterprises have not felt the need to adapt them to these requirements in spite of the widespread theoretical knowledge of the principles of marginal calculus in capitalist countries. Second, because of the properties of production technique the objective function and balance relationships are linear or nearly linear and are not suitable for the application of marginal calculus. It is significant that while in practice capitalist enterprises either

---

<sup>50</sup> See R.L. Hall and C.J. Hitch, *Price Theory and Business Behaviour*, Oxford Economic Papers, no. 2, 1939, and W.Y. Baumol, *Marginalism and the Demand for Cash in the Light of Operations Research Experience*, The Review of Economics and Statistics, no. 3, 1958.

disregarded or made little use of marginal calculus<sup>51</sup>, linear programming was adopted very rapidly. Thus laws deduced from the principle of the maximization of profit on the basis of the assumption that enterprises always use marginal calculus do not reflect the true economic laws operating in the capitalist economy. A similar error is committed by those economists who suppose that within the framework of the capitalist mode of production such methodological means of rational activity are employed which can be applied only when the means of production are socially owned.

*General appraisal of the significance of praxiology in the rationalization of economic activity*

The results obtained by praxiology must consequently be used with caution, without ascribing to those engaged in economic activity the employment of methodological means which are known to praxiology as a science but which are not known to those engaged in economic activity or which lie outside the scope of practical possibilities. On the other hand, the popularization of these results leads to an increase in the methodological rationality of economic activity. Especially important in this respect are the new sciences of operations research and programming as well as praxiology's auxiliary science, cybernetics, which quickly find practical application. When employed within the framework of the capitalist mode of production they increase the private rationality of the activity of capitalist enterprise; at the same time, however, they often aggravate the anti-social consequences resulting from the antagonistic nature of capitalist relations of production. In the socialist mode of production they can become a powerful instrument in increasing the social rationality of the social process of production and distribution. Therefore praxiology, especially such branches of it as operations

---

<sup>51</sup> Marginal calculus has, however, recently found expression in methods of book-keeping used by capitalist enterprises. See J.G. Zieliński, *Szkola marginalna a praktyka "big businessu"* (The Marginal School and the Practice of "Big Business"), "Życie Gospodarcze", 1959, no. 16.

research and programming, have great importance in the planning of the socialist economy. It may be that after double-entry book-keeping and balance accounting and after social economic balances, they will form a third historic stage in the development of the methodological means of rational economic activity.

## APPENDIX

## THE MATHEMATICAL FOUNDATIONS OF PROGRAMMING

1. *Programming as a mathematical problem.* Let  $z$  be the degree of realization of the end, and  $x_1, x_2, \dots, x_n$ , the outlays (i.e., the amounts used) of various means, the number of which is  $n$ . *The objective function is written*

$$(1) \quad z = f(x_1, x_2, \dots, x_n).$$

It is supposed that the degree of realization of the end and the outlays of means are non-negative quantities, i.e. that  $z \geq 0$  and  $x_i \geq 0$ , for  $i = 1, 2, \dots, n$ . To simplify calculation it is also assumed that the objective function has continuous first and second partial derivatives. Finally, it is assumed that the degree of realization of the end is an increasing function of the outlay  $x_i$  of any of the means, i.e., that

$$(2) \quad \frac{\partial f}{\partial x_i} > 0 \quad (i = 1, 2, \dots, n).$$

*Balance relationships* are expressed as  $m$  equations<sup>1</sup>

$$(3) \quad \Phi_r(x_1, x_2, \dots, x_n) = c_r \quad (r = 1, 2, \dots, m).$$

<sup>1</sup> Balance relationships, some or all of them, can also be inequalities

$$\Phi_r(x_1, x_2, \dots, x_n) \leq c_r.$$

By multiplying where necessary by  $-1$  any inequalities can be reduced to this form. These inequalities may however be changed into equations by adding the auxiliary variable  $x_{n+r}$  to the left hand sides. We then get—instead of an inequality—the equation

$$\Phi_r(x_1, x_2, \dots, x_n) + x_{n+r} = 0$$

in which  $x_{n+r} \geq 0$ . For the sake of symmetry of notation, the auxiliary variables  $x_{n+r}$  may also be introduced into the objective function. This function then takes the form

$$z = f(x_1, x_2, \dots, x_n, x_{n+1}, x_{n+2}, \dots)$$

In these equations the right hand sides are constants, i.e.,  $c_r = \text{const.}$  for  $r = 1, 2, \dots, n$ . It is also assumed that the functions  $\Phi_r$  appearing on the left hand side of the balance relationships have continuous first and second partial derivatives, and that

$$(4) \quad \frac{\partial \Phi_r}{\partial x_i} > 0 \quad (r = 1, 2, \dots, m; i = 1, 2, \dots, n).$$

It follows from the assumption (4) that for every balance relationship (3)

$$\frac{\partial x_i}{\partial x_j} = - \frac{\frac{\partial \Phi_r}{\partial x_j}}{\frac{\partial \Phi_r}{\partial x_i}} < 0 \quad (r = 1, 2, \dots, m; i, j = 1, 2, \dots, n; i \neq j).$$

This means that an increase in the outlay of one means requires a decrease in the outlay of some other. The assumption (4) thus indicates that the possibilities of the application of the means are subject to *limiting constraints*; it is not possible to increase the outlay of all the means. The balance relationships express the concrete character of these constraints.

It is also assumed that  $m < n$ , and that the Jacobian of the balance relationships is not equal to zero<sup>2</sup>. We can then express  $m$  of the variables  $x_1, x_2, \dots, x_n$ , as functions of the  $n-m$  remaining variables. Since the order

in which case, in order not to change the properties of the function it is necessary to assume

$$\frac{\partial f}{\partial x_{n+r}} = 0$$

identically for any values of the auxiliary variables  $x_{n+r}$ . In this way balance relationships can always be expressed in the form of equations.

<sup>2</sup> The Jacobian is a determinant of which the elements are partial derivatives of the functions that form the left hand sides of the equations (3). Since  $m < n$ , the rows of the determinant contain only  $m$  derivatives, e.g.,

$$\begin{array}{cccc} \frac{\partial \Phi_1}{\partial x_1} & \frac{\partial \Phi_1}{\partial x_2} & \cdots & \frac{\partial \Phi_1}{\partial x_m} \\ \frac{\partial \Phi_2}{\partial x_1} & \frac{\partial \Phi_2}{\partial x_2} & \cdots & \frac{\partial \Phi_2}{\partial x_m} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\partial \Phi_m}{\partial x_1} & \frac{\partial \Phi_m}{\partial x_2} & \cdots & \frac{\partial \Phi_m}{\partial x_m} \end{array}$$

If the Jacobian is equal to zero, the number of variables which can be expressed as functions of the remaining ones is less than  $m$ . In general: if the rank of the matrix, for which the Jacobian is the determinant, is  $m-k$ , then  $m-k$  variables can be expressed as functions of the  $n-m+k$  remaining variables. According to the terminology which we use below there are then  $n-m+k$  *degrees of freedom*.

of the numeration of variables is arbitrary we express  $x_1, x_2, \dots, x_n$ , as functions of  $x_{n+1}, x_{n+2}, \dots, x_n$ , which is written

$$(5) \quad x_i = \Psi_i(x_{m+1}, x_{m+2}, \dots, x_n) \quad (i = 1, 2, \dots, m).$$

It is seen then, that only the choice of the outlay of  $n-m$  means can be made freely. Once such a choice has been made, the outlays of the remaining  $m$  means is determined by the functions (5). This is expressed by stating that the choice of the outlays of the means has  $n-m$  degrees of freedom.

A set of values of the variables  $x_1, x_2, \dots, x_n$ , e.g.,  $x_1^0, x_2^0, \dots, x_n^0$ —i.e. a set of definite outlays of the various means, is called a *programme*. The set of programmes which satisfies the balance relationships (3) is called the set of *internally consistent* programmes. As we have shown, the set of internally consistent programmes has  $n-m$  degrees of freedom, which means that in this set the outlay of  $n-m$  means can be freely chosen.

Let us now consider the following geometrical interpretation. Every programme  $x_1^0, x_2^0, \dots, x_n^0$  is a point in  $n$ -dimensional Euclidean space. Since  $x_i \geq 0$  ( $i = 1, 2, \dots, n$ ), all the programmes are contained in that part of space consisting entirely of points with non-negative co-ordinates. The assumptions  $x_i \geq 0$  are therefore called *boundary conditions* since they determine the boundaries of the space within which the programmes are contained. The set of internally consistent programmes occupies that part of space which satisfies the conditions of the balance relationships (3). This part of space is *the domain of feasible solutions* of the problem of programming. Programmes outside this domain are not internally consistent and therefore do not constitute feasible solutions. The domain of feasible solutions has only  $n-m$  independent co-ordinates corresponding to the  $n-m$  degrees of freedom of the set of internally consistent programmes. Thus the domain of feasible solutions is a  $(n-m)$ -dimensional geometrical object suspended in  $n$ -dimensional space.

The task of programming is to choose the *optimum* programme (or programmes, if there is more than one) from the set of internally consistent programmes. In the geometrical interpretation the problem is to choose the optimum point (or points) in the domain of feasible solutions. The optimum programme is the programme which gives to the objective function the maximum value in the domain of feasible solutions. The task thus reduces itself to the problem of determining the values of the variables  $x_1, x_2, \dots, x_n$ , for which the objective function (1) reaches its maximum, while  $x_1, x_2, \dots, x_n$ , satisfy the additional conditions of the balance relationships.

The simplest way of solving this problem is by the use of what are called the Lagrange multipliers. This method consists in introducing an auxiliary function, called the Lagrange function, which is defined as follows:

$$(6) L(x_1, x_2, \dots, x_n; \lambda_1, \lambda_2, \dots, \lambda_m) = f(x_1, x_2, \dots, x_n) - \sum_{r=1}^m \lambda_r [\Phi_r(x_1, x_2, \dots, x_n) - c_r].$$

The coefficients  $\lambda_1, \lambda_2, \dots, \lambda_m$  are for the moment undetermined; they are the Lagrange multipliers.

We note that when the balance conditions (3) are satisfied—that is, in the domain of feasible solutions—the sum on the right hand side of the expression (6) is equal to zero. This means that in the domain of feasible solutions, the Lagrange function is identical with the objective function  $(x_1, x_2, \dots, x_n)^3$ . The determination of the maximum value of the objective function which satisfies the constraints (3) may thus be carried out in two stages. We first determine the usual maximum of the Lagrange function for arbitrary values of the multipliers  $\lambda_1, \lambda_2, \dots, \lambda_m$ , and then we choose values for these multipliers which satisfy the constraints (3). The maximum of the Lagrange function obtained in this way is identical with the maximum of the objective function for the constraints imposed by the balance-relationships.

The condition

$$L(x_1, x_2, \dots, x_n; \lambda_1, \lambda_2, \dots, \lambda_m) = \max.$$

determines the values  $x_1, x_2, \dots, x_n$ , (if such a maximum exists). It follows from the expression (6) that these values depend on the values assumed by  $\lambda_1, \lambda_2, \dots, \lambda_m$ , i.e. they are functions of these multipliers. This is expressed by writing

$$(7) \quad x_i = g_i(\lambda_1, \lambda_2, \dots, \lambda_m) \quad (i = 1, 2, \dots, n).$$

When these functions are substituted for  $x_1, x_2, \dots, x_n$  in the balance relationships, these relationships then take the form

$$(8) \quad \Phi(\lambda_1, \lambda_2, \dots, \lambda_m) = c_r \quad (r = 1, 2, \dots, m).$$

This gives  $m$  equations with  $m$  unknowns.

From these equations (assuming that their Jacobian differs from zero) we find the values of the multipliers  $\lambda_1, \lambda_2, \dots, \lambda_m$ . If these values are symbolized  $\lambda_1^0, \lambda_2^0, \dots, \lambda_m^0$ , and substituted in the functions (7), the following values are obtained

$$x_i^0 = g_i(\lambda_1^0, \lambda_2^0, \dots, \lambda_m^0) \quad (i = 1, 2, \dots, n).$$

<sup>3</sup> This result may be extended to the case noted in n. 2, when the balance relationships are inequalities. It may then happen that

$$\Phi_r(x_1, x_2, \dots, x_n) - c_r < 0$$

for certain values of the subscript  $r$ . We then assume  $\lambda_r = 0$  identically and thus the sum appearing on the right hand side of the model (6) is still equal to zero in the domain of feasible solutions.

<sup>4</sup> As a rule  $\lambda_r \neq 0$  since otherwise the sum appearing on the right hand side of the formula (6) would be indeterminate. On the other hand,  $\lambda_r^0 = 0$  in the case when the balance relationships are inequalities and

$$\Phi_r(x_1, x_2, \dots, x_n) - c_r < 0.$$

## THE MATHEMATICAL FOUNDATIONS OF PROGRAMMING 211

These are the values of the variables  $x_1, x_2, \dots, x_n$ , for which the objective function reaches its maximum subject to the constraints imposed by the balance relationships.

Since, if a constant quantity is added to, or subtracted from, a function, the values of the variables for which that function reaches its maximum remain unchanged, we may, instead of the Lagrange function, take the following function

$$\begin{aligned} & L(x_1, x_2, \dots, x_n; \lambda_1, \lambda_2, \dots, \lambda_m) - z_0 = \\ & = f(x_1, x_2, \dots, x_n) - z_0 - \sum_{r=1}^m \lambda_r [\Phi_r(x_1, x_2, \dots, x_n) - c_r], \end{aligned}$$

where  $z_0 = \text{const}$ . The maximum of this function is equal to the minimum of the function with the sign changed, i.e., of the function

$$\begin{aligned} (9) \quad & L_1(\lambda_1, \lambda_2, \dots, \lambda_m; x_1, x_2, \dots, x_n) = \\ & = \sum_{r=1}^m \lambda_r [\Phi_r(x_1, x_2, \dots, x_n) - c_r] - [f(x_1, x_2, \dots, x_n) - z_0]. \end{aligned}$$

This function is identical with the function

$$(10) \quad u(\lambda_1, \lambda_2, \dots, \lambda_m; x_1, x_2, \dots, x_n) = \sum_{r=1}^m \lambda_r [\Phi_r(x_1, x_2, \dots, x_n) - c_r],$$

if the condition

$$(11) \quad f(x_1, x_2, \dots, x) = z_0$$

is fulfilled, that is, for a constant degree of realization of the end.

The problem of maximization of the objective function subject to balance relationships can thus be replaced by the problem of finding the minimum of the function (10) (which, as can be seen, is determined by the form of the balance relationships), under condition that the degree of realization of the end is held constant.

The function (10) is a weighted sum, the value of which depends on the outlays of the means  $x_1, x_2, \dots, x_n$ ; it assigns to these outlays a single numerical value. Therefore this function may be called *the outlay function*. The function (10) thus establishes the commensurability of the various means. The task of programming can hence be formulated in two ways. One consists in maximizing the objective function subject to given balance relationships; the other in minimizing the outlay function for a given value of the objective function. The existence of two variants of the problem of programming is called the *duality* of this problem.

The second variant of the problem of programming is solved in the following way. In view of the condition (11) we have only  $n-1$  independent variables among  $x_1, x_2, \dots, x_n$ ; one of them, say  $x_n$ , is a function of the remaining variables<sup>5</sup>.

<sup>5</sup> The expression of one variable as a function of the remaining variables on the basis of the equation (11) is always possible because of our assumption (2).

The condition

$$L_1(\lambda_1, \lambda_2, \dots, \lambda_m; x_1, x_2, \dots, x_n) = \min.$$

thus determines  $m$  values  $\lambda_1^0, \lambda_2^0, \dots, \lambda_m^0$  and  $n-1$  values  $x_1^0, x_2^0, \dots, x_{n-1}^0$ . The value of  $x_n^0$  is obtained by inserting the last  $n-1$  values in the equation (11). The values  $\lambda_1^0, \lambda_2^0, \dots, \lambda_m^0$  and  $x_1^0, x_2^0, \dots, x_n^0$  determined in this way are the same as those obtained by the application of the first variant. Hence, the values  $x_1^0, x_2^0, \dots, x_n^0$  introduced into the balance relationships (3) satisfy the conditions set by those relationships. The outlay function then takes the value zero, as can be immediately seen from the expression (10). This is the lowest value of this function which it is possible to obtain within the limits of the condition (11). The other values of the outlay function must be positive. A positive value of this function is an indication of waste of means and can serve as a measurement of this waste.

The Lagrange multipliers appearing in the outlay function have a praxiological significance. As can be seen from the example (10), the outlay function appears as a weighted sum. The components of this sum

$$\Phi_r(x_1, x_2, \dots, x_n) - c_r \quad (r = 1, 2, \dots, m)$$

express the degrees of non-fulfilment of individual balance relationships, they indicate the extent to which these relationships have been "overstepped". The multipliers  $\lambda_1, \lambda_2, \dots, \lambda_m$  are weights attached to the "overstepping" of individual balances. The values  $\lambda_1^0, \lambda_2^0, \dots, \lambda_m^0$  of the Lagrange multipliers are these weights in conditions of the optimum use of means when all balance relationships are fulfilled. They are indicators expressing the weight for a given degree of realization of the aim, possessed by the limitation of the possibilities of using the means which results from each balance relationship<sup>6</sup>.

Finally, it should be mentioned that the solution of the problem of programming is invariant under any monotonously increasing transformation of the objective function. If the objective function  $f(x_1, x_2, \dots, x_n)$  is replaced by a monotonously increasing function of it  $F[f(x_1, x_2, \dots, x_n)]$ , chosen arbitrarily, then the function  $F(x_1, x_2, \dots, x_n)$  reaches its maximum for the same values of the variables  $x_1, x_2, \dots, x_n$  as does the function  $f(x_1, x_2, \dots, x_n)$ . This follows from the fact that the value of the function  $F$  always increases when the value of the function  $f$  increases and always

<sup>6</sup> Assuming  $\Phi_r(x_1, x_2, \dots, x_n) - c_r > 0$  for a non-optimum use of the means we always get  $\lambda_r > 0$ . This is because the outlay function has a positive value for all values of  $\Phi_r(x_1, x_2, \dots, x_n) - c_r > 0$  ( $r = 1, 2, \dots, m$ ), which is only possible if  $\lambda_r > 0$ . An exception is the case when the balance relations are inequalities and when  $\Phi_r(x_1, x_2, \dots, x_n) - c_r < 0$  for an optimum use of the means. We then have  $\lambda_r = 0$  identically. Here the balance relation does not restrict the use of the means and its weight is zero. All other balance relationships have positive weight.



decreases when the value of the function  $f$  decreases. This means that in order to solve the problem of programming it is only necessary to know if the value of the objective function increases or decreases, and it is not necessary to be able to measure its change in value. In other words it is sufficient that the degrees of the realization of the end can be ordered, it is not necessary that they should be measurable.

2. *Marginal calculus.* If the objective function and the balance relationships have the required properties which are discussed later, the programming problem can be solved by the use of differential calculus. The differential calculus used in solving this problem is sometimes called *marginal calculus*.

Applying differential calculus we find the conditions necessary for the maximum of the Lagrange function (6). They are as follows:

$$\frac{\partial L}{\partial x_i} = \frac{\partial f}{\partial x_i} - \sum_{r=1}^m \lambda_r \frac{\partial \Phi_r}{\partial x_i} = 0 \quad (i = 1, 2, \dots, n)$$

or

$$\frac{\partial f}{\partial x_i} = \sum_{r=1}^m \lambda_r \frac{\partial \Phi_r}{\partial x_i} \quad (i = 1, 2, \dots, n).$$

In view of (10) these conditions may be written more simply, namely

$$(12) \quad \frac{\partial f}{\partial x_i} = \frac{\partial u}{\partial x_i} \quad (i = 1, 2, \dots, n).$$

These are also the conditions for the minimum of the Lagrange function (9), as is immediately obvious. Thus both variants of the programming problem lead to the same necessary conditions.

The conditions (12) constitute  $n$  equations, by which we determine  $n$  values  $x_1, x_2, \dots, x_n$  as functions of the multipliers  $\lambda_1, \lambda_2, \dots, \lambda_m$  (see (7) above). When these functions are substituted in the balance relationships then  $m$  equations with  $m$  unknowns  $\lambda_1, \lambda_2, \dots, \lambda_m$  are obtained (see (8) above). By means of these equations we determine the values  $\lambda_1^0, \lambda_2^0, \lambda_m^0$  which finally makes it possible to determine the values  $x_1^0, x_2^0, \dots, x_n^0$ , for which the objective function reaches its maximum subject to given balance relations, and for which the outlay function reaches its minimum subject to a given value of the objective function.

The praxiological significance of the equations (12) is simple. The left hand side of these equations represent the *marginal increment of the objective function* caused by the outlay of the given means. The right hand side represents the *marginal increment of the outlay function* caused by the outlay of the given means. The equations (12) state that in the optimum programme for every means the marginal increment of the objective function is equal to the marginal increment of the outlay function.

This condition can be formulated differently. The following equations result from the equations (12).

$$(12a) \quad \frac{\frac{\partial f}{\partial x_1}}{\frac{\partial u}{\partial x_1}} = \frac{\frac{\partial f}{\partial x_2}}{\frac{\partial u}{\partial x_2}} = \dots = \frac{\frac{\partial f}{\partial x_n}}{\frac{\partial u}{\partial x_n}}$$

These equations state that in the optimum programme the marginal increment of the objective function per unit of the marginal outlay of an individual means is equal for all means. If these equations are inverted

$$(12b) \quad \frac{\frac{\partial u}{\partial x_1}}{\frac{\partial f}{\partial x_1}} = \frac{\frac{\partial u}{\partial x_2}}{\frac{\partial f}{\partial x_2}} = \dots = \frac{\frac{\partial u}{\partial x_n}}{\frac{\partial f}{\partial x_n}}$$

we find that the marginal increment outlay of the means necessary to obtain a unit of marginal increment of the objective function (or also, if we wish, the marginal decrement of the outlay function corresponding to a unit of marginal decrement of the objective function) is equal for all means. These two formulations correspond to the two variants of the programming problem.

The conditions (12) are necessary both for the maximum and minimum of the functions under discussion. In order to ascertain whether a maximum or a minimum is involved, it is necessary to find out whether the condition sufficient for a maximum or a minimum is fulfilled. For the maximum or minimum of a function subject to constraints this condition can most readily be formulated by using the Lagrange function.

The condition sufficient for the maximum of the objective function subject to the given balance relationships is

$$(13) \quad d^2L = \sum_{i=1}^n \sum_{j=1}^n \left( \frac{\partial^2 f}{\partial x_i \partial x_j} - \sum_{r=1}^m \lambda_r \frac{\partial^2 \Phi_r}{\partial x_i \partial x_j} \right) dx_i dx_j < 0$$

for the values  $x_1^0, x_2^0, \dots, x_n^0$ , determined by the equations (12), and for all values of  $dx_i$  and  $dx_j$ . It is immediately seen from (9) that this condition is equivalent to the condition

$$(14) \quad d^2L_1 > 0,$$

i.e., to the sufficient condition for the minimum of the outlay function subject to a given value of the objective function. This again shows that the two variants of the programming problem are equivalent.

The necessary conditions (12) and the sufficient condition (13) have the following geometrical interpretation. As we know, the domain of feasible solutions is an  $(n-m)$ -dimensional geometrical object suspended

in an  $n$ -dimensional Euclidean space. The objective function is an  $n$ -dimensional hypersurface in an  $(n+1)$ -dimensional space. For every given definite value  $z_0 = f(x_1, x_2, \dots, x_n)$  there exists a projection of this hypersurface onto an  $n$ -dimensional space. This projection is an  $(n-1)$  dimensional hypersurface; the greater the value of  $z_0$ , the higher that hypersurface is situated with respect to the origin of the system of co-ordinates, which follows from the assumption (2). The necessary conditions (12) state that the domain of feasible solutions is tangential to one of the projections representing the various values of the objective function, i.e., to the projection corresponding to the smallest or greatest value of the objective function. At the tangential point (or points, if there are more of them), the objective function reaches its greatest or smallest value in the domain of feasible solutions. The sufficient condition (13) states that in the vicinity of the tangential point(s) the  $(n-1)$ -dimensional hypersurfaces which are projections of the objective function are convex to the domain of feasible solutions<sup>7</sup>. Because of this convexity, the domain of feasible solutions is tangential to the highest placed of the hypersurfaces mentioned above, i.e., the objective function is maximized.

An analogous geometrical interpretation can be given for the minimum of the outlay function subject to a given value of the objective function. In this case there is only one projection of the objective function onto the  $n$ -dimensional space: this projection now constitutes the domain of feasible solutions. There are, on the other hand, many projections of the outlay function, i.e., one projection for every definite value of the function. The minimum of the outlay function subject to a given value of the objective function is determined by the point(s) of the projection of the objective function tangential to one of the projections of the outlay function. The sufficient condition (14) states that in the vicinity of the tangential point(s) the projections of the outlay function are concave to the projection of the objective function. Because of this the projection of the objective function is tangential to the lowest situated projection of the outlay function, i.e., this latter function is minimized.

The geometrical interpretation outlined here can most easily be visualized for  $n = 2$  and  $m = 1$ . The objective function is then

$$z = f(x_1, x_2).$$

The balance relationship is  $\Phi(x_1, x_2) = c$ .

The necessary conditions (12) assume the form

$$\frac{\partial f}{\partial x_i} = \lambda \frac{\partial \Phi}{\partial x_i} \quad (i = 1, 2).$$

<sup>7</sup> The geometrical interpretation of the inequalities (13) is such that everywhere outside the tangential point(s), the projection of the objective function is further from the origin of the coordinates than the domain of possible solutions.

The projections of the objective function onto the plane  $(x_1, x_2)$  form a family of curves  $L$ , each of which corresponds to a definite value of  $z = z_0$ . This is shown in Fig. 1. The domain of feasible solutions, determined

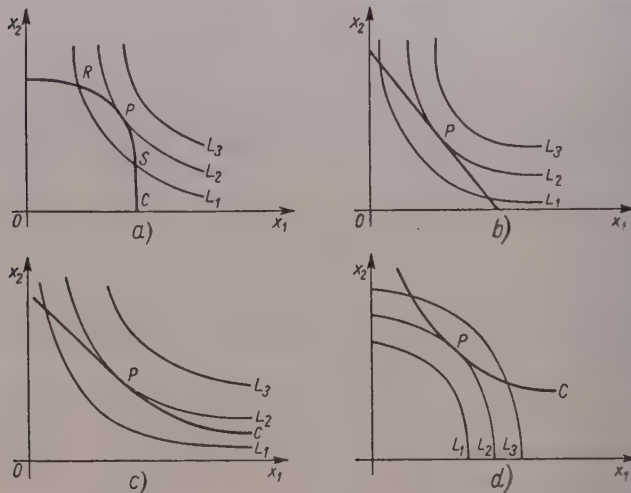


FIG. 1.

by the balance relationships, is represented by the curve  $C$ . The tangential point  $P$  is that point in the domain of feasible solutions which is situated on the highest of the accessible curves  $L$ , that is on  $L_2$ . It is true that the points  $R$  and  $S$  are also in the domain of feasible solutions, but they are on the curve  $L_1$ , situated lower than the curve  $L_2$ . It is true that the curve  $L_3$  is situated higher than the curve  $L_2$ , but it is inaccessible, given that all its points are outside the domain of feasible solutions. Figure 1 also shows the significance of the convexity of the curves  $L$  to the curve  $C$ , as implied by the sufficient condition (13). This condition is satisfied in Figs. 1a, 1b and 1c. In Fig. 1d, on the other hand, the curves  $L$  are concave to the curve  $C$ . As is immediately obvious, in this case the tangential point  $P$  is situated on the lowest accessible curve  $L$ ; the objective function is minimized.

The case in which the outlay function is minimized may be visualized with the help of Fig. 1d. In this graph the curve  $C$  is interpreted as a projection of the objective function whose value is given (i.e., the domain of feasible solutions). The curves  $L$  are projections of the outlay function such that each curve corresponds to a definite value of this function. The tangential point  $P$  is that point of the curve  $C$  which is situated on the lowest accessible curve  $L$ . Here the significance of the sufficient condition (14),

which asserts that the curves  $L$  are concave to the curve  $C$ , is also obvious. This condition guarantees that the outlay function is minimized.

Fig. 1 also shows that it is not necessary to be able to measure the degrees of realization of the end; it is sufficient if their order is known. The monotonously increasing transformations of the objective function  $F[f(x_1, x_2)]$  have the same projections on the plane  $(x_1, x_2)$  as the function  $z = f(x_1, x_2)$ . The projections of the function  $F[f(x_1, x_2)]$  on the plane  $(x_1, x_2)$  are given by the differential equation

$$F' \left( \frac{\partial f}{\partial x_1} dx_1 + \frac{\partial f}{\partial x_2} dx_2 \right) = 0,$$

where  $F'$  is the derivative of the function  $F$  with respect to the function  $f(x_1, x_2)$ . Since  $F' > 0$ , this equation is equivalent with the equation

$$\frac{\partial f}{\partial x_1} dx_1 + \frac{\partial f}{\partial x_2} dx_2 = 0,$$

which is the differential equation of the projection of the function  $f(x_1, x_2)$ . Hence the maximization of the function  $z = f(x_1, x_2)$  is also the maximization of all its monotonously increasing transformations.

This reasoning can be extended to cover any number of variables  $x_1, x_2, \dots, x_n$ . All monotonously increasing transformations of the function  $z = f(x_1, x_2, \dots, x_n)$  have the same projections onto an  $n$ -dimensional space as the function we have dealt with.

3. *Linear Programming.* The application of marginal calculus requires that the objective function and balance relationships possess certain properties. In the first place, the equations (12) must have a solution. In the geometrical interpretation this means that there must be a point (or points) of the projections of the objective function tangential to the domain of feasible solutions. Such tangential point may not exist. Moreover, if condition (13) is not satisfied the objective function may have no maximum (or, if condition (14) is not satisfied, the outlay function may have no minimum). It can be seen that marginal calculus can only be applied to a special kind of objective function and balance relationships possessing properties satisfying the conditions (12) and (13), or (14).

An especially important case in which marginal calculus cannot be applied is *linear programming*, i.e. a programming problem in which the objective function and all the balance relationships are linear. The objective function then takes the form<sup>8</sup>

<sup>8</sup> This is a so-called linear form. The general form of the linear function is

$$z = a_0 + \sum_{i=1}^n a_i x_i.$$

$$(15) \quad z = \sum_{i=1}^n a_i x_i$$

and the balance relationships take the form

$$(16) \quad \sum_{i=1}^n b_{ri} x_i = c_r \quad (r = 1, 2, \dots, m).$$

In these expressions  $a_i$ ,  $b_{ri}$  and  $c_r$  ( $i = 1, 2, \dots, n$ ;  $r = 1, 2, \dots, m$ ) are constants. As before, it is assumed that  $m < n$  and that the assumptions (2) and (4) are satisfied. The problem is to find those values of the variables  $x_1, x_2, \dots, x_n$ , for which the function (15) reaches its maximum under the constraints (16).

It can easily be seen that marginal calculus cannot be applied here, since the necessary conditions (12) here take the form

$$a_i = \sum_{r=1}^m \lambda_r b_{ri} \quad (i = 1, 2, \dots, n).$$

The variables  $x_1, x_2, \dots, x_n$ , do not appear in these equations so that they cannot be used to determine the value of these variables. Furthermore, these equations are self-contradictory for there are more equations than the undetermined multipliers  $\lambda_1, \lambda_2, \dots, \lambda_m$ ; unless the quantities  $a_i$  and  $b_{ri}$  are chosen in such a way that there are not more than  $m$  independent equations. It should also be observed that all the second derivatives of the function (15) and of the expressions (16) are equal to zero. Therefore  $d^2L$  or  $d^2L_1$  are also equal to zero and condition (13) or (14) is not satisfied. Thus we can see that marginal calculus is of no use in the solution of linear programming problem.

The solution of the problem of linear programming is most clearly set out with the help of its geometrical interpretation. The individual balance-relationships (16) form  $(n-1)$ -dimensional hyperplanes suspended in an  $n$ -dimensional Euclidian space. There are  $m$  such hyperplanes. The feasible solutions are formed by the points which lie simultaneously on all  $m$  hyperplanes (since they satisfy a system of  $m$  linear equations (16)). The domain of feasible solutions is the set of points which are common to all  $m$  hyperplanes, that is the set of points which lie at the intersection of those hyperplanes. This set forms an  $(n-m)$ -dimensional convex polyhedron<sup>9</sup>. Projections of the objective function (16) form a family

---

This form can always be changed into a linear form by the introduction of a new variable  $z' = z - a_0$ , i.e., by measuring the value of the function so that at the point  $z = a_0$  it is equal to zero.

<sup>9</sup> The intersection of two straight 1-dimensional lines forms a 0-dimensional point. The intersection of two 2-dimensional planes forms a 1-dimensional straight line, and the intersection of three 2-dimensional

of  $(n-1)$ -dimensional hyperplanes. The point(s) of the polyhedron the surface of which constitutes the domain of feasible solutions, tangential to the projection which is situated highest (i.e., is furthest from the origin of the system of co-ordinates) determine(s) the maximum of the objective function. The projections situated lower correspond to lesser values of the objective function, those which are situated higher are inaccessible, since they lie wholly outside the domain of feasible solutions.

Thus, the geometrical interpretation of the linear programming problem is similar to the geometrical interpretation of the marginal calculus. The difference lies in the fact that in this case the domain of feasible solutions is a polyhedron, an "angular" geometrical object, which cannot touch at every point the hyperplane which is a projection of the objective function. This "angularity" means that differential calculus cannot be applied to the determination of the tangential points. The polyhedron is tangent to the hyperplane at its highest vertex, which determines the maximum of the objective function in the domain of feasible solutions.

Apart from the highest vertex, other vertices of the polyhedron may touch a projection of the objective function. If there is only one vertex of the polyhedron tangent to a projection of the objective function, then the solution is unique. If there are two, then the polyhedron touches a projection of the objective function with the whole of one edge, i.e., a straight line joining the two vertices. If there are three, then the polyhedron touches the hyperplane which is a projection of the objective function with the 2-dimensional area of the triangle determined by the three vertices. Generally, if  $k$  vertices are tangent to a projection of the objective function, then the polyhedron touches that projection with a  $(k-1)$ -dimensional so-called simplex determined by those vertices.

The solution of the linear-programming problem is unique or not according to the number of vertices of the polyhedron which are tangent to a projection of the objective function. If  $k$  vertices of the polyhedron are tangent to a projection of the objective function, the solution has  $k-1$  degrees of freedom; the values of the variables  $x_1, x_2, \dots, x_{k-1}$ , can be chosen arbitrarily, and the remaining variables  $x_k, x_{k+1}, \dots, x_n$  are linear functions of the former. The solution thus depends on the shape of the polyhedron constituting the domain of feasible solutions and is determined by the highest vertex of the polyhedron. The position of the projection of the objective function (i.e., the inclination of the hyperplane) determines whether other vertices of the polyhedron are tangential to this projection as well and consequently whether the solution is unique or not and how many degrees of freedom it has.

---

planes forms a 0-dimensional point. The intersection of two 3-dimensional hyper-planes forms a 2-dimensional plane, the intersection of three 3-dimensional hyperplanes forms a straight line, etc.

This geometrical interpretation can be visualized when  $n-m=2$  or  $n-m=3$ . The domain of feasible solutions is then the surface of either a 2-dimensional polygon or a 3-dimensional polyhedron.

For example, let  $n=10$  and  $m=8$ . The domain of feasible solutions is then the surface of a polygon on the plane  $(x_1, x_2)$ , suspended in 10-dimensional space as shown in Fig. 2.

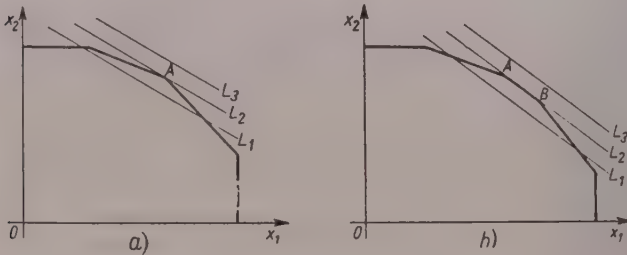


FIG. 2.

In view of the boundary conditions  $x_i \geq 0$  ( $i=1, 2$ ) we are only interested in that part of the polygon which corresponds to the non-negative values of the co-ordinates. The projections of the objective function onto the plane  $(x_1, x_2)$  form a family of straight lines  $L$ . The maximum of the objective function in the domain of feasible solutions is determined by the highest vertex of the polygon, tangent to one of the straight lines  $L$ . Fig. 2a shows a case where there is only one such vertex  $A$ . In Fig. 2b there are two such vertices,  $A$  and  $B$ ; the solution is given by the segment  $AB$  and has one degree of freedom.

Taking in turn  $n=10$  and  $m=7$ , the domain of feasible solutions is the surface of a 3-dimensional polyhedron, the faces of which are planes. The projections of the objective function are also planes. The polyhedron may touch the highest projection of the objective function with one vertex, with an edge, or with a face. Corresponding to these possibilities we have solutions which are unique, which possess one degree of freedom or which possess two degrees of freedom.

The computation of the solution of the linear programming problem is carried out by the methods of linear algebra. There are several algorithms, which starting from arbitrary values of the variables  $x_1, x_2, \dots, x_n$  in the domain of feasible solutions lead by a finite number of successive steps to the values of these variables which maximize the objective function in this domain<sup>10</sup>. These algorithms are connected with the geometrical interpretation which we have set out, since they consist in gradually passing,

<sup>10</sup> Algorithms of this kind have been worked out by G.B. Dantzig, *Maximization of Linear Functions subject to Linear Inequalities*, in *Activity Analysis of Production and Allocation*, New York 1951; R. Frisch, *Principles*



from the lower to the higher vertices of the polyhedron. If there are a great number of variables and balance relationships the practical work involved is very great. This is where electronic computers become extremely useful<sup>11</sup>. The introduction and spread of these machines have had a great deal of influence on the increased practical application of linear programming.

It is worth noting the especial simplicity and symmetry which characterizes the duality of the programming problem when the programming is linear. The problem of maximizing the linear function (15) subject to the linear constraints (16) is equivalent to the problem of minimizing the linear function

$$(17) \quad v = \sum_{r=1}^m c_r \lambda_r$$

subject to the linear conditions

$$(18) \quad \sum_{r=1}^m b_{ri} \lambda_r \geq a_i \quad (i = 1, 2, \dots, n).$$

The same constants  $a_i$ ,  $b_{ri}$ ,  $c_r$  ( $i = 1-2, \dots, n$ ;  $r = 1, 2, \dots, m$ ) appear in both problems, but the number of variables changes from  $n$  to  $m$ , and the number of constraints from  $m$  to  $n$ , while the coefficients of the function in one variant appear as constants in the constraints of the second variant, and these constraints become inequalities<sup>12</sup>.

The proof is simple. Substituting the left side of the equation (16) for  $c_r$  in the expression (17) we get

$$v = \sum_{r=1}^m \lambda_r \sum_{i=1}^n b_{ri} x_i = \sum_{i=1}^n x_i \sum_{r=1}^m b_{ri} \lambda_r.$$

In view of (18) we have

$$v \geq \sum_{i=1}^n a_i x_i$$

i.e.,

$$(19) \quad v \geq z.$$

This holds for all values of  $x_r$  satisfying the equations (16) and for all values of  $\lambda_r$  satisfying the inequalities (18). Hence it follows that

$$(19a) \quad v_{\min} \geq z_{\max}$$

of *Linear Programming*, Oslo 1954, and *The Multiplex Method for Linear Programming*, Oslo 1958; R. Dorfman, P.A. Samuelson and R.M. Solow; *Linear Programming and Economic Analysis*, New York 1958. They are described in most textbooks dealing with linear programming.

<sup>11</sup> See, for example, J. Leseault, *Programme linéaire et calculateurs électroniques*, *Revue de Recherche Operationelle*, Vol. I, no. 4, Paris 1957.

<sup>12</sup> They must be inequalities because  $m < n$ , otherwise the number of equations would exceed the number of unknowns. They could be changed into equations by introducing the auxiliary variables  $\lambda_{m+1}$ ,  $\lambda_{m+2}$ , ...,  $\lambda_n$ , in a similar way to that given in n. 1 on p. 207.

also holds. There is however a value of the function  $v$  and a value of the function  $z$ , let us call them  $v_0$  and  $z_0$ , such that

$$v_0 = z_0.$$

This occurs when  $\lambda_r$  satisfies  $m$  of the inequalities (18) as equations and

$$x_{m+1} = x_{m+2} \dots = x_n = 0.$$

Then

$$v_0 = \sum_{i=1}^m x_i \sum_{r=1}^m b_{ri} \lambda_r = \sum_{i=1}^m a_i x_i = z_0.$$

In view of the inequality (19a) this is, however, only possible when  $v_0 = v_{min}$  and  $z_0 = z_{max}$ , because otherwise it would be possible to disprove this inequality by decreasing the value of  $v$  or increasing the value of  $z$ .

We thus get

$$(19b) \quad v_{min} = z_{max}.$$

The minimization of  $v$  thus means the maximization of  $z$  and vice versa. It is possible to obtain the same result (19) by substituting the left side of the equations (18) for  $a_i$  in (15) and taking (16) into account. Both variants of linear programming are thus equivalent.

From this proof it follows that when (19b) is fulfilled, no more than  $m$  of the values  $x_1, x_2, \dots, x_n$  can be different from zero; they are then, because of the boundary conditions, positive. It is, however, obvious from the equations (16) that at least  $m$  of the values  $x_1, x_2, \dots, x_n$ , must differ from zero (and thus that they are positive because of the boundary conditions) for otherwise there would be more equations than unknowns and the equations could not be independent. As a result we find that in linear programming the optimum programme embraces exactly  $m$  positive outlays of the various means. The number of means used is equal to the number of balance relationships in the first problem.

The weights  $\lambda_1, \lambda_2, \dots, \lambda_m$  attached to individual balance relationships may thus be ascribed to individual means used in the optimum programme; they may be regarded as valuations of the significance of these means arising from the existence of the constraints imposed by the balance relationships. The second variant thus consists in the minimization of the joint significance of the means used of which the linear function (17) is the expression<sup>13</sup>. In other words, we could say that this variant consists in choosing such valuations of the various means as to minimize the obnoxiousness of the balance constraints.

<sup>13</sup> The linear form (17) is connected with the outlay function in the following way. In linear programming the outlay function has the form

$$u = \sum_{r=1}^m \lambda_r \left( \sum_{i=1}^n b_{ri} x_i - c_r \right) = \sum_{r=1}^m \lambda_r \sum_{i=1}^n b_{ri} x_i - \sum_{r=1}^m \lambda_r c_r.$$

The linear form (17) is the subtracted term on the right hand side of this expression. It is the valuation of the joint significance of the balance limitations which appear in the outlay function.

Thus it appears that the problem of linear programming may be set out in the form of the two following equivalent variants. One variant consists in the direct determination of the optimum outlays of the means  $x_1, x_2, \dots, x_n$ ; the second variant on the other hand consists in determining the valuations  $\lambda_1, \lambda_2, \dots, \lambda_m$  of individual means for which the minimization of the significance of the balance limitations takes place. In linear programming there are two separate problems—the problem of determining the optimum outlay of the means and the problem of determining the optimum valuations of individual means. The separation of these two problems is a specific property of linear programming.

Finally, it should be noted that in linear programming the degrees of realization of the end is always assumed to be measurable. This follows from the assumption that the objective function is linear. Only linear transformations of the objective function preserve its linearity. Therefore, the only possible transformations of the objective function are changes in the unit of measurement and changes in the zero point. In this way the application of linear programming is limited to the case where the degree of the realization of the end is measurable.

4. *The question of the existence of an objective function.* As can be seen marginal calculus does not always serve in solving programming problems. In such cases other methods of maximizing the objective function must be used, e.g., linear programming. There are also situations where although marginal calculus can be formally applied, it does not lead to the maximization of the objective function because such a function does not exist. This purely formal application of marginal calculus for which there is no corresponding maximization of the objective function we shall call *marginal pseudo-calculus*. Here, the symbols of marginal calculus are used but they are empty of objective content.

The symbols

$$\frac{\partial f}{\partial x_i} \quad (i = 1, 2, \dots, n)$$

which appear on the left hand side of the necessary conditions (12), may be interpreted as the coefficients of Pfaff's differential equation

$$(20) \quad \sum_{i=1}^n f_i(x_1, x_2, \dots, x_n) dx_i = 0$$

the solution of which is the objective function  $f(x_1, x_2, \dots, x_n)$ . The coefficients  $f_i$  ( $i = 1, 2, \dots, n$ ) are then partial derivatives of that function, its marginal increments, and we may write accordingly

$$f_i = \frac{\partial f}{\partial x_i}$$

It is known, however, that Pfaff's equation does not always have a solution in the form of a function of all the variables  $x_1, x_2, \dots, x_n$ . This depends on the rank of the matrix

$$(21) \quad \begin{pmatrix} f_1 & f_2 & \dots & f_n \\ h_{11} & h_{12} & \dots & h_{1n} \\ h_{21} & h_{22} & \dots & h_{2n} \\ \dots & \dots & \dots & \dots \\ h_{n1} & h_{n2} & \dots & h_{nn} \end{pmatrix}$$

where

$$(22) \quad h_{ij} = \frac{\partial f_i}{\partial x_j} - \frac{\partial f_j}{\partial x_i} \quad (i, j = 1, 2, \dots, n).$$

Such a solution exists when, and only when, the rank of the matrix is not higher than 2. If the matrix is of higher rank, the equation is satisfied by a set of several independent functions, each of which depends on only some of the variables  $x_1, x_2, \dots, x_n$ .<sup>14</sup> The number of these independent functions is at least as great as the rank of the matrix (21)<sup>15</sup>.

In order to verify whether or not an objective function exists, we take the marginal increments

$$\frac{\partial f}{\partial x_i} \quad (i = 1, 2, \dots, n)$$

determined by the equations (12) and write

$$(23) \quad f_i = \frac{\partial f}{\partial x_i} \quad (i = 1, 2, \dots, n)$$

and

$$(24) \quad h_{ij} = \frac{\partial^2 f}{\partial x_i \partial x_j} - \frac{\partial^2 f}{\partial x_j \partial x_i} \quad (i, j = 1, 2, \dots, n).$$

<sup>14</sup> In order to visualize this result let us take the case  $n = 3$ . If the rank of the matrix (21) does not exceed 2, the solution of Pfaff's equation is a function of three variables  $z = f(x_1, x_2, x_3)$ . Its projections onto the space  $(x_1, x_2, x_3)$  are a family of surfaces determined by the equation  $f(x_1, x_2) = \text{const}$ . If, on the other hand, the rank of the matrix (21) is 3, then the solution of Pfaff's equation is a function of two variables, whose projections, determined by the equation  $f(x_1, x_2) = \text{const}$ . (where the numbering of the variables  $x_1, x_2, x_3$ , is arbitrary), form a family of lines situated on any surface in the space  $(x_1, x_2, x_3)$ . When  $n = 4$  and the rank of the matrix (22) is greater than 2, the functions satisfying Pfaff's equation may represent, according to the rank of the matrix, lines or surfaces on 3-dimensional objects in the space  $(x_1, x_2, x_3, x_4)$ . They are then functions of two or three variables from  $x_1, x_2, x_3, x_4$ .

<sup>15</sup> Or one less if the rank of the matrix is even.

These expressions are inserted in the matrix (21) and we note the rank of the matrix. If the rank of the matrix is such that the differential equation (20) possesses no solution in the form of a function of all the variables  $x_1, x_2, \dots, x_n$ , no objective function exists. In such a case there exist only various partial functions, each of which includes only some of the variables  $x_1, x_2, \dots, x_n$ . Such functions shall be called *functions of partial effects*. These partial effects are unco-ordinated and are not subordinate to a common objective. In other words there is no integration of the means by a common end.

In such a case the symbols

$$\frac{\partial f}{\partial x_i} \quad (i = 1, 2, \dots, n)$$

represent only the marginal increments of these unco-ordinated partial effects, and not the marginal increments of a common objective to which all the means would be subordinated. The equations (12) are then not the criterion of the maximization of anything. Neither are they the criterion of the minimization of the outlay function, since the condition that the objective function has a definite constant value has no meaning because the objective function does not exist. This is what we call marginal pseudo-calculus.

Those who follow the subjectivist trend in political economy and treat marginal calculus as an instrument for "maximizing utility" make use of marginal pseudo-calculus. This will be discussed in the next chapter.

## POLITICAL ECONOMY

Political Economy (derived from the Greek, oikos—house, nomos—law), is the science of the social laws governing the production and distribution of material goods to meet human needs. Production, that is, the manufacture of material goods for the purpose of satisfying these needs and the division of these goods among members of the society, also called distribution, is defined by the general term economic activity or, in a more restricted sense, management. This is why it is often said that political economy is the science of economic activity or of management (here it is a question of economic activity carried out by human beings living within the bonds of a society). Production takes place in conditions of social co-operation between people, involving not only co-operation but also division of labour which by its very nature, is a social act. The social nature of management implies that methods of management are the product of historical development. The laws governing production and distribution are also of a historical nature. The historical scope of economic laws varies; some laws act at all (or almost all) stages of social development, others have a very narrow historical scope. But first and foremost are the laws specific to certain social and economic systems, such as feudalism, capitalism and socialism. Political economy investigates these laws, taking their historical scope into account. It tries more particularly to throw light on the functioning of the various methods of production shaped by history and on their relative social systems. For this, it uses the method applied in all empirical sciences: abstraction, based on experience, gradual concretization, bringing the results of this abstraction nearer to reality, and verification by confrontation of results with the practice of economic life. In political economy experience is historical in character; thus abstraction leads to a logical generalization of historical material in the form of economic categories and laws. This generalization reflects the dialectic character of development through internal contradictions of social processes. Political economy sets itself the task of investigating all social and economic systems and of embracing the whole economic development

of mankind within its scope. However, so far, only the analysis of capitalist methods of production has been fully developed. It is only recently that political economy has started studying the economic laws of socialist methods of production. Now, alongside with the political economy of capitalism, the political economy of socialism is emerging as a new aspect of the science of political economy.

Aristotle used the word "economy" to define the science of the laws of household management. The term "political economy" was first used at the beginning of the seventeenth century by the French author A. Montchrétien in his book *Traité de l'économie politique*, published in 1615, in which he dealt with problems of the economic activity of the state, and for this reason added the adjective "political" to the term "economy". From that time on, the term political economy was mainly used in France and England to denote the science of management not only of the state but of the whole human society. This was due to the broad interpretation of the word "political", meaning not only "state" but also "social". W. Petty, for instance, gave the title of *Political Arithmetic* to the book he wrote in 1676-7 dealing with the quantitative processes taking place in human society, including demographic processes. In view of the fact that the meaning of the term "political" was not clear, the term "social economy" began to be used at the end of the nineteenth century. Even earlier, at the end of the eighteenth century, the term "science of the national economy" began to be used (the outstanding Polish economist F. Skarbek, 1859, called his book *Ogólne zasady gospodarstwa narodowego*—General Principles of the National Economy). This term began to be widely used, particularly in Germany (*Nationaloekonomie, Volkswirtschaftslehre*). At the end of the nineteenth century, under the influence of A. Marshall, the term "economics", which had also been used previously from time to time, began to be adopted. This term is today generally accepted in the universities of the Anglo-Saxon countries, where it has almost completely ousted the traditional term of political economy. Under the influence of Anglo-Saxon science, it was also adopted in other countries, among others, in Poland during the inter-war period (A. Krzyżanowski, E. Taylor). However, this term rather narrows down the subject, as it underestimates the social nature of economic activity. For this reason, a reaction developed in the Anglo-Saxon countries and a trend appeared towards rehabilitating the term "political economy". This designation is today in general

use in Poland and the other socialist countries, and also in circles connected with progressive social movements whose main interest is precisely the social nature of economic activity.

### *The Birth and Development of Political Economy*

The birth of the science of political economy is closely connected with the foundation and development of capitalist methods of production. True, writers of ancient times did give some attention to economic problems, but they were mostly problems of household economy, in accordance with the original meaning of the term "economy". Only Xenophon dealt more extensively with the problem of the division of labour and Aristotle devoted quite a lot of attention to problems of exchange; he even introduced a special term "chrematistics" to define the science of exchange as distinguished from economy, which dealt with household economy. In the field of studies on economic problems, Aristotle did not have any successors. In any case, the works of the ancient authors on this subject had the character of ethical evaluations and not of scientific analysis. Studies of economic subjects in the Middle Ages were of the same character. The authors of the Middle Ages, whose most outstanding representative was Thomas Aquinas, dealt with economic problems from the point of view of normative moral evaluations based on theological doctrines. The economic studies of those times were a component part of moral theology. The question of the so-called just price (*iustum pretium*) and the problem of usury were given special importance in these studies. It was only the broad development of the commodity and money-currency economy and trade-capital in the Netherlands, northern France, and England, and then the beginnings of capitalist production in industry that awakened interest in research on the regularities occurring in the national economy that was then taking shape and in utilizing knowledge of these regularities in the economic policy of the state. At first, attention was paid to the financial processes connected with the development of trade, particularly foreign trade. The writers dealing with these problems were given the name of mercantilists (mercantilism). The earliest mercantilists, the so-called bullionists (bullionism), considered that the wealth of the country depended on the amount of metal ore it possessed and they



worked out ways of getting as much of this metal ore into the country as possible. The means to this end was to be foreign trade. The later mercantilists (in the strict sense of the word) paid more attention to the development of commodity production and to producing surpluses of this for foreign trade. The most outstanding of the mercantilists were: in England T. Mun, who in the years 1628–30 wrote *England's Treasure by Foreign Trade* (1664); and in France A. de Montchrétien. The first systematic analysis of the course of the process of production and distribution in society was made in the eighteenth century by French authors known as the physiocrats (physiocratism). They maintained that this process was governed by certain laws (laws of nature), hence the name physiocracy, or the rule of nature. The most outstanding of them, F. Quesney, published his *Tableau économique* in 1758. It was a schematic presentation of production as a constantly repeated process of reproduction, the distribution of products among the various classes of the society of that time being shown against this background.

It is generally thought that the real development of the economic sciences began with the so-called classical political economy, which was born and developed mainly in England alongside with the development of capitalist production. It began simultaneously in France too, and its influence subsequently extended to many other countries. The precursor of classical economics in England was W. Petty and in France P. Boisguillebert. The main subject of interest were the conditions for the development of productive forces. The first systematic presentation of classical economics was A. Smith's work *An Inquiry into the Nature and Causes of the Wealth of Nations* published in 1776 (Polish edition 1954). The source of the development of productive forces in England, particularly in the eighteenth century, was, according to A. Smith, the division of labour connected with the new capitalist organization of production (manufacture), the accumulation of capital and the investment of accumulated wealth with the aim of employing labour in production. Adam Smith also formulated the law of value, showing the dependence of the value of goods on the amount of labour used to produce them. He considered that the production and exchange of goods automatically led to equilibrium directed by an "invisible hand", as it were, (auto-regulation). In connection with this, he regarded interference in economic life on the part of the state, guilds or other economic institutions as harmful, and maintained that feudal landowners were wasting wealth

in a non-productive way. Thus, Smith's teachings were the expression of the aspirations of the industrial bourgeoisie towards unhampered initiative in economic activity.

The most mature and concise presentation of classical economics was given by D. Ricardo in his *Principles of Political Economy and Taxation* published in 1817 (Polish edition 1957). In his opinion, the subject of political economy is the study of the way the products of the community are distributed among the landowners, capitalists and workers. With this end in view, he elaborated a consistent theory of value, determined by the labour needed to manufacture a product and demonstrated how competition between capitalists leads to an exchange of goods at prices corresponding in principle to their value. He explained the land rent as the result of the difference between the amount of labour needed on soils of varying fertility and the diminishing productivity of successive contributions of labour on the same soil (differential rent). In this way, for the first time, he reconciled the theory of land rent with the theory of value. He considered that physical labour was determined by the physiological minimum necessary to maintain a manual worker and his family. If wages fell beneath that minimum figure, there was a drop in the number of working population; on the other hand, a rise in wages above the minimum was accompanied by an increase in the working population (in accordance with the theory of R. T. Malthus). An increase in the population was, according to Ricardo, to lead to a steady increase in the share of land rent in the division of the social income and to a drop in the share of profits, which in turn was to weaken the incentive to accumulate capital and develop productive forces. So Ricardo regarded the landowners as the main obstacle to economic development, which was in agreement with the views of the radical elements of the English bourgeoisie of that time, who were aiming at a reduction of land rent by efforts to lift customs duties on the import of grain. Ricardo devoted a number of his works to problems of money. He also pointed to certain contradictions between the interests of the working class and those of the capitalists, stating that technical progress could have an adverse effect on the conditions of the working class.

The contradictions of class interests appearing in the capitalist methods of production were also noted by the outstanding Swiss representative of classical economics, J. C. Sismondi (*New Principles of Political Economy*, 1815, Polish edition 1955). He also drew attention to

the contradictions between the increase in productive forces and the purchasing power of the population in conditions of capitalist distribution of the national product. The doctrine of classical economics was closely linked with the struggle of the industrial bourgeoisie in England and France against the remnants of feudal relations and the constraints imposed upon its economic activity, and its aspirations to occupy a leading place in social and political life. The bourgeoisie was interested in the scientific analysis of the functioning of the capitalist way of production and the conditions for economic development of which it was the main promoter at that time. However, the political victory of the bourgeoisie brought a change in conditions, all the more so as conclusions began to be drawn from the principles of classical economics, showing the exploitation of the working class by the capitalists and the hampering action of capitalism on social development. This was done by the so-called Ricardian socialists (the most eminent of these was T. Hodgskin, *Labour Defended Against the Claims of Capital*, 1825). As a result, the scope of interest of the bourgeoisie in economic sciences changed. It considered that capitalist production relations were established once and for all, needing no further discussion, and at most calling for justification (apologetics) against growing criticism from the working class movement then taking shape (the mass movement of the Chartists in England, the first workers' rebellion in France). The economic interests of the bourgeoisie then turned to circulation problems, such as the mechanism of market prices, circulation of money, credit, foreign trade, etc. An expression of this change in interests was the appearance of a group of economists whose theories were contemptuously defined by K. Marx as vulgar economics. They considered themselves the followers of classical economics, but in fact they narrowed down the scope of their interest to superficial market phenomena and replaced scientific analysis of production relations by apologetics.

In these conditions, a new approach was made to political economy in connection with the developing working class movement; this new approach came from Karl Marx. Marx transformed all the achievements of classical political economy (and also of the physiocrats). At the same time, he studied the criticisms of capitalist production relations contained in the works of the utopian socialists in France and England and also the literature of the Ricardian socialists. He also drew inspiration from the practical activity of the working class movement, in which he

personally took part. From Hegel's school, he gained a thorough knowledge of philosophy and the approach to human society as the product of historical development. Taking as his point of departure Hegel's view of development as a dialectical process, actuated by its internal contradictions, Marx gave dialectics a material interpretation and used it to explain the historical development of mankind. In this way he created a materialistic approach to history, which enabled him to take a new view of the achievements of classical economics and the works of socialist writers. He did this jointly with his friend F. Engels, with whom he maintained close scientific and political contacts till the end of his life, and who later did much to popularize Marx's teachings.

The first mature work resulting from Marx's economic studies was *Critique of Political Economy* (1859, Polish edition 1955). Marx gave a systematic presentation of his economic theory in *Capital*. Only the first volume of *Capital* was published in Marx's lifetime (1867), the second and third volumes were published by Engels from his unfinished manuscripts in 1885 and 1894. The fourth volume *The Theory of Surplus Value* was published for the first time (1905–10) by K. Kautsky. Marx included political economy in the general theory of social development, based on the materialistic interpretation of history. This led him to the thesis of the historically transitional character of capitalist production methods and the historical nature of economic categories and laws. The economic categories and laws discovered by classical economics are the laws of the functioning of the capitalist economy. But capitalism is subject to the development determined by the economic laws peculiar to it and has, as Marx puts it, its own "law of movement". In order to investigate this "law of movement" Marx used the economic categories and laws discovered by classical economics, at the same time, subjecting them to a more precise and thorough analysis. A more thorough analysis of the law of value enabled Marx to explain the source of income coming from the possession of capital, which neither A. Smith nor D. Ricardo had been able to do. The key to the discovery of that source was the distinction between labour and manpower and the statement of the fact that the value produced by the labour of the worker is greater than the value of products necessary for the reproduction of manpower in the conditions determined by the social and historical level of development of a society. The wages for work are determined by the value of these products, while the surplus of the value produced by the workers over

and above their wages is a surplus value appropriated by the capitalists owning the means of production. In this way, Marx discovered the basic economic reason for the antagonism between the working class and the capitalist class in the bourgeois society. At the same time he pointed to the similarity of that antagonism with the fundamental class antagonisms occurring in the feudal and slave societies in which the ruling class also appropriated the surplus product produced by the peasants or slaves.

In the bourgeois society, the surplus product assumes the form of a surplus value and is obtained by the action of the law of value. The whole of the surplus value produced by the society is divided between the different capitalists in proportion to their capital in production as a result of which there is a certain constant deviation of the price of goods from their value (cost of production). The different categories of capital participate in the division of the whole surplus value in the form of specific categories of income (profits of industrialists, trade profits, interest). Monopoly in land ownership enables the landowners to appropriate part of the surplus value for themselves in the form of the land rent. In demonstrating the mechanism of appropriation of surplus value by the capitalists, by different parts of capital and by the landowners in capitalism, Marx clarified the economic relations between the different classes and strata of the bourgeois society.

The mechanism of production and division of surplus value is the basis of the theory of the development of the capitalist method of production. The competition between the capitalists, the struggle for increased profits and the threat of ousting industrialists producing at higher cost forces the capitalists to introduce technical and organizational improvements, reducing costs of production. The introduction of such improvements calls for additional capital, and as a result the capitalists are forced to transform part of their profits into additional capital; that is accumulation. Accumulation and technical progress become a vital necessity to the capitalists. On the other hand, this leads to replacement of live labour by machines, which in capitalism leads to unemployment in the form of the so-called industrial reserve army. Accumulation of capital, combined with the ousting of the less competitive enterprises, leads to the concentration of capital into big enterprises. The next consequence is the centralization of capital in the hands of a small oligarchy of big capital. An ever-larger part of the society is turned into hired workers of big capital or made dependent on it in

some other way, and this creates conditions for the means of production to be taken over by the whole society, the majority of which is exploited by big capital. The taking over of the means of production becomes a historical necessity as a result of the growing internal contradictions involved in capitalist method of production.

Capitalism led to socialization of the process of labour, organizing it in big industrial enterprises. With private ownership of the means of production, the relations between the various enterprises (co-operation and division of labour) are, however, spontaneously regulated by the action of the law of value. This accounts for the irrational, anarchical character of the capitalist methods of production. Its development is not subject to the conscious management of the society and this leads to breakdowns and catastrophies in the shape of economic crises. This is true in particular when demand fails to keep pace with the growth of production which is a characteristic feature of the capitalist economy. Concentration and centralization of capital augment these contradictions. Finally, the development of productive forces comes into ever greater contradiction with capitalist ownership of the means of production—private-capitalist monopoly ownership of means of production. At the same time, these same economic processes lead to an ever better organization of the working class, which heads the resistance against growing exploitation and capitalist anarchy. A socialist social revolution becomes essential to ensure the society conditions for further development.

Beginning with Marx, the development of political economy went forward in two different trends associated with separate and antagonistic social spheres. Marx's economic theory and the materialist approach to history became the basis of scientific socialism, the social and political doctrine of the revolutionary working class movement. The trend in political economy which grew out of Marx's theory was called the Marxist trend, or simply Marxist political economy. On the other hand, the political economy in bourgeois milieux and milieux connected with the bourgeoisie, (for instance, at universities in capitalist countries) was already called bourgeois economy by Marx. Each of these trends reflected the interest and scope of thought of the social milieux with which it was associated.

Marxist economics became a powerful factor in awakening and shaping the consciousness of the working class; it became a scientific basis on which the organized working class movement based its strategy of

action. The main subject of its interest were the laws of development of capitalist methods of production, their internal contradictions and development prospects and criticism of the doctrines of bourgeois economics, which attempted to present capitalism as a harmonious and rational social system serving the interests of all the social classes, including the working class. There was a particular enlivenment of Marxist political economy at the turn of the present century. At that time, new problems matured and called for solution, particularly the problems of cartels and trusts, the growing intervention of the state in economic life and the reasons for the easing of crises and the rise in real wages. In view of this, a revisionist trend came into being in the working class movement, which questioned the Marxist thesis that the internal contradictions of capitalism were becoming more acute (E. Bernstein, C. Schmidt, E. David, M. Tuhan-Baranowski). Another incentive enlivening Marxist economics was the dispute between the Marxists and the nationalists in Russia as to whether capitalism could master Russia's economy and raise it from its economic and social backwardness. This directed the interest of Marxist economists to problems of capitalist reproduction and accumulation which found their foundation in theoretical schemes, contained in the second volume of *Capital*. This was directly connected with the problem of crises and the question of their lessening or increasing intensity, and also the role of the big capitalist monopolies that were becoming ever more widespread at that time. The dispute with the revisionists was also about the development tendencies of agriculture in capitalism. Extensive Marxist economic literature on this subject appeared, the authors including such names as K. Kautsky, G. Plekhanov, R. Luxemburg, V. Lenin, L. Krzywicki and others.

The final transition of capitalism to the monopolist-imperialist phase of development and the first conflict between powers due to their colonial policies brought the working class movement face to face with problems, the analysis of which could not be conducted without taking into account Marxist economic thinking. This marked a new stage in the development of that science. The first event was the publication in 1910 of R. Hilferding's book *Financial Capital* (Polish edition 1958), which contains an analysis of capitalist monopoly organizations (joint stock companies, banks, cartels and trusts) and the process of the merging of industrial capital with bank capital into a new form of capital—financial capital. Hilferding's book also contains an analysis of the influence of capitalist

monopolies on the division of social income, on the relations between social classes, on the course of crises and the economic cycle, on foreign trade and export of capital. He shows the new role of the capitalist state in the protection of the interests of big monopolies (mainly the tariffs policy) and the tendency of that state towards imperialist expansion, the new social role of nationalism and the big powers policy. On the eve of the outbreak of the First World War, in 1913, R. Luxemburg's book *Accumulation of Capital* appeared (Polish edition 1963) with its significant sub-title *An Economic Explanation of Imperialism*. R. Luxemburg saw the source of imperialism in the very process of capital accumulation and focussed interest on the importance backward countries had in the development of capitalism. She also pointed to the importance of the production of munitions as a new field of accumulation. The struggle for colonies, war and revolution are an inseparable feature of the epoch of imperialism. They accelerated the socialist social revolution. The theoretical foundations of R. Luxemburg's concepts, and particularly her interpretation of Marx's scheme of reproduction, called forth much criticism among Marxist economists (O. Bauer, N. Bukharin, H. Grossman and others).

Then, in 1916, when the imperialist war was being waged to the full, Lenin wrote *Imperialism as the Highest Stage of Capitalism* (1917, Polish edition 1949). This book was preceded by a number of theoretical articles about imperialism, written in the early years of the war. Lenin linked imperialism directly with the monopoly phase of the development of capitalism, defining imperialism as being identical to monopoly capitalism. The epoch of imperialism is marked by the domination of monopolies, oligarchy of financial capital, the great role played by export of capital, and economic division of markets between big international capitalist combinations and the territorial and political division of colonial regions and spheres of influence between the big powers. The uneven development of the various capitalist countries and groups makes this division unstable, and this leads to attempts at revision, resulting in imperialist wars. The epoch of imperialism was synonymous with the epoch of the disintegration of capitalism. The leading imperialist countries turned into rentier-parasite countries, exploiting the peoples of the backward countries. Part of the working class (the working class aristocracy) of the imperialist countries also shared in the fruits of this exploitation, which, according to Lenin, was the source of reformism and



nationalism in the working class movement of these countries. In later works, Lenin points to the further consequences of imperialism, namely, the growth of the national liberation movements among the colonial and dependent peoples. These movements became the allies of the international working class movement. Lenin's works on imperialism and the national liberation movements became the basis for the new strategy, adopted by the revolutionary working class movement, on a world-wide scale.

The development of the bourgeois economy progressed along quite different lines. In principle it was marked by a constant narrowing down of the field of interests. Two trends can be distinguished here. The subjectivist trend continued the tradition of the vulgar economists, further narrowing down its field of interests. The historical trend (the historical school in political economy) went part of the way to negating the existence of economic laws and to transforming political economy into descriptive economic history, and part of the way to an idealistic construction, attributing economic development to changes in the mental attitude of the people. The subjectivist trend was initiated in 1871 by K. Menger and W. S. Jevons. Menger was the initiator of the most consistent version of this trend, namely, the so-called Austrian school, the most outstanding representatives of which were F. Wieser and E. Böhm-Bawerk. In explaining market exchange, the representatives of this school concentrated their attention on the subjective attitude of the participants in this exchange towards the goods purchased or sold. They claimed that this attitude was determined by the marginal utility value the goods had for the individual and the measure of marginal utility was also applied to determine the consumption of goods in the process of production. According to this approach, economics became a science of the disposal of goods according to their marginal utility and the subject of its research was the attitude of man towards things; social relations between people, which were the central problem of classical and Marxist political economy were lost sight of. The same approach to the subject of economics was made in the theory of marginal productivity of the means of production. The most outstanding representative of this theory was J. B. Clark. Like the theory of marginal utility, it often served in practice to justify the capitalist division of the national income, in which the owners of various production factors allegedly received an amount equal to the contribution of the factors they owned to the value of the

social product. The problem of the historical-social character of capitalist means of production was completely overlooked. Subjective elements in the form of evaluation of goods according to their marginal utility are also found in the so-called Lausanne school, the most eminent representatives of which were L. Walras and V. Pareto, and in the so-called neo-classical school, founded by A. Marshall, which won a dominant position for itself in the Anglo-Saxon countries. Walras and Marshall investigated market processes in their entirety according to the pattern of vulgar economics. But they did try to make a deeper analysis of these processes. They sought a means to this end in the application of the theory of marginal utility to explain the demand for consumer goods. Marshall gave a subjectivist interpretation to the cost of production, being of the opinion that the "real social cost" would result in disutility in connection with the labour effort and waiting for the results of the production process. The price paid by the market for this disutility comprises the wages paid for labour and the interest on capital. On the other hand, land rent does not correspond to any social cost. It is "unmerited income". In this, Marshall regarded himself as a follower of classical economics (hence the name neo-classical), particularly of Ricardo's school. Walras, on the other hand, linked the cost of production with the outlays in means of production, determined by the given technical level of development (so-called coefficients of production). Thus, he was nearer to the classical school, which regarded the cost of production as an expression of the objective conditions determining the outlays of labour necessary to produce a given product. Both Marshall and Walras dealt with the theory of money and credit. Using graphic and mathematical aids, Marshall made a detailed analysis of the process of the shaping of market prices (elasticity of demand and supply, market equilibrium—short- and long-term), and also international exchange (terms of trade); he also investigated the influence of interest rates and of credit policy on investments and the level of prices. This type of investigation was continued by other representatives of the neo-classical school, who developed an ingenious technical and analytical apparatus to this end. This was research that suited the practical interests and needs of the bourgeoisie of that time, whose economic decisions called for accurate information on market and money-credit processes. However, the technical and analytical apparatus set up in this way can also be applied for research in other historical and social conditions.

In Germany, the historical trend came into being as criticism of classical political economy. Unlike the latter, it took a favourable view of the historical heritage and the social role of the feudal elements and the state apparatus of the Prussian monarchy, which contributed to the development of capitalism in Germany (the so-called Prussian way of the development of capitalism). But it also separated itself from the historical-materialist theory of social development that was the basis of Marxist political economy. In the first stage of its development (the so-called old historical school: W. Roscher, B. Hildebrandt, K. Knies), this trend negated the existence of economic laws and to an ever greater extent confined its work to historical monographs. This was also the point of departure of the second stage (the so-called young historical school: G. Schmoller, K. Bücher, L. Brentano). The fruits of the activity of the representatives of this trend were important achievements in the field of historical-economic knowledge; they do not, however, belong to the subject of economics proper as a theoretical science. At the end of the first decade of the twentieth century, the historical trend produced the great historical-synthetic works of W. Sombart and M. Weber dealing with the foundation and development of capitalism. Both authors drew on Marx's scientific work from whom they took the concept of the historical category of capitalism and the related problems raised by him. They tried to give a different answer to these problems than that of Marx, basing themselves on the idealistic interpretation of social systems as a result of autonomous development of mental attitudes, expressed in the so-called spirit of the epoch. The problem of the foundation and development of capitalism was thus reduced to the foundation and development of the so-called spirit of capitalism. Another work that was produced under the influence of Marx's theory was *Theory of Economic Development* (1912, Polish edition 1960) by J. Schumpeter, of the Austrian school. Schumpeter, like Marx, saw the source of the dynamics of the capitalist economy in the endeavours of enterprises to achieve technical and organizational progress, to manufacture new products and to introduce other innovations in the process of production. But unlike Marx, he attributed these endeavours to the creative mental attitude of the leading entrepreneurs who were the pioneers of technical progress. A near relation to the historical trend is institutionalism (T. Veblen, W. C. Mitchell, J. R. Commons and others), which originated at the end of the last century and developed at the beginning of the present century in the

United States. Its representatives rejected the theory of the classical school as barren theorizing and concentrated their attention on monographic description of the institutional organization of economic life. Special attention is due to Veblen's work, which contains a critical analysis of the social and economic role of big business. Veblen followed in the footsteps of the specific group of the bourgeois economists associated with bourgeois criticism of capitalism, the views of which were already to be found in the works of Sismondi, and which were next represented by P. Proudhon and J. S. Mill. In the second half of the nineteenth century, this criticism died down; it was revised at the turn of the present century as a reaction against big business monopolies which were expanding and becoming more powerful. This criticism was expressed by J. A. Hobson's book *Imperialism* (1902), which was highly valued and utilized by Lenin in his work on imperialism.

### *The Science of Political Economy Today*

The foundation of the first socialist state in the world, as a result of the victorious October Revolution, and the internal processes going on in monopoly capitalism, created new conditions for the development of political economy. Further developments of these conditions came after the Second World War, when the process of building the socialist social system spread to more countries of Europe and Asia and when the national liberation movements in the colonial and dependent countries became stronger and their peoples made efforts to overcome their backwardness as quickly as possible and to start out along the road of accelerated economic development. The rivalry between these two economic systems, socialism and capitalism, and the problem of the underdeveloped countries brought political economy face to face with entirely new problems.

The establishment and development of socialist production relations as well as the management of the socialist economy and the planning of its development gave rise to the need for a new branch of economic knowledge—a political economy of socialism. The Marxist scientific apparatus, which had been used almost exclusively for research on capitalism, now had to be adapted to the problems of the socialist economy. This was a pioneer task, all the more so because the possibility and need

for a political economy of socialism had been questioned previously. R. Hilferding was of the opinion that in socialism, political economy would be replaced by the science of "the wealth of the nations", the main subject of which would be the organization and development of productive forces. R. Luxemburg considered that the disappearance of the anarchy of capitalist production would make the separate science of political economy unnecessary, the only need being to investigate the regularities connected with the requirements of the reproduction process. Finally, N. Bukharin completely negated the possibility of such a science, saying that in conditions of socialism the science of economic laws would be replaced by a system of descriptions and norms of practical activity. The socialist economy was born and developed in the difficult conditions of countries that were either underdeveloped, from the economic point of view, or simply backward (and not in the leading industrial countries, as was envisaged by Marx and Engels), and, in addition, they were countries devastated by war. As a result, the experience and the laws of the socialist economy took shape gradually and thus their theoretical generalization by science could also only take shape gradually. Scientific analysis of the socialist economy was initiated by Lenin in numerous publications which appeared during the first years after the revolution. It was further developed in the twenties by the lively discussion carried on at that time on the industrialization of the Soviet Union and the socialist reconstruction of agriculture. Other problems raised at the time were the functioning of the socialist economy, the role of commodity and money relations and economic calculus in socialism. Two of the most outstanding economists of that period were N. Bukharin and J. Preobrazhensky. The simultaneous revolutions in Germany and Austria raised the problem of socializing means of production. In connection with this, a number of bourgeois economists (L. Mises, F. Hayek and others) put forward the thesis that rational economic calculus was impossible in a socialist economy. In the discussion on this subject, which took on a fresh lease of life in the capitalist countries during the great economic crisis, the socialist side was represented by O. Leichter, M. Dobb, O. Lange and others. It was then that the question of the role of prices and of the market in regulating the socialist economy was dealt with systematically for the first time.

In connection with the preparation of the first five-year plan for the economic development of the Soviet Union (1928-32), the basic prin-

ciples of methodology for planning the national economy were elaborated. G. Krzyżanowski, W. Bazharov, G. Feldman participated in this work and in the discussions, and so did S. Strumilin, who is still carrying on his rich scientific activity to this very day. In the thirties, the view was prevalent that commodity-money relations were a lasting feature of the socialist economy (as distinct from communism). However, the development of political economy was hampered by an atmosphere of dogmatism. The voluntarist system of economic and political management created by Stalin was not conducive to objective investigations of economic regularities. Apologetics of the current economic policy, were substituted for scientific analysis to an ever increasing degree. The apologetics attempted to present the voluntarist system of management as a result of unavoidable, objective economic laws. The most emphatic expression of this was Stalin's work: *Economic Problems of Socialism in the U.S.S.R.*, published in 1952 (Polish edition 1952). But drawing attention in that work to the objective nature of economic laws and to the appearance of contradictions between production relations and productive forces in socialism opened the way towards a scientific analysis, particularly in the people's democracies where the processes of dogmatization were not so advanced. After these obstacles had been overcome, there was a new enlivenment of activity in 1956. Several textbooks on the political economy of socialism appeared.

The subject of political economics of socialism is the investigation of specific properties and regularities of socialist methods of production. Its basic conceptions are based on the Marxist theory of social development ("the materialistic interpretation of history") and on Marxist economics inasmuch as it deals with economic laws of a scope going beyond capitalist methods of production. However, the specific economic laws of socialism are different from the specific economic laws of capitalism and in this field political economics of socialism must go beyond the theoretical works of Marx and of Marxists who followed him in later times. In particular, there is the new problem of rational management of means of production and manpower. Traditional Marxist economics did not, in principle, deal with this problem, only touching upon it marginally in its criticism of the irrationality of the capitalist economy. The results achieved by bourgeois economics, which only dealt with the problem of rational management in individual enterprises, and if it did go beyond these limits, created an apologetic myth about the rational

nature of the capitalist economic system as a whole, were not very useful either. The achievements of political economy of socialism to date consist first and foremost in the analysis of accumulation and the conditions for economic growth, the creation and distribution of the national income, the fundamental principles of the calculus of investment efficiency and the role of commodity money relations. The problem of the role of the law of value, problems of the theory of money and the principles of the price mechanism and structure in the socialist economy are still the focal points of discussion. The variety of forms of organization and management of the national economy in various socialist countries and the changes in these forms in individual countries supply rich material for comparative observations and studies furthering the development of political economy of socialism.

An essential part of the economy of socialism is the science of planning the national economy. Two distinct stages can be seen in the development of the science of planning. In the first stage, the main, almost exclusive subject of interest was the question of the internal consistency of plans, guaranteeing proportional growth of the different sectors and branches of the national economy. The instrument of internal co-ordination of the plan is the balance account, drawing up the balance of the national economy and its various parts (balances of materials, manpower, etc.). In this first stage, methods of accounting which were developed in capitalist enterprises were applied in the national economy. This general application of economic accounting was foreseen by Marx, and Lenin postulated that it be put into practice. The theoretical basis for the construction of the balances of the national economy is provided by Marx's theory of reproduction, its basic principles being applied exclusively to the capitalist economy. The beginning of the second stage in the development of the science of planning was relatively recent. The main problem here was the question of optimum plans (internal consistency of plans is the condition for its implementation), but it still does not ensure the best possible utilization of the forces and means of the national economy. The choice of the optimum plan calls for comparison of different variants of these plans, which has only now become practically possible thanks to the development of electronic computers enabling the quick and efficient solution of numerous and complicated calculations. These computers also make possible efficient social economic balance accounting. This results in the mathematical formulation of many

problems of the economy of socialism, particularly, the analysis of the process of reproduction.

As can be seen, the development of political economy of socialism to date deals above all with the material and balance aspects of the socialist economy. On the other hand, less attention has been paid to the scientific analysis of problems connected with the internal dialectics of the development of socialist production relations, the problems of the social contradictions latent in these relations and the driving force of economic development. At first, most attention was given to descriptions of the building up of new socialist production relations and its practical problems. It was only in the fifties that attention began to be turned to the question of the economic and non-economic incentives involved in the various ways of shaping socialist production relations and distribution relations (forms of payment, workers share in profits, workers self-government, co-operatives, economic ties between the peasants and the working class, role of the market, etc.).

The foundation of the socialist economy and its rapid development, particularly the foundation of a whole system of socialist states created a new situation, both for monopoly capitalism and for the development of bourgeois thought. The scope of capitalist rule was reduced by one third of the world population, and later the national liberation movements and the formation of a large number of independent states in the former colonial territories reduced the area under the domination of imperialism even more. Capitalism ceased to be the only system in the world economy and was forced to coexist with the quickly developing rival—the socialist system. This weakened the social resistance of capitalism to withstand crises and shocks and created a social need to strive for greater stability of the capitalist economy. In these conditions apologetic justifications of production methods supported by economic theories were no longer enough. Bourgeois political economy was forced to make a critical analysis of the most glaring weaknesses of the capitalist system and to seek methods of remedying the situation. A direct incentive was provided by the big economic crisis of 1929–33 and the great depression that followed it, lasting right up to the outbreak of the Second World War with a few exceptions and short intervals. This depression made all the more evident by the great industrialization of the Soviet Union in this period, did not only strengthen and spread revolutionary tensions among the working class and the so-called middle strata,



but also undermined the confidence of the bourgeoisie in its own strength. And it was in this situation that J. M. Keynes's new economic theory was born. In his book *General Theory of Employment, Interest and Money* (1936, Polish edition 1956), he stated that a mature capitalist economy in which accumulation led to a low profitability of capital due to the rentier-like tendencies of capitalists to evade investment risks, did not usually provide employment for the whole available manpower. Unemployment thus became a structural feature of capitalism. According to Keynes's theory, the way out of this situation was active intervention by the state. This intervention was to consist in encouraging private investments by lowering the rate of interest and increasing demand for consumer goods by social redistribution in favour of the strata with lower incomes, and, if necessity arose, also in direct state investments with the aim of increasing employment and enlivening economic life as a whole. This theory of Keynes, which had its precursors among the Swedish economists of K. Wicksell's school and in the theories of stimulating the business cycle, born in the time of the great depression, initiated the development of a whole trend, usually called the Keynes school. Various factions crystallized clearly within this trend. The so-called Keynes right wing, which came forward in the United States, after the Second World War, justified the state outlays on armaments by the need to provide full employment. The so-called Keynes left wing, the most eminent representative of which was J. Robinson, put forward a wide-scale programme of social reforms and state investments aimed at the state taking over important fields of economic life. Some of the representatives of this faction went as far as to make postulates of a socialist character.

In the middle of the fifties, in the period of relative stabilization of the capitalist economy, the problems dealt with by Keynes were put in the shade (particularly in the United States and the G.F.R.) by views regarding this stability as a lasting achievement of contemporary capitalism, which did not call for any particular intervention on the part of the state, as was thought by Keynes and his followers. On the other hand, there are some who raise the social and psychological problem of the absorption of the "abundance of goods" by the contemporary industrial society. This is the main trend of contemporary capitalist apologetics, although some of its representatives (for instance, J. K. Galbraith: *The Affluent Society*, 1958) criticize capitalism for its inability to satisfy the

collective needs of the society (culture and science, health protection, conservation of natural resources, etc.) and suggest the intervention of the state with the aim of directing part of the national income to the satisfaction of these needs.

The development of political economy of socialism, particularly the science of planning the national economy, and the practical achievements of the socialist economy have had an influence on economic thought and practice of capitalist countries. This has aroused interest in the problems of economic planning, which was also stimulated by the programme postulates of the working class movement in those countries. The method of social economic balance accounting (so-called social accounting), the need for which was also shown by Keynes's policy for the stabilization of the national economy, has been widely applied. The national liberation movements and the endeavours of the economically underdeveloped countries to free themselves from their economic backwardness have aroused interest in the problems of the development of the national economy. This meant going beyond the bounds of bourgeois economics to-date, which mainly investigated the market processes and presented economics (often for the purpose of defending it) as an automatic mechanism for maintaining equilibrium. It did not interest itself in the problem of economic development (particularly the dependence of this development on the system of production relations), which is a basic problem of Marxist economics, nor did it deal with problems of the conditions and possibilities for accumulation, which was the subject of so many discussions in Marxist literature. The topical question of the underdeveloped countries forced it to take an interest in these problems. And this brought about the economics of growth, which has now become one of the main subjects of interest of bourgeois economics. The very nature of the subject called for investigation of problems which so far had been almost the exclusive domain of Marxist economics. This led to the rediscovery of theoretical categories and approaches that have been known for a long time in Marxist literature and partially also to conscious borrowings from Marxist scientific works. The economics of growth has become the subject of special interest in underdeveloped countries, which are seeking knowledge in it about accelerating economic development. In the highly developed capitalist countries, the interest in it stems from the understanding of the importance of the problem of the underdeveloped countries for world economy and politics, and

particularly for the rivalry between capitalism and socialism. But in some circles in imperialist countries theories of growth are being proclaimed which seek to justify the lack of an active policy for accelerating the progress of underdeveloped countries. This is connected with the problem of planning the economic development of these countries. The experience of the socialist states, the majority of which began as underdeveloped countries, has aroused lively interest in problems of planning in all the underdeveloped countries. Many of these countries have now already their own plans for economic development in which the decisive role is played by state investments. The previously mentioned apologetics negate the need for directive planning and postulate that the development of the underdeveloped countries should be based on private capital, particularly capital imported from imperialist countries.

With regard to the economics of growth and also the problems of planning economic development and national economic balances, many economists nurturing traditional bourgeois economic theory, particularly the neo-classical school, started criticizing the usefulness of these theories in gaining an understanding of the basic economic processes. Then came a drive towards going beyond the bounds of market phenomena and towards investigating the process of reproduction and accumulation and of linking the process with the distribution of the national income. As a result, tendencies developed towards a return to the basic conceptions of classical political economy and to those of Marx. This tendency is evidenced by J. Robinson's book *Accumulation of Capital* (1958). P. Sraffa made the boldest move in this direction (*Production of Commodities by Means of Commodities*, 1960). He had already criticized the basic principles of the neo-classical theory earlier. In this situation, wide interest began to be shown in Marx and Marxist economic theory.

After the First World War there was also another wave of criticism of capitalist monopolies, which came from economists with the petty bourgeois and also the middle bourgeois approach. This tendency was strengthened by the growing role of the university intellectuals in making economic studies and publishing their results. It led to a far-reaching professionalization of the science of political economy, making the study of economics into a profession. To some extent, this made economic research independent of the direct interests of the bourgeoisie. A large percentage of the professional economists were members of the so-called

new middle class, whose inclinations were linked with the attitudes of the petty bourgeois and middle bourgeois milieu. In these conditions, the criticism of capitalist monopolies' activity took two forms. One was the theory of imperfect competition (E. Chamberlain and J. Robinson). The second was welfare economics (welfare), the chief representative of which is A. C. Pigou (*The Economics of Welfare*, 1920). The point of departure in the criticism of monopolies by the theoreticians of welfare economics is the ideal model of the functioning of free competition, any departure from which is regarded as waste of the economic resources of the society. The petty bourgeois and middle bourgeois social scope of this approach is very evident. These theoreticians recommended the intervention of the state (sometimes very far-reaching intervention) with the aim of removing or neutralizing the harmful activity of monopolies.

In the same period, socialist criticism of the capitalist system also increased, mostly based on Marxist economics. The Russian revolution, the construction of socialism in the Soviet Union, the serious crisis and the long depression of the capitalist economy in the thirties were a new incentive for the criticism. Numerous Marxist economists engaged in it, both in the Soviet Union (e.g. J. Varga) and in capitalist countries (O. Bauer, P. Sweezy, M. Dobb). Special mention is due to the works of M. Kalecki, *Studies in the Theory of Business Cycles 1933-1939* and others, who taking the Marxist theory of reproduction as a point of departure formulated the theory of the business cycle in an original way and explained the source of the instability of the capitalist system. His explanation is somewhat similar to R. Luxemburg's theory of accumulation. Critical Marxist analysis of monopoly capitalism was continued after the Second World War. On the one hand, it showed the inability of capitalism to industrialize underdeveloped countries (P. Baran), and, on the other hand, it was investigating the new changes in the economic and social structure of the advanced capitalist countries (relation of class forces, international division of labour, neo-colonialism and others). The last mentioned line of research is still in the initial stage. And so far we are still waiting for a systematic theory explaining the basic economic laws of monopoly capitalism, the specific forms that the functioning of the law of value assumes in monopoly capitalism, the process of expanded reproduction and its cyclical character, the distribution of the national income among the various classes and strata, international division of labour and many other problems.

The fact that the socialist system and the capitalist system coexist in the world economy also raises new problems for political economy. So far, this fact has only been taken into account in the political economy of socialism, in the form of emphasizing the significance of the hostile attitude of capitalist circles towards the economy of the first socialist countries and the possibility of learning methods of management from the highly developed capitalist countries (particularly V. Lenin). On the other hand, very little has been done so far in the field of investigating the influence of the existence of the socialist system on the course and functioning of the capitalist economy. It is a question of such problems as the influence of the world socialist market on the course of the business cycle in capitalist countries, the reduced social resistance of capitalism to shocks and crises, and learning methods of planning the national economy from the socialist countries. The existence of the socialist system has an influence on the regularities of the functioning and development of the capitalist economy, which can no longer be investigated separately from the dialectics of the mutual connections and rivalry between socialism and capitalism on a world scale. This dialectics is specifically reflected in the problems of the underdeveloped countries, in the clash of capitalist and socialist influences, which, depending on the internal relation of class forces in these countries and the relation of forces in world politics and economy, determine the direction of the development of these countries. Here political economy has some new fields of action.

### *The Auxiliary Sciences of Political Economy*

Political Economy is a theoretical science; it derives knowledge of concrete economic phenomena from descriptive economics, which embraces also economic history, economic geography and economic statistics. Various fields of applied economics are linked with political economy (economics of industry, of agriculture and of trade, the economics of finance and accounting, and others). They apply the results achieved by theoretical economics and descriptive economics in detailed investigations of certain fields or aspects of economic life. The practical application of the results achieved by economics is called economic policy. It embraces various sectors of industry, agriculture,

finance, and others. Descriptive economics and applied economics are economic sciences together with political economy. They are auxiliary sciences of political economy. In addition, political economy avails itself of the aid of mathematics, particularly mathematical statistics and of philosophy and sociology. The connection of political economy with philosophy is seen above all, in methodology; political economy is particularly closely associated with sociology, which investigates all problems of social links and helps in understanding the links between economic processes and social life as a whole.

Several new auxiliary sciences of political economy have come into being of late. This was the result of the new needs in management of the economy, both in capitalism and in the socialist economy. Econometrics applies mathematical methods (particularly mathematical statistics) for exact and concrete determination of the interrelation of economic phenomena (elasticity of demand, technical coefficients of production, efficiency of investment, etc.). The first stimulus for the development of econometrics was the demand of the monopolies and the capitalist states for more accurate analysis of market processes. This was because the monopolies were able to set prices at a level guaranteeing maximum profit, which could not be done by enterprises in conditions of free competition, for they had to accept the price level set by the spontaneous market mechanism. Interventionist activity by the state also called for a knowledge of the concrete results of such activity, defined quantitatively. Hence, the first econometric works concerned problems of the statistical determination of the elasticity of demand and supply. Further demands for econometric research resulted from such problems as analysis of the factors entering into production costs, forecasts of future demands for various goods, and other problems. In recent years, econometrics has also been applied in socialist countries. The planned character of the socialist economy creates a special demand for a mathematical-quantitative analysis of economic interrelations. Apart from the traditional field of analysis of demand, knowledge of the technical coefficients of production and investments (so-called technical and investment norms) is a matter of primary importance in the planned economy. Knowledge of these coefficients is necessary in drawing up national balances and different parts of these balances. Here, the balance accounting method, known as input-output analysis, is applied. This method, invented by V. Leontief, was inspired by balance accounting introduced in the

Soviet Union, and is much more widely applied in practice in the socialist economy than in the capitalist countries, where it was originally elaborated. The application of econometrics in planning the national economy is sometimes called planometrics (V. Nemchinov). It is worth mentioning that long before econometrics came into being, in the seventeenth and eighteenth centuries, and particularly in the nineteenth century, mathematics, particularly mathematical statistics, was applied in life insurance and other fields of insurance (insurance mathematics, also called actuarial data). But it was only in econometrics that mathematics was applied to a wide range of economic problems.

The science of programming, which is becoming an important branch of contemporary mathematics, is linked with econometrics. It deals with methods of determining optimum programmes for systems embracing a large number of interdependent human activities. In the economic field, its scope of interest is drawing up plans for the work of enterprises and national economic plans (for instance, optimum distribution of investments). The first to develop and apply the science of programming was L. Kantorovich (*Mathematical Methods of Organization and Production*, 1939, Polish edition 1960). Immediately after the Second World War, the science of programming and the so-called operations research, associated with it, were developed in the United States and Great Britain, largely in connection with military problems. Of late, it is being increasingly applied in the Soviet Union and other socialist countries. The widespread practical application of econometrics and the science of programming, and also operations research calls for the use of electronic computers. Only with electronic computers can such a large number of calculations be carried out (e.g. the solution of hundreds of simultaneous equations in a short enough space of time to guarantee that the results will be of current use in the management of the economy). The science of programming and operations research can be regarded as part of praxiology, the general science of rational activity, the actual founder of which was T. Kotarbiński. Praxiology is also of great importance for the methodology of political economy (problems of the so-called principle of good management, or the principle of rational management). But its application is not possible without clear formulation of the tasks and criteria of economic calculus, which econometrics and programming are to serve. This often calls for the extension of the economic theory itself. Thus, econometrics and programming set new problems to be

solved by political economy and require a more precise definition of old problems, in this way contributing to its development.

Lastly, possibilities are opening up for the application of the science of cybernetics in the economic sciences. Cybernetics was founded in 1948 and is the science of controlling and regulating systems composed of elements mutually interacted upon each other and linked by a complicated network of chains of causes and effects. Such problems arise in automatic industrial installations, computers, biological organisms, and also in social systems where a great number of human actions are interlaced with each other. The theoretical apparatus of cybernetics throws new light on problems of the spontaneity of social processes, the possibilities and ways of controlling social processes, the role of information in shaping social processes and others. The planned character of the socialist economy makes cybernetics particularly useful in looking for ways of ensuring efficient management of the national economy and its proper functioning.

The above-mentioned new auxiliary sciences enrich the arsenal of political economy, particularly the political economy of socialism, with precision research tools of high cognitive efficiency. This enhances the role of political economy as an instrument for directing the economic development of the society. Socialism has set us the historic task of overcoming the spontaneity that has characterized social and economic processes in the history of man so far. It has set us the task of creating conditions in which social development will be shaped by man consciously and purposefully according to rational principles based on scientific knowledge. Political economy has a fundamental part to play in this task, as a source of knowledge with which the society can consciously mould its historic destinies. In this way, political economy and the auxiliary sciences that serve it are becoming a factor in the process of mastering the blind play of spontaneous forces by the human mind, conscious of its aims.



## PART II

# REFINING KEYNES'S GENERAL THEORY



THE RATE OF INTEREST AND THE OPTIMUM  
PROPENSITY TO CONSUME\*

BY OSCAR LANGE||

1. By introducing liquidity preference into the theory of interest Mr. Keynes has provided us with an analytical apparatus of great power to attack problems which hitherto have successfully resisted the intrusion of the economic theorist. In this paper I propose first to elucidate the way in which liquidity preference co-operates with the marginal efficiency of investment and with the propensity to consume in determining the rate of interest and to point out how both the traditional and Mr. Keynes's theory are but special cases of a more general theory. Further I propose to show how the analytical apparatus created by Mr. Keynes can be used to handle the problem which bothered the under-consumption theorists since the time of Malthus and Sismondi.

2. The economic relations by which the rate of interest is determined can be represented by a system of four equations.<sup>1</sup>

---

\* *Economica*, Volume V (New Series), Number 17, February 1938, pages 12-32. Reprinted by the courtesy of The London School of Economics and Political Science and the author.

|| University of Chicago.

<sup>1</sup> A similar system of equations has been given for the first time by Reddaway, "The General Theory of Employment, Interest and Money," *The Economic Record*, June, 1936, p. 35. While writing this there has come to my notice a forthcoming paper of Dr. Hicks on "Mr. Keynes and the Classics," in the meanwhile published in *Econometrica*, April, 1937, which treats the subject in a similar and very elegant way. The form chosen in my paper seems, however, more adapted for the study of the problems it is concerned with. Cf. also Harrod, "Mr. Keynes and Traditional Theory," *Econometrica*, January, 1937.

The first of these equations is the function relating the amount of money held in cash balances to the rate of interest and to income. This is the liquidity preference function. If  $M$  is the amount of money held by the individuals,  $Y$  their total income and  $i$  the rate of interest we have<sup>1</sup>:

$$M = L(i, Y) \quad (1)$$

It is convenient to take  $M$  and  $Y$  as *measured in terms of wage-units*, or of any other *numéraire*. Thus  $Y$  is the real income while  $M$  is the real value of the cash balances, both in terms of the *numéraire* chosen. This presupposes, of course, that the ratio of the price of each commodity or service to the price of the commodity or service which is chosen as the *numéraire* is given. These ratios may be thought of as determined by the Walrasian or Paretian system of equations of general economic equilibrium. Thus index numbers are *not* involved in this procedure. We assume that the real value, as defined, of cash balances decreases (or, in the limiting case, remains constant) in response to an increase of the rate of interest and that it increases (or, in the limiting case, remains constant) in response to an increase of real income, i.e.,  $L_i \leq 0$  and  $L_Y \geq 0$ .

The second equation expresses the propensity to consume. The total expenditure on consumption depends on the total income and, possibly, on the rate of interest. Denoting by  $C$  the total expenditure on consumption during a unit of time, we have the function:<sup>2</sup>

$$C = \phi(Y, i) \quad (2)$$

where  $C$  and  $Y$  are measured in wage-units (or in some other *numéraire* chosen). The expenditure on consumption increases

<sup>1</sup> This function is obtained by summation of the liquidity preference functions of the individuals in the same way as a market demand function is obtained from the demand functions of the individuals. It holds only for a given distribution of incomes.

<sup>2</sup> This function is the sum of the functions expressing the propensity to consume for each individual. It holds only for a given distribution of incomes.

in response to an increase of income, though less than the income, i.e.,  $0 < \phi_r < 1$ , while no general rule can be stated as to the reaction of this expenditure to a change in the rate of interest, so that  $\phi_i \cong 0$ .

The investment function which relates the amount invested per unit of time to the rate of interest and to the expenditure on consumption provides us with a third equation. If  $I$  is the investment per unit of time the function is:

$$I = F(i, C) \quad (3)$$

Both  $I$  and  $C$  are measured in wage-units. The investment function is based on the theorem that the amount of investment per unit of time is such as to equalise the rate of net return on that investment (the marginal efficiency in Mr. Keynes' terminology) to the rate of interest. This rate of net return is derived from the rate of net return (marginal efficiency) on capital but it is not identical with it.<sup>1</sup> The lower the rate of interest the larger the investment per unit of time, i.e.,  $F_i < 0$ . Investment per unit of time depends, however, not only on the rate of interest but also on the expenditure on consumption. For the demand for investment goods is *derived* from the demand for consumers' goods. The smaller the expenditure on consumption the smaller is the demand for consumers' goods and, consequently, the lower is the rate of net return on investment. Thus, the rate of interest being constant, investment per unit of time is the larger the larger the total expenditure on consumption, i.e.,  $F_c > 0$ .

---

<sup>1</sup> They are frequently confused. However, the marginal efficiency of capital relates the rate of net return to a *stock* of capital while the marginal efficiency of investment relates it to a *stream* of investment per unit of time. As to how the marginal efficiency of investment is related to the marginal efficiency of capital cf. a forthcoming paper by Mr. Lerner. It also ought to be observed that the investment function holds only for a given capital equipment and for a given distribution of the expenditure for consumption between the different industries.

Finally we have the identity:

$$Y \equiv C + I \quad (4)$$

which provides us with the fourth equation.<sup>1</sup>

If the amount of money  $M$  (in wage-units) is given these four equations determine the four unknowns,  $i$ ,  $C$ ,  $I$  and  $Y$ . Alternatively,  $i$  may be regarded as given (for instance, fixed by the banking system) and  $M$  as determined by our system of equations. These equations determine also the income-velocity of circulation of money which is  $\frac{Y}{M}$ .<sup>2</sup> It must, however, be remembered that  $C$ ,  $I$  and  $Y$  are measured in terms of a *numéraire* (wage-units). If we want them to be expressed in money we need an additional equation which expresses the money price of the commodity or service chosen as *numéraire* (a unit of labour in our case). If  $w$  is this money price and  $Q$  the quantity of money we have:

$$Q = wM \quad (5)$$

which is equivalent to the traditional equation of the quantity theory of money.

3. The process of determination of the rate of interest according to the four equations above is illustrated by the three following diagrams.

<sup>1</sup> This identity is the sum of the budget equations of the individuals. It can also be written in the form  $Y - C \equiv I$  which expresses the equality of investment and the excess of income over expenditure on consumption, i.e., saving. The identical equality of investment and saving holds for investment and saving actually performed. Investment or saving *decisions* can be different. The identity above states, however, that, whatever the decisions, income is bound to change so as to make equal saving and investment actually realised.

<sup>2</sup> It is interesting to notice that the income-velocity resulting from these equations is the "hybrid" corresponding to the definition of Professor Pigou (cf. *Industrial Fluctuations*, 1927, p. 152) and of Mr. Robertson (*Money*, new edition, 1932, p. 38) and not the ratio of income to income deposits only which Mr. Keynes calls income-velocity (cf. *A Treatise on Money*, Vol. II, pp. 24-25).

Fig. 1 represents the relation between the demand for cash balances and the rate of interest. The quantity of money (in wage-units) being measured along the axis  $OM$  and the rate of interest along the axis  $Oi$ , we have a family of liquidity preference curves: one for each level of total income (measured in wage-units).

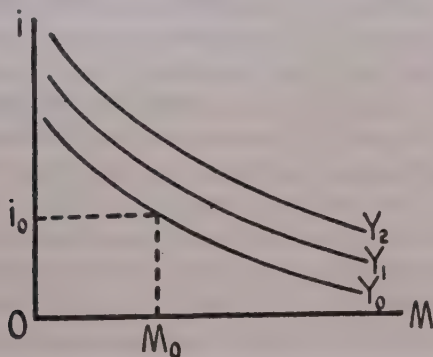


FIG. 1.

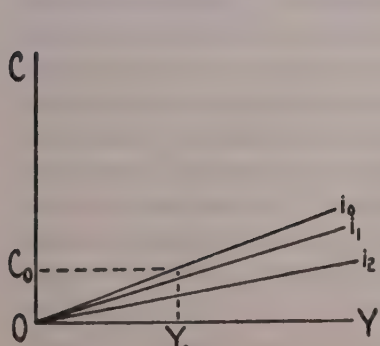


FIG. 2.

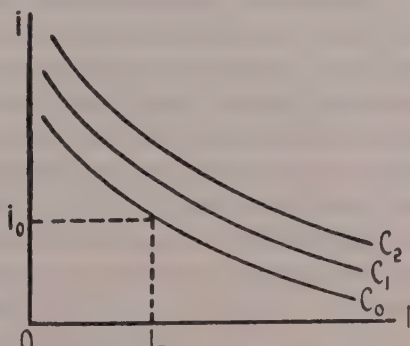


FIG. 3.

The greater the total income the higher up is the position of the corresponding curve.

Further we have a family of curves (one for each rate of interest) representing the relation between income and expenditure on consumption (Fig. 2). Income is measured along  $OY$  and expenditure on consumption along  $OC$ .

The relation between investment and the rate of interest is represented by Fig. 3. Measuring investment per unit of time along the axis  $OI$  and the rate of interest along  $Oi$  we have a family of curves indicating the investment corresponding to each value of the rate of interest.

These curves represent the marginal net return (marginal efficiency) of each amount of investment per unit of time. It is important to notice that there is a separate curve for each level of expenditure on consumption. The greater the expenditure on consumption the higher up is the position of the corresponding curve.

To study the process of determination of the rate of interest let us start with a given amount of money ( $OM_0$  in Fig. 1) which is kept constant throughout the process and with a given initial income  $\gamma_0$ . The position of the liquidity preference curve being determined by the level of income (in Fig. 1 the curve corresponding to the income  $\gamma_0$ ), the amount of money determines the rate of interest, say  $i_0$ . This rate of interest determines the position of the curve in Fig. 2 representing the propensity to consume. This position being determined, we get the expenditure on consumption  $C_0$  corresponding to the initial income  $\gamma_0$ . The expenditure on consumption being given, the position of the marginal efficiency curve in Fig. 3 is determined (i.e., the curve corresponding to  $C_0$ ). When this position is determined the rate of interest  $i_0$  determines the amount  $I_0$  of investment per unit of time. We have thus the expenditure on consumption and the amount of investment. But the sum of these two is equal to the total income (*vide* equation 4). If it happens so that  $C_0 + I_0$  is equal to the initial income  $\gamma_0$  the system is in equilibrium. Otherwise the liquidity preference curve in Fig. 1 changes its position so as to correspond to the new level of income  $C_0 + I_0$ . This gives us a new rate of interest. As a result of this and of the changed income we get a new level of expenditure on consumption. This in turn changes the position of the marginal efficiency curve in Fig. 3 and the new rate of interest determines another amount of investment which, together with the expenditure on consumption, determines a third level of total income. As a result the liquidity preference curve shifts again, etc. This process



of *mutual adjustment* goes on until the curves in our three diagrams have reached a position compatible with each other and with the quantity of money given, i.e., until equilibrium is attained.<sup>1</sup>

4. Let us now consider how changes in the curves of the marginal efficiency of investment and in the curves representing the propensity to consume affect the rate of interest.

If the marginal efficiency curves are all shifted upwards (which, ultimately, must be due to an increase of the marginal net productivity of capital), then a larger amount of investment corresponds to any given rate of interest and expenditure on consumption. Therefore total income increases and the curve of liquidity preference in Fig. 1 shifts upwards. This causes a rise of the rate of interest. Thus, just as in the traditional theory, an increase in the marginal productivity of capital is accompanied by a rise of the rate of interest. The reverse happens when the marginal productivity of capital declines.

On the other hand, a decrease in the propensity to consume (or, in other words, an increase in the propensity to save) is accompanied by a fall of the rate of interest. For with a given initial income and a given rate of interest the expenditure on consumption is now lower. This causes the marginal efficiency curve in Fig. 3 to shift downward and a lower quantity of investment corresponds to any given rate of interest. Total income decreases both as a direct result of the decreased expenditure on consumption and because of the diminished quantity of investment. Thus a downward shift of the liquidity preference curve in Fig. 1 takes place. The consequence is a fall of the rate of interest. In a similar way an increase in the propensity to consume raises the rate of interest.

Thus the two traditional statements that the rate of interest rises together with the marginal net productivity of capital, and vice versa, and that it moves in the opposite direction to the propensity to save, hold fully in our generalised theory. Two limiting cases, however, deserve special attention.

<sup>1</sup> If this process of adjustment involves a time lag of a certain kind a cyclical fluctuation, instead of equilibrium, is the result. Cf. Kalecki, "A Theory of the Business Cycle," *Review of Economic Studies*, February, 1937.

The theory put forward is quite general and formal. The actual reactions, however, depend on the concrete shape of the functions (1), (2) and (3). We are concerned at present with the consequences of different shapes of the liquidity preference function. For the general case it has been assumed that the demand for liquidity is a decreasing function of the rate of interest and an increasing function of total income. The demand for liquidity (i.e., for cash balances) has thus two elasticities: an interest-elasticity which is negative and an income-elasticity which is positive. These two elasticities determine the reaction of the rate of interest to changes in the marginal efficiency of investment (which is correlated to the marginal net productivity of capital) and in the propensity to consume; for the reaction of the rate of interest to these is due to the influence which the change of income caused by them exerts upon liquidity preference. The greater the income-elasticity of the demand for liquidity the more the curve of liquidity preference is shifted when income changes and, consequently, the greater is the reaction of the rate of interest. The shift of the liquidity preference curve changes the demand for liquidity corresponding to any given rate of interest. If, however, the amount of money (in wage-units) is fixed, the rate of interest must change so as to equalise the demand for liquidity to the quantity of money available. The change of the rate of interest which thus follows is the greater the smaller the interest-elasticity of the demand for liquidity. Therefore, the reaction of the rate of interest is the greater the smaller the interest-elasticity of the demand for liquidity.

In the special case in which the income-elasticity of the demand for liquidity is zero the rate of interest does not react at all to changes other than in the quantity of money (measured in wage-units). The demand for liquidity is in this case a function of the rate of interest alone:

$$M = L(r) \qquad (1a)$$

There is but one curve of liquidity preference and the amount of money determines the rate of interest independently of the level of total income. Changes in the marginal efficiency of investment and

in the propensity to consume do not affect the rate of interest at all. The whole brunt of such changes has to be borne by the other variables of the system (i.e., expenditure on consumption, investment and income). The same result is also reached when the interest-elasticity of the demand for liquidity is infinite. In this case, too, the rate of interest does not react to changes in the marginal efficiency of investment or in the propensity to consume. For the change of the rate of interest which is necessary to balance a given change in the demand for liquidity caused by a change of total income is nil in this case. This is Mr. Keynes' theory. Since Mr. Keynes recognises *expressis verbis* the dependence of the demand for liquidity on total income<sup>1</sup> it is obviously the last case he must have in mind.

The other special case is when the interest-elasticity of the demand for liquidity is zero. The demand for cash balances is in this case a function of income alone:

$$M = L(Y) \quad (1b)$$

Both  $Y$  and  $M$  being measured in wage-units (or in any other *numéraire*, for instance, wheat<sup>2</sup>) this equation states simply the proportion of their real income people hold in cash (in real balances). If this proportion is regarded as constant our function becomes:

$$M = kY$$

(where  $k$  is a constant) which is the well known Cambridge equation of the quantity theory of money. Taking into account equation (5) this can be written  $Q = kYw$ , or  $Q = wL(Y)$  in the more general case, where  $Q$  is the quantity of money and  $w$  is the money price of the commodity or service which has been chosen as *numéraire*. The latter being given, the total income is determined by the quantity of money. Total income being given, the rate of interest is determined exclusively by the equations (2), (3) and (4),

<sup>1</sup> Cf. *The General Theory of Employment, etc.*, pp. 171-172 and pp. 199 *et seq.*

<sup>2</sup> The reader will be reminded that Marshall and Professor Pigou have used wheat as a *numéraire* in this connection. Vide Marshall, *Money Credit and Commerce*, p. 44, and Pigou, *Essays in Applied Economics*, p. 177.

i.e., by the propensity to consume, by the marginal efficiency of investment (which in turn depends on the marginal net productivity of capital), and by the condition that investment is equal to the excess of income over expenditure on consumption (i.e., saving). This is the traditional theory of interest.

Thus both the Keynesian and the traditional theory of interest are but two limiting cases of what may be regarded to be the general theory of interest.

5. It is a feature of great historical interest that the essentials of this general theory are contained already in the work of Walras.

Indeed, the demand for liquidity appears in Walras as the *encaisse désirée*. Walras is quite explicit about the fact that the demand for liquidity is a function of the rate of interest. This dependence is expressed as early as in the second edition of his *Éléments d'économie politique pure* which was published in 1889. "In a society—he writes—where money is kept in cash from the moment when it is received until the day when it is given into payment or loaned out, money renders few services and those who keep it, producers or consumers, lose needlessly the interest on the capital which it represents." ("Dans une société où on garde la monnaie en caisse depuis le moment où on la reçoit jusqu'au jour où on la donne en paiement ou jusqu'au jour où on la prête, la monnaie rend peu de services, et ceux qui la détiennent, producteurs ou consommateurs, perdent inutilement l'intérêt du capital qu'elle représente.")<sup>1</sup> This is emphasised even more in his *Théorie de la Monnaie* where we read about the service yielded by a given *encaisse monétaire*: "its satisfaction is obtained at the price of interest and this is why the effective demand for money is a decreasing function of the rate of interest" ("sa satisfaction se paie au prix d'un intérêt et c'est pourquoi la demande effective de monnaie est une fonction décroissante du taux d'intérêt").<sup>2</sup> He goes on, to quote again from the second edition of the *Éléments*, saying: "Suppose that on a cer-

<sup>1</sup> P. 382.

<sup>2</sup> P. 95 of the reprint in *Études d'économie politique appliquée* (published in Lausanne in 1898). This passage does not occur in the original edition in form of a separate book which was published in 1886 (Lausanne).

tain day the existing quantity of money  $Q_u$  has diminished or that the demand for cash  $H$  which represents the utility of money has increased. . . . Equilibrium will be re-established on the next day on the market at a new and higher rate of interest at which the demand for cash will be reduced." ("Supposons qu'un jour la quantité existante de monnaie  $Q_u$  ait diminué ou que l'encaisse désirée  $H$  représentant l'utilité de la monnaie ait augmenté . . . L'équilibre ne s'établirait, le lendemain, sur le marché, qu'à un nouveau taux d'intérêt plus élevé auquel l'encaisse désirée se réduirait.")<sup>1</sup>. Walras also uses the device of expressing the demand for cash balances in real terms. It is a certain real purchasing power over which the individual wants to have command and he expresses it in terms of a *numéraire*.<sup>2</sup> If  $H$  is the demand for liquidity in terms of the *numéraire* chosen and  $Q_u$  is the amount of money in existence, then the price  $p_u$  of money in terms of the *numéraire* is determined by the equation  $Q_u p_u = H$ , which is analogous to the equation (5) above.<sup>3</sup> Walras fails, however, to indicate whether the *encaisse désirée* depends also on the level of real income. But whatever the shortcomings of his presentation, the liquidity preference function has been indicated clearly by Walras.

Our remaining three equations are also contained in the system of Walras. There is, first of all, the propensity to save (instead of our propensity to consume). Saving is defined, as by Mr. Keynes, as the excess of income over consumption (l'excédent du revenu sur la consommation).<sup>4</sup> Now this excess of income over consumption is

<sup>1</sup> P. 383. In the last editions of the *Eléments* the exposition, though put into mathematics, is somewhat obscure. Walras introduces also the question of liquidity (i.e., of stocks) in other commodities. Of each commodity a stock is kept which renders a "*service d'approvisionnement*" (service of storage). The rate of interest is the cost of this service. Cf. *Eléments*, 4th ed., 1900, pp. 179, 298, 303.

<sup>2</sup> Pp. 377-78 of 2nd ed. and *Théorie de la Monnaie* (as reprinted in *Etudes d'économie politique appliquée*), p. 95.

<sup>3</sup> P. 378 and p. 383 of 2nd ed.

<sup>4</sup> P. 281 of first edition published in 1874 (p. 269 of second ed. and p. 249 of final ed.). Walras uses throughout the term *excédent* and the word *épargne* is reserved to denote net saving. Cf. p. 282 of first ed. (p. 270 of 2nd ed. and p. 250 of final ed.).

conceived by Walras to be a function of both the rate of interest and income. He expresses the propensity to save by an equation and states explicitly that this equation "gives the excess of income over consumption as a function of the prices of the productive services and of consumers' goods and of the rate of interest" ("donnant l'*excédent* du revenu sur la consommation en fonction des *prix* des services et des produits consommables et du *taux* du revenu net").<sup>1</sup> By introducing the prices of all commodities he brings income indirectly into the equation expressing the propensity to save. His equation thus corresponds to our equation (2). As a counterpart to our investment function Walras has an equation which determines the total value of "*capitaux neufs*" produced. This value is determined by the condition that the selling price of the *capitaux neufs* (which is equal to the capitalised value of their net returns) is equal to their cost of production.<sup>2</sup> This equation determines the total volume of investment corresponding to any given rate of interest. Unfortunately, Walras fails to indicate on what the net return of the *capitaux neufs* depends. He takes it just for granted and as a consequence there is no relation between their net return and the expenditure on consumption.

Finally Walras expresses in a separate equation the equality of the value of the *capitaux neufs* and the excess of income over consumption.<sup>3</sup> This, however, is *not* equivalent to our equation (4) which states the equality of investment and the excess of income over consumption. For there is an important difference. In our system, as in the theory of Mr. Keynes, equation (4) is an identity. Whatever the investment and saving *decisions* are, the volume of total income always adjusts itself so as to equalise saving and investment *actually performed*.<sup>4</sup> This is a simple budget relationship, for the

<sup>1</sup> P. 271 of 2nd ed. "Taux du revenu net" must be translated by "rate of interest" in this connotation.

<sup>2</sup> Cf. 284 of first ed. (pp. 246-7 and p. 253 of final ed.).

<sup>3</sup> P. 284 of first ed. (p. 252 of final ed.).

<sup>4</sup> It ought to be mentioned here that this has been recognised by many economists before Mr. Keynes. If investment decisions exceed saving decisions "forced saving" takes place according to a widely accepted doctrine. And Mr. Robertson has pointed out (cf. *Money*, London, 1928, pp. 93-97) that if saving

individuals' incomes are equal to the sum of expenditure on consumption and investment. Walras, however, treats the equality of investment and saving not as an identity but as a genuine equation which holds true only in a position of equilibrium. Hence his investment (value of the *capitaux neufs*) and saving (excess of income over consumption) are to be interpreted as *decisions* which finally are brought into equilibrium by a change in the rate of interest and in total income.<sup>1</sup> But this equation does not show how total income changes so as to bring saving actually performed always into equality with investment.

This is done by our identity (4) which corresponds to the sum of the budget equations in the Walrasian system and shows how expenditure on consumption and investment *determine* the total income. When this budget relationship is taken account of, there is no need any more for a separate equation indicating the equilibrium of saving and investment decisions based on some *given* income, however defined. All the relevant relations are expressed by our equations (2), (3) and (4). Thus Mr. Keynes' apparatus involves a considerable simplification of the theory.

6. Having investigated the consequences which the introduction of liquidity preference has for the formulation of the theory of interest, let us see how the general theory outlined above can be applied to solve the problem which is the concern of all theories of underconsumption. Mr. Keynes has scarcely done justice to what is the core of the argument of those theories. "Practically—he writes—I only differ from these schools of thought in thinking that they may lay a little too much emphasis on increased consumption at a time when there is still much social advantage to be obtained from increased investment. Theoretically, however, they are open to the criticism of neglecting the fact that there are *two* ways to expand output."<sup>2</sup> Mr. Keynes treats investment and expenditure

---

decisions exceed investment decisions the excess cannot be saved. It becomes "abortive."

<sup>1</sup> P. 286-7 of 2nd ed. (pp. 266-67 of final ed.). In the process of *tâtonnements* described by Walras all the prices change and thus total income changes, too.

<sup>2</sup> *The General Theory of Employment, etc.*, p. 325.

on consumption as two *independent* quantities and thinks that total income can be increased indiscriminately by expanding *either* of them. But it is a commonplace which can be read in any textbook of economics that the demand for investment goods is *derived* from the demand for consumption goods. The real argument of the underconsumption theories is that investment *depends* on the expenditure on consumption and, therefore, cannot be increased without an adequate increase of the latter, at least in a capitalist economy where investment is done for profit.

Few underconsumption theorists ever maintain that *any* saving discourages investment.<sup>1</sup> Generally they maintain that up to a certain point saving encourages investment while it discourages it if this point is exceeded.<sup>2</sup> This is the theory of oversaving. If people would spend their whole income on consumption, investment would obviously be zero, while the demand for investment would be zero too, if they consumed nothing. Thus mere common sense suggests that there must be somewhere in between an *optimum* propensity to save which maximises investment. But no underconsumption theorist ever has shown what this optimum is and how it is determined. The problem, however, was put forward with unsurpassed clarity already by Malthus: "No considerable and continued increase in wealth could possibly take place without that degree of frugality which occasions, annually, the conversion of some revenue into capital, and creates a balance of produce over consumption; but it is quite obvious . . . that the principle of saving, pushed to excess, would destroy the motive to production . . . If consumption exceeds production, the capital of the country must be diminished, and its wealth must be gradually destroyed from its want of power to produce; if production be in great excess above consumption, the motive to accumulate and consume must cease from the want of will to consume. The two extremes are obvious; and it follows that there must be some intermediate point, though the resources of political economy may not be able to

<sup>1</sup> The most prominent among those who did so was Rosa Luxemburg in her famous book *Die Akkumulation des Kapitals* (Berlin, 1912).

<sup>2</sup> *Vide*, for instance, Hobson, *The Industrial System*, London, 1910, pp. 53-54.



ascertain it, where taking into consideration both the power to produce and the will to consume, the encouragement to the increase of wealth is greatest."<sup>1</sup>

The general theory of interest outlined in this paper enables us to solve this problem and to determine the optimum propensity to save which maximises investment. Since investment per unit of time is a function of both the rate of interest and expenditure on consumption a decrease of the propensity to consume (increase in the propensity to save) has a twofold effect. On the one hand the decrease of expenditure on consumption discourages investment, but the decrease in the propensity to consume also causes, as we have seen, a fall of the rate of interest which encourages investment on the other hand. The optimum propensity to consume is that at which the encouraging and the discouraging effect of a change are in balance.

The condition of such a balance is easily found. A change of the propensity to consume is mathematically a change of the *form* of the function (2) in our equations. We want to discover the conditions this function has to satisfy in order to maximise investment. Let  $\delta C$  be the variation of expenditure on consumption and  $\delta i$  the variation of the rate of interest which are caused by the change of the propensity to consume. Recalling the investment function (3), which is  $I = F(i, C)$ , the condition that investment be a maximum is then:

$$\delta I = F_i \delta i + F_c \delta C = 0 \quad (6)$$

where  $\delta I$  is the corresponding variation of investment.

From equation (4) we derive the variation of total income caused by the change of the propensity to consume:

$$\delta Y = \delta C + \delta I$$

and since  $\delta I = 0$  when investment is a maximum we have in the maximum position:

$$\delta Y = \delta C \quad (7)$$

<sup>1</sup> *Principles of Political Economy*, London, 1820, pp. 8-9 (Introduction). Cf. also pp. 369-70.

Now the change of the rate of interest due to the change of the propensity to consume can be obtained from equation (1), i.e., from the liquidity preference function. We have:<sup>1</sup>

$$\delta M = L_i \delta i + L_Y \delta Y \quad (8)$$

If the sum of real balances available, i.e., the quantity of money measured in wage-units or in any other *numéraire*, is assumed to be constant<sup>2</sup> this reduces to:

$$L_i \delta i + L_Y \delta Y = 0 \quad (8a)$$

whence:

$$\delta i = - \frac{L_Y}{L_i} \delta Y \quad (9)$$

By substitution of (9) and (7) in (6) we arrive at the equation:

$$-F_i \frac{L_Y}{L_i} \delta C + F_c \delta C = 0$$

<sup>1</sup> The liquidity preference function holds only for a given distribution of incomes (cf. footnote 1 on p. 170 above). Similarly the investment function holds only for a given distribution of the expenditure for consumption between the different industries, for even if the total expenditure on consumption remains unchanged a shift of expenditure from goods requiring less to goods requiring more capital to produce, or vice versa, necessarily affects investment. Equations (6) and (8) in the text presuppose, therefore, that changes in the distribution of incomes and in the direction of consumers' expenditure to different industries are either absent, or that their effect on total investment and on the total demand for liquidity is of second order magnitude and can thus be neglected. Since a change of the propensity to consume certainly produces changes in the distribution of incomes and of consumers' expenditure the second assumption is the only realistic one. A more precise theory would have to take into account the effect of these changes, too.

<sup>2</sup> If the money wage (or, more generally, the money price of the *numéraire* chosen) is constant, this means that the nominal quantity of money is constant, too. If not, the nominal quantity of money has to change proportionally to the money price of the *numéraire*. If, however, labour is not regarded as a homogeneous factor the use of labour-units as *numéraire* involves really the use of a particular index number, i.e., the labour standard, and our assumption amounts to assuming that the purchasing power of money in terms of the labour standard is constant.

which can be transformed into:

$$-\frac{L_Y}{L_i} = -\frac{F_c}{F_i} \quad (10)$$

This equation, together with the equations (1), (3) and (4) of our system, determines the optimum propensity to consume under the assumption that the amount of money (measured in wage-units) is constant.<sup>1</sup>

Only such forms of the function representing the propensity to consume which satisfy this equation provide a maximum investment. A very simple economic interpretation can be given to the equation obtained. The right hand side of the equation is the marginal rate of substitution between a change of the rate of interest

<sup>1</sup> If the amount of money (as defined in the text) is allowed to change a more general condition is obtained. For this purpose we must add to our system of equations a supply function of money. Let this function be:

$$M = \psi(i, Y)$$

where  $M$  and  $Y$  are measured in terms of wage-units. We have then:

$$\delta M = \psi_i \delta i + \psi_Y \delta Y$$

and taking into account equation (8) in the text we obtain:

$$\psi_i \delta i + \psi_Y \delta Y = L_i \delta i + L_Y \delta Y$$

which can be written in the more convenient form:

$$(\psi_Y - L_Y) \delta Y = (L_i - \psi_i) \delta i$$

whence we get:

$$\delta_i = \frac{\psi_Y - L_Y}{L_i - \psi_i} \delta Y$$

Substituting this and (7) in (6) we arrive at:

$$F_i \frac{\psi_Y - L_Y}{L_i - \psi_i} \delta C + F_c \delta C = 0$$

which is, finally, transformed into:

$$\frac{\psi_Y - L_Y}{L_i - \psi_i} = -\frac{F_c}{F_i} \quad (10a)$$

This is the most general form of the equation which determines the optimum propensity to consume. Equation (10) obtained in the text is a special case of it when  $\psi_Y = 0$  and  $\psi_i = 0$ .

and a change of the expenditure on consumption as inducements to invest. The left hand side is the marginal rate of substitution between a change of the rate of interest and a change of real income as determining the demand for liquidity. The optimum propensity

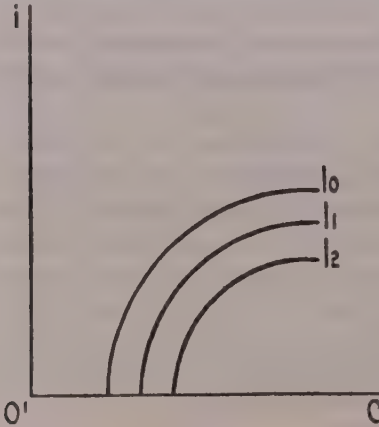


FIG. 4.

to consume is thus determined by the condition that the marginal rate of substitution between the rate of interest and total income as affecting the demand for liquidity is equal to the marginal rate of substitution between the rate of interest and expenditure on consumption as inducements to invest.<sup>1</sup>

It is convenient to have a graphic illustration of this condition. On Fig. 4 we draw a family of indifference curves indicating the possible variations of the rate of interest and of the expenditure

on consumption which do not change the level of investment per unit of time. We may call them *isoinvestment curves*. The expenditure on consumption being measured along the axis *O'C* and the rate of interest along *O'i* these curves slope upward<sup>2</sup> and the greater the

<sup>1</sup> The economic interpretation of equation (10a) is similar to that of equation (10), only the left hand side is here the marginal rate of substitution not along a curve of equal liquidity (isoliquidity curve; *vide* below) but along the curve corresponding to the equation:

$$\psi(i, Y) = L(i, Y)$$

Thus the left hand side of (10a) is the marginal rate of substitution between the changes of the rate of interest and of total income which are compatible with the maintenance of the equality of the supply of and the demand for money. The supply function of money depends on the behaviour of the monetary system.

<sup>2</sup> The slope of these curves is  $-\frac{F_c}{F_i}$ . Since  $F_c > 0$  and  $F_i < 0$  the slope is positive.

level of investment. the more to the right is the position of the corresponding isoinvestment curve.<sup>1</sup> The curves can be expected to be concave downwards, for the stimulus to invest exercised by each successive increment of expenditure on consumption is weaker. This is explained by the increasing prices of the factors of production which diminish the net return derived by entrepreneurs from successive increments of expenditure on consumption (the curves of marginal efficiency of investment in Fig. 3 are shifted upwards less and less). Thus the greater the expenditure on consumption the greater is the increment of it which is necessary to compensate a given rise of the rate of interest. Finally, we reach a point where a further increase of the expenditure on consumption fails entirely

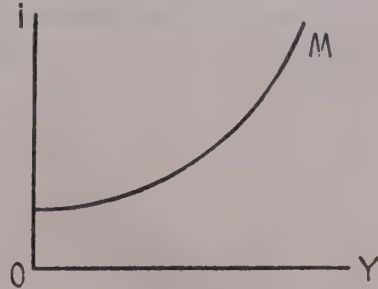


FIG. 5.

to stimulate investment. This happens when the elasticity of supply of the factors of production has become zero, so that an increase of the expenditure on consumption only raises their prices. Thus the isoinvestment curves become horizontal to the right of a certain critical value of the abscissa.<sup>2</sup>

On Fig. 5 we draw an indifference curve which represents all the variations of the rate of interest and of total income which do not affect the demand for liquidity (total income and the demand for liquidity being expressed in wage-units). We may call it the *isoliquidity curve*. Since the amount of money is assumed to be given we have only one such curve (the curve *M* in Fig. 5). It

<sup>1</sup> There are certain combinations of the expenditure on consumption and of the rate of interest at which the existing capital is just maintained by replacement. They determine the curve corresponding to zero investment (i.e., the curve *I*<sub>0</sub> in Fig. 4). All curves to the right of it correspond to positive and all to the left correspond to negative investment.

<sup>2</sup>  $-\frac{F_c}{F_i} = 0$  when  $F_c = 0$ .

slopes upward<sup>1</sup> and is straight, convex or concave downward, according as the demand for liquidity increases with an increase of real income at a constant, an increasing or a decreasing rate, respectively.<sup>2</sup> Downward convexity, however, seems to be the case which is practically most likely to occur.<sup>3</sup>

The optimum propensity to consume can now be determined in a simple way by combining the diagrams of Fig. 4 and Fig. 5.

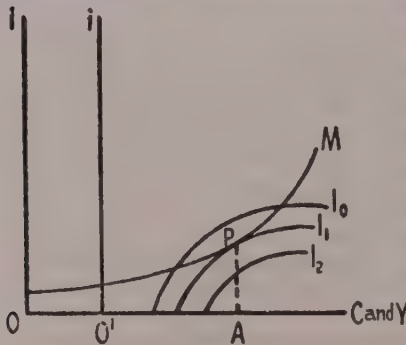


FIG. 6.

Equation (10) states that the slope of the isoliquidity curve has to be equal to the slope of the isoinvestment curve (*vide* the point *P* in Fig. 6). But the position of the origins *O* and *O'* in the combined diagram is not arbitrary. For *OO'* is the difference between total income and expenditure on consumption, i.e., represents the level of investment. Thus to each

level of investment there belongs a special length of *OO'*. The optimum propensity to consume is, therefore, obtained by superimposing Fig. 5 upon Fig. 4 (as in Fig. 6) and moving it horizontally until the isoliquidity curve becomes tangent to the isoinvestment curve whose index (i.e., level of investment) is equal to the length of *OO'*. *OO'* is then the maximum investment, *O'A* and *OA* are the expenditure on consumption and the total income which correspond

<sup>1</sup> The slope of the curve is  $-\frac{L_Y}{L_i}$ . It is positive because  $L_Y > 0$  and  $L_i < 0$ . In the limiting cases, however, where either  $L_Y = 0$  or  $L_i = 0$  we have either  $-\frac{L_Y}{L_i} = 0$  or  $-\frac{L_Y}{L_i} = \infty$  and the isoliquidity curve degenerates into a horizontal or vertical straight line.

<sup>2</sup> We have  $\frac{d^2i}{dY^2} = -\frac{L_{YY}L_i - L_{iY}L_Y}{L_i^2}$ . Taking  $L_{iY} = 0$  approximately and remembering that  $L_i < 0$ , we find that  $\frac{d^2i}{dY^2}$  is of the same sign as  $L_{YY}$ . (Footnote added, 1943.)

<sup>3</sup> The last two sentences were revised by the author, 1943.

to it. The isoinvestment curves<sup>1</sup> being concave downward, an optimum propensity to consume exists and is unique if the isoliquidity curve is convex downward or is a straight line, or even if it is concave downward, provided its concavity is less than that of the isoinvestment curves and its curvature does not change sign.<sup>2</sup>

From Fig. 6 we obtain the expenditure on consumption  $O'A$  and the total income  $OA$  which correspond to maximum investment and which are, as we have seen, uniquely determined. Plotting them on a diagram (*vide* Fig. 7) we obtain a point  $R$  through which the curve representing the propensity to consume has to pass.

Thus the function expressing the optimum propensity to consume is determined only by one point through which it has to pass. Any function which passes through the point  $R$  maximises investment. Any function, however, which does not pass through  $R$  makes total investment smaller.

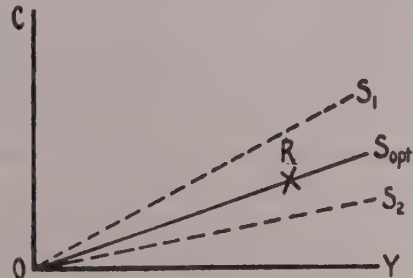


FIG. 7.

Generally we may expect that a decrease of the propensity to consume (i.e., an increase of the propensity to save) leads us from curves which pass above  $R$  to curves which pass below  $R$  (e.g., the curves  $S_1$  and  $S_2$  in Fig. 7). As long as they pass above  $R$  the propensity to consume is above optimum, when they

<sup>1</sup> Balance of this sentence was revised by the author, 1943.

<sup>2</sup> The graphic solution indicated in Fig. 6 is also applicable to the general case where the quantity of money (in terms of wage-units) is not constant. As shown in the footnotes 1 on pp. 185 and 186 the equation (10a) is substituted in this case for the equation (10). Instead of the isoliquidity curve we get a curve corresponding to the equation  $\psi(i, Y) = L(i, Y)$ . It is a projection on the  $Yi$  plane of the curve resulting from the intersection of the two surfaces representing the supply and the demand for money respectively (the isoliquidity curves are a special case of it obtained when the supply surface of money is a plane parallel to the  $Yi$  plane). The shape of the curve depends now also on the form of the supply function of money. The graphic solution is obtained as in the text by moving the diagram of this curve horizontally until the curve becomes tangent to the isoinvestment curve corresponding to the level of investment equal to  $OO'$ .

pass below  $R$  it is below optimum. Maximum investment is attained when we hit upon a curve which passes through  $R$  (e.g., the curve  $S_{opt}$  in Fig. 7). This is a curve of optimum propensity to consume. Any change of the shape of the curve which does not affect its passing through  $R$  is irrelevant.

7. Let us now apply the result obtained to two special cases.

When either the income-elasticity of the demand for liquidity is zero or the interest-elasticity of the demand for liquidity is infinite, which is the case corresponding to Mr. Keynes' theory, we have either  $L_r = 0$  (and  $L_i \neq 0$ ) or  $L_i = \infty$  (and  $L_r \neq 0$ ). It follows immediately from equation (10) that  $F_e = 0$  in either case.<sup>1</sup> The economic interpretation is simple. As we have seen, in this case a change in the propensity to consume does not affect the rate of interest at all. The rate of interest remaining constant, the optimum propensity to consume is *when the expenditure on consumption is such that a further increase does not any more increase the marginal efficiency of investment*. It has been mentioned already that this happens when the elasticity of supply of factors of production becomes zero, so that an increase of the expenditure on consumption only raises their prices but cannot increase investment. This implies the absence of even voluntary unemployment of factors of production. If involuntary unemployment of a factor is defined by its supply being infinitely elastic, it is absent whenever the elasticity of supply is finite. A zero elasticity of supply, however, means that there are no more factors which would offer their services if the remuneration were greater, i.e., are voluntarily unemployed. Until this stage is reached any increase in the propensity to consume stimulates investment.<sup>2</sup> This fits well into the scheme of Mr. Keynes' theory.

<sup>1</sup> It seems, however, highly doubtful that  $L_i = \infty$  over the whole range of the liquidity preference function.

<sup>2</sup> In the general case where the quantity of money is allowed to vary the same result is reached when  $\psi_r = L_r$  (*vide* equation (10a)). In this case the income elasticity of supply of money is equal to the income-elasticity of the demand for liquidity; each change of total income is balanced by exactly such a change of the supply of money that the rate of interest remains constant.



The other special case is when the interest-elasticity of the demand for liquidity is zero which is, as we have seen, the case of the traditional theory. Then  $L_i = 0$  (and  $L_r \neq 0$ ) and by rewriting equation (10) in the form:

$$-\frac{L_i}{L_r} = -\frac{F_i}{F_c}$$

we obtain  $F_i = 0$  for this case. *Any decrease in the propensity to consume stimulates investment* by causing an appropriate fall of the rate of interest. The propensity to save can never be excessive, for the rate of interest falls always sufficiently to make room for additional investment. The only limit is when a further decrease of the rate of interest stops increasing investment ( $F_i = 0$ ), i.e., when the net return on investment becomes zero and the rate of interest is zero, too.

In the general case the optimum propensity to save is somewhere between these two limits and *it is the greater the greater the income-elasticity and the smaller the interest-elasticity of the demand for liquidity*. For the fall of the rate of interest due to an increase in the propensity to save is the greater the greater is the first and the smaller is the second of these two elasticities. The optimum propensity to save is also the greater the greater the elasticity of investment with respect to the rate of interest and the smaller the elasticity of investment with respect to expenditure on consumption.

Thus we arrive at the result that, with the exception of the special case covered by the traditional theory of interest, there exists an optimum propensity to save<sup>1</sup> which depends on the shape of the liquidity preference and of the investment functions. This imposes a maximum limit on investment per unit of time and any attempt to exceed it by raising the propensity to save above its optimum frustrates itself by leading to a diminution of investment.

---

<sup>1</sup> "Optimum" means here merely "maximising investment." This need not be the most desirable propensity to save from the point of view of social policy. From the latter point of view a propensity to save which maximises real income may be more desirable. My "optimum" propensity to save, however, maximises the speed of growth of wealth. (Footnote added in 1943.)

In a society where the propensity to save is determined by the individuals there are no forces at work which keep it automatically at its optimum and it is well possible, as the underconsumption theorists maintain, that there is a tendency to exceed it. Whether this is actually the case is a matter for empirical investigation and cannot be answered by the economic theorist.

The optimum propensity to save is, however, defined only with regard to a given quantity (or more generally: to a given supply function) of money. Therefore, if the propensity to save does exceed its optimum it need not be curbed to avoid its evil consequences. It can be made to benefit economic progress by an appropriate monetary policy which increases the quantity of money sufficiently to reduce the rate of interest so as to compensate the discouraging effect a high propensity to save has on investment.<sup>1</sup> How far such a policy is possible depends on the structure of the monetary and of the whole economic system.

---

<sup>1</sup> The requirement of an increase of the quantity of money to counteract an excessive propensity to save is *not* in contradiction with the teaching of Professor Davidson, Professor Hayek and Mr. Robertson that technical progress does not require an increase of the quantity of money to avoid deflation. If the increase in the propensity to save is accompanied by technical progress which increases the marginal efficiency of investment, investment is not discouraged and no increase of the quantity of money is necessary.

## SAY'S LAW: A RESTATEMENT AND CRITICISM

OSCAR LANGE

University of Chicago and the Cowles Commission

SAY'S law is the proposition that there can be no excess of total supply of commodities (general oversupply) because the total supply of all commodities is *identically* equal to the total demand for all commodities. Under certain assumptions as to the nature of the demand for money this proposition appears as a simple corollary of the general theory of prices. Associated with it is the proposition that there cannot be such a shortage of total entrepreneurial receipts relative to total entrepreneurial cost as to cause losses throughout the whole economy (general overproduction). The present paper intends to investigate the relation of these propositions to each other and to study the implications of Say's law with regard to the problem of underemployment, to the general theory of prices, and to the theory of money.

2. Let us consider a closed system in which  $n$  commodities are exchanged, one of them—say, the  $n$ th commodity—functioning as medium of exchange as well as *numéraire*, i.e., as money. Denote by  $p_i$  the price of the  $i$ th commodity. We have  $p_n \equiv 1$ . Let  $D_i = D_i(p_1, p_2, \dots, p_{n-1})$  and  $S_i = S_i(p_1, p_2, \dots, p_{n-1})$  be the demand function and the supply function, respectively, of the  $i$ th commodity. The equilibrium prices are determined by the  $n - 1$  equations

$$D_i(p_1, p_2, \dots, p_{n-1}) = S_i(p_1, p_2, \dots, p_{n-1}).$$

$$(i = 1, 2, \dots, n - 1) \quad (2.1)$$

The condition of stability of the equilibrium of the price system is expressed by the  $(n - 1)^2$  inequalities and equations<sup>1</sup>

$$\frac{dD_j}{dp_i} < \frac{dS_j}{dp_i} \quad \text{when } j = i.$$

$$(i \text{ and } j = 1, 2, \dots, n - 1) \quad (2.2)$$

$$\frac{dD_j}{dp_i} = \frac{dS_j}{dp_i} \quad \text{when } j \neq i.$$

<sup>1</sup> Cf. J. R. Hicks, *Value and Capital* (London: Oxford University Press, 1939), pp. 66-67. This condition is sufficient. Hicks gives additional conditions for what he calls "perfect stability." The concept of perfect stability, however, refers to the *way* in which the stability of the system is maintained and need not occupy us here.

## 50 MATHEMATICAL ECONOMICS AND ECONOMETRICS

There are only  $n - 1$  independent demand functions and  $n - 1$  independent supply functions, the demand and the supply function for the commodity which functions as money being deducible from the other ones. We have

$$\sum_{i=1}^{n-1} p_i D_i \equiv S_n \quad (2.3)$$

and

$$\sum_{i=1}^{n-1} p_i S_i \equiv D_n. \quad (2.4)$$

Taking account of the last two relationships, we obtain the total demand (measured in money value) for all  $n$  commodities

$$\sum_{i=1}^n p_i D_i \equiv \sum_{i=1}^{n-1} p_i D_i + D_n \equiv S_n + D_n. \quad (2.5)$$

Similarly the total supply (measured in money value) of all  $n$  commodities is

$$\sum_{i=1}^n p_i S_i \equiv \sum_{i=1}^{n-1} p_i S_i + S_n \equiv D_n + S_n. \quad (2.6)$$

Therefore

$$\sum_{i=1}^n p_i D_i \equiv \sum_{i=1}^n p_i S_i, \quad (2.7)$$

i.e., total demand and total supply are identically equal.

I propose to call this identity *Walras' law* because Walras was the first to recognize its fundamental importance in the formulation of the mathematical theory of prices. It should be noted that Walras' law does not require that the demand and supply of each commodity, or of any of them, be in equilibrium. The identity of (2.7) holds independently of whether the equations (2.1) are satisfied or not.<sup>2</sup>

<sup>2</sup> Walras' law holds also in absence of a uniform medium of exchange, i.e., in a moneyless system. Let  $D_{ij}$  and  $S_{ij}$  be that part of the demand or supply, respectively, of the  $i$ th commodity for which the  $j$ th commodity is offered or demanded in exchange. Let, further,  $p_{ij}$  be the price of the  $i$ th commodity in terms of the  $j$ th. We have then

$$S_{ji} \equiv D_{ij} p_{ij} \quad (i \text{ and } j = 1, 2, \dots, n) \quad (1)$$

and

$$D_{ji} \equiv S_{ij} p_{ij} \quad (2)$$

Taking (arbitrarily) one of the commodities as *numéraire* and expressing all prices in terms of it, we have

$$p_{ij} = \frac{p_i}{p_j},$$

SAY'S LAW: A RESTATEMENT AND CRITICISM 51

3. Now let us consider all commodities *exclusive* of money. To simplify the exposition, the term "commodity" will be henceforward understood to exclude money. Thus we shall oppose "commodities" to "money."

The total demand for commodities (exclusive of money) is  $\sum_{i=1}^{n-1} p_i D_i$  and the total supply of commodities (exclusive of money) is  $\sum_{i=1}^{n-1} p_i S_i$ . From (2.3) and (2.4) it follows directly that

$$\sum_{i=1}^{n-1} p_i D_i = \sum_{i=1}^{n-1} p_i S_i \tag{3.1}$$

when and only when

$$D_n = S_n, \tag{3.2}$$

i.e., when the demand for money is equal to the supply of money.

But  $D_n$  and  $S_n$  are the demand for and the supply of money in a

where  $p_i$  and  $p_j$  are the price of the  $i$ th and of the  $j$ th commodity in terms of *numéraire*. Thus

$$p_j S_{ji} \equiv p_i D_{ij} \tag{3}$$

and

$$p_j D_{ji} \equiv p_i S_{ij}. \tag{4}$$

Total demand, expressed in *numéraire* units, for all  $n$  commodities is  $\sum_{i=1}^n \sum_{j=1}^n p_i D_{ij}$

and total supply, similarly expressed, of all  $n$  commodities is  $\sum_{i=1}^n \sum_{j=1}^n p_i S_{ij}$ . On account of (4) we have

$$\sum_{i=1}^n \sum_{j=1}^n p_i S_{ij} \equiv \sum_{i=1}^n \sum_{j=1}^n p_j D_{ji}. \tag{5}$$

Because of symmetry of subscripts ( $i = 1, 2, \dots, n; j = 1, 2, \dots, n$ ) we have also

$$\sum_{i=1}^n \sum_{j=1}^n p_j D_{ji} \equiv \sum_{i=1}^n \sum_{j=1}^n p_i D_{ij},$$

and substituting this in (5) we obtain

$$\sum_{i=1}^n \sum_{j=1}^n p_i D_{ij} \equiv \sum_{i=1}^n \sum_{j=1}^n p_i S_{ij}, \tag{6}$$

i.e., Walras' law. Walras' proof is somewhat different. He has proved the theorem that if demand equals supply for  $n-1$  commodities it does so also for the  $n$ th commodity (cf. *Elements d'économie politique pure* ["édition définitive"; Paris and Lausanne, 1926], pp. 120-21). This implies that total demand equals identically total supply of all  $n$  commodities and is, therefore, equivalent to (6).

## 52 MATHEMATICAL ECONOMICS AND ECONOMETRICS

particular sense, namely, the money demanded in exchange for the commodities offered and the money offered in exchange for the commodities demanded. It is more convenient to express (3.2) in relation to the existing stock of money and to the demand for cash balances. A difference between the money demanded in exchange for commodities and the money offered in exchange for commodities implies a desire to change cash balances relative to the amount of money available. The desired change is equal to that difference. Let us denote by  $\Delta M$  the total increase of cash balances (in excess of a possible increase of the quantity of money) desired by all individuals. We have then:<sup>3</sup>

$$D_n - S_n \equiv \Delta M. \quad (3.3)$$

Condition (3.2) may now be written in the form:

$$\Delta M = 0, \quad (3.4)$$

i.e., there is no desire to change the total sum of cash balances relative to the quantity of money. This means that the total demand for cash balances is equal to the existing stock of money. Thus the necessary and sufficient condition that the total demand for commodities be equal to the total supply of commodities is that the total demand for cash balances be equal to the amount of money in existence. We may call the fulfilment of this condition *monetary equilibrium*.

The total demand for commodities is equal to total supply of commodities only in a state of monetary equilibrium.

4. Say's law makes a much stronger claim than either Walras' law or the equality of total demand for commodities and total supply of commodities under conditions of monetary equilibrium. It states that the total demand for commodities (exclusive of money) is *identically* equal to their total supply:

$$\sum_{i=1}^{n-1} p_i D_i \equiv \sum_{i=1}^{n-1} p_i S_i. \quad (4.1)$$

From (2.3) and (2.4) we see immediately that, in order that Say's law shall hold, it is necessary and sufficient that

$$D_n \equiv S_n, \quad (4.2)$$

which because of (3.3) can also be written

$$\Delta M \equiv 0, \quad (4.3)$$

<sup>3</sup>  $D_n$  and  $S_n$  are, like all quantities demanded or supplied, measured as per unit or period of time. Consequently,  $\Delta M$  is measured in the same way.

## SAY'S LAW: A RESTATEMENT AND CRITICISM 53

i.e., the total demand for cash balances must be *identically* equal to the amount of money in existence.

Thus Say's law implies a peculiar nature of the demand for money, namely, that the individuals in our system, taken together, are *always* satisfied with the existing amount of money and never wish to hold either more or less. There is never a desire to change the total cash balances otherwise than to adapt them to changes in the amount of money available. Under these circumstances purchases of commodities are never financed from cash balances nor do sales of commodities serve to increase cash balances.

This peculiar nature of the demand for money implied in Say's law was clearly understood by its original proponents. They assumed it explicitly by stating that money is only a medium of exchange and abstracting from its function as "store of value." In the *Traité d'économie politique*<sup>4</sup> Say states explicitly that, when there is an oversupply of certain commodities, the difficulty in selling them is only seemingly the lack of money to buy them. The lack of money, says Say, is but an expression of the lack of other commodities because the money to be offered for the purchase of the commodities of which there is an oversupply can be acquired only through the sale of other commodities. This view excludes the use of cash balances for financing purchases of commodities. The same view is also expressed by Ricardo: "Productions are always bought by productions, or by services; money is only the medium by which the exchange is effected."<sup>5</sup>

5. From its very first enunciation Say's law has been associated with the proposition that there can be no "universal glut" or "general overproduction" in the sense of all entrepreneurs suffering losses. As Ricardo puts it, in a sequel to the passage just quoted: "Too much of a particular commodity may be produced, of which there may be such a glut in the market as not to repay the capital expended on it; but this cannot be the case with respect to all commodities."<sup>6</sup> Total entrepreneurial receipts are thought of as being identically equal to total cost plus some measure of profit (to be discussed later), and a deficiency of receipts with respect to one commodity must, therefore, be accompanied by a surplus of receipts with respect to some other commodity (or commodities). "Overproduction" can be only "partial," each partial overproduction being accompanied by a partial underproduction somewhere else in the economic system. We shall investi-

<sup>4</sup> See pp. 347-48 of the *Traité* (Paris, 1861).

<sup>5</sup> *Principles of Political Economy and Taxation*, chap. xxi.

<sup>6</sup> *Ibid.*

## 54 MATHEMATICAL ECONOMICS AND ECONOMETRICS

gate the relation of this proposition to Say's law, with special regard to the nature of the "measure of profit" involved.

Let us distinguish between commodities bought by entrepreneurs and commodities sold by entrepreneurs. We shall call the first "factors" and the other "products." A commodity may be both a factor and a product, or it may be neither. Thus we get the following four classes of commodities: commodities which are only factors, commodities which are both factors and products, commodities which are only products, and, finally, commodities which are neither factors nor products. We shall call these four classes "primary factors," "intermediate products," "final products," and "direct services," respectively. To simplify the notation, let us denote the total demand for and the total supply (both measured in money value) of a class of commodities by  $D$  and  $S$  with a subscript indicating the class. Use the subscripts  $F$ ,  $I$ ,  $P$ , and  $C$  to denote primary factors, intermediate products, final products, and direct services, respectively. Let us further split up the demand for intermediate products into the demand for replacement of the intermediate products used up during the period in question (i.e., the period in terms of which the demand is measured) and the demand for *net* increase of the stock of intermediate products (new investment),<sup>7</sup> using the subscripts  $IR$  and  $IN$  to indicate the two types of demand for intermediate products. Finally, let us denote, as before, by  $D_n$  and  $S_n$  the demand and supply of money in exchange for commodities.

Since our classification is exhaustive, we have

$$\sum_{i=1}^n p_i D_i \equiv D_F + D_{IR} + D_{IN} + D_P + D_C + D_n$$

and

$$\sum_{i=1}^n p_i S_i \equiv S_F + S_I + S_P + S_C + S_n.$$

By Walras' law we have

$$\begin{aligned} (D_F + D_{IR}) + D_{IN} + D_P + D_C + \Delta M \\ \equiv S_F + (S_I + S_P) + S_C, \end{aligned} \quad (5.1)$$

where  $\Delta M \equiv D_n - S_n$ , as before. The part in parentheses on the left-

<sup>7</sup> Thus, if less than the amount of intermediate products used up during the period is replaced, the demand for *net* increase of stock (new investment) is negative. The demand for replacement represents what Keynes calls "user cost" and "supplementary cost" (see J. M. Keynes, *The General Theory of Employment* [New York: Harcourt Brace & Co., 1936], pp. 53 and 56). The actual demand for intermediate products is the demand for replacement plus the demand for *net* increase of stock.



## SAY'S LAW: A RESTATEMENT AND CRITICISM 55

hand side of this equation is the demand, measured in money value, of entrepreneurs for primary factors and for replacement of the intermediate products used up, i.e., the total cost entrepreneurs are ready to incur. The part in parentheses on the right-hand side is the supply of products, measured in money value, i.e., the total receipts planned by entrepreneurs. The difference between the two

$$\Pi \equiv (S_I + S_P) - (D_F + D_{IR}) \quad (5.2)$$

is the total profit entrepreneurs plan to receive.<sup>8</sup> This is the total profit implied in the entrepreneurs' decisions to offer  $(S_I + S_P)$  worth of products and to use  $(D_F + D_{IR})$  worth of factors.<sup>9</sup> We shall call it *planned total profit*.

Taking into account (5.2), we can re-write (5.1) in the form

$$(\Pi - D_{IN}) - (D_P - S_F) \equiv \Delta M - \Delta C, \quad (5.3)$$

where

$$\Delta C \equiv S_C - D_C.$$

Each of the terms in this identity, except  $\Delta M$ , represents an independent set of decisions. The terms in the first parentheses represent entrepreneurial decisions, and the terms in the second parentheses represent decisions to buy from entrepreneurs and to sell to entrepreneurs. We shall call these decisions the *capitalistic sphere* of decisions. On the right-hand side the term  $\Delta C$  represents decisions to sell and to buy direct services. As the offers to sell and to buy direct services are not directed to entrepreneurs, we shall call these decisions the *noncapitalistic sphere* of decisions. On account of (5.2)

$$\Pi - D_{IN} \equiv (S_I + S_P) - (D_F + D_{IR} + D_{IN}),$$

which is the difference between the stream of money demanded and the stream of money offered by entrepreneurs. It is the *net* stream of money demanded by entrepreneurs. The expression  $(D_P - S_F)$  is the difference between the stream of money offered to entrepreneurs and the stream of money demanded from entrepreneurs. It is the *net* stream of money offered to entrepreneurs. On the right-hand side

<sup>8</sup> It is assumed here that entrepreneurs supply exactly the quantities designed, i.e., the quantities indicated by the supply functions. If entrepreneurs' supply is different from what was designed by them (as, e.g., in case of fluctuating crops),  $\Pi$  differs from the profit entrepreneurs plan to receive by the difference between the actual supply and the supply originally designed.

<sup>9</sup>  $S_I$  and  $S_P$  are expressions of the type  $\sum p_i S_i$ , the summation extending over all intermediate products and all final products, respectively.  $D_P$  and  $D_{IR}$  are expressions of the type  $\sum p_i D_i$ , the summation extending over the respective class of commodities. The  $S_i$ 's and  $D_i$ 's are functions of prices. The prices are taken as (arbitrarily) given.

## 56 MATHEMATICAL ECONOMICS AND ECONOMETRICS

$\Delta C \equiv S_c - D_c$  is the difference between the stream of money demanded and the stream of money offered in exchange for direct services, or the demand for increase of cash balances arising in the noncapitalistic sphere of decisions. As  $\Delta M$  is the total demand for increase of cash balances (relative to the quantity of money available),  $\Delta M - \Delta C$  is the demand for increase of cash balances (relative to the quantity of money) arising in the capitalistic sphere of decisions. We shall say that there is monetary equilibrium in the capitalistic sphere of decisions when  $\Delta M - \Delta C = 0$ .

When  $(D_p - S_f) = (\Pi - D_{IN})$ , the *net* stream of money offered to entrepreneurs is equal to the *net* stream of money demanded by them, and entrepreneurs can realize their planned total profit and their demand for new investment. However, when  $(D_p - S_f) < (\Pi - D_{IN})$ , the net stream of money offered to entrepreneurs is less than the net stream of money demanded by them. Given their demand for new investment, entrepreneurs cannot realize their planned total profit. They must either accept a smaller total profit than planned or, instead, increase  $D_{IN}$ , i.e., their demand for new investment. Demand for new investment is an offer of entrepreneurs to buy from themselves. Therefore, an increase in the demand for new investment diminishes the net stream of money demanded by entrepreneurs. Finally, when  $(D_p - S_f) > (\Pi - D_{IN})$ , the net stream of money offered to entrepreneurs is greater than the net stream of money demanded by them. Entrepreneurs can either realize a greater total profit than planned or, alternatively diminish their new investment.

Thus, given the entrepreneurs' demand for new investment,  $D_{IN}$ , a profit less than, equal to, or greater than planned can be realized according as to whether  $(D_p - S_f) \begin{matrix} < \\ \equiv \\ > \end{matrix} (\Pi - D_{IN})$  or, because of (5.3), according as to whether  $\Delta M - \Delta C \begin{matrix} < \\ \equiv \\ > \end{matrix} 0$ . It should be noticed that the

condition which permits entrepreneurs to realize exactly their planned total profit and their demand for new investment is not equivalent to monetary equilibrium for the whole system ( $\Delta M = 0$ ) but to monetary equilibrium in the capitalistic sphere of decisions (i.e.,  $\Delta M - \Delta C = 0$ ). However, in a purely capitalistic system (i.e., in a system in which there are not direct services)  $\Delta C$  disappears and  $\Delta M = 0$  is the condition equivalent with the equality between the net stream of money offered to entrepreneurs and the net stream of money demanded by entrepreneurs.

Under Say's law  $\Delta M \equiv 0$ , and if the economic system is purely capitalistic we have

## SAY'S LAW: A RESTATEMENT AND CRITICISM 57

$$(D_P - S_P) \equiv (\Pi - D_{IN}). \quad (5.4)$$

The net stream of money offered to entrepreneurs is *always* equal to the net stream of money demanded by them. Whatever the total profit and new investment planned by entrepreneurs, the net stream of money offered to them is always such as to enable them to realize their planned profit and new investment, irrespectively of whether there is equilibrium of demand and supply of each separate commodity. Thus total entrepreneurial receipts are, under Say's law, identically equal to total cost plus planned total profit.<sup>10</sup> Consequently, an impossibility of realizing planned profit in one part of the system must be compensated by a possibility of realizing more than planned profit in some other part of the system. It is in this sense that "over-production" can be only "partial."

This holds, however, only for a purely capitalistic system. If direct services are present, the condition  $\Delta M \equiv 0$  does not suffice to make that total entrepreneurial receipts equal to total cost plus planned total profit. It is necessary, in addition, that  $\Delta C = 0$ , i.e. that the market for direct services be in equilibrium. Disequilibrium in the market for direct services may cause a discrepancy between the net stream of money offered to entrepreneurs and the net stream of money demanded by entrepreneurs. Thus Say's law implies the impossibility of a "universal glut" only for a purely capitalistic system.

6. Say's law, however, does *not* imply that the total demand and the total supply of products are identically equal. Neither does it imply an identity of the total demand and the total supply of primary factors and direct services.

We can re-write (5.1) in the form

$$\begin{aligned} (S_F + S_C) - (D_F + D_C) \\ \equiv (D_{IR} + D_{IN} + D_P) - (S_I + S_P) + \Delta M. \end{aligned} \quad (6.1)$$

The left-hand side is the excess supply of factors and direct services (measured in money value). On the right-hand side the two parts in parentheses give the excess demand for (intermediate and final) products (also measured in money value).<sup>11</sup> The identity (6.1) shows that primary factors and direct services are offered in exchange for products and money, while products and money are offered in ex-

<sup>10</sup> This is subject to the qualification stated in n. 8. It should also be noticed that Say's law implies nothing as to the level of planned total profit. Planned total profit may be even negative, as, e.g., when there is large fixed capital equipment.

<sup>11</sup> By "excess supply" we mean the excess of supply over demand; by "excess demand," the excess of demand over supply.

## 58 MATHEMATICAL ECONOMICS AND ECONOMETRICS

change for primary factors and direct services. Under conditions of monetary equilibrium  $\Delta M = 0$ , and an excess supply of factors implies an excess demand of equal size for products, and vice versa. This is clear, because, when monetary equilibrium exists, primary factors and direct services are offered in exchange for products alone, and products alone are offered in exchange for primary factors and direct services. In this case an excess supply of the one means an excess demand for the other.

Under Say's law  $\Delta M \equiv 0$ , and we obtain

$$\begin{aligned} (S_F + S_C) - (D_F + D_C) \\ \equiv (D_{IR} + D_{IN} + D_P) - (S_I + S_P). \end{aligned} \quad (6.2)$$

The two sides of this identity need not be zero. The total supply of primary factors and direct services may, therefore, differ from the total demand for primary factors and direct services. Similarly, the total demand for products may differ from the total supply of products. Neither of the two discrepancies is precluded by Say's law. But (6.2) shows that under Say's law an excess supply of primary factors and direct services *always* implies an excess demand of equal amount for products, and vice versa. This tends directly to restore equilibrium. An excess demand for products causes product prices to rise. This stimulates a decrease of the demand and an increase of the supply of products. A decrease of demand for products is, however, equivalent to a decrease of supply of primary factors and direct services; and an increase of supply of products is equivalent to an increase of demand for primary factors and direct services. Thus equilibrium is restored simultaneously between demand and supply of products and between demand and supply of primary factors and direct services. In a similar way equilibrium is restored directly in case of an excess supply of products.

When Say's law does not hold, an excess supply of primary factors and direct services need not be associated with an excess demand for factors. From (6.1) we see immediately that an excess supply of products may coexist with an excess supply of factors and direct services, and vice versa, as long as  $\Delta M > 0$ . Such a coexistence happens when

$$\Delta M > (S_I + S_P) - (D_{IR} + D_{IN} + D_P) > 0$$

and

$$\Delta M > (S_F + S_C) - (D_F + D_C) > 0,$$

i.e., when there is a desire to increase cash balances (relative to the

## SAY'S LAW: A RESTATEMENT AND CRITICISM 59

quantity of money available) by more than the excess supply of products, and also by more than the excess supply of factors and direct services. In this case there is no direct tendency to restore equilibrium through the simple mechanism of exchange between primary factors and direct services on one side and products on the other side. Equilibrium can be restored only through abatement of the desire to increase cash balances relative to the quantity of money (i.e., through  $\Delta M$ 's becoming again equal to zero). This will happen only if the fall in prices resulting from the excess supply tends to make  $\Delta M = 0$ . We may say that in such cases the conditions for a stable monetary equilibrium are satisfied. Otherwise there is no tendency to reach an equilibrium, and the general stability conditions (2.2) are not satisfied. However, the satisfaction of *all* the stability conditions (2.2) is not implied in Say's law. Say's law implies only that enough of the stability conditions of the system hold, to assure the existence of a stable equilibrium for two broad classes of commodities, namely, the class of products and the class of primary factors and direct services.

This discussion takes us back to the original controversy between Malthus and Ricardo. In his *Principles of Political Economy* Malthus stated: "If commodities were only to be compared and exchanged with each other, then indeed it would be true that, if they were all increased in their proper proportion, to any extent, they would continue to bear among themselves the same relative value."<sup>12</sup> But this is not a correct account, Malthus argued, because "it is by no means true, as a matter of fact that commodities are always exchanged for commodities. The great mass of commodities is exchanged directly for labour, either productive or unproductive; and it is quite obvious that this mass of commodities, compared with the labour with which it is to be exchanged, may fall in value from a glut just as any one commodity falls in value from an excess of supply, compared either with labour or money."<sup>13</sup> Malthus means here by the term "commodity" (as distinguished from "labor") what is designated in this paper as "product." Remembering this, and substituting "primary factors and direct services" for the more restricted concept of "labor" used by Malthus, the statement quoted expresses the relationship stated in (6.1) when  $\Delta M = 0$ . It states that products are exchanged not only for products but that "the great mass" of products is exchanged for primary factors and direct services. In consequence there may be a general excess supply of products which leads to a decline of product

<sup>12</sup> London, 1820, p. 355.

<sup>13</sup> *Ibid.*, pp. 353-54. Cf. also the note on pp. 317-18 of the second edition (London, 1836).

## 60 MATHEMATICAL ECONOMICS AND ECONOMETRICS

prices as compared with prices of primary factors and direct services.

This statement is quite correct, because an excess supply of products implies under these conditions an excess demand for factors and direct services. Malthus, however, thought that by pointing out this correct relationship he had proved *eo ipso* the possibility of a "general overproduction" (as defined above on p. 53). The effect of an excess supply of products would be, according to Malthus, that "commodities [i.e., products] would necessarily fall in value, compared with labour [primary factors and direct services], so as to lower profits almost to nothing, and to check for a time further production. But this is precisely what is meant by the term glut, which, in this case, is evidently general not partial."<sup>14</sup> It is true, as we have seen, that the prices of products would fall relatively to the prices of primary factors and direct services. But, as is clearly seen from (5.3), no "general glut" in the sense of realized total profit falling below planned total profit follows, unless  $\Delta M - \Delta C > 0$ .

Ricardo's<sup>15</sup> answer to Malthus was: "It is quite true that commodities may exist in such abundance, compared with labour, as to make their value so [to] fall, [estimated] in labour, as not to afford any inducement to their further production. In that case labour will demand a great quantity of commodities."<sup>16</sup> Keeping in mind our preceding observation concerning terminology, this passage simply states that an excess supply of products is accompanied by an excess demand for primary factors and direct services, which causes a rise

<sup>14</sup> *Op. cit.* (1820), p. 354.

<sup>15</sup> Say's reply to the same point made by Malthus was merely a terminological evasion: "Commodities, you say, are not only exchanged for commodities: they are also exchanged for labor. If this labor be a produce that some persons sell, that others buy, and that the latter consume, it will cost me very little to call it a commodity, and it will cost you very little more to assimilate other commodities to it, for they are also produce. Then comprising both under the generic name of *Produce*, you may perhaps admit that produce is bought only with produce" (cf. *Letters to Thomas Malthus on Political Economy and Stagnation of Commerce* [London, 1821 (reprinted in 1936 by Harding Ltd.)], Letter 1, pp. 21-22). In this translation the word "not" is omitted in the first sentence. This is obviously a misprint (cf. the French original in *Oeuvres diverses de J. B. Say, Petit volume*, ed. Guillaumin [Paris, 1848], p. 456). The word "produce" obviously means here commodities in general, i.e., primary factors and direct services as well as products.

At a later stage of the controversy Say fell only deeper into his terminological tautologies and defined "produce as a product the receipts for which cover its costs" (see the letter to Malthus of July, 1827, in *Oeuvres diverses*, p. 513, and *Cours complet d'économie politique pratique* [2d ed., 1840], I, 347-48); cf. also E. von Bergmann, *Geschichte der nationalökonomischen Krisentheorien* [Stuttgart: Kohlhammer, 1895], pp. 74-76). Thus the proposition that total cost of "produce" cannot exceed total receipts of entrepreneurs became with Say a mere tautology.

<sup>16</sup> *Notes on Malthus' "Principles of Political Economy,"* ed. Jacob H. Hollander and T. E. Gregory (Baltimore: Johns Hopkins University Press, 1928), p. 163.

## SAY'S LAW: A RESTATEMENT AND CRITICISM 61

in their prices. This is correct under the assumptions of Say's law. Malthus, however, denied that an excess supply of products must be associated with an excess demand for primary factors and direct services. He maintained that there will be also an excess supply of primary factors and direct services, i.e., unemployment.<sup>17</sup> This requires, as we have seen, absence of monetary equilibrium, namely, a desire to increase cash balances (relative to the quantity of money available) by more than the excess supply of products, and more than the excess supply of factors and direct services. In such case a "universal glut" may occur, indeed, provided that some of the demand for increase of cash balances arises in the capitalistic sphere of decisions (i.e., that  $\Delta M - \Delta C > 0$ ).

Malthus had clearly something like this in his mind as is shown by the following statement in a footnote:

Theoretical writers in Political Economy, from the fear of appearing to attach too much importance to money, have perhaps been too apt to throw it out of their consideration in their reasonings. It is an abstract truth that we want commodities, not money. But, in reality, no commodity for which it is possible to sell our goods at once, can be an adequate substitute for a circulating medium, and enable us in the same manner to provide for children to purchase an estate, or to command labor and provisions a year or two hence. A circulating medium is absolutely necessary to any considerable saving; and even the manufacturer would get on but slowly, if he were obliged to accumulate in kind all the wages of his workmen. We cannot therefore be surprised at his wanting money rather than commodities.<sup>18</sup>

But the fact that he had relegated to a footnote this crucial monetary consideration made his argument unconvincing to Ricardo, who argued throughout on the basis of the assumption that money is only a medium of exchange (i.e.,  $\Delta M \equiv 0$ ). Because Malthus had failed to make fully explicit his assumption concerning the demand for money, the discussion between him and Ricardo was carried on at cross-purposes.

7. Now let us study the implication of Say's law for the theory of

<sup>17</sup> *Ibid.*, pp. 361-62. The excess supply of primary factors and direct services is, however, not the same as "involuntary unemployment" in the Keynesian sense. "Involuntary unemployment," as defined in the Keynesian theory, is not an excess of supply of labor but an *equilibrium position* obtained by intersection of a demand and of a supply curve, the supply curve, however, being infinitely elastic with respect to money wages over a wide range, and the point of intersection being to the left of the region where the elasticity of supply of labor with respect to money wages becomes finite. Thus the left-hand side of (6.1) is always zero in the Keynesian theory. The different levels of employment refer to different levels of the demand and supply of labor (cf. Keynes, *op. cit.*, p. 15; and also my article, "The Rate of Interest and the Optimum Propensity to Consume," *Economica*, February, 1938, p. 31).

<sup>18</sup> *Principles of Political Economy* (1820), pp. 361-62.

62 MATHEMATICAL ECONOMICS AND ECONOMETRICS

prices. In the general case the  $n-1$  equilibrium prices are determined by the  $n-1$  equations (2.1) which express, for each commodity, the equality of demand and supply. If the stability conditions (2.2) are satisfied, the actual prices tend toward the equilibrium prices given by (2.1). However, when Say's law holds, the number of independent equations is reduced by one. According to Say's law

$$\sum_{i=1}^{n-2} p_i D_i + p_{n-1} D_{n-1} \equiv \sum_{i=1}^{n-2} p_i S_i + p_{n-1} S_{n-1} \quad (7.1)$$

(where the commodity  $n-1$  is chosen arbitrarily). This expression shows that, if  $D_i = S_i$  for the  $n-2$  first commodities, we have necessarily  $D_{n-1} = S_{n-1}$ . We also have  $D_n \equiv S_n$  by Say's law. The number of independent equations is only  $n-2$ , while the number of equilibrium prices to be determined is  $n-1$ . Thus, when Say's law holds, the equilibrium prices are indeterminate. The equations (2.1) determine in this case  $n-2$  prices as functions of the price of the commodity  $n-1$  (which is chosen arbitrarily), i.e.,  $p_i = f_i(p_{n-1})$ . ( $i = 1, 2, \dots, n-2$ ).<sup>10</sup>

<sup>10</sup> Denoting  $F_i(p_1, p_2, \dots, p_{n-1}) = D_i - S_i$ , the  $n-2$  independent equilibrium equations of the set (2.1) can be written in the form:

$$F_i(p_1, p_2, \dots, p_{n-1}) = 0 \quad (i = 1, 2, \dots, n-2) \quad (1)$$

A solution with respect to  $p_1, p_2, \dots, p_{n-2}$  exists if

$$\frac{\partial(F_1, F_2, \dots, F_{n-2})}{\partial(p_1, p_2, \dots, p_{n-2})} \neq 0,$$

$p_1, p_2, \dots, p_{n-2}$  being then functions of  $p_{n-1}$ . The Jacobian has the required property when the stability conditions are satisfied. The stability conditions of the system (1) are (see eq. [2.2] above and also Hicks, *op. cit.*, p. 315):

$$\begin{aligned} \frac{dF_1}{dp_i} &= \sum_{r=1}^{n-2} \frac{\partial F_1}{\partial p_r} \frac{dp_r}{dp_i} = 0, \\ \frac{dF_i}{dp_i} &= \sum_{r=1}^{n-2} \frac{\partial F_i}{\partial p_r} \frac{dp_r}{dp_i} < 0, \quad (i = 1, 2, \dots, n-2) \\ \frac{dF_{n-2}}{dp_i} &= \sum_{r=1}^{n-2} \frac{\partial F_{n-2}}{\partial p_r} \frac{dp_r}{dp_i} = 0. \end{aligned} \quad (2)$$

Solving the system (2) with respect to  $dF_i/dp_i$ , we obtain

$$\frac{dF_i}{dp_i} = \frac{\partial(F_1, F_2, \dots, F_{n-2})}{\partial(p_1, p_2, \dots, p_{n-2})} \div \frac{\partial(F_1, \dots, F_{i-1}, F_{i+1}, \dots, F_{n-2})}{\partial(p_1, \dots, p_{i-1}, p_{i+1}, \dots, p_{n-2})} \quad (i = 1, 2, \dots, n-2)$$

Since this must be negative the numerator must be different from zero.



## SAY'S LAW: A RESTATEMENT AND CRITICISM 63

This indeterminateness of equilibrium prices which results from the acceptance of Say's law is, however, reduced considerably by taking account of the consequences of the peculiar nature of the demand for money implied in Say's law. Say's law precludes substitution between money and commodities because it implies that purchases of commodities cannot be financed from cash balances and that cash balances cannot be increased out of the receipts from the sale of commodities.<sup>20</sup> This has an important consequence for the structure of the demand and supply functions of commodities. These functions are derived from the theory of substitution. According to the principles of the theory of substitution, a change of the ratios of the prices of the different commodities leads, as a rule,<sup>21</sup> to a substitution of commodities the prices of which are relatively lowered for commodities the prices of which are relatively increased.<sup>22</sup> A proportional change of the prices of all commodities, i.e., of  $p_1, p_2, \dots, p_{n-1}$ , implies a change of the exchange ratio of commodities for money (the price of money  $p_n \equiv 1$  by definition). In the general case this would result in a substitution of money for commodities or vice versa. Say's law, however, precludes such a substitution. Thus, in the case in which Say's law holds, a proportional change of the prices of all commodities cannot affect the demand and supply of commodities relative to the demand and supply of money. But a proportional change of all prices does not induce a substitution between different commodities either. Therefore, the demand and supply functions of commodities are, when Say's law holds, homogeneous of zero degree, i.e., a proportional change of *all* prices does not affect the quantities demanded or offered. These quantities depend merely on the *relative prices*, i.e., on the ratios of the prices

$$\frac{p_1}{p_{n-1}}, \frac{p_2}{p_{n-1}}, \dots, \frac{p_{n-2}}{p_{n-1}},$$

where the commodity  $n - 1$  is chosen arbitrarily.

Denoting the relative prices by  $\pi_i = \frac{p_i}{p_{n-1}}$  ( $i = 1, 2, \dots, n-2$ ),

the equations expressing, for each commodity, the equilibrium of demand and supply can be written

<sup>20</sup> Cf. p. 53 above.

<sup>21</sup> This rule may be counteracted by complementarity.

<sup>22</sup> This holds also for the substitution between factors and products if factors are considered as negative products (cf. Hicks, *op. cit.*, p. 93 and pp. 319-22).

## 64 MATHEMATICAL ECONOMICS AND ECONOMETRICS

$$D_i(\pi_1, \pi_2, \dots, \pi_{n-2}) \\ = S_i(\pi_1, \pi_2, \dots, \pi_{n-2}). \quad (i=1, 2, \dots, n-2) \quad (7.2)$$

They take the place of the  $n-2$  independent equations among the equilibrium equations (2.1), and the equilibrium values of the  $n-2$  relative prices are determinate.

Thus it is possible to determine the equilibrium values of the relative prices, i.e., of the ratios of the money prices, of commodities. The money prices, however, remain indeterminate.

8. Under Say's law the relative prices of commodities are found to be independent of the quantity of money in the system. Money is "neutral,"<sup>23</sup> or, to use the phrase of the classical economists, it is merely a "veil" which can be removed and relative prices can be studied as if the system were based on barter. Indeed, by precluding the substitution of money for commodities or vice versa, Say's law constructs a system which is equivalent to a barter economy. Money in such a system is merely a worthless medium of exchange and a standard of value.

The money prices of commodities are indeterminate in a system in which Say's law is satisfied. In order to determine them, we need to know the price  $p_{n-1}$  (the commodity  $n-1$  being chosen arbitrarily). If this is known, the money prices can be obtained from the relative prices by the relation  $p_i = p_{n-1} \pi_i$  ( $i = 1, 2, \dots, n-2$ ). The price  $p_{n-1}$ , however, cannot be obtained under Say's law because we have only  $n-2$  independent equations of equilibrium of demand and supply. This has led the traditional theory of money to determine the price  $p_{n-1}$  from a supplementary equation—the "equation of exchange"—introduced into the system. This equation can be written

$$k \sum_{i=1}^{n-1} p_i S_i = M, \quad (8.1)$$

where  $k$  is a constant, expressing the proportion of the total supply of commodities, measured in money value, which people want to hold in cash balances, i.e.,  $k$  is the reciprocal of the velocity of circulation of money.  $M$  is the quantity of money.

Since  $p_i = p_{n-1} \pi_i$  (for  $i = 1, 2, \dots, n-2$ ; for  $i = n-1$  we put  $\pi_i \equiv 1$  by definition), the equation (8.1) transforms into

$$k p_{n-1} \sum_{i=1}^{n-1} \pi_i S_i = M. \quad (8.2)$$

<sup>23</sup> Cf. the definition of "neutral" money in J. Koopmans, *Das neutrale Geld* ("Beiträge zur Geldtheorie"), ed. F. A. Hayek (Wien: Springer, 1933), p. 228.

## SAY'S LAW: A RESTATEMENT AND CRITICISM 65

The equilibrium values of the relative prices  $\pi_i$  are determined by the equations (7.2) and the equilibrium quantities of commodities supplied  $S_i$  ( $i = 1, 2, \dots, n-1$ ) are obtained by substituting the  $\pi_i$ 's into the supply functions.<sup>24</sup> The  $\pi_i$ 's and  $S_i$ 's thus given,  $p_{n-1}$  is determined from (8.2).

This is the procedure of the traditional theory of money. It implies a division of the theory of prices in two separate parts: (1) the determination of relative prices and (2) the determination of a multiplier (the "price level") by a monetary equation distinct from the system of equilibrium equations. It results in money being "neutral."<sup>25</sup>

This procedure, however, is self-contradictory. Equation (8.2) is not compatible with Say's law. The left-hand side of this equation is the total demand for cash balances, and the right-hand side is the existing stock of money. The difference is the desired change in cash balances (relative to the quantity of money). We have thus:<sup>26</sup>

$$kp_{n-1} \sum_{i=1}^{n-1} \pi_i S_i - M = \Delta M . \quad (8.3)$$

If  $p_{n-1}$  has a value which does not satisfy (8.2), there is a discrepancy between the amount of money people want to hold and the quantity of money in existence. This implies a discrepancy between the total demand and the total supply of commodities (see eq. [3.3]). Say's law, however, requires that  $\Delta M \equiv 0$  (see eq. [3.4] above). In this case we obtain

$$kp_{n-1} \sum_{i=1}^{n-1} \pi_i S_i \equiv M , \quad (8.4)$$

i.e., an identity, which holds for *any* value of  $p_{n-1}$  and, therefore, cannot serve to determine  $p_{n-1}$ . But  $k$  cannot be constant and must be indeterminate to adjust itself to any value of  $p_{n-1}$ , so that the identity be satisfied. Say's law implies an indeterminate velocity of circulation ( $1/k$ ) and the money prices are indeterminate.

Thus the traditional procedure of the theory of money involves a contradiction. Either Say's law is assumed and money prices are

<sup>24</sup>  $S_{n-1}$  is also obtained because we have  $n-1$  supply functions of commodities, although there are only  $n-2$  independent equilibrium equations.

<sup>25</sup> Except for "frictions" and time lags, which is in this case the only way through which money can influence the relative prices of commodities.

<sup>26</sup> In order that the  $\Delta M$  here be the same as the  $\Delta M$  in (3.3), it is necessary that the unit or period of time over which the change is contemplated be the same as the unit or period of time per which the quantities demanded and supplied are measured. Cf. n. 3 above.

indeterminate or money prices are made determinate—but then Say's law and hence the "neutrality" of money must be abandoned. Say's law precludes any monetary theory.

9. We have seen that Say's law precludes any monetary theory. The theory of money must, therefore, start with a rejection of Say's law. Instead of assuming that total demand and total supply of commodities are identically equal or, what is equivalent, that the total demand for cash balances is identically equal to the amount of money available, these identities have to be replaced by genuine equations. The objective of the theory of money is then to study the conditions under which equilibrium of total demand and of total supply of commodities (or, instead, equilibrium of total demand for cash balances and the quantity of money available) obtains and the processes by which such equilibrium is attained.

This objective was expressed very clearly by Wicksell: "Any theory of money worthy of the name must be able to show how and why the monetary or pecuniary demand for goods exceeds or falls short of the supply of goods in given conditions."<sup>27</sup> Wicksell also observed the difficulty of reconciling this with Say's law. He finally appeased his conscience by stating that total demand and total supply must be equal only "ultimately" but may differ "in the first place."<sup>28</sup> With this observation Wicksell, and with him all monetary theorists, gave up Say's law by substituting for the identity an equation which holds only in equilibrium. The statement that total demand and total supply *tend* to be equal "ultimately" is nothing but an assertion that the stability conditions for the system are satisfied. If the stability conditions (2.2) are satisfied, any disturbance of equilibrium will make the demand and supply of each commodity tend toward equality again; and, since this happens for each commodity in the system, it also implies that total demand and total supply of commodities tend toward equality. But this tendency toward equilibrium, implied in the stability conditions, should not be confused with Say's law.

Since the homogeneity of the demand and supply functions of commodities disappears when Say's law is abandoned, we find that the theory of money cannot be separated from the theory of relative prices. The very basis of monetary theory proves to be incompatible with "neutrality" of money. The money prices of all commodities have to be determined directly from the general system of equilibrium equations (2.1).

<sup>27</sup> *Lectures on Political Economy*, II (London: Routledge & Sons, 1935), 159-60.

<sup>28</sup> *Ibid.*, p. 159.

SAY'S LAW: A RESTATEMENT AND CRITICISM 67

10. The above implications of Say's law for the theory of prices and the theory of money hold also with regard to a dynamic theory of prices which is based on consideration of substitution of goods at different moments of time as well as of substitution of different goods at a given moment of time.

For simplicity let us divide the span of time under consideration in  $m+1$  small and equal intervals indicated by the indices  $0, 1, 2, \dots, m$ , where the index 0 refers to the "present" interval, the other indices referring to "future" intervals. Denote, further, the price of the  $i$ th commodity expected in the  $t$ th interval by  $p_{it}$  and let it be understood that  $p_{i0}$  ( $i = 1, 2, \dots, n-1$ ) are the prices actually obtaining in the "present" interval. We shall call the latter the "current prices." Let  $r_t$  be the rate of interest (per interval) on loans of a duration of  $t$  intervals. The discounted value of the expected price  $p_{it}$  is  $q_{it} = p_{it}/(1+r_t)^t$ . This definition yields  $q_{i0} = p_{i0}$  for  $i = 1, 2, \dots, n-1$ . Current demand and supply of a commodity, i.e., demand and supply in the "present" interval, is a function of all current prices as well as of the discounted values of all expected future prices<sup>20</sup>

$$D_{i0} = D_{i0}(q_{10}, q_{20}, \dots, q_{n-1,0}; q_{11}, q_{21}, \dots, q_{n-1,1}; \dots; q_{1m}, q_{2m}, \dots, q_{n-1,m}) \quad (i = 1, 2, \dots, n-1)$$

and

$$S_{i0} = S_{i0}(q_{10}, q_{20}, \dots, q_{n-1,0}; q_{11}, q_{21}, \dots, q_{n-1,1}; \dots; q_{1m}, q_{2m}, \dots, q_{n-1,m}).$$

The equations of equilibrium are

$$D_{i0}(p_{10}, p_{20}, \dots, p_{n-1,0}; q_{11}, q_{21}, \dots, q_{n-1,1}; \dots; q_{1m}, q_{2m}, \dots, q_{n-1,m}) = S_{i0}(p_{10}, p_{20}, \dots, p_{n-1,0}; q_{11}, q_{21}, \dots, q_{n-1,1}; \dots; q_{1m}, q_{2m}, \dots, q_{n-1,m}). \quad (i = 1, 2, \dots, n-1) \quad (10.1)$$

They determine the equilibrium values of the  $n-1$  current prices  $p_{i0}$  ( $i = 1, 2, \dots, n-1$ ), as functions of the discounted values of the expected future prices. The latter may be regarded as functions of the current prices

$$q_{it} = f_{it}(p_{10}, p_{20}, \dots, p_{n-1,0}). \quad (i = 1, 2, \dots, n-1; t = 1, 2, \dots, m) \quad (10.2)$$

We shall call these functions the "expectation functions" and their

<sup>20</sup> Cf. Gerhard Tintner, "The Theoretical Derivation of Dynamic Demand Curves," *Econometrica*, October, 1938; and Hicks, *op. cit.*, chap xviii.

## 68 MATHEMATICAL ECONOMICS AND ECONOMETRICS

partial elasticities the "elasticities of expectation."<sup>50</sup> Thus, together with the expectation functions, which are  $(n-1)m$  in number, the equations (10.1) determine the equilibrium values of the current prices.

When Say's law holds, we have, as before, only  $n-2$  independent equations among the equations (10.1), and the demand and supply functions are homogeneous of zero degree because Say's law precludes substitution between money and commodities. In the dynamic theory of prices it is, however, *all* the money prices  $q_{it}$ , the discounted values of the expected future prices as well as the current prices, a proportional change of which does not affect the quantities demanded and offered. The demand and supply functions depend then only on the relative prices, i.e., on the ratios of the  $q_{it}$ 's. This, however, does not suffice to make the relative prices determinate because of the expectation functions (10.2). In order that the relative prices be determinate, the expectation functions, too, must involve only relative prices and not money prices. Thus the expectation functions must be homogeneous of the first degree, i.e., a proportional change of all current prices must change the discounted values of the expected future prices in the same proportion. In this case a proportional change of all current prices leaves the quantities demanded and supplied unaffected. The demand and supply functions of commodities depend now only on the ratios of the current prices, and the relative prices are determined by the  $n-2$  independent equations of the system (10.1) and by the expectation functions (10.2). The money prices, however, remain indeterminate.

In the dynamic theory of prices Say's law implies thus, in addition to homogeneity of the demand and supply functions of commodities, homogeneous expectation functions. This additional assumption makes Say's law much more unrealistic in the context of a dynamic theory of prices than it is in the context of static theory. Both in static and in dynamic theory Say's law leaves money prices indeterminate.

<sup>50</sup> The latter term was introduced by Hicks (*op. cit.*, p. 205).

## THE THEORY OF THE MULTIPLIER

By OSCAR LANGE

THE MULTIPLIER is the marginal effect of a change of one economic variable upon another economic variable, of which the first variable is a component; for instance, the marginal effect of a change in primary employment upon total employment, or of a change in investment upon national income. In recent years multipliers of various kinds have been applied as tools of analysis in a number of fields of economic inquiry, such as the theory of employment, national income determination, and foreign trade. There have arisen, however, some misunderstandings and confusions. The present paper intends to clear up many of the difficulties involved by surveying briefly the main types of multipliers and their correct interpretation.

## SIMPLE MULTIPLIERS

Simple multipliers are those which involve but one marginal relationship. The most important of them are the *investment multiplier* and the *consumption multiplier*. The first has gained great prominence on account of its introduction by Mr. Keynes; the second is a symmetric counterpart of the first.

Let  $C$  be the rate of consumption,  $I$  the rate of investment, and  $Y$  the national income per unit of time. Write  $C = C(Y)$  for the consumption function and  $I = I(Y)$  for the investment function. The marginal propensity to consume is  $C' = C'(Y)$  and the marginal propensity to invest is  $I' = I'(Y)$ . From the relation  $Y \equiv C + I$ , we derive

$$\frac{dC}{dY} + \frac{dI}{dY} \equiv 1,$$

whence, if  $I$  is a free variable and  $C = C(Y)$ ,

$$(1) \quad \frac{dY}{dI} = \frac{1}{1 - C'}$$

and, if  $C$  is a free variable and  $I = I(Y)$ ,

$$(2) \quad \frac{dY}{dC} = \frac{1}{1 - I'}$$

(1) is the investment multiplier and is equal to the reciprocal of the marginal propensity to save; (2) is the consumption multiplier and is equal to the marginal reluctance to invest.

These two multipliers can also be obtained, by the Kahn-Clark method, as sums of infinite geometric progressions, namely

$$\frac{dY}{dI} = 1 + C' + (C')^2 + \dots$$

and

$$\frac{dY}{dC} = 1 + I' + (I')^2 + \dots$$

If  $|C'| < 1$  or  $|I'| < 1$ , these sums are equal to the expressions (1) and (2), respectively. The first condition is implied in the well-established empirical fact  $0 < C' < 1$ ; the second condition holds when the system is stable. The stability condition of the system is  $C' + I' < 1$ ,<sup>1</sup> which, given  $0 < C' < 1$ , implies  $0 < I' < 1$ .

The interpretation of the consumption multiplier is similar to that of the investment multiplier. The consumption multiplier indicates the marginal effect upon national income of an increase in the rate of consumption, in the same way as the investment multiplier indicates the marginal effect upon national income of an increase in the rate of investment.

In the relations

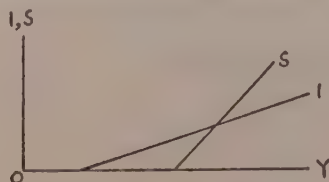
$$(1') \quad dY = \frac{1}{1 - C'} dI$$

and

$$(2') \quad dY = \frac{1}{1 - I'} dC$$

the multiplicand  $dI$  or  $dC$ , respectively, indicates the *total* increment

<sup>1</sup> Denoting the marginal propensity to save by  $S' = S'(Y)$ , we have  $S' \equiv 1 - C'$ , and the stability condition can be stated in the form  $S' > I'$  (the marginal propensity to save is greater than the marginal propensity to invest). In this form



it can be represented by means of the familiar diagram expressing the equilibrium of (planned) saving and (planned) investment. The  $S$ -curve must intersect the  $I$ -curve from below.



in the rate of investment or in the rate of consumption in the economy. As a rule, any initial *autonomous* increment in investment leads to (positive or negative) additional investments, which are *induced* by the increase in national income resulting from the increase in consumption generated by the initial investment. In a similar way, any *autonomous* increment in consumption leads to *induced* additional consumption, due to the increase in national income resulting from the increase in investment generated by the initial increase in consumption. The multipliers  $dI$  and  $dC$  have to be interpreted as representing not the initial increment in  $I$  or  $C$ , but the total increment, which includes all induced increments, in addition to the initial one. This imposes a serious limitation upon the practical application of the multipliers (1) and (2).

Thus our formulae cannot be applied to as simple a problem as the effect of a given government expenditure upon national income. An initial government investment leads, as a rule, to induced private investment and the multiplicand  $dI$  must include the latter. Unless the amount of induced private investment is known to us, we cannot calculate  $dI$ , and our formula of the investment multiplier is practically useless. This uselessness of the investment multiplier formula was particularly apparent during the period 1936-40. At this time, many economists held the belief that, because of its allegedly adverse effect upon business confidence, government investment causes a diminution of private investment to such an extent that it results in a fall of the national income. This argument was frequently expressed in the form of the statement that the multiplier is negative. This statement was a wrong formulation of a basically meaningful (though empirically unfounded) proposition. What the critics of government spending meant to say was that the multiplicand  $dI$ , not the multiplier  $1/(1-C')$ , is negative, because the (allegedly) negative induced private investments outweigh the positive initial increment of investment made by the government.<sup>2</sup>

The same limitation of the multiplier arises with regard to the effect upon national income of an initial increment in governmental consumption expenditure (e.g., for relief, or for the armed forces). The multiplicand  $dC$  includes, in addition to the increase in the government's expenditure, all the induced increases in private consumption. Unless the latter are already known,  $dC$  cannot be calculated and the multiplier formula  $1/(1-I')$  is of no practical use.

<sup>2</sup> This and many other points of the theory of the multiplier have been elucidated by Professor Paul A. Samuelson. Cf. his articles, "The Theory of Pump-Priming Re-examined," *American Economic Review*, Vol. 30, September, 1940, p. 500, and "Fiscal Policy and Income Determination," *Quarterly Journal of Economics*, Vol. 56, August, 1942, pp. 576-577.

The difficulty mentioned can, however, be overcome by means of an extension of the multiplier technique, which leads to multipliers which involve two or more marginal relationships.<sup>3</sup> Such multipliers will be called compound multipliers.

## COMPOUND MULTIPLIERS

Let  $dI_0$  be an initial autonomous increment in the rate of investment. This implies an equal increase in the national income and leads to induced consumption equal to  $C'dI_0$  and to induced investment equal to  $I'dI_0$ . The result is an induced increase in income  $(C'+I')dI_0$ , which, in turn, leads to a further induced increase in income  $(C'+I')(C'+I')dI_0$ ; etc. The total increase in national income is thus

$$dY = [1 + (C' + I') + (C' + I')^2 + \dots] dI_0$$

and the *compound investment multiplier* is<sup>4</sup>

$$(3) \quad \frac{dY}{dI_0} = \frac{1}{1 - (C' + I')},$$

provided  $|C'+I'| < 1$ .

An initial autonomous increment  $dC_0$  in the rate of consumption implies an equal increase in the national income and leads, through induced investment and consumption, to further increments in income  $(C'+I')dC_0$ ,  $(C'+I')(C'+I')dC_0$ , etc. Thus we have

$$dY = [1 + (C' + I') + (C' + I')^2 + \dots] dC_0,$$

and, if  $|C'+I'| < 1$ , the *compound consumption multiplier* is

$$(4) \quad \frac{dY}{dC_0} = \frac{1}{1 - (C' + I')}.$$

In (3) and (4),  $dI_0$  and  $dC_0$  are the autonomous increment in investment or consumption, respectively. These multipliers measure the marginal effect of such an autonomous increment upon the national income and can thus be used for the problems mentioned in the preceding section, for which the simple multiplier formulae proved inadequate. Induced investment and consumption are not included in the multiplicands  $dI_0$  and  $dC_0$ , but are taken care of by the multiplier formula.

<sup>3</sup> This idea seems to have been first suggested by Professor James W. Angell (*Investment and Business Cycles*, McGraw-Hill Book Co., New York, 1941, p. 196) and by the present writer (review of Professor Schumpeter's *Business Cycles*, in the *Review of Economic Statistics*, Vol. 23, November, 1941, p. 191 n.). Both of us used the term "cumulative multiplier."

<sup>4</sup> This formula has been given by Professor Samuelson, "Fiscal Policy and Income Determination," p. 578.

The argument about the alleged negative effect of government spending upon national income can be stated correctly in the form of the statement that the multiplier is negative, if the multiplier meant is the compound multiplier (3) or (4). Such a multiplier can be negative, indeed, if the marginal propensity to invest is negative and outweighs the effect of the positive marginal propensity to consume. Such a situation, however, is incompatible with the stability condition of the system. In order that the multiplier be negative, we must have  $1 - (C' + I') < 0$ , while the stability condition requires  $1 - (C' + I') > 0$ . Thus only in unstable systems can the compound multiplier (3) or (4) be negative. In this case it cannot be finite either, because the convergence condition  $|C' + I'| < 1$  is not satisfied in an unstable system.

From (3) and (4) we obtain

$$(5) \quad \frac{dY}{dI_0} \equiv \frac{dY}{dC_0},$$

i.e., the compound investment multiplier and the compound consumption multiplier are identical. Thus any given autonomous increment in expenditure has exactly the same effect upon national income, irrespective of whether the expenditure is for investment or for consumption. The identity of the two multipliers suggests combining them into one simple multiplier expressing the marginal relationship between national income and spending. For this purpose we need only define  $E' = E'(Y) \equiv C' + I'$  as the *marginal propensity to spend*, and (3) and (4) turn into

$$(6) \quad \frac{dY}{dE} = \frac{1}{1 - E'}.$$

This may be called the *spending multiplier*,<sup>5</sup>  $dE$  is the autonomous increment in the rate of spending. The denominator  $1 - E'$  is the marginal reluctance to spend (propensity to hoard<sup>6</sup>). The stability condition can be expressed in the form  $1 - E' > 0$ , i.e., that the reluctance to spend is an increasing function of national income.

A comparison of (6) with (1) and (2) gives the relation between the simple investment multiplier and the simple consumption multiplier

<sup>5</sup> This is the "cumulative multiplier" of Professor Angell, who also has given the formula (6). Cf. *op. cit.*, p. 196.

<sup>6</sup> It may also be called the "marginal propensity to hoard,"—"hoarding" meaning the difference between planned receipts and planned expenditure. Since  $1 - C' \equiv S'$ , i.e., the marginal propensity to save (see footnote 1 above), we find that  $1 - E' \equiv S' - I'$ , i.e., the marginal reluctance to spend (propensity to hoard) is the difference between the marginal propensity to save and the marginal propensity to invest.

on one side and the spending multiplier (or the two compound multipliers) on the other side. The relation is

$$(7) \quad \frac{dY}{dI} = \frac{dY}{dE} \bigg/ \frac{dI}{dI_0}$$

and

$$(8) \quad \frac{dY}{dC} = \frac{dY}{dE} \bigg/ \frac{dC}{dC_0}.$$

The denominators are multipliers too, namely,

$$(9) \quad \frac{dI}{dI_0} = \frac{1 - C'}{1 - E'}$$

and

$$(10) \quad \frac{dC}{dC_0} = \frac{1 - I'}{1 - E'}.$$

Formula (9) states that the marginal effect of autonomous investment upon the rate of investment in the economy is equal to the ratio of the marginal reluctance to consume (the marginal propensity to save) and the marginal reluctance to spend.<sup>7</sup> Formula (10) states that the marginal effect of an autonomous change in consumption upon the rate of consumption in the economy is equal to the ratio of the marginal reluctance to invest and the marginal reluctance to spend.

In order to evaluate the effect upon national income of any given autonomous change in spending, we can use either the spending multiplier (6), or any of the two simple multipliers (1) or (2). The use of the latter, however, requires a knowledge of the multipliers (9) or (10), which presupposes the same data as the spending multiplier.

#### MULTIPLIERS IN OPEN SYSTEMS

In a closed system, the reluctance to spend (propensity to hoard) is the only leakage in the effect of an autonomous change in the rate of spending upon national income. In open systems other leakages exist, namely the fact that part of the spending is done in such a way that it does not flow back to other income-receivers in the system. We shall call it *external spending* as distinguished from *internal spending*, which flows back to income-receivers within the system. External spending, however, may be offset by receipts of income-receivers in the system derived from external spending in other systems. Such receipts will be called *external receipts*. Two outstanding examples of open systems are (1) a country or region in trade relations with other countries or regions (international or interregional trade), and (2) the relation between a

<sup>7</sup> Or, in other words, the ratio of the marginal propensity to save and the marginal propensity to hoard.

country's private economy and the government's Treasury. Another example might be the relation between the private sector and the socialized sector of a "mixed economy." We shall use the first two examples for illustration of multipliers in open systems.

Denote by  $Y$  the aggregate income of the open system and by  $E$ ,  $E_1$ , and  $E_2$ , the rate of total spending, internal spending, and external spending of the system, respectively.  $E \equiv E_1 + E_2$ . By hypothesis,  $E_1 = E_1(Y)$  and  $E_2 = E_2(Y)$ . Denote further by  $R$  the rate of external receipts of the system, and assume that  $R = R(E_2)$ , i.e., external receipts are a function of external spending. This function may be called the other systems' *propensity to spend back*.  $Y \equiv E_1 + R$ .

Let  $dE_1$  be an autonomous increment in the rate of internal spending. The aggregate income of the system increases by  $dE_1$ , but of this, only  $E_1' dE_1$  is spent within the system and leads to a further increase in the system's income.  $E_2' dE_1$  is spent externally, but, of this  $R' E_2' dE_1$  flows back to the system and contributes to an increase in the system's income. The initial increment  $dE_1$  in the system's income thus leads to a further increase equal to  $(E_1' + R' E_2') dE_1$ . Out of this further increase,  $E_1' (E_1' + R' E_2') dE_1$  is spent internally and  $R' E_2' (E_1' + R' E_2') dE_1$  of the external expenditure flows back. Thus the system's income increases again by  $(E_1' + R' E_2')^2 dE_1$ ; and so forth. The total increase in the system's income, therefore, is

$$dY = [1 + (E_1' + R' E_2') + (E_1' + R' E_2')^2 + \dots] dE_1$$

and the *internal spending multiplier* is

$$(11) \quad \frac{dY}{dE_1} = \frac{1}{1 - (E_1' + R' E_2')}$$

provided  $|E_1' + R' E_2'| < 1$ .<sup>8</sup>

In the case of a country engaged in international trade,  $Y$  has to be interpreted as the country's national income,  $E_1'$  as the marginal propensity to spend for domestic goods, and  $E_2'$  as the *marginal propensity to import*.<sup>9</sup>  $R'$  is the other countries' marginal propensity to spend back. If the multiplier is applied to the relation between the private economy and the Treasury,  $Y$  can be interpreted as aggregate private income,

<sup>8</sup> The stability condition is in this case  $E_1' + R' E_2' < 1$ . If we accept  $E_1' + R' E_2' > 0$  as a property empirically established, the convergence condition is satisfied for stable systems. It should be noted that the stability of an open system does not presuppose that the system be stable when isolated, i.e., that  $E_1' + E_2' < 1$ . If  $R'$  is sufficiently small the open system may be stable even though the aggregate marginal propensity to spend  $E_1' + E_2' \geq 1$ . For a detailed treatment of this question see Lloyd A. Metzler, "Underemployment Equilibrium in International Trade," *ECONOMETRICA*, Vol. 10, April, 1942, pp. 102-103.

<sup>9</sup> This includes the propensity to buy foreign securities.

$E_1'$  as the private marginal propensity to spend (net of taxes and loans to the Treasury), and  $E_2'$  as the Treasury's *marginal propensity to tax and borrow*.  $R'$  is then the Treasury's marginal propensity to spend.

The multiplier (11) can also be written in the form

$$(12) \quad \frac{dY}{dE_1} = \frac{1}{1 - [E' - (1 - R')E_2']},$$

which shows clearly that the internal spending multiplier is the smaller the larger the marginal propensity to import or the marginal propensity to tax and borrow, and the larger the other countries', or the Treasury's, marginal reluctance to spend back, i.e.,  $1 - R'$ . It shows thus the income-reducing effect of imports and of taxation and government borrowing,<sup>10</sup> as well as the income-increasing effect of exports and of government spending. When  $R' = 1$ , formula (12) becomes identical with (6), i.e., with the simple spending multiplier of a closed system, while for  $R' = 0$  it becomes

$$(13) \quad \frac{dY}{dE_1} = \frac{1}{1 - E' + E_2'},$$

in which form it is well known in the treatment of foreign trade problems.<sup>11</sup>

If, instead of an autonomous increment  $dE_1$  in the rate of internal spending, we start with an autonomous increment  $dE$  in the rate of total spending, we find that the first increment in the system's income is  $(E_1' + R'E_2')dE$ , which is followed up by the increments  $(E_1' + R'E_2')^2 dE$ ,  $(E_1' + R'E_2')^3 dE$ , etc. The total increase in the system's income is thus

$$dY = (E_1' + R'E_2')[1 + (E_1' + R'E_2') + (E_1' + R'E_2')^2 + \dots]dE$$

<sup>10</sup> Imports, taxation, and borrowing have this effect only if  $E_2'(Y) > 0$ , i.e., if they are out of income. For imports, taxation, and borrowing which are out of wealth (i.e., stocks of goods or of money)  $E_2'(Y) = 0$  and there is no income-reducing effect.

<sup>11</sup> The marginal propensity to import, or to tax and borrow, is taken here as a function of income, i.e.,  $E_2 = E_2(Y)$ . If it is treated as a function of internal spending, i.e.,  $E_2 = E_2(E_1)$ , we have  $E_2'(Y) = E_2'(E_1)E_1'(Y)$  and (13) must be written in the form

$$\frac{dY}{dE_1} = \frac{1}{1 - E'(1 - E_2')},$$

where  $E' = E'(Y)$  and  $E_2' = E_2'(E_1)$ . Cf., for instance, D. H. Robertson, "Mr. Clark and the Foreign Trade Multiplier," *Economic Journal*, Vol. 48, 1939, pp. 354-356. See also G. Haberler, *Prosperity and Depression*, League of Nations, Third Edition, Geneva, 1941, pp. 464-465. In this form the formula is also used by Professor Samuelson for the study of the income-reducing effects of taxation ("Fiscal Policy and Income Determination," p. 584).

and

$$(14) \quad \frac{dY}{dE} = \frac{E_1' + R'E_2'}{1 - [E_1' + R'E_2']},$$

the convergence condition being taken as satisfied. This is the *total spending multiplier* of an open system. Comparing (14) with (11), we obtain

$$(15) \quad \frac{dY}{dE} = (E_1' + R'E_2') \frac{dY}{dE_1},$$

i.e., the total spending multiplier is the internal spending multiplier times the sum of the marginal propensity to spend internally and the marginal inducement of other systems to spend back.

The effect of internal spending upon external spending can be calculated as follows. An autonomous increase  $dE_1$  in the rate of internal spending raises the system's income by  $dE_1$  and leads to external spending  $E_2'dE_1$ . The system's income, however, increases further by  $(E_1' + R'E_2')dE_1$ , which leads to new external spending  $E_2'(E_1' + R'E_2')dE_1$ . The system's income increases again, now by  $(E_1' + R'E_2')^2dE_1$ , and external spending, in turn, increases by  $E_2'(E_1' + R'E_2')^2dE_1$ ; and so forth. The total increase in external spending is, consequently,

$$dE_2 = E_2' [1 + (E_1' + R'E_2') + (E_1' + R'E_2')^2 + \dots] dE_1,$$

and, in view of (11), we obtain

$$(16) \quad \frac{dE_2}{dE_1} = E_2' \frac{dY}{dE_1}.$$

In a similar way, we find that an autonomous increment  $dE$  of the rate of total spending causes an increase of external spending equal to

$$dE_2 = E_2'(E_1' + R'E_2') [1 + (E_1' + R'E_2') + (E_1' + R'E_2')^2 + \dots] dE,$$

whence, on account of (14), we derive

$$(17) \quad \frac{dE_2}{dE} = E_2' \frac{dY}{dE}.$$

The multipliers (16) and (17) indicate the marginal effect upon the rate of external spending and, consequently, upon the external receipts of the systems to which the external spending is diverted. They may, therefore, be called the *intersystem* internal spending or total spending multiplier, respectively. Thus, for instance, (16) or (17) measures the marginal effect of a change in a country's rate of (internal or total) spending upon its imports (and thus upon the external receipts of other

countries).<sup>12</sup> Another application of (16) or (17) is the marginal effect of a change in private spending (net or gross of taxes and government loans) upon the receipts of the Treasury. The formulae (16) and (17) show that the intersystem multiplier is equal to the product of the marginal propensity to spend externally and the internal or total spending multiplier.

The effect of an autonomous increment in the rate of external receipts upon the system's income is the same as the effect of an increment of equal size in the rate of internal spending. Therefore, interpreting  $dE_1$  as an autonomous increment in the rate of external receipts, we can use formula (11) to evaluate the marginal increase in the system's income.<sup>13</sup> The internal spending multiplier can thus be used also as an external receipts multiplier, e.g., as an export multiplier or government spending multiplier. With the same interpretation of  $dE_1$ , the intersystem multiplier (16) indicates the marginal effect of an increase in the system's rate of external receipts upon its external spending. The multiplier (16) may thus be used to study the marginal effect of a change in the rate of imports upon the country's foreign balance, or of a change in the rate of government spending upon the budget deficit (or surplus). As we see from the formula, this effect is equal to the internal spending multiplier times the marginal propensity to spend externally (i.e., times the marginal propensity to import, or times the marginal propensity to tax and borrow). An autonomous increase  $dE_1$  in the rate of imports, or in the rate of government spending, increases, leaves unchanged, or diminishes, the foreign balance or the budget deficit,<sup>14</sup> according as  $dE_2/dE_1 \leq 1$ , or according as the reciprocal of the marginal propensity to import, or of the marginal propensity to tax and borrow, is greater than, equal to, or less than the internal spending multiplier.

An interesting case arises when a mechanism or a policy exists that tends to equalize changes in external spending and in external receipts of the system, as for instance, in international trade in the absence of capital movements, or under a fiscal policy which maintains a constant budget deficit or surplus (a policy which maintains a balanced budget is a special case of it). In this case,  $dE_2/dE_1 = 1$  and the formula (16) turns into

<sup>12</sup> The formula (17) is used for determination of the effect of investment upon imports by J. J. Polak, "Balance of Payments Problems of Countries Reconstructing with the Help of Foreign Loans," *Quarterly Journal of Economics*, Vol. 57, February, 1943, p. 233.

<sup>13</sup> Such use of (11) as well as of other more complicated formulae is made by Professor Machlup in his book *International Trade and the National Income Multiplier*, The Blakiston Co., Philadelphia, 1943, which appeared after the present article was written.

<sup>14</sup> A surplus can be considered as a negative deficit.



$$(18) \quad \frac{dY}{dE_1} = \frac{1}{E_2'}$$

Applied to international trade, this is Mr. R. F. Harrod's multiplier which expresses the effect of a change in the rate of exports upon the country's income and which is equal to the reciprocal of the marginal propensity to import.<sup>15</sup> The multiplier (18) may also be used to estimate the marginal effect of government expenditure upon private income under a fiscal policy of maintaining a constant budget deficit or surplus (including, as a special case, a policy of a balanced budget). This effect is the reciprocal of the marginal propensity to tax and to borrow out of income,<sup>16</sup> and is *independent of the size of the deficit or surplus*.

#### DYNAMIC MULTIPLIERS<sup>17</sup>

The multipliers treated in the preceding section are all static. The marginal effect expressed by the multiplier formulae does not refer to any specific moment or period of time, it is undated. The multiplier formulae give a comparison of the values the dependent variable has in two equilibrium positions of the system, differing in the values of the independent variable. Nothing is said about the time it takes to pass from one equilibrium position to another, nor about the path of the transition. The procedure is merely one of comparative statics. But whether we recognize it in our formulae or not, the effect of a change of one economic variable upon the value of another does operate in time. If this fact is taken into consideration explicitly, multiplier formulae can be obtained which measure the effect produced at any given moment of time as well as the final limit which the effect tends to approach. The effects produced at successive moments of time are the path by which the system reaches equilibrium. The multipliers which measure the effects in time and the limit these effects tend to approach will be called *dynamic multipliers*.<sup>18</sup> For sake of brevity, our exposition will be confined to the examination of the dynamic spending multiplier. But the same, or similar, formulae can be applied for setting up dynamic counterparts to all the other multipliers discussed in the present article.

<sup>15</sup> See *International Economics*, Cambridge University Press, New Edition, 1939, pp. 122-123.

<sup>16</sup> It is not influenced by taxation and borrowing out of wealth.

<sup>17</sup> I am indebted to Professors Abraham Wald, Paul A. Samuelson, and Harold T. Davis for valuable suggestions concerning this and the following parts of the article.

<sup>18</sup> Professor J. M. Clark's multipliers are, unlike those of Mr. Kahn and Mr. Keynes, dynamic. See *Economic Planning of Public Works*, U. S. Government Publication, Washington, D. C., 1935, pp. 85-96. The dynamic investment multiplier has been discussed also by Professor Fritz Machlup, "Period Analysis and Multiplier Theory," *Quarterly Journal of Economics*, Vol. 54, November, 1939, pp. 11 seq.

Suppose that the rate of spending responds to a change in the national income with a simple time lag equal to one unit of time. Let us denote by  $\alpha$  the dynamic marginal propensity to spend, i.e., the marginal effect of a change in (the flow of) income at any moment of time upon the rate of spending one unit of time later. We have  $\alpha = dE(t)/dY(t-1)$ . An autonomous permanent increment  $dE(0)$  in the rate of spending, starting at the moment  $t=0$ , produces, at the moment  $t=n$ , where  $n$  is integer, an increase in the flow of income equal to

$$dY(n) = (1 + \alpha + \alpha^2 + \cdots + \alpha^n)dE(0),$$

whence

$$(19) \quad \frac{dY(n)}{dE(0)} = \frac{1 - \alpha^{n+1}}{1 - \alpha} \quad (n \text{ integer}).$$

The left-hand side of this expression will be called the *truncated*<sup>19</sup> *dynamic multiplier* corresponding to the period of adjustment  $n$ . It measures the marginal effect of a change in the rate of spending upon the flow of national income  $n$  units of time hence. The *dynamic multiplier* will be defined as

$$(20) \quad \frac{dY}{dE(0)} = \lim_{n \rightarrow \infty} \frac{dY(n)}{dE(0)},$$

and measures the final marginal effect of a change in the rate of spending. It is finite if  $|\alpha| < 1$  and its value is, in this case,

$$(21) \quad \frac{dY}{dE(0)} = \frac{1}{1 - \alpha}.$$

In order to simplify the notation let us write  $y(t) = dY(t)$  and  $e(t) = dE(t)$ . The truncated dynamic multiplier (19) can then be interpreted as a special solution of the difference equation

$$(22) \quad y(t) = \alpha y(t-1) + e(t) \quad (t \text{ integer}).$$

This equation expresses the marginal increment in income at any moment of time as the additive result of (a) an induced increase in income caused by the increase in income  $y(t-1)$ , which took place one unit of time back, and (b) a simultaneous autonomous increase in spending  $e(t)$ . The solution of (22) can be obtained by superposition from solutions of the reduced equation

$$y(t) = \alpha y(t-1).$$

The special solution of the latter, corresponding to the initial condition  $y(s) = e(s)$ , is

<sup>19</sup> This term is due to Professor Samuelson. Cf. his article "A Fundamental Multiplier Identity," in this issue of *ECONOMETRICA*, pp. 221-226.

$$(23) \quad y_s(t) = \alpha^{t-s} e(s) \quad (s \text{ and } t \text{ integer}).$$

An initial *single* increase in spending  $e(s)$ , taking place at the moment  $s$ , produces at the moment  $t$  ( $t \geq s$ ) an increase in income indicated by (23). A set of autonomous increments in spending  $e(0), e(1), \dots, e(n)$ , taking place at the moments  $0, 1, \dots, n$ , respectively, produces thus at the moment  $t = n$  an increase in the flow of income equal to

$$(24) \quad y(n) = \sum_{s=0}^n \alpha^{n-s} e(s).$$

This is the desired solution of (22). If the autonomous increase in spending is constant, i.e.,  $e(0) = e(1) = \dots = e(n)$ , the solution obtained can be written as

$$(25) \quad y(n) = e(0) \sum_{t=0}^n \alpha^t.$$

If we put  $e(0) = 1$ ,  $y(n)$  becomes the truncated dynamic multiplier.

Suppose now that the rate of spending responds to a change in income with a distributed time-lag equal to  $1, 2, \dots, k$  units of time. Denote the marginal propensities to spend corresponding to the distributed time-lag by  $\alpha_1, \alpha_2, \dots, \alpha_k$ , respectively. For instance,  $\alpha_i$  is the marginal effect of a change in income upon the rate of spending  $i$  units of time hence ( $i$  is a positive integer). A change in income at the moment  $t$  is made up of the induced change resulting from changes in income at the moment  $t-1, t-2, \dots, t-k$ , and of an autonomous change in the rate of spending at the moment  $t$ . This relation is described by the difference equation

$$(26) \quad y(t) = \alpha_1 y(t-1) + \alpha_2 y(t-2) + \dots + \alpha_k y(t-k) + e(t).$$

The characteristic equation of this difference equation is

$$(27) \quad \lambda^k - \alpha_1 \lambda^{k-1} - \alpha_2 \lambda^{k-2} - \dots - \alpha_k = 0.$$

Let  $\lambda_1, \lambda_2, \dots, \lambda_r$  be the  $r$  different roots of (27) ( $r \leq k$ ) with multiplicities  $\nu_1, \nu_2, \dots, \nu_r$ , respectively ( $\nu_1 + \nu_2 + \dots + \nu_r = k$ ). The particular solutions of the reduced equation are then of the form

$$(28) \quad \lambda_i^t, t\lambda_i^t, \dots, t^{\nu_i-1}\lambda_i^t \quad (i = 1, 2, \dots, r)$$

and the general solution of the reduced equation is

$$\sum_{i=1}^r q_i(t) \lambda_i^t \quad (t = \text{positive integer}),$$

where the  $q_i(t)$  are polynomials of degree  $\nu_i - 1$ . Since only integer values of  $t$  are considered here, the coefficients of the polynomials are constant.

Consider the initial conditions  $y(s) = e(s)$ ,  $y(s-1) = y(s-2) = \dots = y(s-k+1) = 0$ . These conditions allow us to set up the  $k$  equations

$$(29) \quad \begin{cases} \sum_{i=1}^r q_i(0) = e(s), \\ \sum_{i=1}^r q_i(t-s)\lambda_i^{t-s} = 0 \quad (t = s-1, s-2, \dots, s-k+1), \end{cases}$$

which are linear in the coefficients ( $k$  in number) of the polynomials  $q_i(t-s)$  and which serve to determine the values of these coefficients.<sup>20</sup> Inspecting (29), we see that these values can be expressed as products of  $e(s)$ .<sup>21</sup> Taking this into account, we shall denote the polynomials with the values of their coefficients as determined from (29) by  $\bar{q}_i(t-s)e(s)$ . The special solution of the reduced equation conforming to the initial conditions is thus

$$(30) \quad y_s(t) = \sum_{i=1}^r \bar{q}_i(t-s)\lambda_i^{t-s}e(s) \quad (t \text{ and } s \text{ integer}).$$

It indicates the effect of a *single* increase in spending at the moment  $s$  upon the income at the moment  $t$  ( $t \geq s$ ).

The effect of a set of autonomous increments in spending  $e(0)$ ,  $e(1)$ ,  $\dots$ ,  $e(n)$ , taking place at the moments  $0$ ,  $1$ ,  $\dots$ ,  $n$ , respectively, upon the income at the moment  $t = n$  (where  $n \geq k$ ) is obtained from (30) by superposition. It is

$$(31) \quad y(n) = \sum_{s=0}^n \sum_{i=1}^r \bar{q}_i(n-s)\lambda_i^{n-s}e(s).$$

This is a solution of the complete equation (26). If  $e(0) = e(1) = \dots = e(n)$ , i.e., if the autonomous increase in the rate of spending is constant, (31) can be written as

$$(32) \quad y(n) = e(0) \sum_{t=0}^n \sum_{i=1}^r \bar{q}_i(t)\lambda_i^t.$$

If we put  $e(0) = 1$ , we find that  $y(n)$  is the value of the truncated dynamic multiplier, i.e.,

$$(33) \quad \frac{dY(n)}{dE(0)} = \sum_{i=1}^r \sum_{t=0}^n \bar{q}_i(t)\lambda_i^t$$

and that the value of the dynamic multiplier is

$$(34) \quad \frac{dY}{dE(0)} = \sum_{i=1}^r \sum_{t=0}^{\infty} \bar{q}_i(t)\lambda_i^t.$$

<sup>20</sup> Since (28) is a fundamental system of solutions the solving matrix of (29) is nonsingular.

<sup>21</sup> The determinant in the numerator of the solutions can be written as a product of  $e(s)$  and the corresponding cofactor.

The inner sum in (34) is a power series and the dynamic multiplier is finite when this series converges. The coefficients  $\bar{q}_i(t)$  of the power series being polynomials, we find<sup>22</sup>

$$\lim_{n \rightarrow \infty} \frac{q_i(t)}{q_i(t+1)} = 1 \quad (i = 1, 2, \dots, r).$$

The power series converges when<sup>23</sup>

$$(35) \quad |\lambda_i| < 1 \quad (i = 1, 2, \dots, r).$$

Thus the condition for a finite multiplier reduces to the well-known problem that the absolute values of the roots of a polynomial be less than unity.<sup>24</sup> If the  $\alpha$ 's are assumed to be not negative, it can be shown<sup>25</sup> that this condition is verified when and only when

$$(36) \quad \sum_{i=1}^k \alpha_i < 1.$$

#### CONTINUOUS DYNAMIC MULTIPLIERS

When the time-lag of the response of the rate of spending to a change in income is distributed continuously over the closed interval of time  $[0, k]$  the marginal propensity to spend after  $\tau$  units of time (counting

<sup>22</sup> This follows immediately by repeated application of de l'Hospital's rule.

<sup>23</sup> For real roots  $|\lambda_i|$  is the absolute value, for complex roots the modulus of the root.

<sup>24</sup> Cf. Paul A. Samuelson, "Conditions that the Roots of a Polynomial be Less than Unity in Absolute Value," *The Annals of Mathematical Statistics*, Vol. 12, September, 1941, pp. 360-364.

<sup>25</sup> The necessity of (36) is established in the following way. Suppose  $\sum_{i=1}^k \alpha_i = 1$ . In this case the characteristic equation

$$F(\lambda) = \lambda^k - \sum_{i=1}^k \alpha_i \lambda^{k-i} = 0$$

has a root  $\lambda = 1$ . If  $\sum_{i=1}^k \alpha_i > 1$  then  $F(1) < 0$ . But  $F(\lambda)$  is a continuous function of  $\lambda$  with  $\lim_{\lambda \rightarrow \infty} F(\lambda) = +\infty$ . Thus there exists a root  $\lambda > 1$ . In order to establish the sufficiency of (36) write  $\lambda = r e^{\sqrt{-1}s}$ . We have

$$r^k e^{\sqrt{-1}ks} = \sum_{i=1}^k \alpha_i r^{k-i} e^{\sqrt{-1}(k-i)s},$$

whence

$$r^k = \left| \sum_{i=1}^k \alpha_i r^{k-i} e^{\sqrt{-1}(k-i)s} \right| \leq \sum_{i=1}^k \alpha_i |r^{k-i} e^{\sqrt{-1}(k-i)s}|.$$

Supposing  $r \geq 1$ , we get

$$r^k \leq r^{k-1} \sum_{i=1}^k \alpha_i < r^{k-1}$$

which contradicts the supposition. Consequently,  $r = |\lambda| < 1$ . This is an adaptation of the proof given by A. Smithies, "The Stability of Competitive Equilibrium," *ECONOMETRICA*, Vol. 10, July-October, 1942, p. 269.

from the change in income) is  $\alpha(\tau)$ , a continuous function of time. Instead of the difference equation (26) we obtain the integral equation

$$(37) \quad y(t) = e(t) + \int_0^k y(t - \tau)\alpha(\tau)d\tau \quad (t \text{ and } \tau \text{ real}).$$

This is the well-known equation of hereditary phenomena.<sup>26</sup> By a suitable change of variables it can be transformed into the integral equation of the "closed cycle," which is readily solved.<sup>27</sup> For our purpose, however, it is most instructive to consider a procedure of solving analogous to that which we have adopted in solving the difference equation (26).

Consider the reduced equation

$$y(t) = \int_0^k y(t - \tau)\alpha(\tau)d\tau.$$

By means of trial substitution we find that this equation has the particular solutions (fundamental functions)

$$e^{\mu_1 t}, e^{\mu_2 t}, \dots,$$

where the  $\mu$ 's are simple roots of the characteristic equation

$$(38) \quad f(\mu) = \int_0^k e^{-\mu\tau}\alpha(\tau)d\tau = 1.$$

If multiple roots occur, the particular solutions are

$$(39) \quad e^{\mu_i t}, t e^{\mu_i t}, \dots, t^{\nu_i - 1} e^{\mu_i t} \quad (i = 1, 2, \dots),$$

$\nu_i$  being the multiplicity of the root  $\mu_i$ .<sup>28</sup> The roots of the characteristic equation form an enumerable set. As a rule there is an infinite number of distinct roots.<sup>29</sup> The general solution of the reduced equation is, therefore, given by the infinite series

<sup>26</sup> Cf. Vito Volterra, *Leçons sur la théorie mathématique de la lutte pour la vie*, Paris, Gauthier-Villars, 1931, pp. 148 seq.

<sup>27</sup> Cf. Harold T. Davis, *The Theory of Linear Operators*, Bloomington, Indiana, The Principia Press, 1936, p. 484.

<sup>28</sup> The root  $\mu_i$  of the transcendental equation  $f(\mu) = 1$  is defined as being of multiplicity  $\nu_i$  if  $f'(\mu_i) = f''(\mu_i) = \dots = f^{(\nu_i - 1)}(\mu_i) = 0$  and  $f^{(\nu_i)}(\mu_i) \neq 0$ . We have

$$f^{(n)}(\mu) = (-1)^n \int_0^k \tau^n e^{-\mu\tau} \alpha(\tau) d\tau.$$

By virtue of this relation we can verify by substitution that (39) are solutions of the reduced equation.

<sup>29</sup> The roots form an enumerable set because  $f(\mu)$  is an entire analytic function not constant. At  $\mu = \infty$  this function has an essential singularity. According to Picard's theorem the equation  $f(\mu) = c$  has then an infinite number of roots in

$$(40) \quad \sum_{i=1}^{\infty} q_i(t)e^{\mu_i t},$$

where the  $q_i(t)$  are polynomials of degree  $\nu_i - 1$ . We shall assume that  $\alpha(\tau)$  is such that this series converges uniformly.<sup>30</sup>

The values of the coefficients of the polynomials are determined by the initial conditions  $y(s) = e(s)$  and  $y(t) = 0$  for  $s - k \leq t < s$ . Let us write the polynomials with coefficients thus determined in the form  $\bar{q}_i(t - s)e(s)$ . The special solution of the reduced equation conforming to the initial conditions is then

$$(41) \quad y_s(t) = \sum_{i=1}^{\infty} \bar{q}_i(t - s)\lambda_i^{t-s}e(s),$$

where  $\lambda_i = e^{\mu_i}$ . This solution gives the effect of a *momentary* increase in spending at the moment  $s$  upon the income at the moment  $t$  ( $t \geq s$ ).

The effect of a continuous increase in spending, following the time-pattern  $e(t)$ , upon the income at the moment  $t = n$  ( $n \geq k$ ) is given by superposition of the results (41). It is

$$(42) \quad y(n) = \int_0^n \sum_{i=1}^{\infty} \bar{q}_i(n - s)\lambda_i^{n-s}e(s)ds.$$

If  $e(s) = e(0)$  for  $0 \leq s \leq n$ , this reduces to

$$(43) \quad y(n) = e(0) \int_0^n \sum_{i=1}^{\infty} \bar{q}_i(t)\lambda_i^t dt.$$

When  $e(0) = 1$ ,  $y(n)$  is the value of the truncated dynamic multiplier

$$(44) \quad \frac{dY(n)}{dE(0)} = \int_0^n \sum_{i=1}^{\infty} \bar{q}_i(t)\lambda_i^t dt$$

the neighborhood of  $\mu = \infty$ , except for at most one single value of  $c$ . Unless  $c = 1$  is this exceptional value, the characteristic equation has an infinite number of roots. In the special case, in which  $c = 1$  turns out to be the exceptional value, there are no roots in the neighborhood of  $\mu = \infty$ . All the roots are then contained in some bounded region and their number must be finite. In this special case the series (40) becomes finite.

<sup>30</sup> The present writer has been unable to ascertain the exact conditions which  $\alpha(\tau)$  must satisfy in order to assure the convergence of this series. For any given value of  $t$  the  $q_i(t)$  in (40) reduce to constants and all their partial sums are bounded. The series thus converges (by Dirichlet's test) absolutely if the real parts of the roots  $\mu_i$  can be ordered in a monotone sequence  $R(\mu_i) \rightarrow -\infty$ . For in this case  $|e^{\mu_i t}| = e^{R(\mu_i)t} \rightarrow 0$  monotonically for any  $t > 0$ . Since the absolute convergence, if established, holds for any  $t > 0$ , it can be shown to be uniform. In the exceptional case in which the number of roots is finite the convergence is, of course, trivial.

and the value of the dynamic multiplier is

$$(45) \quad \frac{dY}{dE(0)} = \int_0^{\infty} \sum_{i=1}^{\infty} \bar{q}_i(t) \lambda_i t dt.$$

If integrated by terms, (45) can be written in the form

$$\sum_{i=1}^{\infty} \int_0^{\infty} \bar{q}_i(t) \lambda_i dt.$$

This expression is finite when the integral converges. Since  $\bar{q}_i(t)$  is a polynomial, this happens when

$$(46) \quad |\lambda_i| < 1 \quad (i = 1, 2, \dots).$$

It can be shown<sup>31</sup> that, if  $\alpha(\tau)$  is not negative (as we assume to be the case), the necessary and sufficient condition for this inequality to hold is

$$(47) \quad \int_0^k \alpha(\tau) d\tau < 1.$$

#### CUMULATED MULTIPLIERS

The dynamic multipliers discussed measure the effect of a *permanent* change in the rate of spending upon the flow of national income some (finite or infinite) time hence. They measure the effect of a permanent change of one rate of flow upon another rate of flow and may be designated as *horizontal*<sup>32</sup> multipliers. In addition to these we have *cumulated*<sup>32</sup> multipliers, which measure the sum, over any period of time, of all the marginal increments of income generated by a *single dose* of additional spending made in the first interval of time.

A single dose of spending, extending over the interval of time  $[0, 1]$  or  $\Delta t \rightarrow 0$ , respectively, at the rate  $e(0)$  per unit of time, produces in the  $t$ th unit of time an increment in income as indicated by (30) or (41), respectively, i.e.,

$$(48) \quad y_0(t) = e(0) \sum_{i=1}^r \bar{q}_i(t) \lambda_i t, \quad \text{or} \quad y_0(t) = e(0) \sum_{i=1}^{\infty} \bar{q}_i(t) \lambda_i t \Delta t.$$

The sum of all these increments over the period  $[0, n]$  is

$$(49) \quad e(0) \sum_{t=0}^n \sum_{i=1}^r \bar{q}_i(t) \lambda_i t, \quad \text{or} \quad e(0) \int_0^n \sum_{i=1}^{\infty} \bar{q}_i(t) \lambda_i t dt.$$

<sup>31</sup> The proof is similar to that in the finite case given in footnote 25 above, integration being substituted for summation.

<sup>32</sup> These terms are due to Professor Samuelson. Cf. "A Fundamental Multiplier Identity," in this issue of *ECONOMETRICA*.



If we set  $e(0) = 1$ , this expression gives the value of the cumulated truncated multiplier. But (49) is identical with (32), or (43). Thus the cumulated truncated multiplier equals identically the horizontal truncated multiplier. Consequently, the cumulated multiplier, too, is identically equal to the horizontal multiplier.<sup>33</sup>

*Cowles Commission for Research in Economics*  
*The University of Chicago*

<sup>33</sup> The identity of the cumulated and horizontal multipliers (as well as of the corresponding truncated multipliers) has been proved by Professor Samuelson, "A Fundamental Multiplier Identity," pp. 222-223. In the case of a simple timelag it was known already to Professor Clark. See *op. cit.*, pp. 90-91. Cf. also Haberler, *op. cit.*, p. 458.

# On the Economic Theory of Socialism<sup>1</sup>

## PART ONE

1. The present state of the debate
2. The determination of equilibrium on a competitive market
3. The trial and error procedure in a socialist economy
4. A generalisation of the preceding theory

## PART TWO

5. The economist's case for socialism
  6. On the policy of transition
- Appendix : The allocation of resources under socialism in Marxist literature

## PART ONE

### I. THE PRESENT STATE OF THE DEBATE

SOCIALISTS have certainly good reason to be grateful to Professor Mises, the great *advocatus diaboli* of their cause. For it was his powerful challenge that forced the socialists to recognise the importance of an adequate system of economic accounting to guide the allocation of resources in a socialist economy. Even more, it was chiefly due to Professor Mises' challenge that many socialists became aware of the very existence of such a problem. And although Professor Mises was not the first to raise it, and although not all socialists were as completely unaware of the problem as is frequently held, it is true, nevertheless, that, particularly on the European Continent (outside of Italy), the merit of having caused the socialists to approach this problem systematically belongs entirely to Professor Mises. Both as an expression of recognition for the great service rendered by him and as a memento of the prime importance of sound economic accounting, a statue of Professor Mises ought to occupy an honourable place in the great hall of the Ministry of Socialisation or of the Central Planning Board of the socialist state. However, I am afraid that Professor Mises would scarcely enjoy what seems the only adequate way to repay the debt of recognition incurred by the socialists, and it is difficult to blame him for not doing so. First, he might have to share his place with the great leaders of the socialist movement, and this company might not suit him. And then, to complete the misfortune, a socialist teacher might invite his students in a class on dialectical materialism to go and look at the statue, in order to exemplify the Hegelian *List der Vernunft* which made even the staunchest of *bourgeois* economists unwittingly serve the proletarian cause.

Since the clear and distinct formulation of a problem is certainly a major contribution to science, the economist will have to join the socialists in their recognition of Professor Mises' work on economic calculation in a socialist

<sup>1</sup> As published originally by *The Review of Economic Studies*, No. 1, 1936 and No. 2, 1937.

A revised version was published, together with an article by the late Fred M. Taylor, and with an Introduction by Benjamin Lippincott, by the University of Minnesota Press, 1938. Substantial changes in the original text are listed by Lange in his reply to Aba P. Lerner's 'Note on Socialist Economics' (reprinted in this volume). It explains why the model of market socialism presented here is sometimes called the 'Lange-Lerner solution' or the 'Lange-Lerner mechanism'.

economy. As Professor Hayek has put it: to Professor Mises belongs "the distinction of having first formulated the central problem of socialist economics in such a form as to make it impossible that it should ever again disappear from the discussion."<sup>1</sup> But, unfortunately, besides formulating the problem, Professor Mises has also claimed to have demonstrated that economic calculation is impossible in a socialist society. The economist will scarcely find it possible to accept this claim. From the economist's point of view, he would have done better to confine himself to the formulation of the problem, as Pierson did; though, if he would have done so, he probably would not have merited the great recognition of the socialists. For it was exactly Professor Mises' denial of the possibility of economic accounting under socialism that provided his challenge with such force and power. Thus the socialist and the economist will view the achievement of Professor Mises differently: a strange instance of the divergence of their opinions, which, as Professor Mises thinks, must be always the rule. A solution of the problem, different from that advanced by Professor Mises, was suggested by Pareto as early as 1897<sup>2</sup> and was later elaborated by Barone.<sup>3</sup> The further discussion of the problem, with one exception, which will be mentioned later, has scarcely gone beyond what is contained already in Barone's paper.

Professor Mises' contention that a socialist economy cannot solve the problem of rational allocation of its resources is based on a confusion concerning the nature of prices. As Wicksteed has pointed out, the term price has two meanings. It may mean either price in the ordinary sense, i.e. the exchange ratio of two commodities on a market, or it may have the generalised meaning of "terms on which alternatives are offered." "'Price,' then,—says Wicksteed—in the narrower sense of 'the money for which a material thing, a service, or a privilege can be obtained,' is simply a special case of 'price' in the wider sense of 'the terms on which alternatives are offered to us.'"<sup>4</sup> It is only "prices" in the generalised sense which are indispensable to solve the problem of allocation of resources. The economic problem is a problem of choice between different alternatives. To solve the problem three data are needed: (1) a preference scale which guides the activity of choice, (2) knowledge of the "terms on which alternatives are offered," and, finally, (3) knowledge of the amount of resources available. Those three data given, the problem of choice is soluble. Now it is obvious that a socialist economy may

<sup>1</sup> *Collectivist Economic Planning*, London, 1935. *Vide* Professor Hayek's introduction, p. 32.

<sup>2</sup> *Cours d'économie politique*, vol. II, Lausanne, 1897. p. 364 et seq. Cf. also *Manuel d'économie politique*, Paris, 1910. p. 362-4.

<sup>3</sup> "Il ministero della produzione nello stato collettivista," *Giornale degli Economisti*, 1908. This paper has been published in English as an appendix to the volume on *Collectivist Economic Planning* edited by Professor Hayek. A very lucid exposition of the problem and its solution in a non-mathematical form has been given by Dickinson, "Price Formation in a Socialist Community," *Economic Journal*, June, 1933. Cf. also Heimann, *Sozialistische Wirtschafts- und Arbeitsordnung*, Potsdam, 1932; Zassenhaus, "Ueber die oekonomische Theorie der Planwirtschaft," *Zeitschrift fuer Nationaloekonomie*, Bd. V, 1934; and Knight, "The Place of Marginal Economics in a Collectivist System," *American Economic Review Supplement*, March, 1936.

<sup>4</sup> *The Common Sense of Political Economy*, 2nd ed., London, 1933. p. 28. Similarly Professor Schumpeter has stated that the term "exchange ratio" may be used in a wider sense to indicate the alternatives available, so that production may be regarded as an "exchange" *sui generis*. Cf. *Das Wesen und der Hauptinhalt der theoretischen Nationaloekonomie*, Leipzig, 1908. p. 50 et seq.

regard the data under (1) and (3) as given, at least in the degree in which they are given in the capitalist economy. The data under (1) may be given either by the demand schedules of the individuals, or be established by the judgment of the authorities administering the economic system. The question remains whether the data under (2) are accessible to the administrators of a socialist economy. Professor Mises denies this. However, a careful study of price theory and of the theory of production convinces us that, the data under (1) and under (3) being given, the "terms on which alternatives are given" are determined ultimately by the technical possibilities of transformation of one commodity into another, i.e. by the production functions. The administrators of a socialist economy will have exactly the same knowledge, or lack of knowledge, of the production functions as the capitalist entrepreneurs have. But Professor Mises seems to have confused prices in the narrower sense, i.e. the exchange ratios of commodities on a market, with prices in the wider sense of "terms on which alternatives are offered." As, in consequence of public ownership of the means of production, there is in a socialist economy no market on which capital goods are actually exchanged there are obviously no prices of capital goods in the sense of exchange ratios on a market. And, hence, Professor Mises argues, there is no "index of alternatives" available in the sphere of capital goods. But this conclusion is based on a confusion of "price" in the narrower sense with "price" in the wider sense of an index of alternatives. It is only in the latter sense that "prices" are indispensable for the allocation of resources, and on the basis of the technical possibilities of transformation of one commodity into another they are also given in a socialist economy.

Professor Mises argues that private ownership of the means of production is indispensable for a rational allocation of resources. As, according to him, without private ownership of the means of production no determinate index of alternatives exists (at least in the sphere of capital goods), the economic principles of choice between different alternatives are applicable only to a special institutional set-up, i.e. to a society which recognises private ownership of the means of production. It has been maintained, indeed, by Marx<sup>1</sup> and by the historical school (in so far as the latter recognised any economic laws at all), that all economic laws have only historico-relative validity. But it is most surprising to find this institutionalist view supported by a prominent member of the Austrian school,<sup>2</sup> which did so much to emphasise the universal validity of the fundamental principles of economic theory.

Thus Professor Mises' denial of the possibility of economic calculation in a socialist system must be rejected. However, Professor Mises' argument has been taken up recently in a more refined form by Professor Hayek and

<sup>1</sup> With regard to Marx this statement requires certain qualifications. Cf. the Appendix.

<sup>2</sup> I am, of course, perfectly aware that Professor Mises does not regard himself as an institutionalist and that he has stated explicitly the universal validity of economic theory (cf. *Grundprobleme der Nationalökonomie*, Jena, 1933, pp. 27-26). But there is a spectacular contradiction between this statement and his assertion that private ownership of the means of production is indispensable for a rational allocation of resources. For if this assertion is true, economics as the theory of allocation of resources is applicable only to a society with private ownership of the means of production. The implications of the denial of the possibility of rational choice in a socialist economy are plainly institutionalist.

Professor Robbins. They do not deny the *theoretical* possibility of a rational allocation of resources in a socialist economy, they only doubt the possibility of a satisfactory *practical* solution of the problem. Discussing the solution offered by Barone, Dickinson, and others, Professor Hayek says that: "it must be admitted that this is not an impossibility in the sense that it is logically contradictory."<sup>1</sup> But he denies that the problem is capable of a practical solution in a society without private ownership of the means of production.<sup>2</sup> The issue has been put very clearly by Professor Robbins. "On paper," he says "we can conceive this problem to be solved by a series of mathematical calculations. . . . But in practice this solution is quite unworkable. It would necessitate the drawing up of millions of equations on the basis of millions of statistical data based on many more millions of individual computations. By the time the equations were solved, the information on which they were based would have become obsolete and they would need to be calculated anew. The suggestion that a practical solution of the problem of planning is possible on the basis of the Paretian equations simply indicates that those who put it forward have not grasped what these equations mean."<sup>3</sup> Thus Professor Hayek and Professor Robbins have given up the essential point of Professor Mises' position and retreated to a second line of defence. On principle, they admit, the problem is soluble, but it is to be doubted whether in a socialist community it can be solved by a simple method of *trial and error*, as it is solved in the capitalist economy. The significance of the private ownership of the means of production and of an actual market for capital goods has shifted. Theoretically prices in the generalised sense of "terms on which alternatives are offered" are admitted to be given also without an actual market. The function of the market is, according to them, a different one, namely, to provide a method of allocating resources by trial and error. And it is this latter possibility a socialist economy would be deprived of.

The position taken by Professor Hayek and by Professor Robbins is a significant step forward in the discussion of the problem. It promises a much more fruitful approach than Professor Mises' wholesale denial of the possibility of economic accounting under socialism. Whether by having taken this step they, too, will merit an honourable statue, or at least a memorial tablet, in the building of the Ministry of Socialisation or of the Central Planning Board is yet to be seen. The great importance of the problem makes it quite possible. Already Barone has pointed to the fact that the equations of economic equilibrium must be solved also in a socialist society by trial and error.<sup>4</sup> He regarded such a solution as possible but failed to indicate how it would be done. However, the way in which a socialist economy would solve the problem by a method of trial and error has been indicated quite clearly by Fred M. Taylor in a paper published in 1929.<sup>5</sup> This paper provides in substance the answer to Professor

<sup>1</sup> *Collectivist Economic Planning*, p. 207.

<sup>2</sup> *Ibidem*, p. 208 et seq.

<sup>3</sup> *The Great Depression*, London, 1934, p. 151.

<sup>4</sup> See: "The Ministry of Production in the Collectivist State," reprinted in *Collectivist Economic Planning*, pp. 286-9.

<sup>5</sup> "The Guidance of Production in a Socialist State," the *American Economic Review*, March, 1929. Cf. particularly pp. 6-8. Unfortunately, Professor Hayek seems not to have read this

Hayek's and Professor Robbins' argument, and it is the first contribution which really goes beyond what is contained in Barone's paper. But the great importance of their argument necessitates a more detailed investigation of the problem. It is, therefore, the purpose of the present paper to elucidate the way in which the allocation of resources is effected by trial and error on a competitive market and to find out whether a similar trial and error procedure is not possible in a socialist economy.

## 2. THE DETERMINATION OF EQUILIBRIUM ON A COMPETITIVE MARKET

Let us see how economic equilibrium is established by trial and error on a competitive market. By a competitive market we mean a market in which : (1) the number of individuals is so great that no one can influence prices appreciably by varying his demand or supply and, therefore, is forced to regard prices as constant parameters independent of his behaviour ; (2) there is free entry into and exodus from each trade or industry.

The conditions of equilibrium are twofold : (A) all individuals participating in the economic system must attain their maximum positions on the basis of equilibrium prices, and (B) the equilibrium prices are determined by the condition that the demand for each commodity is equal to its supply. We may call the first the *subjective* and the latter the *objective* conditions. However, these two conditions do not determine equilibrium unless there is added a third condition which expresses the social organisation of the economic system. In our case this condition states that : (C) the incomes of the consumers are equal to their receipts from selling the services of the productive resources they own. This condition is no equilibrium condition in the strict sense, for it holds independently of whether the economic system is in equilibrium or not. Notwithstanding, it is necessary to make equilibrium determinate. Let us call these three conditions A, B, and C, respectively, A and B being the equilibrium conditions *sensu stricto*.

A. The subjective conditions of equilibrium are carried out by the individuals<sup>1</sup> maximising their utility, profit, or income from the ownership of productive resources :

(1) The consumers maximise the total utility they derive from their income by spending it so that the marginal utility of the amount obtainable for a unit of income (expressed in money) is equal for all commodities. Their incomes and the prices being given (the latter are necessary to determine what is the amount of a commodity obtainable for a unit of income) the demand for consumers' goods is determined.

paper, which has so much bearing on his argument, though he quotes it. He quotes it as one of the theoretical solutions alongside of that of Barone, Dickinson, etc., whereas Taylor indicates a solution by trial and error. It is also to be regretted that this paper, which is the only step forward since the treatment of the problem by Barone, has not been reprinted in the volume on *Collectivist Economic Planning*.

<sup>1</sup> The term "individual" is used here in the broad connotation of *Wirtschaftssubjekt* so as to include also collective units (family households, joint-stock companies, for instance).

(2) The producers (in attempting to maximise their profit) minimise their average cost of production.<sup>1</sup> The process of minimising the average cost of production is composed of two parts: (a) the determination of the optimum combination of factors, and (b) the determination of the optimum scale of output. The first is attained by combining the factors of productions in such proportion as to equalise the marginal productivity of the amount of each factor which can be purchased for a unit of money.<sup>2</sup> The prices of the factors being given, so that it is possible to determine what is the amount of each factor obtainable for a unit of money, this condition determines the minimum cost curve of the producer. The optimum scale of output is determined by two conditions, each resulting from a different property of the competitive market. First, the marginal cost has to be equal to the price of the product (which is given on the market) and, second, the average cost has also to be equal to the price of the product. The first results from the producer's aiming to maximise his profit while the price of the product is practically independent of the scale of his output (because of the great number of competing producers), and determines the output of the single producer, the second results from the free entry of producers into or exodus from any industry, and determines the output of the whole industry. Thus, the prices of the products and of the factors being given, the supply of products and the demand for factors is determined.

(3) The owners of the ultimate productive resources (labour, capital, and natural resources) maximise their income by selling services of resources to the highest bidder. The prices of services of resources being given, their distribution between the different industries is determined.<sup>3</sup>

B. The subjective conditions of equilibrium can be carried out only on the basis of a *given* set of prices and of consumers' incomes. The prices are regarded by the individuals as constants independent of their behaviour. For each set of prices and of consumers' incomes we get different quantities of

<sup>1</sup> By average cost the average cost per unit of output is meant throughout this paper.

<sup>2</sup> This statement has to be corrected if limitational factors are used in production. There are two kinds of limitational factors, according as to whether the amount of the limitational factor which must be used in production is a function of the quantity of product we wish to obtain, or of the amount of another factor used. If limitational factors of the first kind are used the statement in the text holds for the substitutional factors, the amount of limitational factors necessary being determined by the scale of output chosen. If limitational factors of the second kind are used the marginal productivity of the substitutional factors must be proportional to their prices *plus* the marginal expenditure for the limitational factors which are a function of the substitutional factor in question; the amount of the limitational factors necessary is then determined by the amount of the substitutional factors used. As to limitational factors of the first kind, cf. Georgescu-Roegen, "Fixed Coefficients of Production and the Marginal Productivity Theory," *REVIEW OF ECONOMIC STUDIES*, October, 1935. Dr. Tord Palander has drawn my attention to the existence of the second kind of limitational factors.

<sup>3</sup> In order to simplify the exposition we disregard the fact that the amount of the resources available, instead of being constant, may depend on their price. Thus the total supply of labour may be a function of the wage-rate. As to capital, its amount may be regarded in the short period as constant, whereas in the long run the rate of interest certainly affects saving. In long-period equilibrium the amount of capital is determined by the condition that the rate of its marginal *net* productivity (i.e. the interest rate) is equal to the time preference of the individuals (which may be, and probably is, zero). See my paper "The Place of Interest in the Theory of Production," *REVIEW OF ECONOMIC STUDIES*, June, 1936., cf. also Knight, "Professor Fisher's Theory of Interest," *Journal of Political Economy*, April, 1931, p. 197 et seq., and Hayek, "Utility Analysis and Interest," the *Economic Journal*, March, 1936, pp. 58-60.

commodities demanded and supplied. Condition C states that the incomes of the consumers are equal to their receipts from selling the services of the ultimate productive resources they own.<sup>1</sup> In virtue of this condition incomes of consumers are determined by prices of the services of ultimate productive resources, so that, finally, prices alone remain as the variables determining demand and supply of commodities. By assuming different sets of prices we obtain the demand and supply schedules. Now, the objective conditions of equilibrium serve to pick out a special set of prices as the only one which assures the compatibility of the subjective maximum positions of all individuals participating in the economic system. These conditions mean that the demand and the supply of each commodity has to be equal. Prices which satisfy these conditions are the equilibrium prices. If the demand and supply schedules are all monotonic functions there exists only one set of prices which satisfies the objective equilibrium condition; otherwise, there may be a multiple solution, but some of the price sets obtained represent unstable equilibria.<sup>2</sup>

Such is the theoretical solution of the problem of equilibrium on a competitive market. Now let us see how the problem is solved actually by *trial and error*. The solution by trial and error is based on what may be called the *parametric function of prices*, i.e. on the fact that, although the prices are a resultant of the behaviour of all individuals on the market, each individual separately regards the actual market prices as given data to which he has to adjust himself. Each individual tries to exploit the market situation confronting him which he cannot control. Market prices are thus parameters determining the behaviour of the individuals. The equilibrium value of these parameters is determined by the objective equilibrium conditions B. As Walras has so brilliantly shown<sup>3</sup> this is done by a series of successive trials (*tâtonnements*).

Let us start with a set of prices given *at random* (for instance, by drawing numbers from an urn). On the basis of this *random* set of prices (Walras's *prix criés par hasard*) the individuals fulfil their subjective equilibrium conditions and attain their maximum positions. For each commodity a quantity demanded and a quantity supplied is established. Now the objective equilibrium conditions come into play. If the quantity demanded and the quantity supplied of each commodity happen to be equal the entire situation is settled and the prices are the equilibrium prices. If, however, the quantities demanded and the quantities supplied diverge, the competition of the buyers and sellers will alter the prices. Prices of those commodities the demand for which exceeds the supply rise while the prices of the commodities where the reverse is the case fall. As a result we get a *new* set of prices which serves as a new

<sup>1</sup> During periods of transition from one equilibrium to another also entrepreneurs' profits have to be added to the right-hand side of this equality.

<sup>2</sup> If the demand and supply schedules are not monotonic functions the first must have an increasing and the latter must have a decreasing branch. Demand can be an increasing function of price in the case of competing commodities and, as Walras has shown, supply can be a decreasing function of price when the commodity in question has a personal utility for the seller. If either demand is an increasing or supply is a decreasing function of price there may be a multiple solution even if those functions are monotonic. However, these are quite exceptional cases.

<sup>3</sup> Cf. *Elements d'économie politique pure*, éd. définitive, Paris, 1926, pp. 65, 132-3, 214-15, 217 et seq., 259-60, 261 et seq.



basis for the individuals striving to satisfy their subjective equilibrium conditions. The subjective equilibrium conditions being carried out, we get a new set of quantities demanded and supplied. If demand and supply are not equal for each commodity, prices change again and we have *another* set of prices which now again serves as a basis for the individuals rearranging their choices; and thus we get a new set of quantities demanded and supplied. And so the process goes on until the objective equilibrium conditions are satisfied and equilibrium finally reached.<sup>1</sup> Actually it is the *historically given* prices which serve as a basis for the process of successive trials.

We have to apologise to the reader for having occupied his attention with this textbook exposition of the elements of the theory of economic equilibrium. But the very fact that the possibility of determining prices (in the wider sense of "terms on which alternatives are offered") in a socialist economy has been denied seems to indicate that the meaning of these elements has not been fully grasped. Now let us see whether a similar method of trial and error cannot be applied in a socialist economy.

### 3. THE TRIAL AND ERROR PROCEDURE IN A SOCIALIST ECONOMY

In order to discuss the method of allocating resources in a socialist economy we have to state what kind of socialist society we have in mind. The fact of public ownership of the means of production does not in itself determine the system of distributing consumers' goods and of allocating people to various occupations, nor the principles guiding the production of commodities. Let us now assume that freedom of choice in consumption and freedom of choice of occupation is maintained and that the preferences of consumers, as expressed by their demand prices, are the guiding criteria in production and in the allocation of resources. Later we shall pass to the study of a more centralised socialist system.<sup>2</sup>

In the socialist system as described we have a genuine market (in the institutional sense of the word) for consumers' goods and for the services of

<sup>1</sup> Thus each successive set of prices is nearer to satisfying the objective equilibrium conditions than the preceding one. However, as a change of the quantity supplied generally requires a period of time some qualification must be made. In industries where changes of output can be effected in a more or less continuous way, by varying some factors of production and leaving the others unchanged, and by extending, as time goes on, the number of factors which are made variable, the process of adaptation is determined by a family of short-period supply (and cost) curves. With this type of adaptation, which may be called the Marshallian, each successive price is nearer to the equilibrium price. But where output can be varied only by jerks, as in the case of crops, the mechanism described by the cobweb theorem comes into action and successive trials approach equilibrium only under special conditions. However, the Marshallian type of adaptation of supply seems to be the dominant one. Cf. on this point my paper "Formen der Angebotsanpassung und wirtschaftliches Gleichgewicht," *Zeitschrift fuer Nationaloekonomie*, Bd. VI, Heft 3, 1935.

<sup>2</sup> In pre-War literature the terms socialism and collectivism were used to designate a socialist system as described above, and the word communism was used to denote more centralised systems. The classical definition of socialism (and of collectivism) was that of a system which socialises production alone while communism was defined as socialising both production and consumption. At present these words have become political terms with special connotations.

labour. But there is no market for capital goods and productive resources outside of labour.<sup>1</sup> The prices of capital goods and productive resources outside of labour are thus prices in the generalised sense, i.e. mere indices of alternatives available, fixed for accounting purposes. Let us see how economic equilibrium is determined in such a system. Just as in a competitive individualist régime, the determination of equilibrium consists of two parts. (A) On the basis of *given* indices of alternatives (which are market prices in the case of consumers' goods and of the services of labour and accounting prices in all other cases) both the individuals participating in the economic system as consumers and as owners of the services of labour, and the managers of production and of the ultimate resources outside of labour (i.e. of capital and of natural resources) make decisions according to certain principles. These managers are assumed to be public officials. (B) The prices (whether market or accounting) are determined by the condition that the quantity demanded of each commodity is equal to the quantity supplied. The conditions determining the decisions under (A) are the *subjective* while those under (B) are the *objective* equilibrium conditions. Finally, we have also a condition C expressing the social organisation of the economic system. As the productive resources outside of labour are public property, the incomes of the consumers are divorced from the ownership of those resources and the form of condition C is determined by the principles of income formation adopted. The possibility of determining condition C in different ways gives to a socialist society a considerable freedom in matters of distribution of income. But the necessity of maintaining freedom of the choice of occupation limits the arbitrary use of this freedom, for there must be some connection between the income of a consumer and the services of labour performed by him. It seems, therefore, convenient to regard the income of consumers as being composed of two parts: one part being the receipts for the labour services performed and the other part being a social dividend constituting the individual's share in the income derived from the capital and the natural resources owned by society. We assume that the distribution of the social dividend is based on certain principles, reserving the content of those principles for later discussion. Thus condition C is determinate and determines the incomes of the consumers in terms of prices of the services of labour and social dividend, which, in turn, may be regarded as determined by the total yield of capital and of the natural resources and by the principles adopted in distributing this yield.<sup>2</sup>

A. Let us consider the subjective equilibrium conditions in a socialist economy:

(1) Freedom of choice in consumption being assumed,<sup>3</sup> the subjective

<sup>1</sup> To simplify the problem we assume that all means of production are public property. Needless to say, in any actual socialist community there must be a large number of means of production privately owned (e.g. by peasants, artisans, and small-scale entrepreneurs). But this does not introduce any new theoretical problem.

<sup>2</sup> In formulating condition C capital accumulation has to be taken into account. Capital accumulation may be done either "corporately" by deducting a certain part of the national income before the social dividend is distributed, or it may be left to the savings of individuals, or both methods may be combined. But "corporate" accumulation must certainly be the dominant form of capital formation in a socialist economy.

<sup>3</sup> Of course, there may be also a sector of socialised consumption the cost of which is met by

equilibrium conditions of a competitive market apply also to the market of consumers' goods in a socialist economy. The incomes of the consumers and the prices of consumers' goods being given, the demand for consumers' goods is determined.

(2) The decisions of the managers of production are no longer guided by the aim to maximise profit. Instead, there are certain rules imposed on them by the Central Planning Board which aim at satisfying consumers' preferences in the best way possible. One rule must impose on each production plant the choice of the combination of factors of production and the scale of output which minimises the average cost of production. The output of the whole industry must be determined by the rule to produce exactly as much of a commodity, no more nor less, than can be sold to consumers or "accounted for" to other industries at a price which equals the average cost of production. The first rule replaces the private producer's aiming to maximise his profit, while the prices of factors and of the product are independent of the amount of each factor used and of the scale of output. This rule leads to the factors being combined in such proportion that the marginal productivity of that amount of each factor which is worth a unit of money is the same for all factors,<sup>1</sup> and further, to the scale of output of a plant being such as to equalise marginal cost and the price of the product. The second rule replaces the free entry of firms into an industry or their exodus from it. This leads to an equality of average cost and the price of the product. Both rules together determine the number of plants in each industry. To enable the managers of production to follow these rules the prices of the factors and of the products must be given. In the case of consumers' goods and services of labour they are determined on a market, in all other cases they are fixed by the Central Planning Board. Those prices being given, the supply of products and the demand for factors are determined.

The reasons for adopting the two rules mentioned are obvious. Since prices are indices of "terms on which alternatives are offered" the method and scale of production which minimises average cost also minimises the alternatives sacrificed. Thus the first rule means simply that each commodity has to be produced with a minimum sacrifice of alternatives. The second rule is a necessary consequence of following consumers' preferences. If the second rule were not carried out certain lower preferences would be satisfied while other preferences higher up on the scale were left unsatisfied.

(3) Freedom of choice of occupation being assumed, labourers offer their services to the industry or occupation paying the highest wages. For the publicly owned capital and natural resources a price has to be fixed by the Central Planning Board with the provision that these resources can be directed only to industries which are able to "pay," or rather to "account for," this price. This is a consequence of following the consumers' preferences. The

taxation. Such a sector exists also in capitalist society and comprises not only the provision of collective wants, in Cassel's sense, but also of such other wants the satisfaction of which is of too high social importance to be left to the free choice of individuals (for instance, free hospital service and free education). But this problem does not represent any theoretical difficulty and we may disregard it.

<sup>1</sup> See, however, the correction for limitational factors in footnote 2 on p. 58.

prices of the services of the ultimate productive resources being given, their distribution between the different industries is also determined.

B. The subjective equilibrium conditions can be carried out only when prices are *given*. This is also true of the decisions of the managers of production and of the productive resources in public ownership. Only when prices are given can the minimum average cost, the output which equalises average cost and the price of the product, and the best allocation of the ultimate productive resources be determined. But if there is no market (in the institutional sense of the word) for capital goods nor for the ultimate productive resources outside of labour, can their prices be determined objectively? Must not the prices fixed by the Central Planning Board necessarily be quite arbitrary? If so, their arbitrary character would deprive them of any economic significance as indices of "the terms on which alternatives are offered." This is, indeed, the opinion of Professor Mises.<sup>1</sup> And the view is shared by Mr. Cole, who says: "A planless economy, in which each entrepreneur takes his decisions apart from the rest, obviously confronts each entrepreneur with a broadly given structure of costs, represented by the current level of wages, rent, and interest. . . . In a planned socialist economy there can be no objective structure of costs. Costs can be imputed to any desired extent. . . . But these imputed costs are not objective, but *fictitious* costs determined by the public policy of the State."<sup>2</sup> However, this view is easily refuted by recalling the very elements of price theory.

Why is there an objective price structure in a competitive market? Because, as a result of the parametric function of prices, there is generally only *one* set of prices which satisfies the objective equilibrium conditions, i.e. equalises demand and supply of each commodity. The same objective price structure can be obtained in a socialist economy if the *parametric function of prices* is retained. On a competitive market the parametric function of prices results from the number of competing individuals being too large to enable any one to influence prices by his own action. In a socialist economy, production and ownership of the productive resources outside of labour being centralised, the managers certainly can and do influence prices by their decisions. Therefore, the parametric function of prices must be imposed on them by the Central Planning Board as an *accounting rule*. All accounting has to be done *as if* prices were independent of the decisions taken. For purposes of accounting prices must be treated as constant, as they are treated by entrepreneurs on a competitive market. The technique of attaining this end is very simple: the Central Planning Board has to fix prices and see to it that all managers of plants, industries, and resources do their accounting on the basis of the prices fixed by the Central Planning Board, and not tolerate any use of other accounting. Once the parametric function of prices is adopted as an accounting rule, the price structure is established by the objective equilibrium conditions. For each set of prices and consumers' incomes a definite amount of each commodity is supplied and demanded. Condition C determines the

<sup>1</sup> *Vide* "Economic Calculation in the Socialist Commonwealth," reprinted in *Collectivist Economic Planning*, p. 112.

<sup>2</sup> G. D. H. Cole, *Economic Planning*, New York, 1935, pp. 183-4.

incomes of the consumers by the prices of the services of ultimate productive resources and the principles adopted for the distribution of the social dividend. With those principles given, prices alone are the variables determining the demand and supply of commodities. The condition that the quantity demanded and supplied has to be equal for each commodity serves to select the equilibrium prices which alone assure the compatibility of all decisions taken. *Any price different from the equilibrium price would show at the end of the accounting period a surplus or a shortage of the commodity in question.* Thus the accounting prices in a socialist economy, far from being arbitrary, have quite the same objective character as the market prices in a régime of competition. Any mistake made by the Central Planning Board in fixing prices would announce itself in a very objective way: by a physical shortage or surplus of the quantity of the commodity or resources in question, and would have to be corrected in order to keep production running smoothly. As there is generally only one set of prices which satisfies the objective equilibrium conditions both the prices of products and costs<sup>1</sup> are uniquely determined.<sup>2</sup>

Our study of the determination of equilibrium prices in a socialist economy has shown that the process of price determination is quite analogous to that in a competitive market. The Central Planning Board performs the functions of the market. It establishes the rules for combining factors of production and choosing the scale of output of a plant, for determining the output of an industry, for the allocation of resources, and for the parametric use of prices in accounting. Finally, it fixes the prices so as to balance the quantity supplied and demanded of each commodity. It follows that a substitution of planning for the functions of the market is quite possible and workable.

Two problems deserve some special attention. The first relates to the determination of the best distribution of the social dividend. Freedom of choice of occupation assumed, the distribution of the social dividend may affect the amount of services of labour offered to different industries. If certain occupations received a larger social dividend than others, labour would be diverted into the occupations receiving a larger dividend. Therefore, the distribution of the social dividend must be such as not to interfere with the optimum distribution of labour services between the different industries and occupations. The optimum distribution is that which makes the value of the marginal product of the services of labour in different industries and occupations proportional to the marginal disutility<sup>3</sup> of working in those industries

<sup>1</sup> Professor Hayek maintains that it would be impossible to determine the value of durable instruments of production because, in consequence of changes, "the value of most of the more durable instruments of production has little or no connection with the costs which have been incurred in their production," (*Collectivist Economic Planning*, p. 227). It is quite true that the value of such durable instruments is essentially a capitalised quasi-rent and, therefore, can be determined only after the price which will be obtained for the product is known (cf. *ibidem* p. 228). But there is no reason why the price of the product should be any less determinate in a socialist economy than on a competitive market. The managers of the industrial plant in question have simply to take the price fixed by the Central Planning Board as the basis of their calculation. The Central Planning Board would fix this price so as to satisfy the objective equilibrium conditions, just as a competitive market does.

<sup>2</sup> However, in certain cases there may be a multiple solution. Cf. p. 59 above.

<sup>3</sup> It is only the *relative* disutility of different occupations that counts. The absolute disutility may be zero or even negative. By putting leisure, safety, agreeableness of work, etc.,

or occupations.<sup>1</sup> To secure this not only wages but also the social dividend received by individuals must bear some relation to the marginal disutility of the particular kind of labour services performed. The social dividend paid to each individual must be such as not to disturb the proportionality of the supply price of the different services of labour and of the disutility of performing them. This is attained by making the social dividend a *fixed percentage* of the wage rate. As a result of this principle of distributing the social dividend the money incomes earned in different occupations are proportional to the value of the marginal product of the labour services performed by each occupation, but they are not equal to it. The excess of money incomes over the value of the marginal product of the services of labour is the social dividend.

The other problem is the determination of the rate of interest. We have to distinguish between a short-period and a long-period solution of the problem. For the former the amount of capital is regarded as constant and the rate of interest is simply determined by the condition that the demand for capital is equal to the amount available. When the rate of interest is set too low the socialised banking system would be unable to meet the demand of industries for capital; when the interest rate is set too high there would be a surplus of capital available for investment. However, in the long period the amount of capital can be increased by accumulation. If the accumulation of capital is performed "corporately" before distributing the social dividend to the individuals, the rate of accumulation can be determined by the Central Planning Board *arbitrarily*. The Central Planning Board will probably aim at accumulating as much as to make the marginal *net* productivity of capital zero,<sup>2</sup> this aim being never attained because of technical progress (new labour-saving devices), of the increase of population and discovery of new natural resources, and, possibly, because of the shift of demand towards commodities produced by more capital-intensive methods. But the rate, i.e. the *speed*, at which accumulation progresses is arbitrary. The arbitrariness of the rate of capital accumulation "corporately" performed means simply that the decision regarding the rate of accumulation reflects how the Central Planning Board, and not the consumers, evaluate the optimum time shape of the income stream. One may argue, of course, that this involves a diminution of consumers' welfare. This difficulty could be overcome only by leaving all accumulation to the saving of individuals.<sup>3</sup> But this is scarcely compatible with the organisation of a socialist society. The loss of his power to determine the rate of accumulation of capital is the price the consumer has to pay for living in a socialist

into the preference scales, all labour costs may be expressed as opportunity costs. If such a device is adopted each industry or occupation may be regarded as producing a joint product: the commodity or service in question *and* leisure, safety, agreeableness of work, etc. The services of labour have to be allocated so that the value of this marginal *joint* product is the same in all industries and occupations.

<sup>1</sup> If any limitational factors are used it is the *difference* between the value of the marginal product of the services of labour and the marginal expenditure for the limitational factors which has to be proportional to the marginal disutility.

<sup>2</sup> Cf. Wicksell, "Professor Cassel's System of Economics," reprinted in *Lectures on Political Economy*, vol. I, London, 1935, p. 241.

<sup>3</sup> This method has been advocated by Barone. Cf. *The Ministry of Production in the Collectivist State*, pp. 278-9.

society.<sup>1</sup> It seems to us that this price would be well overcompensated by the advantages a socialist economy offers, but the discussion of this point is postponed.

Having treated the theoretical determination of economic equilibrium in a socialist society, let us see how equilibrium can be determined by a method of *trial and error* similar to that in a competitive market. This method of trial and error is based on the *parametric function of prices*. Let the Central Planning Board start with a given set of prices chosen *at random*. All decision of the managers of production and of the productive resources in public ownership and also all decisions of individuals as consumers and as suppliers of labour are made on the basis of these prices. As a result of these decisions the quantity demanded and supplied of each commodity is determined. If the quantity demanded of a commodity is not equal to the quantity supplied the price of that commodity has to be changed. It has to be raised if demand exceeds supply and lowered if the reverse is the case. Thus the Central Planning Board fixes a new set of prices which serves as a basis for new decisions, and which results in a new set of quantities demanded and supplied. Through this process of trial and error equilibrium prices are finally determined. Actually the process of trial and error would, of course, proceed on the basis of the prices *historically given*. Relatively small adjustments of those prices would constantly be made, and there would be no necessity of building up an entirely new price system.

This process of trial and error has been described excellently by the late Professor Fred M. Taylor. He assumes that the administrators of the socialist economy would assign provisional values to the factors of production (as well as to all other commodities) and he continues: "If, in regulating productive processes, the authorities were actually using for any particular factor a valuation which was too high or too low, that fact would soon disclose itself in unmistakable ways. Thus, supposing that, in the case of a particular factor, the valuation . . . was too high, that fact would inevitably lead the authorities to be unduly economical in the use of that factor; and this conduct, in turn, would make the amount of that factor which was available for the current production period larger than the amount which was consumed during that period. In other words, too high a valuation of any factor would cause the stock of that factor to show a surplus at the end of the productive period."<sup>2</sup> Similarly, too low a valuation would cause a deficit in the stock of that factor. "Surplus or deficit—one or the other of these would result from every wrong valuation of a factor."<sup>3</sup> By a set of successive trials the right accounting prices of the factors are found.

Thus the accounting prices in a socialist economy can be determined by the same process of trial and error by which prices on a competitive market are determined. To determine the prices the Central Planning Board does not need to have "complete lists of the different quantities of all commodities

<sup>1</sup> Of course, the consumers remain free to save as much as they want out of the income which is actually paid out to them, and the socialised banks could (and in order to prevent hoarding would have to) pay interest on savings. But *this* rate of interest would not have any necessary connection with the marginal *net* productivity of capital. It would be quite arbitrary.

<sup>2</sup> *The Guidance of Production in a Socialist State*, p. 7.

<sup>3</sup> *Ibidem*, p. 8.

which would be bought at any possible combination of prices of the different commodities which might be available.”<sup>1</sup> Neither would the Central Planning Board have to solve hundreds of thousands (as Professor Hayek expects<sup>2</sup>) or millions (as Professor Robbins thinks<sup>3</sup>) of equations. The only “equations” which would have to be “solved” would be those of the consumers and the managers of production plants. These are exactly the same “equations” which are solved in the present economic system and the persons who do the “solving” are the same also. Consumers “solve” them by spending their income so as to get out of it the maximum total utility; and the managers of production plants “solve” them by finding the combination of factors and the scale of output which minimises average cost. They “solve” them by a method of trial and error, making (or imagining) small variations *at the margin*, as Marshall used to say, and watching what effect those variations have either on the total utility or on the average cost of production. And only few of them have been graduated in higher mathematics. Professor Hayek and Professor Robbins themselves “solve” at least hundreds of equations daily, for instance, in buying a newspaper or in deciding to take a meal in a restaurant, and presumably they do not use determinants or Jacobians for that purpose. And each entrepreneur who hires or discharges a worker, or who buys a bale of cotton, “solves equations,” too. Exactly the same “equations,” no less and no more, have to be “solved” in a socialist economy and exactly the same kind of persons, the consumers and the managers of production plants, have to “solve” them. To establish the prices which serve to the persons “solving equations” as parameters no mathematics are needed either. Neither is there needed any knowledge of the demand and supply functions. The right prices are simply found out by watching the quantities demanded and the quantities supplied and by raising the price of a commodity or service whenever there is an excess of demand over supply and lowering it whenever the reverse is the case, until, by trial and error, the price is found at which demand and supply are in balance.

As we have seen, there is not the slightest reason why a trial and error procedure, similar to that in a competitive market, could not work in a socialist economy to determine the accounting prices of capital goods and of the productive resources in public ownership. Indeed, it seems that it would, or at least could, work *much better* in a socialist economy than it does in a competitive market. For the Central Planning Board has a much wider knowledge of what is going on in the whole economic system than any private entrepreneur can ever have; and, consequently, may be able to reach the right equilibrium prices by a much shorter series of successive trials than a competitive market actually does.<sup>4</sup> The argument that in a socialist economy the accounting

<sup>1</sup> Professor Hayek in *Collectivist Economic Planning*, p. 211.

<sup>2</sup> *Ibidem* p. 212.

<sup>3</sup> *The Great Depression*, p. 151.

<sup>4</sup> In reducing the number of trials necessary a knowledge of the demand and supply schedules derived from statistics, on which Mr. Dickinson wants to base the pricing of goods in a socialist economy, may be of great service, but such knowledge, though useful, is not necessary to find out the equilibrium prices. However, if the managers of production units adhere literally to treating as constant the prices fixed by the Central Planning Board, in certain branches of production the fluctuations described by the cobweb theorem might appear also in a socialist economy.



prices of capital goods and of productive resources in public ownership cannot be determined objectively, either because this is theoretically impossible, or because there is no adequate trial and error procedure available, cannot be maintained. In 1911 Professor Taussig classified the argument that "goods could not be valued" among the objections to socialism that are "of little weight."<sup>1</sup> After all the discussions since that time, no reason can be found to change this opinion.

#### 4. A GENERALISATION OF THE PRECEDING THEORY

The procedure of trial and error described is also applicable to a socialist system where freedom of choice in consumption and freedom of choice of occupation is non-existent and where the allocation of resources, instead of being directed by the preferences of consumers, is directed by the aims and valuations of the bureaucracy in charge of the administration of the economic system. In such a system the Central Planning Board decides which commodities are to be produced and in what quantities, the consumers' goods produced being administered to the citizens by rationing and the various occupations being filled by assignment. In such a system also rational economic accounting is possible, only that the accounting reflects the preferences of the bureaucrats in the Central Planning Board, instead of the consumers. The Central Planning Board has to fix a scale of preferences which serves as the basis of valuation of consumers' goods. The construction of such a preference scale is by no means a practical impossibility. The consumer on a competitive market is never in doubt as what to choose if only the prices of the commodities are given, though he certainly would find it impossible to write down the mathematical formula of his utility (or rather preference) function. Similarly, the Central Planning Board does not need to have an elaborate formula of its preferences. By simple judgment it would assign, for instance, to a hat the valuation of ten monetary units, when 100,000 hats are produced monthly, whereas it would assign a valuation of eight monetary units to a hat when 150,000 hats per month are produced.

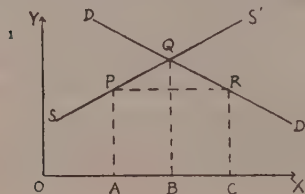
The preference scale of the Central Planning Board being given, the prices, which in this case are *all* accounting prices, are determined in exactly the same way as before. The Central Planning Board has to impose on the managers of production plants the rule that factors of production should be combined and the scale of output chosen so as to minimise the average cost of production. For each industry the rule must be adopted to produce exactly as much of a commodity as can be "accounted for" at a price equalling average cost, and on the managers of ultimate productive resources the rule must be imposed to direct them only to the industries which can "account for" the price fixed by the Central Planning Board. The last two rules were formerly consequences of following the preferences of the consumers, now they are consequences of

But in such cases the Planning Board would not have much difficulty in modifying the rules about the parametric character of prices so as to avoid such fluctuations.

<sup>1</sup> Cf. *Principles of Economics*, vol. II, New York, 1911, p. xvi. Cf. also pp. 456-7.

keeping to the preference scale fixed by the Central Planning Board. They are thus rules which make the decisions of the managers of production and of productive resources consistent with the aims set by the Central Planning Board. In other words: they are rules of internal *consistency* of the planned economy. The first rule secures *efficiency* in carrying out the plan. Finally, the Central Planning Board has to impose the parametric function of the accounting prices fixed by itself and to fix them so as to balance the quantity supplied and the quantity demanded for each commodity. The price fixing can be done by trial and error, exactly as in the case studied before, and the equilibrium prices thus fixed have a definite objective meaning. The prices are "planned" in so far as the preference scale is fixed by the Central Planning Board; but once the scale is fixed, they are quite determinate. Any price different from the equilibrium price would leave at the end of the accounting period a surplus or a shortage of the commodity in question and thus impair the smooth running of the production process. The use of the right accounting prices is vital to avoid disturbances in the *physical* course of production and those prices are far from being arbitrary.

The determinateness of the accounting prices holds, however, only if all discrepancies between demand and supply of a commodity are met by an appropriate change of its price. Thus, outside of the distribution of consumers' goods to the citizens, rationing has to be excluded as a method of equalising supply and demand. If rationing is used for this purpose the prices become arbitrary. But it is interesting to observe that, even if rationing is used, within certain limits, there is a tendency towards producing the same quantities of commodities as would have been produced if all adjustments between demand and supply were made exclusively by price fixing. If, for instance, the accounting price has been set too low, there is an excess of demand over supply. The Central Planning Board would have to interfere in such a case and order the industry producing the commodity in question to increase its output while ordering the industries using this commodity as a factor of production to be more economical in its use.<sup>1</sup> Thus the method of rationing leads, by a very rough approximation, to the point where fixing the equilibrium price would have led. But if rationing becomes a general procedure the rules enumerated above cease to be reliable indices of the consistency between the decisions of the managers of production and the aims established by the plan. The consistency of those decisions with the plan can be, instead, measured by fixing quotas of output and comparing them with the actual achievement (as is done in the Soviet Union). But there is no way of measuring the *efficiency* in carrying out the plan without a system of



Let  $DD'$  and  $SS'$  be the demand and the supply curve respectively.  $BQ$  is the equilibrium price and  $OB$  the equilibrium quantity. If the price is set at  $AP$  the quantity  $OA$  is forthcoming while  $OC$  is demanded. As a result of the intervention of the Planning Board the quantity produced will be set somewhere between  $OA$  and  $OC$ .

accounting prices which satisfy the objective equilibrium conditions, for the rule to produce at the minimum average cost has no significance with regard to the aims of the plan unless prices represent the relative scarcity of the factors of production.<sup>1</sup>

By demonstrating the economic consistency and workability of a socialist economy with free choice neither in consumption nor in occupation, but directed rather by a preference scale imposed by the bureaucrats in the Central Planning Board, we do not mean, of course, to recommend such a system. Mr. Lerner has sufficiently shown the undemocratic character of such a system and its incompatibility with the ideals of the socialist movement.<sup>2</sup> Such a system would scarcely be tolerated by any civilised people. A distribution of consumers' goods by rationing was possible in the Soviet Union at a time when the standard of living was at a physiological minimum and an increase of the ration of any food, clothing, or housing accommodation was welcome, no matter what it was. But as soon as the national income increased sufficiently, rationing was given up, to be replaced to a large extent by a market for consumers' goods. And, outside of certain exceptions, there was always freedom of choice of occupation in the Soviet Union. A distribution of consumers' goods by rationing is quite unimaginable in the countries of Western Europe or in the United States.

But freedom of choice in consumption does not imply that production is actually guided by the choices of the consumers. One may well imagine a system in which production and the allocation of resources is guided by a preference scale fixed by the Central Planning Board while the price system is used to distribute the consumers' goods produced. In such a system there is freedom of choice in consumption but the consumers have no influence whatever on the decisions of the managers of production and of the productive resources.<sup>3</sup> There would be two sets of prices of consumers' goods. One

<sup>1</sup> There exists, however, a special case where prices are not needed to carry out the plan efficiently. This is the case of constant coefficients of production. If all factors of production are limitational there is no economic problem in finding out the best combination of factors. The combination of factors of production is imposed by the technological exigencies of production. But there remains the problem of determining the optimum scale of output and for this purpose the prices of the factors of production are needed. But if the amount required of all factors of production is simply proportional either to the quantity of the product (if the limitational factors are of the first kind) or to the quantity of another factor used (if the limitational factors are of the second kind)—this is Pareto's case of constant coefficients of production—average cost per unit of output is independent of the scale of output. The problem of choosing the optimum scale of output is thus ruled out, too. In this particular case where all coefficients of production are constant, no prices and no cost accounting whatever are needed. Efficiency in production is maintained merely by technological considerations of avoiding waste of materials, etc. It seems that those who deny the necessity of an adequate price system in a socialist economy have this case in mind. If the quotas of consumers' goods to be produced are given, all further problems of planning production are purely technological and no price system or cost accounting is needed. But we need not say how extremely unrealistic the assumption that all coefficients of production are constant is. The very fact that in the Soviet Union such great stress is laid on cost accounting shows how far from reality this special case is removed. But if cost accounting is to fulfil its purpose of securing efficiency in carrying out the plan, the accounting prices cannot be arbitrary.

<sup>2</sup> Cf. "Economic Theory and Socialist Economy," *REVIEW OF ECONOMIC STUDIES*, October, 1934.

<sup>3</sup> Of course, there remains the possibility of influence through political channels, but there is no regular economic mechanism through which the consumers automatically influence the direction of production. Dr. Zassenhaus has suggested a very interesting theoretical formulation

would be the market prices at which the goods are sold to the consumers; the other, the accounting prices derived from the preferences scale fixed by the Central Planning Board. The latter would be the prices on the basis of which the managers of production make their decisions. However, it does not seem very probable that such a system would be tolerated by the citizens of a socialist community. The dual system of prices of consumers' goods would reveal to the people that the bureaucrats in the Central Planning Board allocate the community's productive resources according to a preference scale different from that of the citizens. The existence of a dual price system of consumers' goods could scarcely be concealed from the people, especially if there existed an institution (like the Workers' and Peasants' Inspection in the Soviet Union<sup>1</sup>) giving to the rank and file citizen the right to pry into the book-keeping and into the management of the community's resources. As a result the accounting prices of consumers' goods would be permitted to deviate from the market prices only in exceptional cases in which there is general agreement that such deviation is in the interest of social welfare. For instance, it might be agreed upon that the consumption of whisky ought to be discouraged while the reading the works of Karl Marx, or of the Bible (or of both, as certainly would be the case in an Anglo-Saxon community), ought to be encouraged, and the prices of those things would be fixed accordingly. But such things do happen also in capitalist society. If the bureaucrats want successfully to impose a preference scale of their own for the guidance of production, they have to camouflage the inconsistency of their preference scale with that of the citizens by resorting to rationing in the sphere of producers' goods and of resources.<sup>2</sup> Thus a socialist community which has been able to impose the principle that rationing must be excluded and price fixing used as the only method of balancing quantities demanded and quantities supplied,<sup>3</sup> may be fairly confident that it will be able to insure that the Central Planning Board follows the preferences of the consumers.

OSKAR LANGE.

of the influence through political channels, analogous to the economic theory of choice. Cf. *Ueber die oekonomische Theorie der Planwirtschaft*, p. 511 et seq.

<sup>1</sup> This institution was abolished in June, 1934, and replaced by the Commission of Soviet Control. A part of its functions have been taken over by the trade unions. Cf. Webb, *Soviet Communism*, vol. I, London, 1935, pp. 99 and 474-8.

<sup>2</sup> It seems highly probable that the great extent to which rationing was used in the Soviet Union in allocating factors of production and resources was dictated by the necessity to conceal the real cost of the programme of industrialisation. However, this remark is not intended as a criticism of the industrial policy of the Soviet Government, which was justified on political grounds, chiefly those of national defence.

<sup>3</sup> One may think of a Supreme Economic Court whose function would be to safeguard the use of the nation's productive resources in accordance with the public interest and having the power to repeal decisions of the Central Planning Board which are in contradiction to the general rules of consistency and efficiency enumerated above just as the United States Supreme Court has the power to repeal laws held unconstitutional. This court would have to repeal any decisions involving rationing.

# On the Economic Theory of Socialism

## PART TWO

### 5. THE ECONOMIST'S CASE FOR SOCIALISM

THE rules of consistency of decisions and of efficiency in carrying them out are in a socialist economy exactly the same as those that govern the actual behaviour of entrepreneurs on a purely competitive market. Competition forces entrepreneurs to act exactly as they would have to act were they managers of production in a socialist system. The fact that free competition tends to enforce rules of behaviour similar to those in an ideal planned economy makes competition the pet idea of the economist. But if competition enforces the same rules of allocating resources as would have to be accepted in a rationally conducted socialist economy, what is the use of bothering about socialism? Why change the whole economic system if exactly the same result can be attained within the present system, if only it could be forced to maintain the competitive standard?

The analogy between the distribution of resources in a competitive capitalist and a socialist economy is, however, purely formal. The *formal* principles are the same, but the *actual* distribution may be a quite different one. This difference is due to two features which distinguish a socialist economy from an economic system based on private ownership of the means of production and private enterprise.

One feature is the distribution of incomes (condition C in the determination of economic equilibrium). Only a socialist economy can distribute incomes so as to attain the maximum social welfare. In any system with private ownership of the means of production, the distribution of incomes is determined by the distribution of ownership of the ultimate productive resources. This distribution is an historical datum which originates independently of the requirements of the maximisation of social welfare. For instance, the distribution of landed property is different in countries where the big landed estates of the feudal epoch have been broken up by bourgeois and peasant revolutions than where they have been left intact. Under capitalism the distribution of the ownership of the ultimate productive resources is a very unequal one, a large part of the population owning only their labour power. Under such conditions demand price does not reflect the relative urgency of the needs of different persons<sup>1</sup> and the allocation of resources determined by the demand

<sup>1</sup> This criticism presupposes, of course, that the utility derived from a given income by different persons is comparable. The theory of economic equilibrium does not need any such assumption, for being an *explanation* of behaviour under given conditions, it is concerned only with individuals, each maximising his utility separately. But the possibility of such comparison is a postulate necessary (except in a Robinson Crusoe economy) if different equilibrium positions are to be interpreted in terms of *human welfare*. And such interpretation is required for choosing different economic policies. If this possibility is denied, any judgment as to the merits of economic policies, transcending the question of purely formal consistency of decisions and of efficiency in carrying them out, is impossible. In such case also no reason can be found why the allocation of

price offered for consumer's goods is far from attaining the maximum of social welfare. While some are starving others are allowed to indulge in luxury. In a socialist society the incomes of the consumers could be determined so as to maximise the total welfare of the whole population.

Free choice in consumption and free choice of occupation being assumed, the distribution of incomes maximising the total welfare of society has to satisfy the following two conditions: (1) the distribution has to be such that the same demand price offered by different consumers represents an equal urgency of need; this is attained if the marginal utility of income is the same for all consumers; (2) the distribution has to lead to such apportionment of the services of labour between the different occupations as to make the differences of the value of the marginal product of labour in the various occupations equal to the differences in the marginal disutility involved in their pursuit.<sup>1</sup> Assuming the marginal utility curves of income to be the same for all individuals, condition (1) is satisfied when all consumers have the same income. But condition (2) requires a differentiation of incomes, since, to secure the apportionment of labour services required, differences in the marginal disutility of the various occupations have to be compensated by differences in incomes. The contradiction, however, is only apparent. By putting leisure, safety, agreeableness of work, etc., into the utility scales of the individuals, the disutility of any occupation can be represented as opportunity cost. The choice of an occupation offering a lower money income, but also a smaller disutility, may be interpreted as the purchase of leisure, safety, agreeableness of work, etc., at a price equal to the difference of the money-income earned in that particular occupation and in others. Thus the differences of incomes required by condition (2) are only apparent. They represent prices paid by the individuals for different conditions of work. Instead of attaching to the various occupations different money incomes, the administration of a socialist economy might pay to any citizen the same money income and charge a price for the pursuit of each occupation. It becomes obvious that there is not only no contradiction between both conditions, but condition (2) is necessary to satisfy condition (1).<sup>2</sup>

resources ought to be based on the demand prices resulting from the free consumers' choices, rather than to the whim of a dictator. Any other preference scale chosen at random by the Central Planning Board would do equally well. To deny the comparability of the urgency of need of different persons and at the same time to regard the allocation of resources based on demand prices as the only one consistent with economic principles would be contradictory. It would be, as Mr. Dobb has rightly observed, a manoeuvre which enables "the scientific dignity of an ethical neutrality to be combined with an undiminished capacity to deliver judgments on practical affairs." ("The Problems of a Socialist Economy," *Economic Journal*, December, 1933, p. 591.) The logical fallacy of such a trick is easily exposed.

<sup>1</sup> Cf., however, the qualification contained in footnote 1 on p. 65 of Part One of this paper. If the total amount of labour performed is not limited by legislation or custom regulating the hours of work, etc., the value of the marginal product of labour in each occupation has to be equal to the marginal disutility.

<sup>2</sup> Thus Mr. Dobb is wrong when he maintains that these conditions are contradictory. Cf. *The Problems of a Socialist Economy*, pp. 591-2. Unless education and training for the different occupations are free, condition (1) is also necessary to satisfy condition (2), for if the marginal utility of income were not the same for all persons the value of the marginal product of the services of labour (which is equal to wages) would be higher, relatively to the disutility, in those occupations which have a higher cost of training. This happens in capitalist society where those who can afford expensive education and training are paid out of any proportion to the relative

Our argument holds strictly if the marginal utility curve of income is the same for all individuals.<sup>1</sup> Of course, this does not correspond to reality, and one might think of taking into account the differences between the marginal utility curves of income of different individuals by granting higher incomes to the more "sensitive" persons. But as such differences as to "sensitiveness" cannot be measured the scheme would be impracticable. Besides, the differences in "sensitiveness" existing in present society are chiefly due to the social barriers between classes, e.g. a Hungarian count being more "sensitive" than a Hungarian peasant. Such differences would disappear in the relatively homogeneous social stratification of a socialist society and all differences as to "sensitiveness" would be of purely individual character. Such individual differences may be assumed to be distributed according to the normal law of error.<sup>2</sup> Thus, basing the distribution of incomes on the assumption that all individuals have the same marginal utility curve of income, a socialist society would strike the right average in estimating the relative urgency of the needs of different persons, leaving only random errors, while the distribution of income in capitalist society introduces a constant error—a class bias in favour of the rich.

The other feature which distinguishes a socialist economy from one based on private enterprise is the *comprehensiveness* of the items entering into the price system. What enters into the price system depends on the historically given set of institutions. As Professor Pigou has shown, there is frequently a divergence between the private cost borne by an entrepreneur and the social cost of production.<sup>3</sup> In the cost account of the private entrepreneur only those items enter for which he has to pay a price, while such items as the maintenance of the unemployed created when he discharges workers, the provision for the victims of occupational diseases and industrial accidents, etc., do not enter, or, as Professor J. M. Clark has shown, are diverted into social overhead costs.<sup>4</sup> On the other side there are the cases where private producers render services which are not included in the price of the product. An economic system based on private enterprise can take but very imperfect account of the alternatives sacrificed and realised in production. Most important alternatives, like life, security, and health of the workers, are sacrificed without being accounted for as a cost of production. A socialist economy would be able to put *all* the alternatives into its economic accounting. Thus it would evaluate *all* the services rendered by production and take into the

disutility of their work. Condition (2) would not work, however, in the case of exceptional talents (for instance, prominent artists or surgeons) which form a natural monopoly. In such cases the value of the marginal product of the services of labour must be necessarily out of any proportion to the marginal disutility. If rewarded according to the value of the marginal product of their services such persons would form a privileged group drawing very high incomes (as writers are in the Soviet Union). But a socialist society might also pay them incomes which are far below the value of the marginal product of their services without affecting the supply of those services.

<sup>1</sup> This does *not* imply that all individuals have the same utility scales, although it would follow from the latter assumption.

<sup>2</sup> Such differences in the marginal utility curves of income of different individuals as are not purely random but due to age, family status, infirmity, etc., would be easily recognised and incomes could be differentiated accordingly.

<sup>3</sup> Cf. *The Economics of Welfare*, third edition, London, 1929, Part II, chapter IX.

<sup>4</sup> See *Studies in the Economics of Overhead Costs*, Chicago, 1923, pp. 25-7, 397-403, and 463-4.

cost accounts *all* the alternatives sacrificed ; as a result it would be also able to convert its social overhead costs into prime costs. By doing so it would avoid much of the social waste connected with private enterprise. As Professor Pigou has shown, much of this waste can be removed by proper legislation, taxation, and bounties also within the framework of the present economic system, but a socialist economy can do it with much greater thoroughness.

As a result of the possibility of taking into account *all* the alternatives a socialist economy would not be subjected to the fluctuations of the business cycle. Whatever the theoretical explanation of the business cycle, that cumulative shrinkage of demand and output caused by a cumulative reduction of purchasing power could be stopped in a socialist economy. In a socialist economy there can be, of course, grave mistakes and misdirection of investments and production. But such misdirections need not lead to shrinkage of output and unemployment of factors of production spreading over the whole economic system. A private entrepreneur *has* to close his plant when he incurs grave losses. In a socialist economy a mistake is a mistake, too, and has to be corrected. But in making the correction *all* the alternatives gained and sacrificed can be taken into account, and there is no need to correct losses in one part of the economic system by a procedure which creates still further losses by the secondary effect of a cumulative shrinkage of demand and of unemployment of factors of production. Mistakes can be *localised*, a partial over-production does not need to turn into a general one.<sup>1</sup> Thus the business cycle theorist would lose his subject of study in a socialist economy, but the knowledge accumulated by him would still be useful in finding out the ways to prevent mistakes and methods of correcting them, if made, which do not lead to further losses.

The possibility of determining the distribution of incomes so as to maximise social welfare and of taking *all* the alternatives into the economic account makes a socialist economy, from the economist's point of view, superior to a competitive régime with private ownership of the means of production and with private enterprise,<sup>2</sup> but especially superior to a competitive capitalist economy where a large part of the participants in the economic system are deprived of any property of productive resources other than their labour. However, the actual capitalist system is not one of perfect competition ; it is one where oligopoly and monopolistic competition prevail. This adds a much more powerful argument to the economist's case for socialism. The wastes

<sup>1</sup> The decisions of the Central Planning Board being guided not by the aim to secure a maximum profit on each separate investment but by considerations of making the best use of all the productive resources available in the whole economic system, an amount of investment sufficient to provide full employment for all factors of production would be always maintained.

<sup>2</sup> The deficiencies due to inequality of incomes would be absent in a competitive system where the private ownership of the means of production is equally distributed among the population (Marx called such system " einfache Warenproduktion "). Such a system is incompatible with large-scale industry. But, on account of the approximate equality of incomes in such a system, a socialist economy could embody such a system partly into its own. Therefore, socialism does not need to abolish the private ownership of the means of production in small-scale industry and farming, provided large-scale production is not more economical in these particular fields. By appropriate legislation, taxes and bounties a socialist economy can induce those small-scale entrepreneurs to take *all* alternatives into consideration and avoid the danger of their causing serious business fluctuations.



of monopolistic competition have received so much attention in recent theoretical literature that there is no need to repeat the argument here. The capitalist system is far removed from the model of a competitive economy as elaborated by economic theory. And even if it would conform to it, it would be, as we have seen, far from maximising social welfare. Only a socialist economy can fully satisfy the claim made by many economists with regard to the achievements of free competition. The *formal* analogy, however, between the principles of distribution of resources in a socialist and in a competitive régime of private enterprise makes the scientific technique of the theory of economic equilibrium, which has been worked out for the latter, also applicable to the former. The actual capitalist system is much better described by the analysis of Mrs. Robinson and of Professor Chamberlin than by that of Walras and of Marshall. But the work of the latter two will be more useful in solving the problems of a socialist system. As a result, Professor Chamberlin and Mrs. Robinson face the danger of losing their jobs under socialism, unless they agree to be transferred to the department of economic history to provide students of history with the theoretical apparatus necessary to understand what will appear to a future generation as the craze and folly of a past epoch.

Against these advantages of a socialist economy the economist might put the disadvantage resulting from the arbitrariness of the rate of capital accumulation, if accumulation is performed "corporately." A rate of accumulation which does not reflect the preferences of the consumers as to the time-shape of the flow of income may be regarded as a diminution of social welfare. But it seems that this deficiency may be regarded as overbalanced by the advantages enumerated. Besides, saving is also in the present economic order determined only partly by pure utility considerations, and *the rate of saving is affected much more by the distribution of incomes, which is irrational from the economist's point of view.* Further, as Mr. Robertson has already shown,<sup>1</sup> and Mr. Keynes has elaborated in his analysis of the factors determining the total volume of employment,<sup>2</sup> in a capitalist economy the public's attempt to save may be frustrated by not being followed by an appropriate rate of investment, with the result that poverty instead of increased wealth results from the people's propensity to save. Thus the rate of accumulation determined "corporately" in a socialist society may prove to be, from the economic point of view, much more rational than the actual rate of saving in capitalist society is. There is also the argument which might be raised against socialism with regard to the efficiency of public officials as compared with private entrepreneurs as managers of production. Strictly speaking, these public officials must be compared with corporation officials under capitalism, and not with private small-scale entrepreneurs. The argument thus loses much of its force. The discussion of this argument belongs to the field of sociology rather than of economic theory and must therefore be dispensed with here. By doing so we do not mean, however, to deny its great importance. It seems to us, indeed, that the real danger of socialism is that of a bureaucratisation of economic life,

<sup>1</sup> Cf. *Banking Policy and the Price Level*, London, 1926, pp. 45-7, and *Money*, new edition, London, pp. 93-7.

<sup>2</sup> Cf. *The General Theory of Employment, Interest and Money*, London, 1936.

and not the impossibility of coping with the problem of allocation of resources. Unfortunately, we do not see how the same, or even greater, danger can be averted under monopolistic capitalism.

However, the really important point in discussing the economic merits of socialism is not that of comparing the equilibrium position of a socialist and of a capitalist economy with respect to social welfare. Interesting as such comparison is for the economic theorist, it is not the real issue in the discussion of socialism. The real issue is *whether the further maintenance of the capitalist system is compatible with economic progress*. That capitalism has been the carrier of the greatest economic progress ever witnessed in the history of the human race the socialists are the last to deny. Indeed, there has scarcely ever been a more enthusiastic eulogy of the revolutionising achievements of the capitalist system than that contained in the Communist Manifesto. The bourgeoisie, states the Manifesto, "has been the first to show what man's activity can bring about. It has accomplished wonders far surpassing Egyptian pyramids, Roman aqueducts, and Gothic cathedrals; it has conducted expeditions that put in the shade all former exoduses of nations and crusades. . . . The bourgeoisie, by the rapid improvement of all instruments of production, by the immensely facilitated means of communication, draws all, even the barbarian, nations into civilisation. . . . The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together. Subjection of Nature's forces to man, machinery, application of chemistry to industry and agriculture, steam navigation, railways, electric telegraphs, clearing of whole continents for cultivation, canalisation of rivers, whole populations conjured out of the ground—what earlier century had even a presentiment that such productive forces slumbered in the lap of social labour?" The question arises, however, whether the institutions of private property of the means of production and of private enterprise will continue indefinitely to foster economic progress, or whether, at a certain stage of technical development, they turn, from being promoters, into becoming shackles of further advance. The last is the contention of the socialists.

The unprecedented economic progress of the last 200 years is due to innovations increasing the productivity of a given combination of factors of production, or creating new commodities and services. The effects of such innovations on the profits of private enterprise are twofold: (1) the entrepreneur introducing an innovation gains an immediate, though under free competition only temporary, profit, or increase in profit; (2) the entrepreneurs using the antiquated means of production, or producing competing goods which are replaced by the cheapening rivals, suffer losses which ultimately lead to a devaluation of the capital invested in their business; on the other side there may be entrepreneurs who profit by new demand created in consequence of the innovation. In any case, each innovation is necessarily connected with a loss of value of certain old investments. In a competitive régime, with the parametric function of prices and with free entry of new firms into each industry, entrepreneurs and investors *have* to submit to the losses and devaluation of old investments resulting from innovations, for there is no

possibility of counteracting it. The only way is to try to introduce innovations in their own business, which, in turn, inflict losses on others. But when business units become so large as to make the parametric function of prices and the possibility of free entry of new firms (and investments) into the industry ineffective, there arises a tendency to avoid a devaluation of the capital invested. A private enterprise, unless forced by competition to do otherwise, will introduce innovations only when the old capital invested is amortised, or if the reduction of cost is so pronounced as to offset the devaluation of the capital already invested, i.e. if the average total cost becomes lower than the average prime cost of producing with the old machinery or equipment. But such slowing up of technical progress is against the social interest.<sup>1</sup> The tendency to maintain the value of existing investments becomes even more powerful when the ownership of the capital invested is separated from the entrepreneurial function, as is increasingly the case in modern so-called *financial capitalism*. For the industrial enterprise has to replace the full value of the capital invested or to fail. This is strictly true if the financing of the enterprise has been made through bond issues, but even if it has been made by stock issues a pronounced decline of stock quotations injures its financial prestige.

But the maintenance of the value of invested capital is not compatible with cost-reducing innovations. This has been pointed out very brilliantly by Professor Robbins: "The maintenance of the value of invested capital may very well mean that producers who find prospects in one industry more attractive than the prospects in any others are prevented from entering it, that cost-reducing improvements of technique which would greatly cheapen the commodity to consumers are held up, that the 'wasteful competition' of people who are content to serve the consumer for lower returns than before is prevented from reducing prices. Every schoolboy knows that the cheapness which comes from importing corn is incompatible with the maintenance of the value of the corn lands which would be cultivated if import were restricted. The platitudes of the theory of international trade do not lose any of their force if they are applied to domestic competition. The argument, for instance, that road transport diminishes the value of railway capital has just as much and just as little force as the argument that cheap food lowers the value of agricultural property. . . . Economic progress, in the sense of cheapening of commodities, is not compatible with the preservation of the value already invested in particular industries."<sup>2</sup> Therefore, when the maintenance of the value of the capital already invested becomes the chief concern of the entrepreneurs, further economic progress has to stop, or, at least, to slow down

<sup>1</sup> It is in the interest of society that *any* improvement available be introduced, irrespective of what happens to the value of capital already invested. If the improvement allows the commodity to be produced at an average total cost which is lower than the average prime cost of producing it with the old machinery, a replacement of the old machinery by the new is obviously in the interest of the public. But even if the average total cost of the new method of production is not lower than the average prime cost of producing with the old machinery, its introduction is in the interest of the public. In such case both the old and the new machinery ought to be employed in production, the public getting the benefit of lower prices. The loss of value of the old capital invested is exactly compensated by the public's gain in consequence of price reduction. Cf. Pigou, *The Economics of Welfare*, third edition, London, 1929, pp. 190-2.

<sup>2</sup> *The Great Depression*, p. 141.

considerably. And in present capitalism the maintenance of the value of the particular investment has, indeed, become the chief concern. Accordingly, interventionism and restrictionism are the dominant economic policies.<sup>1</sup> But since innovations very frequently reduce the value of capital in other firms or industries rather than in that which introduces them, innovations cannot be stopped altogether. When the pressure of new innovations becomes so strong as to destroy the artificially preserved value of the old investments a frightful economic collapse is the result. The stability of the capitalist system is shaken by the alternation of attempts to stop economic progress in order to protect old investments and tremendous collapses when those attempts fail. The increasing instability of business conditions can be remedied only by either giving up the attempts to protect the value of old investments or by successfully stopping new innovations.

But holding back technical progress would involve the capitalist system in a new set of difficulties because of capital accumulation finding no outlet in profitable investment opportunities. Without technical progress (of the labour-saving kind), discovery of new natural resources, or considerable increase in population (and the latter two are not sufficient in our day to outbalance a lack of the first) the marginal *net* productivity of capital is liable to reach a level insufficient to compensate the liquidity preference of the capital-holders. This result will be even more accentuated when a part of the industries enjoy a monopoly position which enables them to protect the value of their investments, for new capital finding free entry only into those industries where free competition still prevails depresses the marginal *net* productivity of capital much more than would otherwise be the case. As substantiated by Mr. Keynes' brilliant analysis,<sup>2</sup> this would lead to a deflationary pressure resulting in chronic unemployment of the factors of production. To prevent such chronic unemployment the State would have to undertake great public investments, replacing thus the private capitalist where the latter refuses to enter because of the low rate of return on the investment. Unless further capital accumulation is prohibited effectively, the State would have to replace the private capitalists more and more in their function as investors. Thus the capitalist system seems to face an unescapable dilemma: holding back technical progress leads, through the exhaustion of profitable investment opportunities, to a state of chronic unemployment which can be remedied only by a policy of public investments on an ever-increasing scale, while a continuance of technical progress leads to the instability due to the policy of protecting the value of old investments which has been previously described.

It seems to us that the tendency to maintain the value of old investment can be removed successfully only by the abolition of private enterprise and of

<sup>1</sup> The protection of monopoly privileges and of particular investments is also the chief source of the imperialist rivalries of the Great Powers.

<sup>2</sup> Cf. *The General Theory of Employment*, pp. 217-21 and 308-9. It ought to be mentioned that the difficulties involved for the capitalist system in capital accumulation finding no outlet in profitable investment-opportunities were discussed, though without having reached any definite conclusions, by a long series of writers of the Marxist school: Tugan-Baranowski, Hilferding, Rosa Luxemburg, Otto Bauer, Bucharin, Sternberg, Grossmann, and Strachey are only the most important of them. Those writers have, however, been much more successful in explaining the bearing of those difficulties on the imperialist policy of the capitalist states.

the private ownership of capital and natural resources, at least in those industries where such tendency prevails. Two other ways of removing it are conceivable.

One way would be the return to free competition. This way, however, does not seem to be possible because of the large size of modern business units. In a system based on the pursuit of private profit each entrepreneur has the natural tendency to exploit all possibilities of increasing his profit. The tendency to restrict competition is as natural for private enterprise as the tendency to protect the value of old investments is natural for private ownership of capital. As Adam Smith long ago remarked: "The interest of dealers in any particular branch of trade or manufacturers is always in some respect different from, or even opposite to, that of the public. To widen the market and to narrow the competition is always the interest of the dealers. To widen the market may frequently be agreeable enough to the interest of the public, but to narrow the competition must be always against it."<sup>1</sup> Or in another passage: "People of the same trade seldom meet together, even for merriment or diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices."<sup>2</sup> No private entrepreneur or private capitalist can be expected to renounce voluntarily an opportunity to raise his profit or the value of his investment:

"Al mondo non fur mai persone ratte  
a far lor pro ed a fuggir lor danno."

(*Inferno*, canto II.)

The system of free competition is a rather peculiar one. Its mechanism is one of *fooling* entrepreneurs. It requires the pursuit of maximum profit in order to function, but it destroys profits when they are actually pursued by a larger number of people. However, this game of blindman's buff with the pursuit of maximum profit is possible only as long as the size of the business unit is small and the number of entrepreneurs is consequently large. But with the growth of large-scale industry and the centralisation of financial control the pursuit of maximum profit destroys free competition. The picture would not be complete without adding that political interference in economic life is frequently used to protect profits or investments.<sup>3</sup> This political intervention is also a result of the growing size of industrial and financial units. Small-scale enterprises are too small to be politically significant, but the economic power of big corporations and banking interests is too large not to have serious political consequences. As long as the maximisation of profit is the basis of all business activities it is unavoidable that industrial and financial corporations should try to use their economic power to increase profits or the value of their investments by proper State intervention.<sup>4</sup> And unless the executive and

<sup>1</sup> *Wealth of the Nations*, vol. I, p. 250, of Cannan's third edition, London, 1922.

<sup>2</sup> *Ibid.*, p. 130.

<sup>3</sup> Such political interference plays a much greater rôle in Europe than in the United States.

<sup>4</sup> This has also an important influence on the selection of business leaders. Under free competition the most successful leader of a business enterprise is he who is able to produce at the lowest cost. With interventionism and restrictionism the best business man is he who knows how best to influence in his interest the decisions of the organs of the State (for instance, in getting tariffs, government subsidies or orders, advantageous import quotas, etc.). A special ability in

legislative organs of the State are abstract metaphysical entities beyond the reach of any earthly influence, they will yield to the pressure of those powers. A return to free competition could be accomplished only by splitting up the large-scale business units to destroy their economic and political power. This could be attained only at the cost of giving up large-scale production and the great economic achievements of mass production which are associated with it. Such an artificially maintained system of free competition would have to prohibit the use of advanced technology.

The other way would be the control of production and investments by the government with the purpose of preventing monopoly and restrictionism. Such control would signify planning of production and investment without removing private enterprise and private ownership of the means of production. However, such planning can scarcely be successful. The great economic power of corporations and banks being what it is, it would be rather they who would control the public planning authorities than the reverse. The result would be planning for monopoly and restrictionism, the reverse of what was aimed at. But even if this could be avoided, such control would be unsuccessful. To retain private property and private enterprise and to force them to do things different from those required by the pursuit of maximum profit would involve a terrific amount of *regimentation* of investment and enterprise. To realise this one has but to consider that government control preventing restrictionist preservation of the value of old investments would have to force producers to act in a way which imposes on them actual *losses* of capital. This would upset the financial structure of modern capitalist industry. The constant friction between capitalists and entrepreneurs on the one side and the controlling government authorities on the other side would paralyse business. Besides, the corporations and big banks could use their economic power to defy the government authorities (for instance, by closing their plants, withdrawing investments, or other kinds of economic sabotage). As a result the government would have either to yield, and thus to give up any effective interference with the pursuit of maximum profit, or to transfer the defying corporations and banks into public ownership and management. The latter would lead straight to socialism.

Thus, monopoly, restrictionism, and interventionism can be done away with only together with private enterprise and the private ownership of the means of production, which, from being promoters, have turned into obstacles of economic progress. This does not imply the necessity, or wisdom, of abolishing private enterprise and private property of the means of production in those fields where real competition still prevails, i.e. in small-scale industry and farming. But the most important part of modern economic life is just as far removed from free competition as it is from socialism: <sup>1</sup> it is choked up with

this direction may well compensate the incapacity to produce at a low cost. The best lobbyist becomes the most successful business leader. What formerly was regarded as a special trait of the munitions industry becomes in interventionist capitalism the general rule.

<sup>1</sup> According to the United States Senate Report on "Industrial Prices and Their Relative Inflexibility" (74th Congress, 1st Session, Doc. No. 13, p. 10), written by Professor G. C. Means, in the United States, "more than one half of all manufacturing activity is carried on by 200 big corporations, while big corporations dominate the railroad and public utility fields and play an

restrictionism of all sorts. When this state of things will have become unbearable, when its incompatibility with economic progress will have become obvious, and when it will be recognised that it is impossible to return to free competition, or to have successful public control of enterprise and of investment without taking them out of private hands, then socialism will remain as the only solution available. Of course, this solution will be opposed by those classes who have a vested interest in the *status quo*. The socialist solution can, therefore, be carried out only after the political power of those classes has been broken.

## 6. ON THE POLICY OF TRANSITION

The preceding treatment of the allocation of resources and of pricing in a socialist economy refers to a socialist system already *established*. The question does not present any special theoretical difficulty if a sector of small-scale private enterprise and private ownership of means of production is embodied in the socialist economy. However, on grounds which result from our previous discussion of the problem, this sector should satisfy the following three conditions: (1) free competition must reign in it; (2) the amount of means of production owned by a private producer (or of the capital owned by a private shareholder in socialised industries) must not be so large as to cause a considerable inequality in the distribution of incomes; and (3) the small-scale production must not be, in the long run, more expensive than large-scale production. But the problem of *transition* from capitalism to socialism presents some special problems. Most of those problems refer to the economic measures made necessary by the political strategy of carrying through the transformation of the economic and social order. But there are also some problems which are of a purely economic character and which, therefore, deserve the attention of the economist.

The first question is whether the transfer into public property and management of the means of production and enterprises to be socialised should be the first or the last stage of the policy of transition. In our opinion it should be the first stage. The socialist government must start its policy of transition right away with the *socialisation* of the industries and banks in question. This follows from what has been said before on the possibility of successful government control of private enterprise and private investment. If the socialist government would attempt to control or supervise them while leaving them in private hands, there would emerge all the difficulties of forcing a private entrepreneur or capitalist to act differently than the pursuit of profit commands. In the best case the constant friction between the supervising government agencies and the entrepreneurs and capitalists would paralyse business. After such an unsuccessful attempt the socialist government would have either to give up its socialist aims or to proceed to socialisation.

important rôle in the fields of construction and distribution.' Cf. also A. A. Berle and G. C. Means, *The Modern Corporation and Private Property*, New York, 1933, Book I, chap. III, and A. R. Burns, *The Decline of Competition*, New York, 1936.

The opinion is almost generally accepted that the process of socialisation must be as gradual as possible in order to avoid grave economic disturbance. Not only right-wing socialists but also left-wing socialists and communists<sup>1</sup> hold this theory of economic *gradualism*. While the latter two regard a speedy socialisation as necessary on grounds of political strategy, they nevertheless usually admit that, as far as economic considerations alone go, a gradual socialisation is decidedly preferable. Unfortunately, the economist cannot share this theory of economic gradualism. An economic system based on private enterprise and private property of the means of production can work only as long as the security of private property and of income derived from property and from enterprise is maintained. The very existence of a government bent on introducing socialism is a constant threat to this security. Therefore, the capitalist economy cannot function under a socialist government unless the government is socialist in name only. If the socialist government socialises the coal mines to-day and declares that the textile industry is going to be socialised after five years, we can be quite certain that the textile industry will be ruined before it will be socialised. For the owners threatened with expropriation have no inducement to make the necessary investments and improvements and to manage them efficiently. And no government supervision or administrative measures can cope effectively with the passive resistance and sabotage of the owners and managers. There may be exceptions in the case of industries managed by technicians rather than by business men. Those technicians, if assured that they will keep their places, may be quite sympathetic to the idea of transfer of the industry into public ownership. Also a scheme of proper compensation for expropriated owners may help to solve the difficulty. But to be fully effective the compensation would have to be so high as to cover the full value of the objects expropriated. The capital value of these objects having been maintained on an artificially high level by monopolistic and restrictionist practices, the compensation would have to be far in excess of the value of these objects in a socialist economy (and also under free competition in capitalism). This would impose on the socialist government a financial burden which would make any further advance in the socialisation programme almost impossible. Therefore, a comprehensive socialisation programme can scarcely be achieved by gradual steps. A socialist government really intent upon socialism has to decide to carry out its socialisation programme *at one stroke*, or to give it up altogether.<sup>2</sup> The very coming into power of such a government must cause a financial panic and economic collapse. Therefore, the socialist government must either guarantee the immunity of private property and private enterprise in order to enable the capitalist economy to function normally, in doing which it gives up its socialist aims, or it must go through resolutely with its socialisation programme at maximum

<sup>1</sup> How far the Russian Bolsheviks before taking power conceived socialisation as a gradual process can be seen from Lenin's pamphlet "The Threatening Catastrophe and How to Fight It" (*Works*, vol. XXI, Book I).

<sup>2</sup> This is true of any policy aiming at a radical change in property relations, not only of socialisation. For instance, an agrarian revolution like that taking place in Spain and due in many countries of Eastern Central Europe cannot proceed gradually if agricultural production is not to be ruined by many years of uncertainty.



speed.<sup>1</sup> Any hesitation, any vacillation and indecision provokes the inevitable economic catastrophe.<sup>2</sup> Socialism is not an economic policy for the timid.

On the other hand, as a complement to its resolute policy of speedy socialisation, the socialist government has to declare in an unmistakable way what sorts of property and enterprise are going to remain in private hands and to *guarantee their absolute security*. To avoid the growth of an atmosphere of panic in the sector of private property and private enterprise the socialist government may have to prove the seriousness of its intentions by some immediate deeds in favour of the small entrepreneurs and small property holders (including holders of saving deposits and small stock and bondholders). It has to make it absolutely clear to everybody that socialism is not directed against private property as such, but only against that special type of private property which creates social privileges to the detriment of the great majority of the people or creates obstacles to economic progress, and that, consequently, all private property in the means of production and private enterprise which does have a *useful social function* will enjoy the full protection and support of the socialist State.

We have seen that a socialist government faces the dilemma of either carrying out socialisation by a great and bold stroke, or giving up its socialist aims altogether. If it does the latter it remains socialist in name only, its real function being the administration of the capitalist economy, which can be done successfully only if the property of the capitalists and the freedom of the capitalist entrepreneurs to realise their profits are safeguarded. In such a case the socialists would do much better to turn over the office to a capitalist government which, having the confidence of the business world, is more fit to administer a capitalist society.

There exists, however, a special situation where a socialist government, even if it has not got the power to achieve a comprehensive socialisation, may have a useful task to fulfil, a task which a capitalist government may be unable to carry out. If the marginal efficiency of capital (as defined by Mr. Keynes<sup>3</sup>) is very low and the liquidity preference of the capitalists is very high, as usually is the case in a depression, a bold programme of public investments is needed to restore employment to a higher level. In principle, there is no reason why a capitalist government should not be able to perform those investments. But since they have to be effected without regard to the low rate of return upon them, i.e. in violation of the fundamental principle of the capitalist economy that investments ought to be made for profit only, they may appear to all the capitalist parties as "unsound." Thus it may take a socialist government,

<sup>1</sup> In the necessity to choose between these two alternatives lay the tragedy of all right-wing socialist governments.

<sup>2</sup> This was brought out clearly by the experience of the first eight months after the Bolsheviks got into power in Russia. The Soviet Government tried honestly to avoid speedy and wholesale socialisation of industries. An economic collapse was the result. Most of the socialisation decrees during those months were emergency measures which had to be taken because the old owners were unable to run their factories without the necessary security of property and profit and without the necessary authority over the workers. For details see Dobb, *Russian Economic Development since the Revolution*, New York, 1928, chapter II.

<sup>3</sup> Cf. *The General Theory of the Employment*, chap. 11.

free from the ballast of bourgeois prejudices about economic policies,<sup>1</sup> to restore the capitalist economy. In such circumstances the socialists might form a government with a Labour Plan to attack unemployment and the depression. But as soon as the Labour Plan is carried out the socialist government faces its unescapable dilemma: either the socialist government uses the popularity it has won through its success in handling the depression and unemployment for a general attack on the capitalist system (the opportunity for it may come, for instance, when the capitalists, who suffered the socialist government in a period of panic, want to get rid of it), or it degenerates into becoming purely the administrator of capitalist society. Thus a Labour Plan is either a start for the wholesale attack on the capitalist system, or it must end in a betrayal of socialism.

Marshall placed caution among the chief qualities an economist should have. Speaking of the rights of property he observed: "It is the part of responsible men to proceed cautiously and tentatively in abrogating or modifying even such rights as may seem to be inappropriate to the ideal conditions of social life."<sup>2</sup> But he did not fail to indicate that the great founders of modern economics were strong not only in caution but also in courage.<sup>3</sup> Caution is the great virtue of the economist who is concerned with minor improvements in the existing economic system. The delicate mechanism of supply and demand may be damaged and the initiative and efficiency of business men may be undermined by an improvident step. But the economist who is called to advise a socialist government faces a different task, and the qualities needed for this task are different, too. For there exists only one economic policy which he can commend to a socialist government as likely to lead to success. This is a policy of *revolutionary courage*.

## APPENDIX

### THE ALLOCATION OF RESOURCES UNDER SOCIALISM IN MARXIST LITERATURE

It is interesting to see how the problem of allocation of resources in a socialist economy is solved by the leading writers of the socialist movement and to compare it with the solution offered by modern economic theory. As the theoretical foundations of the socialist movement have been elaborated chiefly by the Marxists, it is their views which are of foremost interest. For this purpose let us review briefly the statements of some of the most prominent of them.

<sup>1</sup> It ought to be mentioned, however, that sometimes socialist governments have proved to be affected much more by the bourgeois prejudices regarding economic and financial policies than capitalist governments often are. The reason for it was that by the "soundness" of their policies they wanted to make up for the lack of confidence of the business and financial world. It need not be said that even at this price a socialist government scarcely wins the sympathy of the big capitalist and financial interests while it forfeits its only chance of success in its economic policies.

<sup>2</sup> *Principles of Economics*, eighth edition, London, 1930, p. 48.

<sup>3</sup> *Ibid.*, p. 47.

To begin with Marx, it is not difficult to prove by quotations that he was well aware of the problem, though he tried to solve it in a rather unsatisfactory way. Discussing the economics of Robinson Crusoe he writes: "Moderate though he be, yet some few wants he has to satisfy, and must therefore do a little useful work of various sorts. . . . Necessity itself compels him to apportion his time accurately between his different kinds of work. . . . This our friend Robinson soon learns by experience, and having rescued a watch, ledger, and pen and ink from the wreck, commences, like a true-born Briton, to keep a set of books. His stock book contains a list of the objects of utility that belong to him, of the operations necessary for their production, and, lastly, of the labour-time that definite quantities of those objects have, on the average, cost him. All the relations between Robinson and the objects that form this wealth of his own creation are here so simple and clear as to be intelligible without exertion even to Mr. Sedley Taylor. And yet those relations contain all that is essential to the determination of value."<sup>1</sup> And he continues: "Let us now picture to ourselves, by way of change, a community of free individuals, carrying on their work with the means of production in common. . . . All the characteristics of Robinson's labour are here repeated, but with this difference, that they are social instead of individual. . . . The total product of our community is a social product. One portion serves as fresh means of production and remains social. But another portion is consumed by the members as means of subsistence. The mode of this distribution will vary with the productive organisation of the community, and the degree of historical development attained by the producers. We will assume, but merely for the sake of a parallel with the production of commodities, that the share of each producer in the means of subsistence is determined by his labour-time. Labour-time would, in that case, play a double part. Its apportionment in accordance with a definite social plan maintains the proper proportion between the different kinds of work to be done and the various wants of the community. On the other hand, it also serves as a measure of the portion of common labour borne by each individual and of his share in the part of the total product destined for individual consumption."<sup>2</sup> Each worker would enjoy freedom of choice in consumption within the limits thus determined: "He receives from society a voucher that he has contributed such and such a quantity of labour (after deduction from his labour for the common fund) and draws through this voucher on the social storehouse as much of the means of consumption as costs the same quantity of labour."<sup>3</sup> The importance of the problem of allocating resources is stated very clearly in a letter written in 1868 to Kugelmann: "Every child knows that a country which ceased to work, I will not say for a year, but for a few weeks, would die. Every child knows, too, that the mass of products corresponding to the different needs require different and quantitatively determined masses of the total labour of society. That this necessity of distributing social labour in definite proportions cannot be done

<sup>1</sup> *Capital*, vol. I, edited by Untermann, Chicago, Kerr, 1908, p. 88 (p. 43 of the sixth German edition, Hamburg, Meissner, 1909).

<sup>2</sup> *Capital*, vol. I, pp. 90-1 (p. 45 of the sixth German edition).

<sup>3</sup> *Critique of the Gotha Programme*, London, 1933, p. 29. (I have had to correct the translation, which is inaccurate.)

away with by the *particular form* of social production, but can only change the *form it assumes*, is self-evident. No natural laws can be done away with. What can change, in changing historical circumstances, is the *form* in which these laws operate. And the form in which this particular division of labour operates, in a state of society where the interconnection of social labour is manifested in the *private exchange* of the individual products of labour, is precisely the *exchange value* of these products."<sup>1</sup>

The places quoted show that Marx was fully aware of the problem of allocation of resources in a socialist economy. However, he seems to have thought of labour as of the only kind of scarce resource to be distributed between different uses and wanted to solve the problem by the labour theory of value. The unsatisfactory character of this solution need not be argued here, after all our preceding discussion of the subject. Professor Pierson and Professor Mises have certainly merited the gratitude of the student of the problem by exposing the inadequacy of this simplistic solution.<sup>2</sup> But even accepting the labour theory of value as a basis for the solution of the problem, the question of utility (or of demand) cannot be avoided, or the amounts of the various goods to be produced would be indeterminate. This was recognised clearly by Engels: "The utility yielded by the various consumption goods, weighted against each other and against the amount of labour required to produce them, will ultimately determine the plan."<sup>3</sup> Whoever knows the rôle the concept of "gesellschaftliches Beduerfnis" plays in the third volume of *Das Kapital* has to admit that Marx was well aware of the rôle demand (or utility) has in determining the allocation of resources, though, not unlike Ricardo,<sup>4</sup> he was not able to find a clear functional expression of the law of demand. The limitations of Marx and Engels are those of the classical economists.

From Marx and Engels let us pass to Kautsky, who more than anybody else has contributed to the propagation of Marxian ideas the world over. In a lecture on "The Day after the Revolution,"<sup>5</sup> given in 1902, which to a

<sup>1</sup> Cf. *The Correspondence of Marx and Engels*, International Publishers, New York, p. 246. This and some other statements disprove the generally accepted view that Marx regarded all economic laws as being of an historico-relative character. His position seems to have been, however, that the economic laws of universal validity are so self-evident that there is scarcely need for a special scientific technique for their study and economic science ought to concentrate, therefore, upon investigating the particular form these laws assume in a definite institutional framework. Cf. also Engels, *Anti-Dühring*, twelfth edition, Berlin, 1923, pp. 149-50.

<sup>2</sup> Cf. Pierson, "The Problem of Value in the Socialist Society," reprinted in *Collectivist Economic Planning*, p. 76 *et seq.*, and Mises, *Economic Calculation in the Socialist Commonwealth*, *ibid.* p. 113 *et seq.*

<sup>3</sup> *Anti-Dühring*, pp. 335-6. With some benevolent interpretation this statement of Engels may be regarded, indeed, as containing all the essentials of the modern solution. Interpreting the amount of labour necessary to produce a certain good as the *marginal* amount, all costs may be reduced, in long-period equilibrium, to labour-costs. The prices of the services of natural resources may be regarded as differential rents, and if capital accumulation has been carried on as far as to reduce the marginal *net* productivity of capital to zero (as a socialist society would tend to do, cf. p. 65 of Part One), interest charges are eliminated. Thus the production of each commodity has to be carried so far as to make the ratio of the marginal amount of labour used in producing the different commodities equal to the ratio of the marginal utilities (and of the prices) of those commodities. But such long-period solution eliminating interest would be of little use for practical purposes.

<sup>4</sup> *Vide* Ricardo's treatment of demand in connection with the theory of rent.

<sup>5</sup> Published as a second part of the booklet *The Social Revolution* (quoted according to the edition by Kerr, Chicago, 1910).

certain extent was an answer to Professor Pierson's challenge, Kautsky formulates his view as to the rôle of money and prices in a socialist economy. He makes it quite clear that, as a result of freedom of choice in consumption and of freedom of choice of occupation, money and prices have to exist also in a socialist economy. "Money [he says] is the simplest means known up to the present time which makes it possible in as complicated a mechanism as that of the modern productive process, with its tremendous far-reaching division of labour, to secure the circulation of products and their distribution to the individual members of society. It is the means which makes it possible for each one to satisfy his necessities according to his individual inclination (to be sure within the bounds of his economic power)."<sup>1</sup> And with regard to the allocation of labour to the different industries in a socialist economy he observes: "Since the labourers cannot be assigned by military discipline and against their wishes to the various branches of industry, so it may happen that too many labourers rush into certain branches of industry while a lack of labourers is the rule in the others. The necessary balance can then only be brought about by the reduction of wages where there are too many labourers and the raising of them in those branches of industry where there is a lack of labourers until the point is reached where every branch has as many labourers as it can use."<sup>2</sup> Unfortunately, Kautsky did not enter into the question of the criteria to be used in planning production. However, he carried his ideas farther in his book *The Labour Revolution*, written in 1922.<sup>3</sup> Raising again the point that socialism does not imply the abolition of money, he states very clearly the connection of the problem with the freedom of choice in consumption: "Without money only two kinds of economy are possible: First of all the primitive economy already mentioned. Adapted to modern dimensions, this would mean that the whole of productive activity in the State would form a single factory, under one central control, which would assign its task to each single business, collect all the products of the entire population, and assign to each business its means of production and to each consumer his means of consumption in kind. The ideal of such a condition is the prison or the barracks. This barbarous monotony lurks in fact behind the ideas of the 'natural economy' of Socialism."<sup>4</sup> Quoting a socialist enthusiast of "natural economy" who finds no difficulty in rationing consumption, Kautsky remarks: "Assuredly not, if the entire life of a civilised man is to be reduced to war rations, and everybody to have the same quantity of bread, meat, accommodation, clothes, personal taste not playing any part and distinctions not being observed, although there is to be special cooking for poets and children. Unfortunately, we are not told how many hundredweights of books are to be allotted to each citizen in the course of a year, and how frequently the inhabitants of each house are to go to the cinematograph."<sup>5</sup> The other kind of socialist economy which might do without money is, according to Kautsky, that where all commodities would be free goods.<sup>6</sup>

<sup>1</sup> *The Social Revolution*, p. 129.

<sup>2</sup> *Ibid.*, pp. 134-5.

<sup>3</sup> New York, 1925. The title of the German original is: *Die proletarische Revolution und ihr Programm*, Berlin, 1922.

<sup>4</sup> *Loc. cit.*, p. 260.

<sup>5</sup> *Ibid.*, p. 260.

<sup>6</sup> *Ibid.*, p. 261.

Kautsky also recognises the necessity of a price system for cost accounting. Like all Marxists of the old school he uses the labour theory of value as a basis for elucidating the problem of the distribution of resources in a socialist economy. But what is most important, he quite explicitly admits the practical impossibility of calculating the amount of labour socially necessary to produce a given commodity: "Consider what colossal labour would be involved in calculating for each product the amount of labour it had cost from its initial to its final stage, including transport and other incidental labour."<sup>1</sup> Hence the necessity of a price system: "The appraisal of commodities according to the labour contained in them, which could not be achieved by the most complicated State machine imaginable, we find to be an accomplished fact in the shape of the transmitted prices, as the result of a long historical process, imperfect and inexact, but nevertheless the only practical foundation for the smooth functioning of the economic process of circulation."<sup>2</sup> Thus money prices are the basis of economic accounting: "Whatever may be the lines upon which a socialist society is organised, very careful accountancy would be required. . . . This object would be quite impossible of attainment if the incomings and outcomings were entered *in kind*."<sup>3</sup> The great leader of orthodox Marxism in pre-war times knows, of course, very well the distinction between the Marxian concept of capitalism and that of a money economy: "Thousands of years passed before a capitalist mode of production came into existence. As the measure of value and means of circulation of products money will continue to exist in a socialist society until the dawn of that blessed second phase of communism which we do not yet know whether will be ever more than a pious wish, similar to the Millennial Kingdom."<sup>4</sup> Finally, he concludes: "The monetary system is a machine which is indispensable for the function of a society with a widely ramified division of labour. . . . It would be a relapse into barbarism to destroy this machine, in order to resort to the primitive expedients of natural economy. This method of combating capitalism recalls the simple workers of the first decades of the last century who thought they would make an end to capitalist exploitation if they smashed the machines which they found to hand. It is not our desire to destroy the machines, but to render them serviceable to society, so that they may be shaped into a means of the emancipation of labour."<sup>5</sup>

But are perhaps these views of Kautsky's a heretical deviation from the orthodox line of Marxist thought? Maybe they are not representative for modern Marxists, a large part of whom are bitter opponents of the political strategy advocated by him? Let us examine the views of another group of Marxist leaders. The following quotation from Trotsky to begin with: "If there existed the universal mind that projected itself into the scientific fancy of Laplace . . . such a mind could, of course, draw up *a priori* a faultless and an exhaustive economic plan, beginning with the number of hectares of wheat and down to the last button for a vest. In truth, the bureaucracy often conceives that just such a mind is at its disposal; that is why it so easily frees itself from the control of the market and of Soviet democracy. But in reality

<sup>1</sup> *The Labour Revolution*, p. 264.<sup>2</sup> *Ibid.*, p. 267.<sup>3</sup> *Ibid.*, p. 262.<sup>4</sup> *Ibid.*, p. 262.<sup>5</sup> *Ibid.*, p. 270.

the bureaucracy errs frightfully in this appraisal of its spiritual resources. . . . The innumerable living participants of economy, State as well as private, collective as well as individual, must give notice of their needs and of their relative strength not only through the statistical determination of plan commissions but by the direct pressure of supply and demand. The plan is checked and to a considerable measure realised through the market. The regulation of the market itself must depend upon the tendencies that are brought out through its medium. The blueprints brought out by the offices must demonstrate their economic expediency through commercial calculation."<sup>1</sup> And after the critic of the Soviet economic policy let us listen to its leader. In discussing the problem of Soviet trade Stalin observes: "Then we have to overcome prejudices of another kind. I refer to the Leftist chatter . . . about Soviet trade being a superseded stage. . . . These people, who are as far removed from Marxism as heaven is from earth, evidently do not realise that we shall have money for a long time to come, until the first stage of communism, i.e. the socialist stage of development, has been completed."<sup>2</sup>

But Marx anticipated also a second phase of communism (which sometimes is also called communism *sensu stricto* while the first phase is called socialism) in which the distribution of incomes is quite divorced from the labour services performed by the individual and based on the principle "from each according to his capacity, to each according to his need."<sup>3</sup> Bertrand Russell calls this form of distribution very aptly "free sharing."<sup>4</sup> Free sharing presupposes, of course, that the commodities in question are practically free goods. An outstanding Marxist like Kautsky speaks, therefore, with irony of "that blessed second phase of communism which we do not yet know whether will ever be more than a pious wish, similar to the Millennial Kingdom," while Lenin<sup>5</sup> and Stalin believe seriously in the possibility of such a stage of economic evolution in the future.

The idea of distributing goods and services by free sharing sounds utopian, indeed. However, if applied to only a part of commodities free sharing is by no means such economic nonsense as might appear at a first glance. The demand for many commodities becomes, from a certain point on, quite inelastic. If the price of such a commodity is below and the consumer's income is above a certain minimum the commodity is treated by the consumer *as if* it were a free good. The commodity is consumed in such quantity that the want it serves to satisfy is perfectly *saturated*. Take, for instance, salt. Well-to-do people do the same with bread or with heating in winter. They do not stop eating bread at a point where the marginal utility of a slice is equal to the marginal utility of its price, nor do they turn down the heat by virtue of a similar consideration. Or would a decline of the price of soap to zero induce them to be so much more liberal in its use? Even if the price were zero, the amount of salt, bread, fuel, and soap consumed by well-to-do people would

<sup>1</sup> *Soviet Economy in Danger*, Pioneer Publishers, New York, 1932, pp. 29-30.

<sup>2</sup> "Report on the work of the Central Committee of the Communist Party of the Soviet Union made to the Seventeenth Party Congress held in Moscow, January 26 to February 10, 1937."

<sup>3</sup> *Critique of the Gotha Programme*, p. 31.

<sup>4</sup> See *Roads to Freedom*, London, 1919, p. 107 *et seq.*

<sup>5</sup> Cf. "The State and Revolution," chapter V (4) (*Works*, vol. XXI, Book II.).

not increase noticeably. With such commodities saturation is reached even at a positive price. If the price is already so low, and incomes so high, that the quantity consumed of those commodities is equal to the *saturation* amount, free sharing can be used as a method of distribution.<sup>1</sup> Certain services are distributed in this way already in our present society. If a part of the commodities and services is distributed by free sharing, the price system needs to be confined only to the rest of them. However, though the demand for the commodities distributed by free sharing is, within limits, a fixed quantity, a cost has to be accounted for in order to be able to find out the best combination of factors and the optimum scale of output in producing them. The money income of the consumers must be reduced by an equivalent of the cost of production of these commodities. This means simply that free sharing provides, so to speak, a "socialised sector" of consumption the cost of which is met by taxation (for the reduction of consumers' money-incomes which has just been mentioned is exactly the taxation to cover the consumption by free sharing). Such a sector exists also in capitalist society, comprising, for instance, free education, free medical service by social insurance, public parks, and all the collective wants in Cassel's sense (e.g. street lighting). It is quite conceivable that as wealth increases this sector increases, too, and an increasing number of commodities is distributed by free sharing until, finally, all the prime necessities of life are provided for in this way, the distribution by the price system being confined to better qualities and luxuries. Thus Marx's second phase of communism may be gradually approached.

The statements quoted are sufficient to prove that the leading writers of the Marxist school were and are quite aware of the necessity of the price system in a socialist economy. It is, therefore, very much exaggerated to say that the Marxian socialists did not see the problem and offered no solution. The truth is that they saw and solved the problem only within the limits of the labour theory of value, being thus subject to all the limitations of the classical theory. But it ought to be mentioned that in Italy, due to the influence of Pareto, the socialist writers were much more advanced in this field. The difference between the traditional Marxist and the modern position on the problem is thus but a difference as to the technique applied. Only the technique provided by the modern method of marginal analysis enables us to solve the problem satisfactorily. Professor Mises' challenge has had the great merit of having induced the socialists to look for a more satisfactory solution of the problem, and it is only too true that many of them became aware of its very existence only after this challenge. But, as we have seen, those of the socialists who did not or do not realise the necessity and importance of an adequate price system and economic accountancy in the socialist economy are backward not only with regard to the present state of economic analysis: they do not even reach up to the great heritage of Marxian doctrine.

London.

OSKAR LANGE.

<sup>1</sup> See Russell, *Roads to Freedom*, pp. 100-10.



## A Note on Socialist Economics

IN criticism of Dr. Lange's important article on this subject that is appearing in the present and the next number of the REVIEW, I have one major comment to make and a number of minor ones. I shall deal with the latter first.

(1) The distinction between the short period in which the supply of capital is considered as fixed and the long period in which it can be varied by accumulation (p. 65) does not seem to be justified. However short the period one considers there is a certain rate of flow of *free* capital that is being invested or reinvested, and this flow can be varied considerably, rising above the amount necessary to maintain the existing capital (however arbitrarily that may be defined) when there is net investment and falling below that measure when there is net disinvestment. Dr. Lange's analysis for the long period is, however, perfectly satisfactory for the short period too.

(2) There is no reason why technical progress or other dynamic changes should prevent the rate of interest and the marginal net productivity of capital from falling to zero. On the contrary, the expectation of further change, by putting a limit to the period during which one may expect any new capital good to continue to be useful, has the effect of diminishing the scope of interest yielding investment. It is just this consideration which may bring within feasible limits the rate of investment which corresponds to a zero marginal net productivity of capital. After a transition period which may not be so very long it should be possible to maintain investment at this rate and, consequently, the marginal net productivity of capital at zero.

(3) Dr. Lange says: "The loss of his power to determine the rate of accumulation of capital is the price the consumer has to pay for living in a socialist society" (p. 65). This suggests that it is the taste of the consumer rather than the distribution of wealth and the structure of corporations that is the important determinant of the rate of accumulation of capital in a capitalist society, whereas Mr. Keynes has even shown that thrift on the part of the consumer in a capitalist society usually has the effect of *diminishing* rather than increasing the rate of capital accumulation. It is true that in the socialist society limits will have to be imposed on the accumulations of individuals in the interests of the maintenance of the income structure that is considered desirable from a social point of view. But it does not follow that these restrictions need be even as onerous as death duties and income taxes have had to be in capitalist society (although they would have to become operative at much lower levels—the scale of incomes would of course be much less extended). For great wealth is not acquired by thrift alone.

It is possible for the consumer in a socialist society to have much more influence on the rate of accumulation of capital than he has in a capitalist society. Apart from the democratic governmental machinery that might be concerned with such an issue and where the consumer might use his vote, there would be possibilities of using the even more democratic market mechanism to discover the desires of consumers in this matter. Within the socially determined limits (to the *rate* of saving as well as to the amount

accumulated, for a very poor existence is at least as objectionable as great luxury) consumers can be allowed to distribute their consumption through time in the same way as they can distribute it between different consumption goods at the same time. The principle that price should correspond to cost demands that consumers postponing consumption should get interest on their postponement in accordance with the increase (if any) in product that is made possible by the postponement, while consumers who anticipate consumption should suffer a corresponding diminution of consumption or discount. The thriftiness or otherwise of the consumers can then be observed in the degree to which consumption is postponed or anticipated—as shown by the debits and credits of consumers with the state bank—and the authorities could, if they wished, take this index of time preference into account in deciding the rate of accumulation of capital. It might, for instance, be decided to keep the rate of investment at that level which corresponded to a rate of interest at which postponements of consumption, or lendings by consumers, exactly equalled their anticipations or borrowings. Or some other criterion might be preferred. But if there existed the desire to heed consumers' time preferences this could be observed much more scrupulously than is possible in a capitalist society.

(4) Dr. Lange declares that the social dividend must be distributed as a percentage on the wage rate if it is not to interfere with the ideal distribution of labour between different occupations (p. 21). This seems to me to be an error. According to Dr. Lange, "The optimum distribution is that which makes the value of the marginal product of the services of labour in different industries and occupations proportional to the marginal disutility of working in those industries or occupations." If this were so and if, in addition, as Dr. Lange tacitly assumes, the marginal disutility of working in different occupations is proportional to the income obtained by so working, his conclusion would follow. But there is no basis for either of these two propositions.

The optimum distribution is reached if it is impossible by moving a labourer from one position to another to increase the product by more than is necessary to give him to compensate him for any net increase in disutility involved by the change. This means that the difference between the incomes obtained in different occupations (which, with freedom of movement, will measure the difference in the disutility of working in the different occupations) must be equal to the difference between the values of the marginal products. In other words, the difference between the total income, including social dividend, that can be obtained by working in different occupations must be exactly equal to the difference in the wage (for the wage is equal to the value of the marginal product). Our conclusion is the exact opposite of Dr. Lange's. There must be *no* connection between the social dividend and the wage (or the occupation, since this would connect the dividend with the wage) otherwise it will interfere with the optimum distribution of resources. If the social dividend is made proportional to the wage, there will be an undue attraction of workers to the occupation with the greater wage on account of the greater social dividend obtainable there in addition to the greater wage.

A numerical example may clarify the matter further. Let productivities and wages in occupations *A* and *B* equal £2 and £3 per week respectively, while the social dividend is 100 per cent of the wage, so that total incomes are £4 and £6 per week respectively. In such an equilibrium, workers in *B* are no better off than those in *A*, the greater disutility of working there being just compensated by, and therefore equal to, the £2 difference in their income. But if a man were shifted to *A* and given £5 a week he would enjoy a net gain of £1. This can be done without social cost, for the shifting of the man from *B* to *A* diminishes the product by only £1. The initial position, chosen by Dr. Lange is therefore not the optimum. If, however, the social dividend is the same in either occupation for any individual (though it may be different for different individuals) the difference in the incomes is only £1 and the difference in the disutilities is just equal to the difference in product so that nothing can be gained by shifting anybody and we have the optimum position. The social dividend may be distributed on any basis whatever, the only restriction is that it must be independent of the wage.

(5) I now come to my main point which is concerned with the two accounting rules given by Dr. Lange for the achievement of economy and consistency in the management of the socialist society.

The first rule is addressed to the managers of individual productive plants and directs them to minimise the average cost of production (a) by adjusting the proportions of the factors used, given the output, and (b) by adjusting the volume of output. The second rule, which directs that the total output of each commodity shall be such that its market price equals this minimised average cost, does not seem to be addressed to anybody in particular, but it can be considered either as defining the function of the Commissar of the Industry or as an invitation to any potential producer to come into the industry if he can make a profit and a warning to any producer who is incurring a loss that he must clear out. As Dr. Lange sees, the successful carrying out of the rules would result in a faithful copy of classical, long period, stationary (or static) competitive equilibrium.

Methodologically my objection is that Dr. Lange takes the state of competitive equilibrium as his *end* while in reality it is only a *means* to the end. He fails to go *behind* perfect competitive equilibrium and to aim at what is really wanted. Even though it be true that if the state of classical static perfectly competitive equilibrium were reached and maintained in its entirety the social optimum which is the *real* end would thereby be attained, it does not follow that it is by aiming at this equilibrium that one can approach most nearly the social optimum that is desired. It would first have to be shown (a) that the technical conditions for the perfectly competitive equilibrium exist, (b) that the rules which, if perfectly carried out would give the perfectly competitive equilibrium (since they are based on the description of that equilibrium) are also the rules that are in fact calculated to give the closest approach to the equilibrium in the course of the continually frustrated attempts to reach it in a dynamic world, and (c) that the degree of approximation to the equilibrium so corresponds to the degree of approximation to the desired social optimum that by maximising one approximation the other is maximised

too. Unfortunately the first two, at least, of these three conditions fail to be satisfied.

The technical conditions for competitive equilibrium are that in the production of *every* commodity in the economy there shall be needed a large number of plants working at their optimum in order to produce the appropriate output. For if only a few plants are necessary it will be only by a fortunate accident that the optimum output of any whole number of plants is such as reduces the price to the minimum cost. There is a clash between Dr. Lange's two rules. The difficulty of maintaining competition under capitalism is the increase in the size of the optimum plant or firm, and this will interfere with Dr. Lange's copy of competitive equilibrium nearly as much as it does with actual competitive equilibrium. *Nearly* as much because the increase in the size of the productive unit will tend to upset the equilibrium *before* the technical difficulty arises, insofar as it facilitates combinations of relatively few producers for the purpose of obtaining monopoly gains. This aggravation is prevented in Dr. Lange's scheme by the principle of treating prices as parameters, but the primary difficulty remains. It is fundamentally the same as that in the way of restoring competitive conditions under capitalism by state intervention—the interference with progress in productive methods—and is to be found in the tendency of the technical prerequisites for a competitive regime to give way to those of another social order. To insist on the framework fitted to the old conditions is in the strict sense of the word reactionary.

More important than this is a further implication of Dr. Lange's solution. Even if the ultimate technical conditions for perfect competition do obtain, are his rules such as to give the closest approach to the optimum desired in the course of the continuously frustrated attempts—in a dynamic world—to reach the equilibrium?

In competitive equilibrium prices are equal and therefore also proportional to both average and marginal cost. But it is the proportionality of price to marginal cost that is significant for the optimum distribution of resources, for that condition alone is necessary and sufficient to ensure that no resources that could be used to satisfy a greater need (or marginal utility as measured by demand) are used to satisfy a lesser need. In all cases where the complete system of perfectly competitive equilibrium cannot be attained—and that means always—it is important that the proportionality of marginal cost to price shall be sought after and not some other condition whose only merit is that it is to be found together with the desired condition in the competitive equilibrium. Thus, if for any reason there is an excess of equipment for the production of any product so that the production of the output which makes price equal to marginal cost makes price less than the average cost, it would be a social waste to restrict output to that which makes price equal to average cost. This would be equivalent to the attempts in monopolistic capitalism to maintain capital values which Dr. Lange so forcibly and rightly condemns. Yet that is his rule. Based on too close a pre-occupation with the achieved competitive equilibrium it becomes too static.

In describing Dr. Lange's scheme as reactionary and static I would not like it to be thought that I do not consider his work to be anything but the

## THE REVIEW OF ECONOMIC STUDIES

most up to date of what has been written so far on the subject, and, indeed, I use those words in a rather specialised sense. But I have always been puzzled by the degree to which nearly every writer on this subject has been so dazzled by the picture of competitive equilibrium that he has not been able to pick out the elements in it that are significant for this purpose from those that are not. The peculiarity seems to be bound up with the more general attractiveness of averages. I have no doubt that Dr. Lange, like others who start with the simple average notions will make reservations and complications about the counting of rents and quasi-rents and about the way in which average costs are to be calculated which will do much to correct any errors that result from too simple an application of the rules, but all these commentaries and complications are unnecessary if one gets the essentials clear in the beginning.

The two rules which are necessary for the economic running of a socialist society in accordance with the tastes of the spenders of income in the society are :

(1) Every producer must produce whatever he is producing at the least total cost.

(2) A producer shall produce any output or any increment of output that can be sold for an amount equal to or greater than the marginal cost of that output or increment of output (or some multiple of the marginal cost fixed for everybody by the Minister of Production, since *proportionality* is all that is necessary). (Prices must always be taken as parameters so that this rule insists that producers shall increase their output as long as price is above marginal cost even if this has the effect of making the total receipt of the firm less than its outlay—price will always be equal to marginal cost.)

These are the *general* rules for economic accounting. The first rule ensures economy in the narrower sense. The second ensures what Dr. Lange calls consistency—the direction of resources in accordance with the urgency with which they are demanded. If there happen to exist the conditions for competitive equilibrium, and if adjustment is able to catch up with dynamic change, the other conditions of competitive equilibrium will arise automatically. Each plant will be working at the point of least cost, and the marginal cost will be equal to the average cost as well as to the price. But whether these conditions are there or not the more closely these rules are observed the greater will be the economy and consistency of the society.

*London School of Economics.*

A. P. LERNER.

## Mr. Lerner's Note on Socialist Economics

IN reply to Mr. Lerner's note published in the last issue of the REVIEW I have to make the following remarks. I take up the various points in the order in which they have been presented by Mr. Lerner.

1. I do not see how the rate of interest could become zero except by the accumulation of a quantity of capital sufficient to reduce the marginal net productivity of capital to zero. It is true that the rate of flow of free capital can be varied considerably also in the short period by changing liquidity preference. But it seems doubtful whether the quantity of capital available for investment could in this way be increased sufficiently to attain a zero rate of interest. It seems that for this purpose a substantial increase in the quantity of capital is required which can be obtained only by saving during a longer period of time. In a socialist society, however, liquidity preference would certainly be much lower and, consequently, also the rate of interest would be much lower than it is in the present economic system.

2. Technical progress and other dynamic changes which increase the marginal net productivity of capital must have, *ceteris paribus*, the effect of raising the rate of interest. But Mr. Lerner is right in observing that this tendency is counteracted by the increased risk of obsolescence due to expectation of further change. As to what the *net* result would be no general statement seems possible.

3. I quite agree with Mr. Lerner's remarks on the rate of capital accumulation. In Part Two of my paper, where I discuss the problem, I have stated explicitly that the rate of accumulation depends rather on the distribution of incomes than on the tastes of the consumers. I am afraid, however, that my exposition was not clear enough. I have, therefore, rewritten the passage in question. Mr. Lerner's interesting proposal how the time preference of the consumers could be ascertained in a socialist society and how the rate of capital accumulation could be regulated accordingly deserves full attention.

4. As to the distribution of the social dividend I accept Mr. Lerner's criticism. My argument was wrong.

5. Mr. Lerner's criticism of my including the equality of price to average cost among the directives for the allocation of resources in a socialist economy is justified in so far as an inconsistency has crept into my exposition of the subject. I failed to distinguish clearly enough between what is a directive rule, a guiding principle for the managers of production plants to be followed in *any* situation, from what is a result of an equilibrium position already reached. Let me, therefore, restate my position briefly. For the managers of existing plants the rule holds to produce the output which equalises marginal cost to the price of the product. This they have to do in any circumstances, even if it involves their plants in losses. But this rule is not sufficient to determine the output of the whole industry, for additional plants may be built or old plants may not be replaced. A second rule is, therefore, necessary which is addressed

not to the managers of the existing industrial units (plants) but to the managers of the whole industry (e.g. to the directors of the National Coal Trust). This rule, as envisaged in my article, is that the output of the whole industry ought to be such as to equalise the price of the product to average cost. Whenever the price of the product is (and/or is expected to remain for some period) higher than the average cost, the industry ought to be expanded while it ought to be contracted whenever the reverse is the case. Thus both rules are guiding principles for action: the first for the action of managers of the individual plants, the other for the action of the managers of the whole industry. The last rule determines whether new plants are to be built (or old ones enlarged), and whether and to what extent old plants are to be replaced. Only when equilibrium of the industry is reached, i.e. when price is equal to average cost, the individual plants reach, by following the first rule, the scale of output which minimises average cost. But this is already a result of equilibrium being attained and has no value as a guiding principle for action. Unfortunately, my exposition was unclear on this point.

Mr. Lerner is quite right in pointing out that there are difficulties in the application of the second rule when the industry is composed of only a few very large plants. In such case expansion or contraction of the industry can be effected only by discontinuous jerks and there is a certain range of indeterminateness of the solution. It ought also to be mentioned that my formulation of the rule determining the output of the whole industry is valid only under the assumption of constant returns to the industry as a whole (i.e. a homogeneous production function of the first degree). This assumption was made tacitly throughout my paper. If it is dropped the rule has to be reformulated into saying that the output of the industry ought to be such as to equalise marginal cost (for the industry as a whole) and the price of the product. My formulation is a special case of this more general statement. Thus the principle of equalising marginal cost and the price of the product may be taken, as Mr. Lerner is perfectly right in pointing out, as the most general rule ensuring the consistency of the decisions with the aims of the plan. It has, however, to be addressed not only to the managers of the existing plants but also to the managers of the whole industry (marginal cost of the whole industry being meant in the latter case). I believe there is perfect agreement between Mr. Lerner and myself on this matter.

*London.*

OSKAR LANGE.

July 31, 1940

Professor F.A. Hayek  
8, Turner Close  
London, N.W. 11

Dear Professor Hayek:

I thank you very much for the reprint of your article on 'Socialist Calculation'. I appreciate it very much. I had already read it as soon as the issue of *Economica* reached Chicago, and I was very much impressed with it. I think it contributes to a further clarification of the issue, as well as to its discussion from a new angle, namely, that of the dynamic aspects of anticipation, etc. I hope you won't be cross if I should characterize your position as taking a third line of defence, this time shifting the issue from the purely static to the dynamic aspects. By doing so, however, the issue is shifted, in my opinion, to the plan which really matters, and where new research and clarification has to be done before it can be answered satisfactorily. You certainly have succeeded in raising an important issue and pointing out the loopholes in a purely static solution as the one given by myself.

I intend to do some work on the problem and write a reply to your article as well as to Mr. Dobb's, who took up the problem from a different angle, namely that as to whether the marginal cost rule is sufficient to secure automatically full employment. Some other work (on the economics of national defence and on the effects of technical progress on employment) is keeping me busy at the moment. But I expect to be able to prepare an article on the issue raised by your paper sometime in the autumn, and to submit it to you and possibly to the editorial board of *Economica* at that time.

There is one point where there is a misunderstanding. I do not propose price fixing by a real central planning board, as a practical solution. It was used, in my paper, only as a methodological device to show how equilibrium prices can be determined by trial and error even in the absence of a market in the institutional sense of the word. Practically, I should, of course recommend the determination of the prices by a thorough market process wherever this is feasible, i.e. wherever the number of selling and purchasing units is sufficiently large. Only where the number of these units is so small that a situation of oligopoly, oligopsony or bilateral monopoly would obtain, would I advocate price fixing by public agency on the principles laid down in my booklet as a practical solution. But in such cases, price fixing is done under capitalism also, only that it is monopolistic price fixing, and not price fixing in the interests of a policy of public welfare. I should also like to add that, as pointed out in the last part of my booklet, only in these fields where the automatic process of a competitive market does not function, do I advocate, practically, socialization of industries. In the first part of my essay the picture may be somewhat obscured by the fact that, again as a methodological device, I assumed all production to be socialized. I am afraid, however, that the misunderstanding which confuses methodological device of analysis with actual political proposals is due to insufficient clarity of distinction in my essay. Quite a



number of readers have felt the same difficulty, and I feel that I must take the blame. I shall clear up that point in my article.

I was also very glad to receive your reprint because it shows that you are carrying on all right personally, which we here are all very glad to learn.

With very best regards.

Yours cordially,  
(Oskar Lange)

(re-written by T. Kowalik from a copy of a letter found in O.L.'s posthumous papers)

## THE ECONOMIC OPERATION OF A SOCIALIST SOCIETY: I

OSKAR LANGE

*The sixth in a series of lectures on Capitalism and Socialism, conducted by Oskar Lange, at the University of Chicago, Department of Economics, presented by The University of Chicago Socialist Club, Friday 8 May 1942, at 7.30 p.m.*

PROFESSOR LANGE: I am supposed to speak about the economic operation of a socialist society and it is probably only fair if I start by explaining what I mean by a socialist society. The term socialism is a very much abused and misused term. Adolph Hitler calls himself a socialist, too, thus it will not be out of place to explain exactly what I mean by the term socialism before talking about how a socialist economy can or should operate.

By a socialist society, I mean a society in which economic activities, particularly production, is carried on in such a way as to maximise the welfare of the population. What these terms of maximise and welfare mean I will explain at a somewhat later stage. Another term which is very similar and very frequently confused with socialism is collectivism, and we very frequently speak of an individualistic or private enterprise versus a collectivist economy. Now, the first problem I want to clear up is what is exactly the relation between a socialist and a collectivist economy. A socialist economy means both something more than a collectivist economy and also something less. By a collectivist economy, we mean one in which production is carried out by public institutions according to some purposes set up by these institutions. Whether they be government, municipalities or any special institutions created for a specific purpose. But when we speak of collectivism, this is essentially all which we usually mean by this word. We do not mean to indicate anything about the purpose for which those public institutions carry on their economic activities. And in this sense, I say socialism means more because it means not only collectivist economy, but also a collectivist economy which operates its economic agencies for a particular purpose, namely, the purpose which I have stated, the maximisation of the population's welfare. In this sense, as you see, socialism means more than collectivism. It excludes all types of collectivism where economic activity is carried on for purposes other than social welfare. In another way, however, socialism may mean less than collectivism, because the socialists' accent is rather on the purpose than on the means. It is the view of the socialists that in present society, this purpose, namely, to maximise the welfare of society, can be only carried out by collectivists' measures,

and this means by public ownership or operation of a major part of the productive system. But it does not insist that this is the only way. If there are possibilities of achieving this same purpose by non-collectivist methods, but on the basis of private enterprise in small scale industry, small trade, etc., socialism does not deny the legitimacy of such type of private enterprise. The accent, as I said, is rather on the purpose than on the means, and the means are suited to the purpose. And if socialism and socialists advocate collective ownership in the operation of a major part of our production system, then it is just as a tool to achieve this purpose. They just as decidedly repudiate such collective ownership if it is used for purposes contrary to social welfare, and they just as decidedly acknowledge room and place for private entrepreneurial activity if such activity helps to achieve the purpose of maximising social welfare. However, it is more or less agreed among contemporary socialists that this purpose of maximising social welfare requires today collective ownership and operation of a major part of the productive system, and namely of that part which today is operated in opposition to the exigencies and the requirements of social welfare.

Now, in this discussion I shall make a certain simplification. I shall assume that the socialist society is a hundred per cent collectivised society. That means that all productive activity is carried on by public agencies which are the owners of all productive resources other than labour. Now I say that is a simplification because practically no serious socialist ever has proposed this and if you go over the socialist literature, you always find discussions about farmers, small business, etc., which is sufficient to indicate that socialism leaves room for private enterprise in this field. But the discussion of these private enterprise fields is not a very interesting problem because it is a thing with which we are rather familiar and do not need to look so very much for new principles. The really interesting and important problem to discuss is the operation of the public agencies which are charged with carrying on economic activity in a socialist society. Because here we have to do with the new form of economic operation with which we are not yet familiar historically or familiar possibly only in certain exceptional and very narrow cases.

Thus, I make the simplified assumption that all productive resources other than labour, that means capital, as well as natural resources, are in public ownership and operated by public institutions. Now by saying that they are in public ownership and operated by public operation, I do not mean that they necessarily have to be operated by the institutions of the present political state. That, for instance, socialised railroad system would have to be operated exactly in the same way as the post office, where the local Postmaster would be the Chairman of the Committee of the party in office and where the Postmaster General would be the National Chairman of that party. Rather, the socialist idea is that though socialism advocates public enterprise, it does not advocate government enterprise and activity in the sense indicated, but rather wants to see the public institutions which are charged with the operation of our productive system to be autonomous institutions, independent from the political state. For instance, the Tennessee Valley Authority (TVA) or similar institutions which are public, but notwithstanding, perfectly autonomous to operate

according to certain recognised economic principles and not according to the whim of temporary and changing political influences. Now further, and this has been always the traditional intent of socialism, it is understood that such independent autonomous public institutions charged with the operation of our production system, or sections of it should be under direct democratic control, a control which may take the form of different channels, may be partly controlled by those who are employed in them, partly controlled by those who consume their products, partly controlled by those who represent some other types of public interests. To give a concrete example of what I mean, I may give an example of the socialisation proposals of the German Socialisation Commission in 1919 after the German Revolution, which proposed that the socialised industries should be controlled by representatives, first of all of the consumers of these industries which may be consumers in the sense of private persons or other industries which consume their products; then by representatives of the employees in these industries, and then by representatives of some other broader agencies, whether it be a political agency of the government or Congress or some special agency charged with coordination and planning of the whole economy. The important thing is that these controlling boards may emerge from direct democratic representation, directly responsible to certain groups which elected them, rather than to the political government which administers, say, the army needs, justice, etc.

Now, having said so much about the operation of the socialist society, I shall discuss the principles of economic operation. I think that Maynard Kruger last Friday, talked to you about the type of economic problems which any type of society has to face. You know, and socialists have always been taught, to distinguish the different economic principles and laws in different societies, and it has always been one of the points made in socialist and Marxist literature to show the specificity of all economic phenomenon and show the economics of capitalism as quite something else than the economics of a medieval manor, of the slave economy in ancient Greece and still something different than the economy of, say, the Navaho Indians was before the Spanish Conquest. However, this recognition of the essential differences between the different economic systems should not blind us to certain common features and certain common economic functions which have to be carried out in all of them. And in the specialist society, like in any other, the basic economic functions would be as follows: first, it would have to decide that all resources available of the society are employed. Obviously, an economy which tolerates unemployed resources—they may be unemployed men or machines or unemployed natural resources—would be a very irrational kind of economy and the most powerful argument for socialism is exactly its claim to be able to do away with this type of waste which is more or less permanently attached to the capitalist system. Thus, the first problem will be that of assuring that all resources are fully employed. If this problem is solved, there is the second problem, namely, to assure that all resources be employed in the best possible way; by the best possible way meaning the one which maximises the welfare of the society. This would mean two types of decisions: to decide for the production of what kind of goods their resources are to be used, whether we shall produce clothing or shoes or food, what kind of food; and second, in what amounts within, of course, the

limit of available resources, the different goods should be produced. Whether we should use our labour or machinery or natural resources to produce, for instance, more clothing or better housing or more food. Within the production of food, whether we should produce more, for instance, meat or use the meat to feed cattle and produce cattle and produce more meat instead. This is usually what is called in economics the problem of allocation of resources.

Thus, we have the two basic problems: that of full employment, which very frequently is found under the title of the problem of economic stability, by stability meaning a continuous utilisation of all the resources; and the other the problem of location or use of the location of the resources that are employed. Now, I should discuss these two problems in the reverse order. I shall speak first of the location of resources, assuming that somehow the problem of full employment has been solved, and I shall later discuss the problem of stability or the maintenance of full employment. I shall do it in this order simply because if we solve the second problem, we will see that essentially this supplies us with a major part of the apparatus for solving the first one, too. Thus we assume that all the resources are always made usable in the socialist economy. No unemployment of any resources is tolerated, and then there are the two basic problems: What goods to produce and in what amounts?

Well, there are different ways in which this problem may be solved in a collectivist society, if we do not want it to be a socialist society. That is, if we do not specify any purpose for which this collectivist economy is to operate. Well, there would be one simple solution. We could have some agency; we might call it the Central Planning Board, or any other name you like to give it, and make it decide simply how much to produce of everything according to what they think the people will need. They think they need so many shoes, so much clothing of a given type, so many houses of a given type, and they produce it, and then distribute it, by a type of rationing. You would get so many pounds of meat, so many pounds of bread, so many pairs of shoes per year, and so on. In such an economy it wouldn't be only sugar which was rationed, but practically everything which was rationed and allotted. Now, it is not essentially the solution proposed by the socialists because it is not the solution which is likely really to produce the greatest possible social welfare. It will rather be a solution which produces what the people who have the offices in this Planning Board think that the greatest social welfare is. Even assuming that they are very honest and public spirited persons, and will not seek their own power and their own benefit, or of their group, but the benefit of the people, it will rather reflect their desires than the desires of the people. Thus, if we really want to take the term maximizing social welfare seriously, as an objective to be achieved by socialist economy, then this solution has to be discarded, because it would not be one where the people decide what is to be produced and in what quantities, but somebody decided for them. It would be, at best, a kind of benevolent and enlightened economic system. Now, particularly since the decision of what commodities to be produced in what amounts also automatically implies a decision where to employ labour in what occupations and what industries. And if this would just be decided by some board in a way that everybody would be told, you have to do this job here, and you have to do

this job, and so on, then as you immediately see, it wouldn't be a set-up which would leave very much individual freedom to the world. Thus, this solution has to be discarded.

Well, we can think of a second solution which still lets some kind of Central Planning Board decide what goods and in what quantities to produce, but where the distribution of goods, or the obtaining of the labour in the different occupations necessary to produce the goods decided upon and in the quantities decided upon would be done not by location or demand, but by recourse to a rather old institution, an institution which is so characteristic of capitalism that it is frequently confused with capitalism but which actually is historically much older than capitalism, namely to the market. The Central Planning Board could decide what quantities of commodities to produce and then, instead of allocating them by general rationing system, could give to each person in the community a certain amount of, say, tokens or chips like you use in playing cards, for instance, unless you play for money, and then say, 'For this commodity you will have to give five chips a pound, and for the other only three chips,' etc., and set a kind of equivalence between quantities of this commodity and the number of chips which has been given, such as exactly the amount that has been decided to be produced would be taken from the stocks; and instead of commandeering labour just to go into that occupation and do that work, it would rather, again, pay to give us an amount of chips and if a certain occupation particularly wants labour, it gives them more chips for which they can get goods from the stores than another occupation. Now whether you call these chips money or not, it is merely a matter of taste. Obviously, there is no essential difference between them. It will behave exactly like money behaves in the present society and particularly if you give out more chips than there are goods, you will see that people will offer more and the prices of these goods will rise. Now what I have essentially said is that people would be given money, incomes, and with these incomes, they could buy the goods on the market. Now, I still assume that this Planning Board makes its own decisions as to what goods and in what quantities it wants produced and that it does make up its own idea as to what the social welfare is.

Instead, it might be more democratically inclined and think that it really doesn't want to impose upon them their own ideas but it rather wants the people to decide what they think they want to have. And then that is a pretty easy criterion, to find out how to organise its production plan, because if they sell that and people will want more of certain goods than other goods, they will be offering to pay more for them and in consequence the price which will have to be charged for these goods in order to exactly sell the amount which is available will be higher and such a rise in price might serve as an indicator to the Central Planning Board that the production of such goods should be expanded. If, on the other hand, people dislike certain goods and they don't want them, they don't want to buy them, in order to sell the available amount, the price has to be lowered, and this would be an indicator again that they aren't wanted and that the production of them should be diminished. If this is done, the price system would essentially serve as an indicator of what goods people want and in what amounts. If, in addition, the socialist economy, instead of

commandeering labour, rather attracts labour to different occupations by paying a money income, then, if people particularly dislike an occupation, it would have to pay a very high wage for people to enter it, and if we would keep a kind of cost accounting, we would find out that the cost of this particular commodity is very high, and if it would somehow then compare the price and the cost, it would produce fewer such commodities which would mean that there would be relatively little requirement for people to go into occupations which are rather disliked. If people, on the other hand, like very much certain occupations, just the reverse would happen. Thus, you see that the price system may serve as an indicator of what the people desire—what people's desires for certain products are, as well as their desires for the occupations they prefer to work in. And if the Central Planning Board follows the movement of these prices, that is an index of what the people's desires are, and it would be much more likely to produce the maximum possible social welfare by following these indexes than by simply acting according to what it thinks it is that the people need or want.

Now at first you may say, 'Well, if that is what the socialist society would do, then what is the difference between this and capitalism?' And that is actually a criticism which has been brought forward, particularly by opponents of socialism, who have said, 'Well, after all, the best thing a social economy could do is to do exactly what capitalism does under a different name.' Some other people would make the decisions, but essentially it is the same. Except under capitalism those goods are produced and in the amounts which the people want to buy and the people go into those occupations they prefer, and the market in a capitalist economy acts more or less like, it has been said, a constant poker, whereby each dollar a consumer spends on a commodity induces producers to produce that commodity, and for each dollar he refused to spend on a commodity, he induces them to stop production on this commodity. Now there would really be very much to that argument if this were exactly the way in which the capitalist economy would work, but as you all know, that is not exactly the way it works. First, I disregard the problem of full employment which I postponed for our next meeting, but even assuming this full employment, there are certain rather important differences. At best we might say the capitalist economy works so only insofar as it is competitive, because it is only under competition that you have this type of response of producers to changes in the market. We know that certainly modern or present capitalism isn't very competitive, that it is rather a typical monopolistic economy, where production does not at all react to changes in consumers' demands in the way I have indicated. It reacts in certain ways, but quite different ones, and thus, we certainly do not mean that those goods are produced and those quantities which best satisfy the desires of the consumers. This point alone really would be sufficient to refute that argument, because even if it is true about the capitalism which existed fifty or sixty years ago, there is very little it helps us today, because today's capitalism is definitely monopolistic and not competitive. But it is not wholly true in any case, even if capitalism is competitive. Because even in this case there is a very important difference. If we go back to this comparison which has been made between the price system and the continuous poll

which decides what goods are to be produced or not, then it should rather be compared not with a poll where there is equal suffrage, but a poll where there are strong pluralities where different people and different social groups have very different amounts of votes to be cast. And obviously you know what these pluralities consist of. Simply the unequal distribution of income. The argument is simply that if somebody needs more of a commodity, he will be ready to pay more for it and then if exactly the commodity is produced for which consumers want to pay, well then exactly the commodities are produced which consumers want most. But this is not true obviously if the consumers have different amounts of money to spend on commodities. If there is one person who has little money and needs the commodity very urgently and can offer for it very little, and the other person has lots of money and really doesn't need it very much, if he had less money he wouldn't buy it possibly at all, but still he can offer a much higher price. And thus it is really not an equal vote, but a vote with a plurality in which the price system under capitalism represents — we might compare it, to give another example, to political democracy under capitalism. Of course, it is true about this argument that in a way production is adapted to consumers' demand. It is true also under capitalism, say, in a capitalist democracy, politics in a way is adapted to the people's wishes, and there are certain limits, and it is exactly these limits which make the whole difference between capitalist democracy and fascism, and whoever has lived in a fascist country probably knows the difference. Notwithstanding all that, in the capitalist democracy, the influence and public opinion which different groups can exercise is not the same, but it is different according to the economic power which this group exercises, and that the democracy, though a certain element of it always remains present, becomes strongly distorted. And it is exactly the same, we might say, with the price system or market under capitalism and just as socialists do not propose to abolish democracy because it is distorted under capitalism, but rather to abolish its distortions and make it real by supplementing it with the necessary economic and social democracy, so we need not abolish the market because capitalism distorts it, but rather have to readapt our system so that the market will actually perform the functions it can and should perform. I have indicated that the main difference here between the operation of prices under capitalism and under socialism would be the difference as to the distribution of incomes. Under socialism the distribution of incomes would be much more equal. Now, what would be actually the sources of incomes in a socialist society? Well, if we want to maintain freedom of choice of occupation and thus rely to a certain extent upon peculiar motives in the choice of occupation that people will choose a certain occupation because they are offered something for it in return, then this would mean that part of the people's incomes would have to be connected with the occupation or would have the form of wages. But this in a socialist society would not be the only income because there is a remaining part of the income which comes from the resources of capital and natural resources which are owned by the whole community and not by individuals, and which provide a fund out of which incomes can be paid to individuals, a fund form of incomes which I shall propose to call social dividends. We might, therefore, think of each citizen of a social society as



being like a shareholder in a big corporation, this corporation being the society's productive enterprises, deriving some wages in return for his labour and some social dividend which he got as a shareholder of this communal enterprise. Now, it is this social dividend which leaves to a socialist society a considerable amount of freedom of how income can be distributed. Essentially, the social dividend can be distributed according to any criteria which we would regard as desirable. In a socialist society, this social dividend would be distributed more or less equally, with certain possible allowances for special situations. There might be special allowances for sick people, or according to age, family obligations or some other factors. There would, of course, be some additional differentiation in incomes in a socialist society also on account of differences in wages paid in different occupations or possibly different places. Because obviously if we do not want to commandeer labour or conscript labour, but rely on free choice of occupation or place of labour, then the only way to induce people to go into one occupation rather than another or live in one place rather than another would be to pay them in return. Now, these differences in income probably could not become very substantial because they would be rather minor differences which result from differences of work. Then we could regard them as only just. For instance, less desirable and more difficult labour is paid higher. Probably the result would be that what today are regarded as the lowest occupations might be paid the highest simply because nobody would want to take them and you might have to give very high inducements to induce people to enter such occupations. But otherwise, as you know from experience, preferences, likings as well as talents are more or less evenly spread. One man has his likings and talents for one type of job and the other has his likings and talents for another type of job, so it is not likely that this should create serious inequalities. Today's inequalities are, of course, largely due to inequalities of income pre-existent to a choice of occupation, or inequalities of income because certain occupations require expensive training and only people with the necessary income or the necessary income of their parents have access to these expensive trainings and can enter such occupations, or they are more or less monopoly situations. For instance, in a lot of corporations you may have to have certain personal conduct, be somebody's nephew or brother-in-law or something to get the well paid jobs, etc. Now, with these factors being removed, there would be no cause for great inequalities of incomes to develop and such inequalities which would develop would be just inequalities due to higher efficiency and thus be an improvement and an inducement to improve the efficiency, or would be inequalities due to disagreeableness of the job, etc., both types of inequalities which certainly are just and desirable.

Now, I said that the present capitalism is largely monopolistic and that the main difference between a socialist economy will be that the economic system will not operate on a monopoly basis. Now, let us see what this would mean in terms of the criteria by which it is decided what quantities, what commodities and in what quantities are to be produced. Well, the simple criterion for the socialist society would be to produce that amount of each commodity which can be sold at a price which covers costs. If it can be sold at a price higher than cost, that simply would

mean that the people are ready to offer for that commodity more than the costs to produce, and that, therefore, they should get more, because they want it more urgently, with a greater intensity, and are ready to pay the higher price. Thus, it doesn't cost so much to produce it and there is a good reason to produce more of it, and as much more until the price will fall to a level covering costs. If, on the other hand, the price of the commodity would be less than the costs of producing it, this would mean that the people are not ready to pay so much as it costs, that they don't want it with such intensity, and, therefore, they should get less of it, the production of it should be curtailed until the price rises sufficiently to cover costs. We may call this principle of determining how much of a commodity to produce, the public service principle, which would mean just to produce and distribute the commodities at the cost price. Now, as you know, the public service principle has to be distinguished from the profit principle or maximum profit principle which is applied under capitalism where that amount of a commodity is produced which gives the highest possible profit to the producer. Now, it is true that under certain cases under capitalism, the private profit principle or maximum profit principle works out exactly in the same way as the public service principle, namely, in a case where there is real effective competition between producers, because then, as you all probably know, the competition of producers will put it to a point where exactly it can be sold only at the cost price, and it is true, therefore, that insofar as competition would be effective, really effective, which is pretty seldom under capitalism, then capitalism, disregarding the question of distribution of income, which I have discussed before, would lead to a similar result as socialism. We know, however, that actually competition is not effective usually under capitalism, at least there are large parts where it is not. Then and therefore, the maximum profit principle leads to quite different results than the public service principle. However, the fact that under certain conditions the private profit principle leads to the same result as the public service principle gives us a rather important indication, namely, what kind of private enterprise a socialist society can cultivate, exactly that kind of private enterprise where the private profit seeking of the producer will lead to substantially the same results to which a public ownership and operation would lead. Now, in defining the social public service principle as producing that amount of goods which can be disposed of at the price covering costs, I have to make one qualification as to the term cost, namely, in economics, you usually distinguish between private and social costs of production, and it is social costs which would be relevant for a socialist economy. Now, to indicate the distinction between private and social costs, I will give a famous example. A factory is established, say, in a certain community and produces something, we will let it be steel, for instance, at a certain cost, which is scattered very carefully by accountants, bookkeepers, etc., and after the introduction of this factory, and there is a big smoke stack, several of them that make lots of smoke, and it is found that later all the owners of the houses have to repaint their houses more frequently. Formerly they did it once in five years and now they have to repaint them in a year. Now obviously this is part of the cost of production of this steel, the labour, paint used to repaint the houses, because it occurred because the steel plant has been introduced.

Then you find, for instance, the air has been polluted and that people get sick, hospitals have to be built and people have to go to doctors, and so that is again part of the cost of producing steel. There are industrial accidents and some people get disabled, are not able to work for the rest of their lives, must be supported by the community in one way or another; that is a part of the cost of producing steel. Now those are all what we call the social costs. Now, this cost does not appear in the private bookkeeping of the corporation which produces steel. In a socialist society, obviously, all of these additional costs have to be taken into account. It is the social costs, as I said, which have to be taken into account. Sometimes social costs may be negative. There may be certain social benefits. For instance, a farmer plants a forest and this affects the soil, improves the climate and improves the crops obtained by the farms in the whole neighbourhood. Now, this is a part that is a negative cost, that is a certain social benefit, you see, which was produced by this farmer, but which nobody pays him for, and it will never appear in his bookkeeping. It will be just the price of the lumber he expects to get for his forest which will appear in his bookkeeping. But it should be put in there; the socialist economy would put it in there. And thus, the very type of cost accounting under socialism would be pretty different from that under capitalism and it would take into account all social effects of any productive activity, both detrimental, such as costs, and advantages. There is here again a difference between socialism and capitalism. Capitalism operates only on the basis of private costs, only private costs are rewarded and repaid, and not social costs. And even in a competitive capitalism where competition forces producers to sell at cost price takes into account only private costs and not social costs.

Thus we have now, I think, a certain basic principle for the allocation of the productive resources in the socialist society, namely, it seems that the most desirable type of allocation would be that on the basis of market prices in distributing the goods and on the basis of a free labour market in allocating labour to different locations, and that the principle, according to which the market of consumers' goods and market of labour, the authorities in the socialised society would decide what to produce and in what quantities, would be what I call the public service principle. They would produce a commodity, such commodities in such amounts which can be disposed of to the consumers at the price which covers the social costs of their production.

This is, so to speak, the socialist solution of the first problem. Next time we are going to discuss the second problem, that of securing full employment of all resources.

## THE ECONOMIC OPERATION OF A SOCIALIST SOCIETY: II

OSKAR LANGE

*The seventh in a series of lectures on Capitalism and Socialism, conducted by Oskar Lange, of the University of Chicago, Department of Economics, presented by the University of Chicago Socialist Club, Friday, 15 May 1942, at 7.30 p.m.*

PROFESSOR LANGE: At our last meeting we were discussing the problem of how a socialist society would carry out the basic economic functions and we saw that this basic economic function is the decision as to the proper use of the available productive resources, namely, the decision as to what goods should be produced and in what quantities. And we defined socialism as a society where these decisions are made in a conscious way so as to maximise social welfare, and as a criterion of social welfare, we had accepted the willingness of the people to have certain goods rather than others.

Now, we have found that under this condition, there is only one way in which these basic economic decisions can be carried out and this is by the use of the price system. And thus, we go to the result which at first seemed rather startling to many socialists although not to those who had followed socialist literature in greater detail, namely, that prices and money are not only characteristics of modern capitalism, but are an institution which has to be preserved in the socialist society. I mentioned that prices and money are much older than modern capitalism and, therefore, should not be confused with it. We saw, however, that there is a certain difference; there are several differences of great importance between the function of the price mechanism in a socialist and in a capitalist society. We saw that these differences were connected first with the distribution of income; that the price mechanism in a socialist society would reflect the urgency of the needs of the different persons, whereas today the reflection is rather the ability to pay determined by the existing system of property. We have also seen that the price mechanism would differ in a socialist society from what it is in a capitalist one by the fact that the cost and price accounting would take into consideration all social costs. You remember the example of smoke and housing that I gave at our last meeting, and also all the advantages which a given line of production carries with it. Further, we have seen that the proper criterion on which productive establishments in a socialist society would have to decide whether to produce more or less of a certain commodity would be what I called the public-service principle, as distinguished from the profit maximising principle which regulates production under capitalism, and that this public service principle consisted of providing such amount of each commodity

which can be sold to the consumers at the price which covers the social costs of producing. Now, this criterion is essentially sufficient to determine what amount of commodities to produce. However, there remain two questions which are still undecided and one question is the question of capital accumulation.

You know in a modern society we not only try to reproduce the existing instruments of production which are used up in the process of production, but we try to increase their stock and it is this process which is called the accumulation of capital or net investment. Now, the criteria which I have given really do not answer the question, how should we determine the optimum, from the social point of view, rate of net investment or rate of accumulation of capital. The other problem which was yet unsettled is the following: I spoke of the price mechanism and the prices consumers are willing to pay as the criteria according to which managers of production in a socialist society can decide whether they should expand or contract the output of any given commodity. But there is one difficulty. The decisions as to production are not only decisions concerning the present, but also decisions concerning the future. If you make a plan of production, build a plan, so really it is not so much having in mind what the present demand for the product is, and what the present cost of producing is, but rather much more with the question in mind, what will it be in the future during the period when the plan is supposed to operate. Now this is really one of the most difficult problems in capitalist society where the capitalist entrepreneur faces at each state, the problem of estimating, anticipating the future and guessing as best he can what to do in order to meet future conditions. Well, the same problem does exist also in a socialist society and we will see that there are good reasons to believe that the socialist society, though far from perfect in this regard — but always to be perfect, you have to have perfect foresight of the future, and this is beyond human capacity — but could do certainly a better job than is done at present. Now, connected with these two problems, that of capital accumulation and of anticipating the future, and these two problems are strictly connected among themselves, because capital accumulation is, in a sense, of provision for the future, at least our stock of productive instruments for the purpose of being able to obtain a larger output, a larger national income in the future than you have at present. So these two problems are inter-connected and strictly connected with them is a third problem, namely, that of assuring the full employment of all productive resources available in the community. You all know that it is this last problem in which capitalism fails so miserably and fails with an increasing intensity. And if ever there will be a chance to substitute a socialist society for capitalism, it will be only because exactly capitalism failed to solve this problem of unemployment and because there will be sufficient evidence that a socialist economy could do a much better job in this field.

Now, the reason capitalism fails to provide always full employment and why full employment under capitalism really takes place only during short periods and then which are alternated by periods of large-scale unemployment and depression. The reason for this is exactly the fact that capitalism has no definite criteria according to which the accumulation of capital would be regulated. And these criteria of an accumulation of capital under capitalism is of a largely more or less haphazard

nature and subject largely to all the errors which entrepreneurs make in anticipating the future. Very frequently in the popular literature, you will find an opinion that it is the very existence of a market and of the price system which causes crises and depressions and this is the doctrine of the so-called anarchy of capitalist production. Although there is something to this doctrine, it is much of an exaggeration. It pictures the capitalist economy as if production were just governed by pure chance, as if it were just by pure chance that, say, an entrepreneur decides to produce so much and not more or less of a given commodity. Now this, as you all know, is not true, because production, as you know, under capitalism, is governed by the profit motive and the profits are dependent on the state of demand and of costs. And as you know, when the price for a commodity increases because demand has increased, and increases profit and induces an increase in the output of this commodity. If price falls in consequence of a falling demand, profits fall and the output of that commodity is contracted. Thus, it is far from being true that production under capitalism is purely an anarchy and only regulated, governed by mere chance. The mechanism of supply and demand provides a quite efficient regulator of production. However, there is a certain element of truth in the doctrine about the anarchy of capitalist production and the element of truth is this: first, obviously, it is not sufficient to base production on the present state of the market, the present demand, but since most production decisions are decisions for the future, entrepreneurs have to be able to anticipate future demands and future costs. And the bases of these anticipations under capitalism are extremely poor, and it is true that these anticipations of entrepreneurs about the future are very frequently a purely haphazard type or even are subject to the quite erratic influences of mass psychology. You get panics, waves of unbounded optimism in the capitalist system. Capitalist entrepreneurs are subjected to it and very likely to make decisions which have no objective basis at all. Of course the most conspicuous field in which capitalist decisions are made rather accidentally and governed by the moods of mass psychology, is the Stock Exchange, but the same refers to producers. But about the Stock Exchange, there is just one example I wanted to give you which I think illustrates how capitalist decisions are affected by moods of mass psychology. I don't know whether you read regularly the reports on the Stock Exchange in the financial sections of the papers. Now, if you would have read it, say, last fall, particularly, and also one of the most prominent Stock Exchange reporters wrote about it, and how they interpreted it was: Well, stocks have gone up; Wall Street is optimistic, full of confidence. Well, what has happened? The Red Army has won a victory over the Nazis. The next day you read the reverse. There was a slump on Wall Street, and what made Wall Street so pessimistic? The Nazis had some success against the Red Army and it was really one of the most ironical things for an observer of Wall Street to see how the optimism of Wall Street had to be boosted by the successes of the Red Army. But you see the kind of bases on which entrepreneurs' of capitalism decisions were made. On these bases, with no economic basis whatsoever, with certain general moods of mass psychology not much different than those on which political decisions are made. Well, it is thus quite true that the expectations about the future are from the economic

point of view very much subject to chance influences and this is the element of truth in the doctrine of anarchy of production.

The other element of truth is exactly the question of capital accumulation. What portion of the national income is being saved and consumed, and what portion is being invested in the creation of new productive instruments is largely decided on in a haphazard way. Why this is so will be made clear by the following consideration. You know that in a modern society only part of the national income and part of many persons private income is consumed. The other part is saved. Now, if that part which is not consumed, but saved, would be actually invested in the creation of new productive instruments, there would be really no trouble because what it would mean, let's say, less labour and less machines, fewer raw materials are employed in producing consumers' goods and more are employed in producing other machines, other raw materials in order to produce consumers' goods in some more or less distant future. The very mechanism of the economic process would not be affected adversely by such a situation. However, what happens in a capitalist society is that the decisions to save and the decisions to invest are made on quite different grounds and quite independently. In many cases, really, in most cases today they are even made by different people, and in consequence, they need not always fit into each other. If they would fit, as I said, there would be no problem. If the people would decide to invest and increase the stock of capital, would decide to do it exactly in the same amount in which the others decide to save, then things would be all right, because if one group of people decides to save a certain part of their income, this means the diminishing by the given amount, by a certain amount its demand for consumers goods; whereas the others who decide to invest and increase their capital equipment, increase the demand for producers' goods. Now, if this diminution of the demand for consumers' goods is exactly equal in amount to the increase of the demand for producers' goods, things will be all right. Simply, consumers' goods prices will fall because there is a smaller demand; producers' prices will increase because there is a larger demand; it will pay capitalist entrepreneurs to produce fewer consumers' goods and to produce more capital goods. Capital and labour will shift from consumers' goods producing to producers' goods producing industries, and things will be all right. There will be full employment as there was, by assumption, before, only the composition of the nation's output will be different. There will be more producers' goods produced and fewer consumers' goods, and the productive equipment of the community will be thus increased, which will give it in the future a greater potential of producing producers' goods. But trouble arises if these two things do not fit each other, and there are two possibilities: That the amount the one group of persons, the capitalists, the entrepreneurs decide to invest is less than the amount which the other group decides to save. As I say, if the same people were saving and investing these decisions are very independent. Let's assume that the entrepreneurs decide to invest more than has been decided — or take it the other way around, first — decide to invest less than it was decided to save. Then the decision to save a certain part of incomes diminishes the demand for consumers' goods by that amount. Now, there is some decision to invest and thus to increase the

capital stock, but if it is less than the decision to save, that means that the increase in demand for producers' goods will be less than the fall in the demand for consumers' goods. There will be a net decrease in demand. And thus, if the output of consumers' goods falls in consequence, not all the resources, labour, raw materials, machinery and all other things which have been now released through the contraction of output of consumers' goods will be able to find employment in the production of producers' goods, and the result will be that there will be some unemployment, and this unemployment will be the greater, the greater the discrepancy between the decisions to save and the decisions to invest. Now, let's see what would happen in the opposite case — in the case where the decisions to invest are in excess of the decisions to save. Then you see the increase in demand for producers' goods will be greater than the diminution of demand for consumers' goods. In the producers' goods industries, they would want, therefore, to have more labour, materials, machinery, etc. than has been decreased in the consumers' goods industries. The result would be that they can't have them. But if they can't have them in the capitalist economy with free prices, they will try to attract the resources by paying higher prices, to labour, or material or equipment. The result will be an increase in prices of productive resources and an increase in wages, an increase in raw materials and machinery, etc., but such an increase in the prices of productive resources would mean higher incomes of labour, higher profits and would mean also, in consequence, a higher demand for consumers' goods. Now, the entrepreneurs in the producers' goods industries still wanting to increase their output, wanting to make investments, would bid further for the resources, would have to pay still higher prices and would again increase income and what we would have would be a process of general rising prices which is called inflation. You see, if the decisions to invest exceed the decisions to save, we have inflation. If the reverse happens, we have unemployment. Well, really, we needn't always have unemployment when the decisions to save exceed the decisions to invest, because as I have described, the thing is not symmetrical. I said when decisions to invest exceed decisions to save, you get a rise in prices, and if the opposite is true, you get a fall in employment. You say, might we not get instead of a fall in employment simply a fall in prices? Might it not be possible that if the demand for consumers' goods falls off more than the demand for producers' goods increases, wages and prices of other productive factors fall to a point which will make it profitable to reemploy all of the available amount? That is an argument which has been raised by many economists and is held even today by many economists who believe that we have unemployment simply because they say wages are rigid — simply because the workers refuse to accept a lower wage. If they would accept a lower wage, it would be again profitable to re-employ them. Now, under certain conditions this argument would hold, but the conditions are extremely unrealistic, at least in our present society. If wages and prices of other productive resources fall, wages fall, profits fall, this would increase employment only under one condition, namely, that the demand for products falls less than wages. In such case, actually, you see, the demand for products and consequently profit prices would fall less than prices for productive resources and cost profits would be greater; it



would be worth while for entrepreneurs to expand production. Now, we know, however, that if wages fall, other factors, prices of productive resources fall and this means diminishing of consumers' incomes and also, in consequence, a diminished demand for products, and if the fall in wages and other resource prices is not to be accompanied by an equal fall in the demand for products, then there must be some other source which maintains the demand for products even though consumers' incomes do fall. Now, such a source exists under certain considerations and really, the traditional economists had this source in mind. This is money. They thought that if with a given quantity of money, prices fall, then people, both consumers and firms do not want to hold as much money as before in their pockets, savings or bank accounts, because obviously nobody wants to hold just money for the very pleasure of holding it. People prefer to spend their money and they only hold a certain amount of money because they need to make certain provisions. If they find out that prices have fallen, goods are cheaper, they think that they really don't need so much money and start to spend part of their money, or as we say frequently, they start dishoarding it, and this dishoarding of existing money creates an additional demand which keeps up the demand for goods and services although the incomes of labour and owners and other productive resources falls. That is really the argument of those who say that if saving exceeds investment, you needn't have unemployment provided wages and other resource prices are sufficiently flexible and will fall.

Now, I said that this argument isn't very realistic unless on two grounds: First, money in our present system is far from being constant. As you know, money in our present economy is not simply the gold or even the Federal Reserve Notes, but it is money created by banks. It is the deposit that counts, the demand deposits which banks open for their customers largely on a credit basis, and what happens usually when the prices fall is that the very value of these bank deposits shrink at the same time. In other words, that the quantity of money shrinks more or less in proportion to the fall in prices and in consequence, this additional source of demand, the dishoarding of money, does not come into play, and however much wages and other resource prices fall, there is no increase in employment. And however flexible wages and resource prices are, an excess of saving over investment causes unemployment and no amount of wage and price reductions can remove it, because hand in hand with the reductions of costs goes an equal reduction in the money.

We have been discussing the relations between saving and investment. We found that these two are really quite independent decisions. We have also found that if people decide to save more than to invest, unemployment results, and if the reverse happens, there is a general rise in prices which we call inflation. Now, why are there discrepancies between these two types of decisions? For this purpose we have to consider what determines the decisions to save and what determines the decisions to invest, and the answer is very simple. The decisions to save are to a large extent, to a major extent, determined by certain habits, what we may simply call the saving habits of the population. People want to take certain precautions for the future and given their income, according to the type of habits about taking

precautions for the future, they save more or less. The other factor which determines their savings is income. Obviously people will save more the higher their income. People with low incomes cannot save anything. If their incomes will increase, they will save something, and still higher, save more. So it is the level of one's income and the saving habits which determine how much out of the given income will be saved. Now, the decisions to increase investments in the modern economy depend on two factors: one is the profit expected by the entrepreneur who makes the investment. Obviously, he won't make an investment and increase the amount of his machinery and materials unless he sees a profit. But it is not enough that he sees a profit in the modern economy. Few entrepreneurs invest only their own money. They invest to a large degree other people's money which they get through the banks, through investment trusts, from insurance companies and other financial institutions. Now, in order to get this money, they have to pay interest and before deciding whether to make an investment, the entrepreneur compares the profit which he expects to accrue and that expectation about the future, which he expects to accrue in the future from the investment, and the interest he has to pay for the capital he borrows, and since there exists a system of well-established and developed financial institutions, he will make his comparison, even if he invests his own capital, because if the profit which the investment would bring is less than what a bank would pay in interest for the money, or what he could get for the money if he would buy bonds, he would, of course do one of these things rather than investing it in his enterprise. And thus the relation between profit and the rate of interest on loans determines how much the capitalist, the entrepreneur invests.

We may say briefly, without going into technicalities, the marginal profit or the profit of the last unit of investment, which is equal to the rate of interest on money, determines how much will be invested. If the additional units of money can be invested at a profit which exceeds the rate of interest, they will be invested; if they can't they won't. And thus the amount invested is such that the last unit invested brings an expected profit equal to the rate of interest. Now, the expected profit partly depends on present profit and partly, as I mentioned, on expectations which are extremely erratic. The rate of interest today is practically determined by banking policy, by what the banks want to charge and how much credit they want to give. If the banks are pretty optimistic about the safety of the investments, they will lower interest rates and give loans to everybody who asks for the money. If they are concerned about their solvency, they will do the reverse. Now, this is the mechanism of saving and investment in the capitalist society. And this mechanism determines the rate of capital accumulation because it determines how much will be invested, and you see that essentially the rate will depend on saving habits of the population, but it will also depend on what the entrepreneur's profit expectation is about future profit, how optimistic or how pessimistic, and on banking policy.

Now, let us see how the rate of capital accumulation could be determined in a socialist economy. First, if a socialist economy wants to make the optimum use of its productive instruments, it has to use a device similar to capitalism, namely, the rate of interest, in deciding where to allocate its capital, whether in the production of

shoes or in agriculture or in the building of new houses and so on. And the simplest way of doing this is simply that the banks, who will be, of course, a public institution in the socialist society, for instance, the RFC, imposes a certain rate of interest and then the managers of the different productive establishments either ask for money to make investments or don't ask, according to whether the return they expect from the investment will be more or less than the rate of interest imposed by the bank. If this is the procedure adopted, then automatically the distribution of the existing productive resources will be according to the importance attached to them by the consumers because if the consumers attach to a certain kind of capital resources a greater importance, it means they are ready to pay a higher price for the goods produced by this industry. There would be a high return expected and according to the public service principle which would guide production in the socialist society, the production managers will find that they should expand production and they will apply to the socialised banking system for the funds to the expansion. If the consumers think they don't want much of these commodities, prices will fall, the return would be low, and if it would be so low as to be below the rate of interest established by the bank, the producers, the production managers would have an indication that they should curtail output, which would mean they wouldn't need money; repay part of the money they had taken before, and thus actually dis-invest some of the capital, not replace all the raw materials and machinery which are used up. Thus, the procedure of using an interest rate charged by the financial institutions in the socialist society to allocate the capital between different industries and different establishments of each industry will automatically tend to assure the best allocation of the capital resources of the community. But this procedure will also automatically determine the amount of net investment or the rate of capital accumulation. It will determine it in the following way. Assume that the banks — for instance, the RFC becomes the only bank in the country. All the other banks are somehow absorbed or coordinated with them, and cease to be private institutions. The RFC sets a certain rate of interest and then lowers it. If it lowers it, then managers of production will find that certain plans of production which formerly, according to the public service rule should not have been produced, should be produced now because the cost has fallen just by the amount the interest has fallen, and the price at which they sell the existing output exceeds the cost, and, therefore, it is a clear-cut indication to expand the output. And this would happen not only to one single industry, but throughout the whole economy, because I assume the interest rate has been lowered uniformly and each productive establishment now gets its financial resources at a lower interest rate. And the consequence will be a general expansion of output and to expand output, obviously, you would need more producers' goods and so the first expansion will be an expansion of producers' goods. If the reverse would happen, the rate of interest would be raised, then all productive establishments would plan to produce less, just for the reverse of the reasons which were given before. This would mean there would be a smaller need for producers' goods and the demand for producers' goods would fall and capital accumulation would fall. Thus, by setting an interest rate, the financial institutions, whether it would be

the RFC or Federal Reserve Board, or however you call it, would automatically determine the rate of capital accumulation in the community.

But in determining it, it has to count with one factor, the saving habits of the people. There are two possibilities with which saving is managed in a socialist society. One possibility would be that each private person is left to decide how much he wants to save. He is given an income and then, for instance, he wants to take a vacation and make a trip to California, and saves part of his income. Or he may want to have more money in the future for a certain purpose and saves up part of his income. Then, individuals would do more or less the same thing — open savings accounts or buy some kind of bonds, and somehow keep the money. Now, this is one way saving can be performed. Of course there is another form in which saving can be performed in a socialist society and which is really already performed in the present society, and that is what we call today, corporate savings. You know that not all saving is done by private consumers. If you go to large corporations, you know that a corporation very frequently does not pay out all its profit to the stockholders but reinvests part of it. This is usually called corporate saving. Of course, such corporate saving could be done also in a socialist society and on a much larger scale. The establishment of the socialised productive establishment in the socialist society, if they get some surpluses, instead of paying them out in higher wages, could transfer them to some fund, Federal Reserve Board or any kind of special fund and this fund would, so to speak, do the saving. Then we can have, of course, mixtures of both, like we have today. Which means some saving will be done by private individuals and some other saving by socialised industrial establishments. Now, it really makes no difference at this stage of our argument how it is done, but the fact is that there must be some relationship between the level at which the rate of interest is set by the banks in the socialist society and the savings made either by individuals or by public corporations in the socialist economy. Because, if this information is not kept, then we will run into the same trouble we run into under capitalism, namely, there will be unemployment, or there will be inflation. The essential point is that the socialist economy can keep this in a very easy way. If all the saving is done in the corporate way, just by the productive corporations in the socialist economy and not by individuals, then things can be coordinated extremely easily. You do not allow each separate establishment to say how much it wants to pay out in wages and how much it wants to save, but you have to impose certain regulations which have to be made by some central authority. You may call it a Central Planning Board or whatever name you want, Federal Reserve Board or RFC or just any other existing authority for that purpose, and give it the necessary powers and expand its functions. That is an administrative problem which may be rather interesting, but which is beyond the scope of our discussion today. You would decide that so much has to be saved and then estimate what amount of new investment will be decided upon by the managers of production if the rate of interest is set at a certain level, and then to set the rate of interest at such a level that the managers of production will decide to invest that amount which equalises the investments with the savings made so that there will be neither unemployment or inflation. Of course, in the capitalist system, it is always

like a pendulum which swings between unemployment and danger of inflation. Once you have unemployment, and a year or two later you are in danger of inflation. Now, this can be done very easily if instead the saving is done by the individuals. It may be somewhat more difficult, but there is really no profound difficulty in doing it. The savings of the individuals can be more or less estimated. Individual saving habits don't just fluctuate erratically. If you use some statistics, you will see there is a certain regularity in it, and you can estimate it, and knowing more or less the saving habits of the individuals, similarly, the banks in the socialist society have to set a rate of interest which will bring forth an amount of investment equal to the savings done by the individuals. If it set a rate of interest which is too low, then there would be the danger of inflation. If it set the rate of interest too high, there would be the danger of unemployment, and this would last for a time. If a mistake would be made, at the very first notice that a mistake has been made, it can be corrected. The principle is very simple, to set a rate of interest which equalises investment and saving, and this is exactly the rate of interest which maintains full employment and avoids at the same time inflation. Now, this can be done in a socialist society extremely simply because the rate of interest which is set does not depend on the private profit motives of the banks, nor on the consideration of their solvency, but is determined purely by planning of some authority which has the authority to set it. It is as simple as that and it can always set a rate of interest which will secure the equilibrium between saving and investment, and if it makes a mistake, it immediately can correct it. It needn't go through a long process of unemployment or process of rising prices and inflation. It can do it immediately, as soon as signs of a certain mistake appear. You need only to raise it or lower it, and that is all. Thus, what under capitalism is so difficult to maintain, full employment on one side, or avoid inflation on the other side, can be solved under the socialist economy quite simply and easily.

Why can't it be so under capitalism? Because, as I indicated, the rate of interest first depends on the profit motives of the banking system, on their solvency conditions. Thus, the banking policy is not determined by social objectives, but by private motives. But that is not all. You might say, it might be sufficient to socialise the bank and you wouldn't need to socialise anything else. Well, in a way it is true. If you would do this one thing, it would be a great step forward toward the stabilisation of the economy. Why this is not likely to be done is largely a political and social problem. You aren't likely to be able to socialise the banks unless you are able to socialise at the same time the key monopolistic industries, too, and if you get a Government that has the willingness and power to do one thing, it will have willingness and power to do the other thing, too. So from the purely economic point of view of some economists, to abolish unemployment on one side and inflation on the other side, to socialise the banks would be sufficient. But this is only really half the truth because if we did have a system to socialise the banks, there would be two difficulties: one, and unfortunately I don't have time to expand the point sufficiently, is that the way in which the producers respond to changes in interest rates, does not quite hold in the modern capitalist economy. It only holds in so far as the capitalist producers are competitive. If they are monopolistic, their output policies are based on quite

different criteria. And so with the socialisation of the banks with private industry remaining as it is now, a monopolistic private industry, it would not help very much. The socialised banking system would set down the rate of interest to zero, you see, and still private monopolies might not be induced to expand output and increase their investment, or it might rise and they might not be induced to curtail output and investment. Because there are other factors which are much more important for their decisions. I can't enter now into the technical details of what these factors are. So if a government should start to try to stabilise the economy by socialising the banking system as it is under modern monopolistic capitalism, it would have to take the second step, too. Now there is also the other point about capitalism which I mentioned: that entrepreneurial expectations as to future prices, future profits are extremely volatile and subject to all the erratic influences of mass psychology. Now, if the expectations of the managers of production in a socialist society would be of the same erratic kind, some trouble might arise from this source, though less trouble than under capitalism, because the interest rates can be easily changed in the socialist society. Because in the capitalist society it is very difficult — you would have to interfere with the private profit motives of the bank, and would first have to socialise the banks to bring about the equalisation of saving and employment. So that is possible under socialism and socialist society would be in a better position to stabilise economic life even if socialist managers of production would be just as subject to influences of mass psychology as managers under capitalism. But still there might be some difficulty because if, for instance, all managers would become extremely pessimistic about the future and think that future demands, each in his industry, would be extremely low, then they wouldn't expand and make investment, no matter how low the rate of interest is. That is what happens in capitalism. If you asked a banker before the depression, he would have told you, 'Yes, the banks have it in their power. Just given the chance, they can stabilise the economy.' But after the depression, he would say, 'No we can't do it.' He runs around, offers credit to entrepreneurs at extremely low interest and nobody wants to take the money because everybody is afraid to invest it, because he will make losses. Now, if expectations of demand fall further, then even low interest rates won't help to maintain employment — even zero. Now, if the expectations are the reverse, there would be such a scramble for investment, that even high interest rates wouldn't stop the boom. Today, if you increased the rate of interest by two or three per cent, that wouldn't stop expansion. Thus the socialist society will have to take certain steps which will normalise the reaction of managers to changes in interest rates, by normalising the basis on which they form their expectations about the future. That won't be an easy problem, but certain things can be done and much better than under capitalism, and that is simply because the capitalist entrepreneur does things without knowing what his rival does, and each one keeps secret what he does. In a socialist society, since there would be no private profit motive, there would be no reason why things should be kept secret and everything done in one productive establishment would and should also be done by the managers of each productive establishment. There might be some special clearing house of public information where each manager has to give all the statistical data of what is

happening in his plant and industry which is open to managers of other industries so as to provide the possibility of coordination. This alone would take out much of the possibility of fluctuations of optimism and pessimism. Then in addition, there could be established certain rules. For instance, we might have certain anticipations about the future not made by individual managers of different plants, but made by a special institution or planning board which makes certain forecasts and also thinks certain things will be desirable, and then sends these forecasts to the managers of production and tells them to take them into account in making their decisions in their plants or localities. One simple such way of forcing them to keep in line would be for such a planning board or whatever you call this institution which makes the forecasts about the future, to fix, so to speak, in advance, for calculation purposes, future prices of the different goods which have to be entered into the bookkeeping, and ask the managers to calculate all costs and returns on the basis of these prices fixed by the Central Planning Authority, and if it does this, then it is really the Central Planning Authority which makes the anticipations, fixes these anticipations in the form of an established system of future prices, and all the managers of the particular plants or industries have to do is just to adapt their decisions to the data which are furnished by them. How this could be best organised is a technical problem. There is no unique answer; it may be different. We may try to experiment with it. But in any case, in a socialist society this problem of normalising the expectations of the future, of taking them out of the erratic influence of mass psychology, can be solved much more easily than under capitalism, whereas the problem of interest rates is no problem at all. Thus, the socialist society should have no difficulty whatever in maintaining the stability of the economic system. I said one of the distinctions is that under capitalism no one entrepreneur knows what the other is doing. Each one tries to keep secret what he does. Under socialism this would not exist. A rather prominent British socialist once told me the following: he said, 'We in Britain have an official secrets act. Under socialism, industry will have to have an official publicity act.'

THE PRACTICE OF ECONOMIC PLANNING AND  
THE OPTIMUM ALLOCATION OF RESOURCES

Students of welfare economics and of the theory of a Socialist economy are very well acquainted with a whole literature on the subject that is concerned with developing the criteria of the optimum allocation of resources. This literature can be considered as a special branch of welfare economics that has developed the principles of an optimum allocation of resources in any type of rational economic organization. It has been developed largely between the two world wars by economists at a time where there was only one experience in planned economy, namely, that given in the Soviet Union. The literature was developed in a rather formal, abstract way, without reference to that experience.

This situation is changed now, by the fact that in certain parts of Europe, particularly Eastern Europe, new types of a planned and socialist economy have been developed. We have got in Eastern Europe (particularly countries like, for instance, Poland or Czechoslovakia) a developed system of economic planning. The purpose of my address is to give first, a very brief review of the fundamentals of this system, and then ask questions as to how far this system compares with the criteria developed in the literature on welfare economics and of the theory of economic planning. I have to warn you in advance that I shall be able to ask certain questions, indicate certain problems, rather than give ready-made answers. The problem is a highly interesting problem for study, on which the proper research and investigation still have to be made.

The system of planning that has been developed in the countries of Eastern Europe is characterized by one feature; namely, that the economies in these countries consist of two sectors, one of which has been socialized and the other of which is a sector of private enterprise. Consequently, the plans that are made are a combination, first, of plans that are normative for the socialized section, and of certain previsions (forecasts) that are made for the private-enterprise sector. However, it should be understood that since in all these countries the State has the strategic positions in the economy, with nationalization of all the major and medium-sized industry and further nationalization of banking, the results of decisions in the private-enterprise sector are highly influenced by governmental policy. In this sense they are not entirely



automatic, but are partly a response to certain policy decisions of the State.

The approach to planning that is made, is made at this stage, I would say, in macroeconomic rather than in microeconomic terms.

The plan pursues two objectives: one of which is purely economic, and the other of which is social and political. The economic objective is an increase in the aggregate national income; the social and political objective is the achievement of a certain change in the social structure of the country and consequently also in the cultural pattern and type of civilization that is based on the social structure. It is a characteristic feature of the countries of Eastern Europe that the second factor is a basic, if not *the* basic factor of their economic planning. The major feature of that economic planning, therefore, is industrialization of the country. An industrialization which, again for social and cultural and political reasons, it is desired to achieve at the most rapid rate possible.

This objective of industrialization determines the basic macroeconomic decisions of the plan, namely, determination of the fraction of the national income that is to be invested. Now, this fraction is determined by a kind of compromise of the objective of achieving the greatest possible rate of industrialization and the objective of achieving it at a not-too-great sacrifice in the development of the production of consumers' goods.

For instance, in Poland it was decided to have at the same time an increase in the national income, and a diminution of the percentage of population engaged in agriculture, while at the same time having a steady growth of both total and per capita output of consumers' goods. Such a decision, of course, is a basic political decision which is not being made in the form that could be put in terms of any marginal analysis.

This is the first basic decision of a macroeconomic nature. However, it is not possible to avoid the microeconomic choices as to what goods and what quantities are going to be produced. I must say that, up to now, there has not been developed any theory of these choices. Nor is it possible to say that any of the existing theories has been in any conscious way used as a basis of a plan. On the other hand, the problem *does* exist. Those who are responsible for the planning are aware of the problem, and there actually has been some discussion.

At the moment, the problem does not enter into the conscious decisions for one reason. The reason is this: The planning is divided into two stages, which I would roughly describe as the stage of reconstruction and the stage of expansion. These stages are practically not quite so distinct as I put them now for our theoretical discussions; but still the distinction does exist and is rather basic. In Eastern Europe most of the countries suffered heavily from the war, both in terms of actual

destruction, and in terms of depletion of capital through lack of replacement. The first stage of decisions taken is simply one of restoration of the status quo. Factories are being rebuilt to produce what they did before; bridges that were destroyed are being rebuilt, and so on. Consequently, the problems of choices as to investment and production are very much simplified. They are simply solved by deciding to restore what was before.

The next step, after that, is the step of expansion. The two steps, of course, are not quite independent; and the question may be raised: Is it really a rational thing to decide to restore exactly what was before the war? Conditions have changed, conditions, directions of demand; and, consequently, is it at all possible to distinguish between such a stage of restoration or reconstruction and a stage of expansion? The question is quite legitimate; and the answer, *a priori*, would be that there is no justification for such a distinction. However, I think here a hypothesis can be made to rationalize and justify the approach that has been made in practice. The hypothesis would be this: that all decisions on expansion contain as a part of them the restoration of the existing old levels of output, and that, consequently, the choices to restore the old levels of output are made legitimately, insofar as they are an integral part of any program of expansion. I think this justifies the procedure followed in practice; but at the same time it really postpones the real problem of choices for a further future.

This being so, we have got a system of economic plans in most of the countries of Eastern Europe that are based on the restoration or reconstruction of the status quo, although, even in the first period, they do contain certain elements of expansion. The problem of choice up to now has been simplified further by the fact of the existence of an inflationary gap. The high investment program, which results from the fact that all these economic plans are connected with a political decision of industrialization at a rather speedy rate, produced everywhere an inflationary gap which is being solved in some countries by rationing, in different ways in other countries. On the whole, however, the problem has been solved by different means of monetary policy which do maintain a certain stability of the price level.

This makes for a constant pressure of excess demand in all markets, which, in turn, creates a situation that any increase in output, in whatever field, appears as a desirable thing. Mr. Stafford has mentioned in his earlier paper that the strict criteria of choice disappear or are thoroughly obscured under such a situation of full employment and inflationary pressure. Consequently, again the output levels are largely determined simply by limitations on the supply side, by the possibilities of increasing the supply that exists under given technical conditions, rather than by

a condition of the relative urgency and strength of the demand. The relative urgency and strength of the demand is taken into consideration, in certain respects, but insofar as the decision as to the division of the total output between the output of producers' goods and consumers' goods goes, the basic plan of industrialization, creates a certain system of priorities determined by public policy. To a certain extent, of course, the market demand effect on prices and on the calculation of cost and profit has repercussions on the plans of investment and expansion of different industries, though these appear in very crude forms which are not easily translatable into the precise forms of theoretical analysis.

Such is, roughly, the basic experience of economic planning in the countries of Eastern Europe. The questions that are raised are the following. The first is a critical question: From the point of view of our present theoretical knowledge, how efficient can this planned economy be considered? How near or how far are they from the social optimum as given by the criteria of modern welfare economics?

The second question is this: Is the practice of this planning such that it can be translated into the concept of modern welfare economics and marginal analysis? And also the question directed toward marginal analysis, a question which was raised in the preceding paper by Mr. Stafford, namely whether the criteria of welfare economics, particularly of the marginal analysis are operationally sufficiently clear so that they can be applied practically. If yes, what kind of development in the concepts and methods of public accounting do we require? If no, how have they to be changed and readapted, and by what criteria to be replaced, in order to give us a theory that would be sufficiently operationally definite in order to be applicable to the solution of our practical problems?

These are the problems that have to be answered. I do not claim to be able to give the answer at this moment. I can only make a few general observations, and these general observations would be the following: It seems that in all the planned economics that we know empirically, as in the Soviet Union, or the alternative type that we now have in Eastern Europe, there are certain elements of the economic plans, certain choices which are made on the basis of criteria that are not connected with marginal analysis.

The second general observation, I think, that can be made, is that marginal analysis requires much further elaboration in terms more operational than at present, to make it serve as a basis for practical decisions.

The question arises whether the planned economies in Eastern Europe, for instance, can be regarded as an economic success. I think that the question can be answered.

In order to make the question operationally significant it has to be put in the following form: How much more are these planned economies of Eastern Europe efficient than the prewar economic systems had been? I think there the answer is very simple. Through the adoption of planned economy and all the social changes connected with it these countries, which before the war were countries of chronic industrial and economic stagnation, have entered into a period of great and dynamic economic development, with a great rapid reconstruction, industrialization, undoubted increase in national income, diminution if not full disappearance of their large agricultural surplus population (a form of disguised unemployment), the disappearance of unemployment in industry which existed in the period between the two world wars or at least over a part of this period. The planned economies undoubtedly are an economic success. This economic success can be attributed largely to two factors: First, because these economies *do* operate on the basis of a full employment with a further plan to remove the element of disguised unemployment that exists in form of an agrarian surplus population, this surplus population is being absorbed by the process of industrialization. And, second, because there are no more the handicaps to the utilization of resources and industrialization, which existed before the war in the form of private industrial monopolies. Such monopolies were a very potent handicap of economic development of these countries. These are factors that both can be evaluated roughly in terms of quite simple economic analysis, terms that are quite sufficient to provide the foundation for basic political decisions.

As I have said, the more refined choices appeared less important because the need for such choices was very much limited by the fact that the choices were largely those of reconstruction or restoration of the status quo. But of course in all these planned economies the problems of more refined choices involved in the determination of the levels of the different outputs of the different industries, or that of agriculture, do appear and their importance will increase the farther we get away from the stage of reconstruction and enter into the stage of expansion. And in this case, I think the problem of a refinement of the method of analysis and of the criteria used for economic planning will be needed in order to solve the practical problems of economic planning.

I think that, for us economists, a study of these experiments in economic planning is a rather interesting subject. I think that, up to now, the literature on the theory of economic planning suffered very heavily from the fact that it was purely abstract without relation to the institutional set-up of the existing types of economic systems. And I do believe that by studying the recent experiments in economic planning, the practice of economic planning, as well as theoretical economics, can benefit mutually.

## HOW I SEE THE POLISH ECONOMIC MODEL

The Polish economic model, the model of a socialist economy, adapted to the historical and geographical conditions of Poland and meeting the needs of the Polish nation, cannot be formulated from above, worked out at a conference table. It stems from the great movement towards socialist democracy which has permeated the country, from the setting up of workers' self-government, from the renewal of the self-governing co-operative movement, from the search for new forms of self-government and of social initiative among farmers. It stems from the ideological quests—passionate and creative—of the young intelligentsia, from the real need to introduce effective economic incentives, to replace management of the national economy by administrative directives.

The experience of this great movement must, however, be analysed scientifically in order to draw practical conclusions from it, and to enable the Party to make use of it and to direct the construction of a Polish model of the socialist economy. The scientific analysis of this experience will be one of the principal tasks of the Economic Council, which will shortly be established under the Council of Ministers. It is as yet difficult to anticipate the results of a detailed analysis of the problems of constructing a new model of the socialist economy, corresponding to Polish conditions and needs, from available theoretical and practical knowledge. The outline of such a model is, however, now crystallizing and further conclusions can be drawn from it.

*Central Planning and the Decentralization of Management*

The Polish model of the socialist economy will undoubtedly be marked by the link between the central planning of the development of the national economy and the decentralization of management based on self-government of workers and partly also of co-operatives and regions. A further characteristic of this model will be the use of economic

incentives as the basic instrument for implementing the national economic plans.

Central planning should cover the general lines of development of the national economy, as well as those areas which are of fundamental importance to the national economy as a whole or whose management must, for technical reasons, be centralized. The subject of central planning should, thus, be: the allocation of national income to investment and consumption and, connected with this, the rate of growth of the national economy, the wages fund and other incomes of the population, the value of goods produced to meet consumer needs, the quantity of currency in circulation. Planning the level of these is necessary to ensure equilibrium in the development of the national economy.

In addition, however, central planning must ensure that the national economy develops on lines consistent with the needs and wishes of the nation which are expressed by the highest organ of State authority, the House of Representatives (the Sejm). Therefore, investment should be subject to central planning. Primary investment must be planned directly by the centre; subsidiary investment, of less significance to the whole economy, could be planned by departments, national councils and enterprises, within the framework of general allocations and directives laid down by the central plan. Finally, the national economic plan should cover the production of commodities which are basic to the national economy, such as coal, steel and other important raw materials, fertilizers, machines, transport, equipment and goods for mass consumption. The production of other goods should be determined by autonomous regional plans or directly by individual enterprises.

The national economic plan must also cover the basic means (especially in the form of appropriate investment), needed to ensure technical progress. In branches of production where centralized management is required for technological reasons, as in the steel industry, the national economic plan must itself make specific innovations in production techniques.

### *The Basis of Management: the Autonomous Enterprise*

The basis of the management of the national economy should be the autonomous socialist enterprise. Such enterprises should function

as teams of people implementing common social tasks, personally interested in the favourable outcome of these tasks, and linked together by a feeling of friendly co-operation. In a State-owned economy, socialist enterprises are trustees of property belonging to the nation as a whole, which they manage autonomously within the framework of the national economic plan and the general directives of State economic policy. In a co-operative economy the socialist enterprises are themselves property-owners. It is clear, however, that they too should, to a certain extent, be considered as trustees of the nation's business and act within the framework of the national economic plan and the general economic policy of the State.

Since small-scale private production—and even, up to a certain size, small-scale capitalist production in agriculture, in handicrafts and in small-scale local industry—will continue to exist in Poland for a long time yet, national economic plans will have to be able to influence such production, by appropriate manipulation of economic incentives inducing small-scale producers to conform to State economic plans.

It is the task of socialist enterprises, both State-owned and co-operative, to implement the national economic plan, to carry out the production of goods not covered by the plan, to reduce costs, to introduce technological advances, and to attain a suitable profit level. The implementation of these tasks should be based above all on workers' material interest in the profits of the enterprise. Profit should become the basic criterion determining whether the enterprise fulfils its socio-economic tasks.

At present there is often conflict between the profitability of producing a particular assortment of goods and the social demand for such an assortment. Enterprises frequently show a tendency to produce an assortment which is more profitable, but socially less necessary. Such a conflict is the result of a bad price structure, incompatible with the law of value. With a proper price structure an assortment which is socially more necessary should also be more profitable. The socialist enterprise, guided by the profitability of production, would then automatically fulfil its socio-economic tasks.

The relations between socialist enterprises should generally be based on a system of direct contracts which would replace the present system of allocation from above. Allocation from above should be limited to exceptional cases in which the shortage of certain commodities, partic-

ularly raw materials, cannot be eliminated by a price increase, since the implementation of the national economic plan requires more selective means than a price policy.

### *The Principle of Pricing*

The basic means of linking socialist enterprises to each other, as well as of linking them to consumers and private producers (peasants and craftsmen), should be prices. In other words, these links should be based on the operation of the law of value. In such conditions pricing will become the essential instrument for guiding the national economy.

Pricing must remain in the hands of the State, i.e. of the central or regional authorities, depending on the nature and general economic importance of a given product. In the case of products of fundamental importance to the whole national economy, whose production is directly controlled by the national economic plan, prices must be set by the central authorities. This is essential for the creation of economic incentives to ensure the implementation of plans. The prices of products decided by regional economic plans, or of products not covered by a plan, can be set by the regional authorities. Only in exceptional cases, in small-scale industry, either social or private, in which there is a large number of enterprises effectively competing with each other, can prices be freely determined by the market mechanism. Here too, however, a certain measure of control by the State authorities is necessary. In the case of agricultural products, prices would be determined partly by the State through purchases by State and co-operative trade organizations, and partly by the open market in direct transaction between peasants and consumers.

The principle of pricing by the State is necessary also to prevent the rise of monopoly syndicates among socialist enterprises. If socialist enterprises could themselves fix prices for their products, they could raise their profits, not by increasing output, reducing costs by technological progress, but, by raising prices, leaving production, costs and techniques unchanged. Socialist enterprises or their associations would then be transformed into monopolistic owners of the means of production and would cease to be trustees of property belonging to and managed in the interest of society in general.



### *Everyday Experience Will Decide*

This is how I think the general outline of a Polish model of the socialist economy will look. It must be emphasized, however, that this picture is only provisional and may be considerably modified as a result of further studies and investigations. For the new model of the Polish socialist economy must grow from experience, and especially from experience gained from the great movement of workers' self-government. It cannot be worked out theoretically. The steel industry must be managed differently from the industry producing leather goods or buttons; managerial methods in industry requiring large central investments must be different from those in local industry. Similarly, the degree of independence must also vary from enterprise to enterprise and even the nature of workers' self-government.

Great help in exchanging experience in the course of constructing the new economic model can be given by conferences of delegates from workers' councils and from the management of factories in particular sectors of the national economy, conferences of representatives from co-operatives, and so on. Such conferences would provide valuable material for the management of the national economy in their policy making. At the appropriate moment, it would be necessary to call a general Polish congress of workers' councils which would define the principles governing the activity of these councils and their role in the management of the national economy. Such a congress would also be of great political significance in formulating and co-ordinating, the activities of the working class, thus furthering the process of industrial democracy.

The new model of the socialist economy will also require certain changes in the political structure of the State. A logical consequence of basing the management of the national economy on the self-government of factory workers, and on co-operatives, and other forms of peasant self-government, which are only just developing, will be to set up a second chamber in the House of Representatives (Seym), representing the self-government of individual industries of the socialist economy. Such a chamber would be an essential organ of socialist democracy constituting, as Marx puts it, "an alliance of free people working with the help of communal means of production".

---

## Political economy of socialism\*

---

The founders of scientific socialism, Marx and Engels, devoted all their efforts to the analysis of the capitalist economy. They made only a few highly generalized remarks about the socialist economy. As a matter of principle, they refused to enter into the problem in greater detail, out of fear of proving more utopian than scientific. The great socialist movement of the nineteenth and the beginning of the twentieth century also devoted all its scientific efforts to the analysis of capitalism, although Bebel and Kautsky made some attempt to utilize the perspective of a socialist society.

The situation changed after the First World War. Under the impact of the October Revolution, the question of socialist construction became a practical problem. The revolutions in Central Europe, in Germany and Austria, brought forward the question of the transition from capitalism to socialism. In this period, therefore, there is some literature which deals with the economic problems of socialism. In the Soviet Union, Lenin, first of all, took up the problems of a socialist economy, which were also considered in the writings of Bukharin, Preobrazhensky, Strumilin and others. The social democratic movement at the same time produced the writings of Otto Bauer, Kautsky and others, which dealt in a tentative way with the problems of a socialist economy. During this period there also emerged a considerable non-Marxist literature which sought to show the impossibility of establishing a proper economic accounting under socialism. Max Weber, von Mises, Hayek and others presented arguments which the socialist side sought to answer. I myself wrote on this subject, and in England there were Abba Lerner, H. D. Dickinson and Maurice Dobb.

In the meantime in the Soviet Union, socialism became a viable, functioning system. Though it provided new experiences, for the time being they called forth only a few theoretical generalizations, such as the writings of Ostrovitianov. The first important attempt at theoretical generalization from the experiences of the Soviet economy was given in the famous booklet by Stalin on *Economic Problems of Socialism in the USSR*, and then in the textbook of political economy, recently published by the Soviet Academy of Sciences. In the meantime other socialist experiences were accumulating, first in Yugoslavia, later in China, Poland and the other people's democracies. One can conclude that the time is slowly maturing for a synthetical, theoretical account of the principles of socialist economy.

Of course such a synthesis can be only preliminary and provisional. What I am going to say here, therefore, represents only my personal view. Among Polish economists, despite an active discussion, there are many divergent views, as

\*An address delivered on 18 November 1957 at the Institute for International Politics and Economics, Belgrade.

would be inevitable considering the fact that the problem is still in its infancy. What I am going to present, as a consequence, are my views of the moment, which may later be modified both as a result of further study on my own part and further practical developments in the living experience of a socialist economy.

The basis of the scientific treatment of the political economy of socialism is the assumption that there exist in a socialist society objective economic laws. I shall start my exposition with the statement that socialist society is subject, first, to the general laws of social development which are formulated in the theory of historical materialism, and, secondly, to special economic laws.

Concerning the operation of general laws of social development, it has sometimes been denied that socialist society is subject to the laws of historical materialism. For instance, in Poland the great Marxist sociologist, Krzywicki, maintained that these laws are not applicable to a socialist society. Besides such a formal, explicit denial, there has frequently been an implicit denial. This was done by denying that the development of socialist society takes place through the operation of contradictions. It was thought that all social contradictions, all contradictions in human life, automatically disappear in a socialist society.

This view is quite incompatible with Marxist theory. It expresses a Christian-eschatological and not a Marxist-scientific attitude. Socialism is not the realization of the religious ideal of the Kingdom of God, but a new stage in the development of human society, a stage which can and must be studied with the methods of Marxist analysis. It has been the merit of Mao Tse-tung to have recalled with emphasis the fact that socialist society, too, develops through contradictions.

The basic contradictions which are the moving force of social development are, according to the theory of historical materialism, two: first, the contradiction between the development of the productive forces and the restrictive character of the relations of production; and second, the contradiction between mode of production (or what is called the economic base of society) and the superstructure of organization and management of the economy, of political organization, of moral and psychological attitudes, of conservatism of habits and so on. These basic contradictions also arise in the course of the development of a socialist society. The essential difference, however, between a socialist society and one based on class domination is this: that in societies based on class domination these contradictions – particularly the contradiction between the development of the productive forces and the restrictive character of the relations of production – are connected with class interest and take the form of class struggle. This does not happen in a socialist society. Therefore, we usually speak of these contradictions under socialism as being non-antagonistic in character.

But this does not mean that social conflicts cannot develop in societies, for, in addition to social classes, there exist social strata. The difference between social classes and social strata is that, whereas social classes are based on the relations of production, social strata have their economic base in the particular form of the superstructure of the society. To give an example: in a capitalist society capitalists are a class, but bankers, merchants, lawyers, priests, government officials form social strata. These latter have their economic base in the organization of the superstructure, not in the relations of production. In terms of the source of the

income which they receive, 'classes' receive income through the process of the primary distribution of income, such as wages and surplus value, while 'social strata' derive their income from a secondary distribution. For instance, government officials get their income from taxes, priests from donations, merchants and bankers from a part of the surplus value which is used to remunerate their non-productive (but, in the capitalist framework, necessary) activities.

In all societies, therefore, there are social strata. It follows that the contradictions which may arise in the development of a socialist society between the requirements of the economic base and antiquated superstructures (such as methods of management of the national economy, political superstructures and so on) may also provoke an opposition of the vested interests of certain strata which makes a change difficult. But these are not social classes; there are no class struggles. The overcoming of these obstacles does not require a basic change in the relations of production, that is a social revolution, though it may lead to all sorts of friction in the superstructure during the period of the transformation and adaptation of superstructure to the new requirements of the economic base.

That much can be said about the operations of the laws of historical materialism in a socialist society. I do not wish to dwell on the further perspective of what happens to the social strata in the transition of communism. Nothing could be said at present regarding this stage without abandoning scientific method, since the relevant empirical facts are not yet in existence.

The second problem concerns the operation of economic laws in a socialist society. Some Marxist economists have held the view that no economic laws operate in a socialist society, and that political economy loses its role as a science with the end of capitalism. The most prominent exponent of this view was Rosa Luxemburg who actually coined the famous phrase that the proletarian revolution is the last act of political economy as a science. Others who took the same view, particularly in the early years of the Soviet Union, were probably under the influence of Rosa Luxemburg. Bukharin and his school took essentially the same view, that political economy is a science of capitalism and ends when the capitalist system ends. Not only does this theory contradict the views of Marx, Engels and Lenin; more importantly, the experience of existing socialist economies has shown that economic laws do operate within them.

At a certain period in the Soviet Union, though the view was not always very clearly and openly put, there was a tendency which later was called by Soviet economists 'voluntarism'. 'Voluntarism' denied that economic laws operated under socialism and put forward the assumption that in a socialist state the controllers of economic policy can do whatever they wish. The very fact that Stalin in his last book on *Economic Problems of Socialism in the USSR*, strongly insisted upon the continued existence of objective economic laws is impressive testimony that such laws exist and cannot be neglected.

The essential difference in the operation of economic laws in a socialist society is that they do not operate there in an elemental way. Organized society shapes in a conscious, purposive way the circumstances which determine their operation. Economic laws can thus be made to operate in accordance with human will, just as man through modern technology utilizes the laws of nature and makes them operate in

conformity with his will. Such was the famous idea expressed by Engels, when he spoke of the ability of society to control consciously the laws of its own operation, and called this 'the leap from the kingdom of necessity to the kingdom of freedom'.

With reference to the economic laws operating in a socialist society, I think we can distinguish four types of such laws, according to their relationship to the socialist mode of production.

First there are laws which are general in the sense that they operate in every socio-economic system. These are the laws of production and reproduction. They are the laws which concern the general features of the organization of the labour process, the cooperation and division of labour, the role of indirect labour crystallized in the means of production and direct (live) labour in the process of production. Then there are also the laws of reproduction which concern the replacement of the means of production used up in the process of production, and the laws governing the division of the product between consumption and accumulation, and the laws of balance in the process of reproduction in the various branches of economic activity. All such laws apply to any mode of production, whether socialist, capitalist, feudal or any other. In any society these laws establish certain technical balances between material objects. They show, for instance, that one cannot accumulate if one consumes the whole net product, that one cannot maintain reproduction if one does not replace the means of production used up, that, if one wants to produce a certain amount of steel, one needs to have a certain amount of coal for that purpose. Such balances between material objects must be provided in any economy, whatever the social system, since they refer to the operation of productive processes.

The second type includes the laws which are specific to the socialist mode of production, in other words, such laws as are determined by the socialist relations of production. The relations of production determine the incentives which govern human economic activity since the ownership of the means of production determines for what purposes the means of production will be used. For instance, ownership under capitalism exists for the profit of these owners; under socialism ownership exists for the satisfaction of the wants of society. I believe that the terminology used by Stalin in his book, when he spoke of a fundamental law which underlies every economic system, is rather helpful. But the thought is really to be found in Marx. It says: when we study a social system, we have to discover the economic law which organizes the whole system, and this law will be found to depend on the existing relations of production. Under capitalism it determines that production be for private profit; under socialism it determines that production be for the satisfaction of human wants. Thus there exists, first of all, this 'fundamental law' of each mode of production which determines the purpose of the use of the means of production.

In addition to the purpose for which the means of production are used and for which the whole production process is organized, the relations of production also determine the mode of social interaction of human activities: for instance, whether the interaction of human activities takes the form of competition, or monopoly, or of planned direction. This is also a result of the mode of production, and here the socialist relations of production do produce certain specific economic laws.

Thus socialist relations of production which consist of the social ownership of the means of production have two consequences. One is that production and all economic activity is carried on for the satisfaction of the needs of society. The other is that the basic mode of social interaction in economic activity is planning, by which I mean a conscious guidance of economic processes by an organized society. I do not enter here into the methods of planning, whether centralized or decentralized and so on, but the very fact that the means of production are social property carries the consequence that the whole productive economic process is consciously and purposively guided by a socialist society, and in this sense is planned. This is the reason why the economic laws in such a society are not elemental, but their operation is consciously directed by the social welfare.

Besides these general economic laws which operate in any social system, and laws specific to a particular mode of production, there are also laws of an intermediate nature. These are not general, but specific to more than one mode of production. They operate in several modes of production and express certain common features of these modes of production. Such are the economic laws which are the result of commodity production, such as the law of value; and as commodity production in practice implies exchange for money, there should also be mentioned the elementary laws of monetary circulation. In pure theory we may distinguish between the process of exchange of commodities and monetary circulation, but in practice the two are always connected. Developed commodity production is production where exchange takes place with the aid of money. Thus I would add here the elementary laws of monetary circulation.

Commodity production is carried on – and consequently the laws of value and monetary circulation operate – already in precapitalist societies, though in a restricted field. Under capitalism all production takes the form of commodity production and is subject to the law of value and the laws of monetary circulation. In a socialist economy the law of value continues to operate because production continues to be commodity production. The reasons why production in a socialist economy is commodity production (and consequently subject to the law of value) is the existence of a multiplicity of owners of products in a socialist society. This multiplicity of owners results from two of the features of a socialist society. First, the existence of various forms of social ownership of the means of production has the consequence that there is not just one owner of the means of production; there are many. Secondly, the method of distribution of the product in a socialist society passes the products produced in a socialist production process directly into the private ownership of the consumers.

The reason why there are various forms of social ownership of means of production is historical. In the existing socialist countries, as we know, means of production may be owned socially, either as the property of the whole nation or that of cooperatives, of municipalities, of various societies and institutions (for instance, trade unions). Thus it is clear that there are various types of property under socialist ownership. These various types result from the historical conditions under which the transition from capitalism to socialism has taken place. There are differences in various countries. In the nineteenth century and at the beginning of the twentieth, many Socialists thought that there would be only one form of socialist ownership

(namely, the national ownership) which in the long run (when national socialist states had merged into one world socialist federation) would merge into an international socialist ownership. It was also thought that the transition from capitalism to socialism would take place solely through the expropriation of the capitalist class (which by the way would then possess a high concentration of capital) so that the social revolution would be a rather simple and easy act.

Historical experience has shown that the crisis of the capitalist system took place earlier than expected; namely, before capitalism has had the possibility of destroying non-capitalist forms of production, particularly small commodity production. Owing to the rise of imperialism, the breakdown of capitalism has occurred first in the less developed countries. Socialism starts to develop first in those countries which imperialism has prevented from developing along traditional capitalist lines. Thus in addition to the expropriation of the capitalist class (which leads to one type of socialist ownership, national ownership) it is necessary to organize socialist ownership on the basis of small commodity production; hence the great significance of the cooperative form of socialist ownership.

In some countries the working class is able to get control of municipal and local government before it is able to conquer state power. This may lead to the development of municipal forms of social ownership of the means of production.

These examples do not exhaust all the possibilities. But they are sufficient to show that the particular historical conditions under which the capitalist system breaks down and the construction of a socialist society begins determine the variety of forms of socialist ownership of the means of production. This fact (as well as the fact that distribution under socialism passes the products of socialist production directly into the private property of the consumers) causes production to have the nature of commodity production. Therefore the law of value operates.

I might add that the second condition alone is a sufficient one. Even if there were only one form of socialist ownership of the means of production, for instance, national, then by the very fact that distribution passes the products into the individual ownership of consumers would be enough to give to socialist production the character of commodity production and to make the law of value operate. The multiplicity of types of socialist ownership of the means of production is still another reason.

Products become commodities and become subject to the operation of the law of value when they change owners. That happens, as we saw, under a socialist economy. But the question might be asked: how should we consider products which are 'exchanged' between units of the nationalized sector of the economy? If they are exchanged between cooperatives, then they of course pass from one owner to another. But means of production which pass from one unit of the national sector to another do not change owners. I call such products quasi-commodities. The law of value operates here indirectly by means of imputation. Since the final products are sold to consumers or to cooperatives, municipalities or whomever, they are commodities. By imputation this transfers a kind of commodity character to the means of production which have been used to produce the final commodities. The values of the final commodities are by any accounting process reflected backwards to the means of production which are used to produce them.

Thus the law of value operates in a socialist society. But it is not specific to the socialist mode of production alone. It operates also in the capitalist mode of production, just as it operated in a limited way also in the pre-capitalist societies. It expresses a certain common feature of several modes of production.

There is still a fourth type of economic law in a socialist economy. This comprises the laws which are not connected with the socialist mode of production, but result from the particular types of the superstructure of the management of socialist economy. These laws, therefore, change when the organizational and managerial superstructure changes. In capitalist economy there are also laws which are specific not to capitalism as a whole, but to particular types of organizational and managerial superstructure. To give an example, there are general laws of monetary circulation, which, by the way, are not specific to capitalism but to commodity production. But where there is a gold standard or paper money, specific laws operate which are peculiar to the particular type of monetary system. A second such law in the field of monetary circulation is Gresham's Law, which operates only if both types of metallic money have the same legal value.

Different methods of managing a socialist economy not only change historically and from country to country, but produce their own particular economic laws. They produce specific economic laws because they produce specific incentives and opportunities for action.

There are two points to be considered here: on the one hand the law of value, on the other the relative scope of administrative allocation of goods. In a socialist society the law of value operates. But under certain forms of management of the socialist economy, use may also be made of various administrative allocations (something that sometimes happens under capitalism). Of course the relative operation and interaction of administrative allocation and of the law of value produce their own economic consequences and regularities which have the character of economic laws operating under these circumstances, for instance, various types of 'blackmarket' phenomena.

Another point relates to the consequences of different types of remuneration for labour: how labour is paid, how far and in what form the workers share in the profit of the enterprise, and so on. These practices produce certain economic consequences (of the nature of economic laws) of a quite regular character. I shall give you an example from our Polish experience. The fact that premiums paid to managing personnel and to workers in the enterprises were related to the extent to which the plan was overfulfilled has caused, with the regularity of an economic law, two consequences: first, the plans are put too low because there is an incentive to have a low plan which can easily be exceeded; secondly, plans tend to be only slightly overfulfilled so that they will not be raised too much the following year. For these reasons we have now abolished in Poland the relation between the payment of premiums and the overfulfilment of the plan. The same procedure is now being proposed in Czechoslovakia. We wish, so to speak, to abolish this type of economic law. Instead, premiums will be based on how much the results of the enterprise improve over the situation of the preceding year.

This brings me to the question of opportunities and incentives in a socialist economy. The social ownership of the means of production implies new opportu-



nities for economic development. Private vested interests no longer hamper the rational use of the means of production in the social interest. Social ownership of the means of production makes economic planning possible: planning the rate of accumulation, the basic investments which determine the developmental direction of the national economy, the division of the national income, and finally planning production so as to secure coordination of the various branches of the national economy and a harmonious economic development.

These opportunities, however, are only opportunities. They result from the abolition of obstacles (inherent in the capitalist system) which prevent the rational use of the means of production and a harmonious economic development. They do not automatically guarantee the attainment of these objectives. To this end proper incentives must exist in the organization and methods of management of the socialist economy. Such incentives in part result directly from the socialist relations of production, and in part depend on the organizational and managerial superstructure of the economy.

With regard to incentives resulting from the socialist relations of production, it must be recognized that production and other economic activities are organized in the form of socialist enterprises; that is, they are organizations of activities designed to carry out certain specific social tasks. In order to carry out these tasks properly, the persons participating in the socialist enterprises must be interested economically and morally in the satisfactory performance of the task of the enterprise. The incentives, therefore, must be established in such a way that the personal and collective interest of the staff constituting the enterprise is identical with the social task the enterprise has to perform.

In order that this be the case, the socialist enterprise must satisfy two conditions. It must act as trustee of the general social interest, and it must be a self-governing body. As there are two types of socialist ownership of the means of production, namely, national and group ownership (cooperative, municipal, and so on), there is a difference in the legal status of the corresponding type of socialist enterprises. In cooperatives and other group forms of enterprises, the group owns the means of production and governs itself autonomously. In nationally-owned enterprises, the enterprise acts as a trustee of the means of production which are national property. In both cases, however, the socialist enterprise is a trustee acting in the general interest of society. This holds also for cooperatives and other enterprises based on group ownership which in a socialist society must act in accordance with the general social interest. The justification for cooperatives and other group forms of socialist ownership is that in certain fields it allows better harmonization of the incentives of the staff of the enterprise with the general social interest. In nationally-owned enterprises, in contrast, there must be substantial self-government of the workers of the enterprise; otherwise the economic and moral incentives are not operative, the enterprise becomes bureaucratic and either does not fulfil its social task or does so very inefficiently.

Thus socialist enterprises must be bodies of self-governing workers acting as trustees of the social interest. Two extremes may endanger the proper socialist character of the enterprise. One is the absence of trusteeship of the public interest. In this case the ownership of the means of production, whatever its formally legal

character, ceases to be socialist ownership and becomes purely group ownership devoid of any responsibility to society. I shall call this the extreme anarcho-syndicalist degeneration.

The other extreme, which I shall call the bureaucratic degeneration, is found when there is no effective self-government of the workers in the enterprises. In such cases the socialist character of the ownership of the means of production becomes rather fictitious, because the workers have little direct influence on the practical use made of the means of production; whatever influence exists, goes through the channels of a centralized bureaucratic machine. There arises the danger of a new type of 'alienation' (to use a well-known term of Marx) of the producer from his product; thus there follows a deformation of the socialist character of the relations of production. The socialist ownership of the means of production implies both: the use of means of production in the interest of society as a whole, and the effective democratic participation of the producers and other workers in the administration of the means of production.

These are essential features of socialism. The particular forms in which they may be embodied may vary from country to country, and from one stage of development of socialist society to another. In the transition period and in the first stages of socialist society, some deformation may take place by necessity. For instance, cooperative ownership may not act sufficiently in the general social interest; or the needs of centralized management may hamper the development of workers' self-government. The extent to which such deformations disappear is therefore the measure of the degree of maturity attained by the socialist society.

In addition, as a result of the social ownership of the means of production, incentives can also be determined by the managerial superstructure of the economy, the methods of planning and of realization of the plan, the principles of economic accounting adopted, the methods of payment of wages and salaries, the types of participation in the profits of the enterprises, the role of the market and so on. All these help to determine the incentives of the workers. Thus proper organization of the managerial superstructure of the economy is essential to promote the operation of the incentives necessary to assure adjustment of production to the needs of society, the rational use of resources and the promotion of technical progress.

Special consideration has to be given to the role of the state in the construction and guidance of the socialist economy. This role varies in the different stages of its development. Unlike the bourgeois revolution (which came when capitalist relations of production had already considerably developed within feudal society), the socialist revolution precedes the establishment of socialist relations of production. The revolutionary state – the dictatorship of the proletariat – abolishes capitalist relations of production and establishes and organizes socialist relations of production. This process may be sudden or more or less gradual, but in any case the political power of the state is the motive force. In underdeveloped countries (in which most socialist revolutions have so far taken place), socialist relations of production result also from the development of productive forces (industrialization, modernization of agriculture) which the new revolutionary state initiates.

Thus in the first stages of the emergence and development of the socialist economy, the extra-economic force of the state plays a dominant role. It is the

creative factor which brings about the changes from capitalist to socialist relations of production and which, particularly in underdeveloped countries, fosters the rapid development of the productive forces. In this period the economic laws specific to capitalism are being abolished and the economic laws of the new socialist society emerge and take shape. As the economic laws of socialist society become increasingly operative, the role of the extra-economic force of the state recedes. Extra-economic force is replaced gradually by the operation of economic laws, that is, by the establishment of proper economic incentives which produce the results desired by the will of organized society.

The organizational expression of the replacement of extra-economic force by the utilization of economic laws must be a gradual separation of the management of the national economy from the extra-economic activities of the state, that is, from the exercise of political power. Let me remind you of the distinction made by Engels between 'government of persons', 'administration of things', and 'the direction of production processes'. In the long-run perspective of communist society, the 'government of persons' gradually disappears, while the 'administration of things' and the 'direction of production processes' remain the chief objectives of social organization. This is the substance of the process of the 'withering away' of the state.

While this is certainly a long-run perspective, the institutional preparation has to be undertaken at a much earlier stage. It is done through the gradual separation of the institutions of economic management from the institution of political government. As early as 1918, Lenin said in his address to the First Congress of Councils of National Economy:

There is not the slightest doubt that the further the gains of the October Revolution progress, the more profound the change which it commenced becomes, the more firmly the gains of the socialist revolution become established and the socialist system becomes consolidated, the greater and higher will become the role of the Councils of National Economy, which alone of all the state institutions are destined to occupy a permanent place. And this place will become all the more durable the more closely we approach the establishment of the socialist system and the less need there will be for a purely administrative apparatus, for an apparatus which is solely engaged in administration. After the resistance of the exploiters has been finally broken, after the toilers have learned to organize socialist production, this apparatus of administration in the proper, strict, narrow sense of the word, this apparatus of the old state, is doomed to die; while the apparatus of the type of the Supreme Council of National Economy is destined to grow, to develop and become strong, and to perform all the main activities of organized society.

The process of gradual separation of economic management from political government thus prepares the institutional conditions for the 'withering away' of the state. The gradual reduction of political guidance of economic processes is an essential reflection of the process of maturation of the socialist society. The further away socialist society has moved from its capitalist heritage, as well as from the heritage of the period of transition, in which extra-economic force plays a decisive role, the more the guidance of economic processes becomes separated from the exercise of political government. This process prepares the long-run perspective of the 'withering away' of the state.

---

## Role of planning in socialist economy\*

---

Economic planning, or more precisely, the planning of economic development, is an essential feature of socialism. It expresses the fact that socialist economy does not develop in an elemental way, but that its development is guided and directed by the conscious will of organized society. Planning is the means of subjecting the operation of economic laws and the economic development of society to the direction of human will.

The experiences of the construction of socialism in various countries indicate that the establishment of planned economy is one of the first achievements of the socialist revolution. It precedes the full development of socialist relations of production though it needs a certain minimum of such relations. In the transitional period, when non-socialist modes of production still play an important role, the economy becomes already subject to planned direction of its development. This is made possible by the existence in the economy of a large socialist sector which controls, as one frequently says, the 'commanding heights' of economic life. This is the minimum requirement of establishing a planned economy.

Economic planning starts with the direct intervention of the state in economic relations. This intervention has for its objectives the liquidation of capitalist relations of production, the establishment of socialist relations of production and the control of the non-socialist sectors of economy which still remain. The basis which makes control of the non-socialist sector possible is the existence of a socialist sector, particularly that part of the socialist sector which is nationalized (i.e. state-owned), and which controls the commanding outposts of the economy.

In this first, transitional phase the new revolutionary state is not neutral in relation to the various sectors of economy. It consciously utilizes the nationalized socialist sector as an instrument to regulate the development of the whole economy. The means it utilizes consist of economic instruments which result from the existence of the nationalized sector comprising the decisive controlling part of the economy, and also of intervention by political force, i.e. non-economic force. In the first revolutionary period, intervention in the economic processes by political force plays a decisive role.

In the first phase of development of a socialist economy, both the planning of economic development and the day-to-day management of the socialist sector is highly centralized.

There may be some doubts as to what extent this represents a universal necessity. For instance, in Poland, we had some discussions whether the transition through such a period of highly centralized planning and management was a

\*An address delivered on 19 November 1957 at the Institute for International Politics and Economics, Belgrade.

historical necessity or a great political mistake. Personally, I hold the view that it was a historical necessity.

It seems to me that the very process of the social revolution which liquidates one social system and establishes another, requires centralized disposal of resources by the new revolutionary state and, consequently, centralized management and planning. This holds good, in my opinion, for any socialist revolution.

In underdeveloped countries, there has to be added a further consideration. Socialist industrialization – and particularly very rapid industrialization – which was necessary in the first socialist countries, particularly in the Soviet Union, as a political requirement of national defence and of the solution of all kinds of political and social problems due to backwardness, requires centralized disposal of resources. Thus the very process of transformation of the social system and in addition, in the underdeveloped countries the need for rapid industrialization, impose the necessity of high centralization of planning and management.

The process of rapid industrialization requires such centralized disposal of resources for two reasons. First, it is necessary to concentrate all resources on certain objectives and avoid dissipation of resources on other objectives which would divert resources from the purpose of rapid industrialization. This is one of the reasons which leads to highly centralized planning and management and also to the allocation of resources by means of administrative establishment of priorities. The second reason why rapid industrialization demands centralized planning and management is the lack and backwardness of industrial cadres. The cadres who are available in the period of rapid industrial growth are new and inexperienced. Such old cadres who possess some experience in management of industry and other economic activities are frequently politically hostile to the socialist objectives. In consequence, high centralization of managerial decisions becomes necessary.

Thus the first period of planning and management in a socialist economy, at least as far as our experience goes, has always been characterized by administrative management and administrative allocation of resources on the basis of priorities centrally established. Economic incentives, during this period, are replaced by moral and political appeals to the workers, by appeals to their patriotism and socialist consciousness. This is, so to speak, a highly politicalized economy; both incentives it utilizes.

This, I believe, can be described broadly as a *sui generis* war economy. The methods of war economy are not peculiar to socialism; they are introduced in capitalist countries, too, in wartime. It was during the First and Second World War that these methods were first evolved. In capitalist countries, similar methods, *viz.* concentration of all resources towards one basic objective, which is the production of war materials, centralization of disposal of resources in order to avoid leakages of resources to everything that was considered non-essential, *i.e.* everything not connected with the prosecution of war, were used during wartime.

Allocation of resources by administrative decision according to administratively established priorities and large-scale use of political incentives to maintain the productivity and discipline of labour through patriotic appeals were characteristic of war economy. This was done in all capitalist countries during the war.

Thus it is that such methods of centralized planning and management are not peculiar to socialism, that they are rather certain techniques of war economy. The difficulty starts when these methods of war economy are identified with the substance of socialism and are treated as being essential to it.

One of the methods of war economy, which most of the socialist countries have resorted to at one stage or another, is the compulsory delivery by peasants of part of their product. Many Communists in Poland feel rather upset by the present programme of our government of abolishing such deliveries. They fear that this implies giving up some socialist principle. I usually answer them by asking if they remember who first introduced compulsory deliveries in Poland. For, the fact is that such deliveries were first introduced during the First World War by the occupation army of Kaiser Wilhelm the Second, whom I do not think anybody regards as a champion of socialism. These methods cannot be considered as an essential aspect of socialism; they are merely methods of war economy necessary in a revolutionary period of transition.

The fate and history of these methods is a classical example of the dialectical character of the development of socialist society. Methods which are necessary and useful in the period of social revolution and of intensive industrialization become an obstacle to further economic progress when they are perpetuated beyond their historic justification. They become obstacles because they are characterized by a lack of flexibility. They are rigid, and they lead therefore to waste of resources, resulting from this inflexibility; they require a wasteful bureaucratic apparatus and make it difficult to adjust production to the needs of the population. However, it seems that the greatest obstacle to further progress results from the lack of proper economic incentives in this bureaucratic centralistic type of management. This hampers proper economic utilization of resources, encourages waste and also hinders technical progress.

Therefore, the moment when socialist society starts to overcome these centralistic, bureaucratic methods of administrative planning and management, indicates, so to speak, that the new socialist society has matured. In the earlier discussion we spoke about the period of transition – when it ends and how it should be defined. I would not want to enter into the problem here and make this a final definition of the period of transition. But I might say, that the substitution of the methods of administrative and centralized management and development by new methods based on the utilization of economic laws indicates the end of the period of transition and the beginning of the functioning of an established socialist economy. I would not say that this is the only aspect of the problem of the period of transition, but it certainly is an important aspect of it.

The period of centralized planning and management, as I said, is the result partly of the requirements of the revolutionary transformation of society and, in underdeveloped countries, also of the needs of rapid industrialization. In studying this period a certain important sociological factor has to be taken into account, and that is the weakness of the working class in an underdeveloped country. It seems to me that it is on the basis of this weakness of the working class, under conditions of underdevelopment, that the bureaucratic state machine gains great importance,

and phenomena like that of the 'cult of personality' develop. It substitutes, in a certain sense, the spontaneous activity of the working class.

But here again the dialectics of the processes of construction of socialism becomes apparent. The centralistic methods are successful in achieving rapid industrialization and, as a consequence, cause a rapid growth of the working class. The working class grows in numbers as well as in consciousness and political maturity. Next to the growth of the working class, another important sociological element appears. This is the growth of a new socialist intelligentsia, which largely comes from the ranks of the workers and peasants. When it becomes clear that the highly centralized administrative and bureaucratic methods of management create obstacles to further progress, even a part of the political and state apparatus becomes convinced that a change of methods of administration and management is needed. Thus new social forces mature which require and also make possible a change of these methods.

This, precisely, is the basic difference between the development of socialist society and a society which is based on class relations. There is no force which may oppose these changes. There may be, as I said earlier, certain strata or groups, which have a vested interest in the old methods and create obstacles, but these obstacles can never become of such importance as to make impossible the changes required by new historical circumstances.

This becomes very clear if you take, for instance, the experience of Poland, where industrialization by means of centralized administrative planning and management has led to a great increase of the working class. Our working class is now more than three times what it was before the war. The working class has gained experience in large industrial establishments. It was, at first, to a large extent of peasant origin and that, of course, weighed on its psychology. But that was only a transitional phase. Industrialization and the social revolution have created a new intelligentsia, largely coming from workers and peasants. All these have led to a maturation of the forces of the new socialist society. In consequence we got such a phenomena as the great movement of workers' councils demanding self-government of workers in industry, the general demand to change the methods of management of the national economy. The Party has accepted these demands and given them organized expression.

Changes in the methods of planning and the management of the economy are taking place today practically in all socialist countries. Forms, contents are different, but all these changes imply a certain decentralization or deconcentration of management of the economy. I do not want to enter into a description of what is happening in the various socialist countries. I shall rather present to you what I personally believe is the proper formulation of the role and methods of planning in a socialist economy.

First, it must be stated that in a socialist society planning of the economy is active planning. Some of the economists in Poland use the term 'directive planning', but this term is ambiguous; I shall rather use the term 'active planning'. By this I mean that planning does not consist only of coordination of the activities of various branches of the national economy. It is something more, namely, it is an active determination of the main lines of development of the national economy. If

planning is mere coordination, the development of socialist economy would be elemental; it would not really be directed by the will of organized society. If economic development is not to be elemental but is to be directed by organized society, then planning must be active economic planning.

Two problems arise with regard to active economic planning. They are: (1) what is the scope of active economic planning? What are the activities in the economy to be planned? And (2) what are the methods to be used in securing the realization of the plan?

The active character of planning does not require that the plan goes into each detail of economic life. Most of the socialist countries, perhaps with the exception of China which benefited by the experiences of other socialist countries, have passed through a period when the output of even the least important commodity was planned. In Poland there was the famous joke – really it was not a joke, but it was true – that the production of pickled cucumbers was included in the national economic plan. Another case, which was not a joke either, was that the State Planning Commission made a plan of the number of hares which will be shot during the year by hunters. At the same time, you could not get, for instance, buttons or hairpins for ladies, simply because they had forgotten these items in the national economic plan.

Active planning and effective direction of the development of the national economy is quite possible without planning such details. Even more, planning such details hampers effective direction of the national economy. It may be said that putting such details in the national economic plan had nothing to do with planning. It was a part of the high centralization of day-to-day management of the economy by means of administrative measures. This is a different thing than planning.

However, the national economic plan, which to determine the development of the national economy, must include at least two things: firstly, the division of our national income between accumulation and consumption; secondly, the distribution of investments among the different branches of the economy. The first determines the general rate of economic growth, the second determines the direction of the development.

Unless these two things are in the plan, there can be no active guidance of the development of the national economy. This is, therefore, the minimum requirement of the plan. In addition, the plan may or may not include the targets of the production of certain basic commodities, like basic raw materials, basic means of production and so on. These are technical and not fundamental problems.

These are the fundamental aspects of the plan which determine the pace and the direction of development of the economy. In addition to these, economic planning must be concerned with coordination of the activities and the various branches of the economy. First of all is coordination of the financial and physical aspects of the plan, in particular coordination of the total purchasing power at the disposal of the population and the amount of consumer goods which are provided for individual distribution. The plan must also in some way and by some means be interested in the coordination of the output of the various branches of the national economy. Otherwise, the determination of the directions of development established by the plan



may become impossible to realize. If there is no proper coordination between the output of the various branches of economy, investments may not be possible to be realized, because the necessary investment goods are not produced. All kinds of dislocations may appear and cause difficulties which may make it impossible to carry out the investment plan. So much about the content of the plan.

The second problem is concerned with the methods of securing the realization of the plan. Here we have basically two possible methods, one of which is administrative orders and administrative allocation of resources. The various units in the socialist economy are required to do certain things, for instance, to produce such and such thing in such and such quantity. The resources which are necessary for that purpose, both material and financial, are allocated in an administrative way. This was the traditional method of realizing the plan in the past period. The second method consists in the use of what we call 'economic means,' namely, of setting up a system of incentives which induces people to do exactly the things which are required by the plan. It seems to me, that in an effective planning of a socialist economy, both methods have to be used, though in different proportions.

Preference should, however, be given to the use of economic means. Administrative methods should be limited to such fields where, for one reason or other, economic means are ineffective. Such situations, where economic means are not effective, always do exist. They exist particularly in periods of very great changes, because economic means are rather subtle instruments responding to 'normal' changes in the situation, and frequently breaking down when very fundamental or revolutionary changes are needed. In such cases the use of administrative means must be accepted. Even in a capitalist economy, in situations of profound changes, the state introduces in its economic policy measures of administrative control because the normal kind of economic means are not sufficient to provoke the responses which are necessary.

The fundamental decisions of the plan concerning the division of national income between accumulation and consumption and concerning the basic directions of investments are really of a political character while the means of implementation must be partly administrative. The decision of the plan concerning the rate of accumulation is basically realized by administrative measures. Part of the national income produced is not paid out in the forms of individual incomes, part of the profits of the socialist enterprises are held back by the state – all these are administrative measures. So also are all forms of taxation of enterprises and individuals. The basic directions of investments, for instance, the decision to build an electric power plant, are usually not made as a reaction to market situations, but are made as basic decisions of economic policy. Though in this case the realization of the decision may make use of all kinds of economic instruments.

We may ask in what sense must economic plans take account of economic laws. Even when the realization of the plan is achieved by administrative measures the plan must observe the general economic laws concerning the proportions necessary in the process of production and reproduction. For instance, if the plan envisages an increase in the production of steel, it must also provide for a certain additional output of coal which is needed to produce the additional steel. Planning has to take account of such objective kinds of relationships.

There are also other economic laws which must be observed by the plan. These are the laws which result from the operation of economic incentives under the circumstances created by the plan. The process of realization of the plan sets into motion definite economic incentives to which the people react in a certain way which can be calculated. Even in the period of administrative planning, certain economic incentives were operative and their consequences had to be taken into account. In this period, however, economic means were only subsidiary in relation to the administrative. The situation now has to change, in the sense that economic means are now the rule and administrative means only a subsidiary. Thus the plan has to observe the laws of production and reproduction, in so far as the realization is based on the use of economic means, i.e. the operation of economic laws.

By utilizing economic means planning makes use of the automatic character of people's responses to given incentives. Thus certain automatic processes in the economy are established. However, these automatic processes are not elemental. These two things should be distinguished. The difference is that in a socialist society, where the automatic processes are part of the method of realization of the plan, the conditions establishing incentives are set up by economic policy, whereas in capitalist society these conditions develop in an elemental way. There is a basic difference: in one case (i.e. capitalist) the incentives develop in an elemental way and are not subject to conscious control of society, while in the other case (i.e. socialist) they are consciously established by organized society in such a way as to produce the desired results. As Engels said: 'The social causes set into motion will produce to an ever increasing extent the results desired by man.'

I shall illustrate this by an analogy. The capitalist economy may be compared to an old-fashioned balloon which is moved by the current of air in the direction in which the wind pushes it. Man has no control whatever over the direction in which the balloon is moving. The socialist economy in the period of realization of the plan by administrative measures can be compared to an old-fashioned airplane, where the pilot with his hands moves the steering rod. By sitting always by the steering rod the pilot directs the plane in the direction he chooses, whenever the current of the air changes he moves the rod in such a way as to keep his chosen direction.

I would compare planning in which the realization is based on economic means to a modern plane which has an automatic steering mechanism. The pilot sets the mechanism in the direction in which he wants the plane to go and the automatic mechanism keeps the plane in the desired direction. The pilot can read a book or a newspaper in the meantime, and the plane by itself keeps the desired course. But it is not the direction where the wind pushes the plane but the direction which the pilot has chosen, consciously chosen. It is the pilot who determines the direction of the plane, if he wishes he can change the direction by setting the automatic mechanism in a different direction.

If I would carry the analogy to the end, I would say that the pilot must, of course, from time to time, watch whether the automatic steering mechanism works. As a rule, experience shows that for the time when the wind is very strong the automatic mechanism does not work and the pilot has to take the steering rod in his hand and steer himself. When the wind becomes more quiet he can again let

the automatic mechanism do the work. In sudden upsetting situations, administrative measures have to be used in managing socialist economy.

The next problem is to what extent the decisions implied in the plan, not the realization, can be centralized, or can, or even must be decentralized. The need for centralized decisions obviously results from the need for coordination. Such decisions like the basic directions of investments, since they also must be coordinated through the coordination of various branches of economy, must be centrally planned. I would say that the basic decisions of the plan must be made centrally. In addition to that the plan may have as subsidiary parts certain decentralized subsidiary plans, in order to secure the proper flexibility of the plan. There are two criteria which determine the decentralization which economic planning can or must have. One determines the possibility of decentralization and the other the necessity of decentralization.

Economic planning can be decentralized if it is possible – and to the degree it is possible – to set up economic incentives in such a way that the decisions of the decentralized units are the same as the decisions which would be made centrally. Secondly, economic planning must be decentralized in all cases where the central decision responds to a situation too late. Because in such cases, unless there is decentralization, central planning becomes fictitious, what actually is obtained is an elemental development. It is important to notice that in all socialist countries, in the period of highly centralized planning and management, there was a great number of this type of elemental processes in the economy.

For instance, in Poland, at a certain period the amount of elemental processes became so great that you could ask if there still existed a planned economy. On the one hand there was a plan, but on the other the economy produced results in a very elemental way. The elemental character of this process was the result of two factors. One was the over-centralization of the plan. Before developments that took place in various branches of the economy came to the attention of the central authority and before the central authority took action, irreversible things had already happened. The result was purely elemental. The other factor was the existence of 'wrong' economic incentives. When the old incentives of the moral and political appeal stopped working, because such incentives can only work for a certain period, it was discovered that all kinds of incentives were implicit in the plan of which the central authority did not know, and which hampered the realization of the plan.

Thus it is a question of practical importance how many of the decisions are made in the central economic plan, and how many decisions are delegated to lower economic units, etc. This is particularly important with regard to the investment plans. In Poland, for instance, we are now evolving a scheme which provides central planning of what we call fundamental investments, i.e. the building of a new plant or enlarging substantially an existing plant. We shall give the enterprises the right to undertake the subsidiary investments autonomously without asking anybody for approval.

The latter has proved to be necessary in order to assure greater flexibility of investment decisions. Our experience shows that by the time the unit concerned received the approval of the central authority to undertake the necessary invest-

ments, the situation had already changed. Thus the situation was clearly inflexible. The financial resources for such subsidiary investments would consist of a part of the amortization fund of the enterprise and of bank credits it could take up for the purpose of such investments. Investments of small enterprises are to be entirely financed by bank credits, without appearing at all in the central economic plan.

Now one thing should surely be kept in mind. The fact that a part of that investment is financed by bank credits does subject them in an indirect way to central planning because, obviously, the bank can refuse to give the credit. The bank acts on the basis of a certain general economic policy – how much credit it can advance and to what purpose and under what conditions. These are indirectly the ways of influencing by the central authority of the subsidiary investments.

A similar economic problem, and a more acute one, exists with regard to the planning of production. In the former period even the least important product had to be in the central economic plan. Now, however, only the basic production of enterprises is included in the central economic plan, the enterprise having the right to undertake what is called subsidiary production, which is not in the plan. There is quite a discussion among Polish economists as to whether production should be in the economic plan. There are a few who think that production should not at all be on the economic plan, it should only respond to the economic incentives of the market. The practical solution which will probably be adopted in Poland will be to put in the central economic plan the output of certain basic commodities, like coal, steel, raw materials, certain means of production, textiles of mass production, i.e. commodities of special significance to the national economy. As to the rest, the enterprises will have a plan of output in terms of total net value of output without prescribing the specific varieties. A shoe factory, for instance, will have only a total value plan of output and it will have the right to produce any variety of shoes, according to its own decision.

All these are already problems of techniques and not problems of principle. I think that the one essential thing in the socialist economy is that the plan has to be an active plan which determines the pace and the direction of development of the national economy. The other things are really questions of techniques which may change under different conditions. There is, however, one more problem which I want to mention in this connection. This is an essential and not a technical thing – the plan must be based on correct economic accounting. Correct accounting of economic costs and economic benefits, and consequently a correct price system, are indispensable.

In a socialist economy prices have two purposes: one is as a means of distribution and the other as a means of economic accounting. Therefore, there are two principles which must be taken into account in the formulation of prices. This requires some calculation, of two kinds of prices, *viz.* market prices and accounting prices.

Unless distribution of consumer goods is done by rationing, the market price must obviously be such as to establish equilibrium on the market, to equalize demand and supply. The same holds good also for prices of the means of production when administrative allocation is removed and enterprises freely buy and sell their products. Market conditions determine the equilibrium prices which equalize

demand and supply. The principle of determining the market prices is very simple: they simply must equalize demand and supply.

Market prices, however, are not sufficient. In addition there must be calculated accounting prices which reflect the social cost of production of the various products. The accounting prices may surely strongly differ from the market prices. We propose now, in Poland, to calculate what we call the initial or normal prices which would be the cost of production plus a profit, which will serve to cover accumulation and collective consumption of society. To these normal prices we propose to add a positive-or-negative marking in order to obtain the market prices which equalize demand and supply on the market. Then the positive-or-negative differences between the market prices and the normal prices would be an indicator for economic planning.

The indication would be to increase in the next plan the output (by making the necessary investments) of the commodities, where the market price is high above the normal price, to stop expansion or even scale down output where the market price does not even realize the normal price.

The great controversy at this moment among Polish economists concerns the rate of cost that should be included in the normal prices, whether it should be average cost of the enterprises in a given industry or marginal cost. The majority of economists take the view that it should be marginal cost. The others are in favour of average cost. But those who are in favour of average cost really consist of two groups: one group which in principle are in favour of average cost, the other, in principle, are in favour of marginal cost but believe that it would, in practice, be a very difficult system of calculation. And thus it is that they take average cost, simply because the other solution, though theoretically better, is very difficult to realize in practice.

The proponents of marginal cost, of course, propose to use a practical approximation to marginal cost. The cost on the basis of which the normal price is to be calculated is the average variable cost of the group of enterprises which have the highest cost in the industry. Classify the enterprises into several groups (not too many, because it has to be practically easy) and then take the group of enterprises which have the highest cost as the pilot group which serves as the indicator and take the average variable cost in this group. There is a reason why that average variable cost should be taken. If we take just one enterprise at random we may get a very accidental result, and we do not want to have purely accidental fluctuations. We want to have something which represents the real cost structure of the industry. Therefore we take the average variable cost of the enterprise in that last group.

The argument in favour of marginal cost and of this procedure of practical interpretation of marginal cost is this. We have, for instance, electric power plants. Each plant produces at a different cost. Suppose we save some electric power, what then is the diminution of cost to society? Obviously, when we save electric power we will stop or diminish production not in the plants which have the lowest cost, but in the plants which have the highest cost. The cost in the latter plants represents the resources we save, it represents the saving of cost to society. If we have to expand output of electricity, the cost to society is the cost of operation of electric power plants which produce at the highest cost and which are necessary to

cover the increased demand for electricity. Consequently, if variations in the use of electric power take place, the effect on cost to society of these variations is in the most costly plants, i.e. the marginal cost. We consider the average variable cost in the most expensively producing power plants because the fixed cost is already given and does not change in consequence of a change of utilization of electricity.

This is basically the system which a majority of Polish economists propose. To the marginal cost there must be added something to cover all the fixed costs in the industry. This may be zero, because the larger profits of the enterprises which produce at lower cost may be sufficient for this purpose. If that is not the case, we will have to add to marginal cost. Such additions would have to be, everywhere, proportional to the marginal cost so that the normal prices would be proportional to the marginal costs of the various products to cover the fixed cost.

The indicator for the plan would be whether the market price is higher or lower than this normal price, i.e. whether it socially pays to expand or reduce the output of a product. I have to add that this normal cost would also have to include a surcharge to cover capital accumulation, and collective consumptions would have to be in the same proportion in all branches of the economy so as not to effect the proportions between the normal prices and marginal costs.

So much on this subject. It should now be clear that good and effective economic planning requires a development of economic science, that it must be based on scientific economic analysis. This is one of the basic differences between socialist and capitalist economy. In capitalist economy the economic processes are elemental, whereas under socialism they can be directed on the basis of scientific knowledge of the needs and possibilities of the whole national economy.

## FROM ACCOUNTING TO MATHEMATICS

The application of mathematics to the management and planning of the national economy is steadily gaining in popularity. Amongst other reasons, this is due to the development of knowledge and to the elimination of prejudice and dogmatic belief that mathematics cannot be applied to economics since the latter is a humanistic discipline. The widening scope of application of mathematics in recent years, and particularly the development of its new branches, has shown that mathematics is today becoming more and more important in humanities, and that at least in some branches of humanistic disciplines its role is comparable to that in the natural sciences. The growing interest for the use of mathematics in the planning and management of the national economy is also a result of new needs which have been brought about by the development of the socialist economy.

The more the socialist economy grows and the more it matures, the more precise and refined are the methods required for planning its further growth and for managing its everyday activities.

*Balancing Calculations*

Looking back at the history of the development of planning under socialism, we can distinguish two fairly distinct stages. The first stage, during which the main problem was the co-ordination of particular branches of the economy, aimed at ensuring internal consistency in national economic plans. The national economy constitutes a closely knit entity, and its development plan must also constitute an integrated entity. If we plan to raise the output of steel, we also have to plan for appropriately increased supplies of iron ore, coal and many other factors. In the absence of such co-ordination, the plan will turn out to be lacking in internal consistency and its practical implementation will not be feasible.

This problem was solved by balancing calculations. The method of making out balance sheets, historically developed in capitalist enterprises,

subsequently has been extended to cover the national economy. The balancing and the co-ordination of particular branches of the national economy has become a basis for planning economic growth.

At first, simple bookkeeping arithmetic sufficed. But even at a fairly early stage it turned out that balance sheets are like equations in which certain magnitudes are given by objective conditions, others are postulated as the assumptions of the plan and others still must be calculated, being the unknowns in these equations. In this way, balancing calculations have led, in their further development, to a mathematical analysis of balance sheets which assumes the form of input-output analysis. This was the first step toward the introduction of mathematics in national economic planning. But this first step, if it is to become something more than a theoretical postulate and an interesting mathematical exercise, requires tools with which sets of many equations could be solved rapidly. This possibility is provided by electronic computers and, therefore, the development and the application of mathematical methods to balancing calculations is closely related to the development of electronic computers.

The role played by mathematical methods in balancing calculations is today generally known and recognized. However, we are now only at the very initial stage of their practical application. Studies in input-output analysis are, so far, of a rather retrospective nature and they are still concerned with past statistics. If these methods are to become an actual tool of economic planning, they have to be applied to prospective, hypothetical statistical data.

This requires, however, that certain quantities be determined. Even in traditional methods of planning we have introduced standard norms for the wear and tear of machinery and equipment, norms for material and labour input; these norms are calculated per unit product. They are technical norms and have been worked out in workshops and laboratories. Where such norms are lacking, statistical norms are used as temporary substitutes. These norms are basic coefficients used in input-output analysis. They are parameters appearing in sets of equations. In addition to these technical parameters there are others, such as the composition of labour resulting from demographic processes and the consumer demand for particular goods and services depending upon income and the price structure. All these parameters can be called econometric parameters. As we know, their determination and the forecasting of their development is the task of econometrics.



### *The Optimization of the Plan*

These were the main characteristic features of the first stage in the development of socialist economic planning, and of the role of mathematical methods during this stage. The second stage, which has begun only recently, introduces into planning the concept of the optimization of the plan. Today we are not satisfied with ensuring internal consistency of the plan. There may be many such plans (theoretically their number may be infinite) and it is necessary to select the optimal plan (or plans). This, of course, has also been done before, albeit in an intuitive way, and lively discussions and arguments used to be held, concerning the content and the nature of the plan and of its possible alternatives. But these discussions were based on the criteria of common sense and intuition. Today, this approach does not suffice. Science with its newly developed theory of programming and the techniques of electronic computers are very helpful in achieving further progress in this field. These new techniques now make feasible and practicable numerical calculations of optimum plans with a large number of parameters and unknowns.

In practice the optimization of the plan is still at a rather embryonic stage; we have just managed to comprehend fully the importance and the ramifications of the problem. We have also attained the beginning stage of applying optimization calculus to particular problems, such as some transportation problems, combinations of factors at which the cost of production is minimized, etc. We still do not apply optimization calculus to the national economy as a whole. But sooner or later such a need will arise. With economic growth and with the resultant increasing complexity of the socialist economy simple common sense and intuitive criteria will not suffice any more. They are partly inadequate even today. The practical significance of the application of optimization calculus to the national economy as a whole is that a choice can be made between alternative plans.

Today, we do not avail ourselves of this chance as yet. We prepare our plans according to certain criteria of common sense and intuition, and then we balance them and are quite satisfied when the balanced plan does not display any major internal inconsistencies. Then, during further discussions within government authorities at different levels and in Parliament certain connections are introduced. Nobody raises the

question of preparing an alternative plan, because this would not be feasible from the practical point of view. The preparation of the plan and the balancing calculations are a tremendous task requiring the co-operation of so many people that, quite naturally, once the draft of the plan is prepared, it carries a great deal of weight and becomes rigid and inflexible. The possibility of a broader approach to and greater precision in the solving of the problem of the optimization of the plan for the whole national economy is closely tied up with technical means of rapidly performing balancing calculations and of computing different variants of the plan already balanced.

### *Criteria of Appraisal*

What is the best plan? What are its proper criteria? Even today heated discussions go on amongst economists concerning the question whether in a socialist economy one can talk of a single target expressed quantitatively, to which the whole economy could be subordinated, or whether there are many such targets, not comparable with each other; or, using the language of mathematics, whether the aim of a socialist economy can be conceived as a magnitude that can be expressed in terms of scale and, thus, in the form of a single numerical index, or whether it is a vector whose magnitude cannot be uniquely controlled, a set of different, not comparable indices. Personally, I think that the aim of a socialist economy can be assumed to be a magnitude of scale expressed in terms of national income. In this case, the task of the optimization of plans would be a programming problem in which, given the limiting conditions, the object is to maximize the national income within a defined period of time. It can be shown, that this is tantamount to the maximization of the rate of growth of national income within a given period of time. In this way, we have a uniquely defined magnitude to be maximized, that is to say, a target function, and national economic planning becomes simply an ordinary mathematical programming problem.

The problem of the target function for the national economy is a very important one. Depending upon the target set for the whole economy, the subordinate targets are automatically determined and thus also the target functions, in particular partial objectives of programming. For instance, for a long time now discussions have been going on concerning

criteria of the effectiveness of investments in a socialist economy. These discussions were inconclusive because in the circumstances under which they were held they could not have been conclusive. The effectiveness of investments in the national economy depends upon the target set for the economy. If this target is not distinctly determined, then it cannot be determined which investment is better and which is worse. If, for instance, we determine the target of national economic planning as the maximization of national income, or, what amounts to the same, as the maximization of its increase within a definite period of time, then we automatically obtain certain criteria of the effectiveness of investments. The criterion of the effectiveness of investments is then the extent to which a given investment contributes to the increase in national income. When other targets are set for a socialist economy, other criteria of the effectiveness of investment will have to be used.

In this way, we are embarking upon the second stage in the development of national economic planning, the stage of searching not just for balanced plans, but for optimum plans of the development of the national economy. It can be said that, not only in Poland but also in other socialist countries, and particularly in the Soviet Union, discussions indicate clearly the transition to the second stage. The problem of optimum plans has now become the crux of economic discussions.

### *Mathematics and Management*

There is also the problem of applying mathematical methods to management, to the day-to-day functioning of the socialist economy. Here too the problem of optimization arises with respect to the optimal organization of the national economy, the optimal methods of its functioning. Several years ago an extensive discussion has been going on in this country about these problems, treated as the problems of the "model" of the socialist economy. Today, the same subject is extensively discussed in the U.S.S.R. A very valuable contribution can be made in this field by econometric methods. They can help to determine how changes in prices and in the distribution of income affect demand, how changes in the wage structure affect the efficiency of labour, etc. This should increase the precision and logic of reasoning in solving problems involved in managing the national economy. The problem of planning

and managing the national economy and the application of mathematical methods to these tasks are peculiar to a socialist economy; to a limited extent, these problems also exist in capitalist countries. We are now witnessing in those countries a growing interest in mathematical methods and their application to the management of the national economy. But in those countries such possibilities are very limited because a capitalist economy considered as an entity is not a consciously managed system, such as a socialist economy is. For this reason, in a socialist economy these methods can be applied on a national scale and can be used for seeking an optimum system for the organization and management of the national economy.

The problem now facing a socialist economy is not only the development of productive resources but also the development of the methods of managing the economy. In this respect mathematical methods will play an increasingly important part. Up to the present, we have been using the method of common sense and intuition, but mathematical methods do not contradict common sense or good intuition which plays an important part both in scientific research and in every day human activities. On the contrary, these methods are of great help and they provide common sense with precise criteria and tools for checking whether intuition is correct, for facilitating its precise formulation and very often they give rise to new intuition.

### *Economic Cybernetics*

The importance of mathematical methods is not confined to their purely computational application or to the formulation of balancing and programming tasks and to solving them by mathematical methods. I think that of very great importance is the educational role of these methods as a school of precision in formulating these tasks. It is now possible to approach these problems in a more precise way owing to the development of a new discipline closely related to mathematics, a discipline called cybernetics. The problem of particularly great importance is the optimal ratio of centralization to decentralization in managing the national economy. This subject is often discussed, but, strictly speaking, there is not much sense in talking about an economy completely centralized or completely decentralized. The management of a socialist

economy can be more or less centralized or more or less decentralized; the point is to arrive at optimal relations and scope. This gives rise to many important problems. One of them is the circulation of information in the national economy; another is the decision making capacity of particular centres of authority.

Let us consider, as a starting point, a system completely centralized in which all decisions are made by only one central authority. Such a system could hardly operate in practice, since the decision making capacity of one central authority is limited. It would turn out that problems awaiting decision pile up and are considerably delayed at the central authority. If to this we add the length of time required for the transmission of information to the authority, and for the channelling back of decisions, as new information, to lower authorities which are to implement them, it would turn out that most decisions would arrive too late. This would be the case, for instance, if all fire brigades in the whole country had to report each fire to the head office in Warsaw and wait for a decision as to what should be done. In most cases fire brigade intervention based on this system would be too late. On the other hand, however, we would not want to have, say, twenty independent fire brigade centres in one city. It would be too costly, it would require a great deal of equipment which would not be fully utilized and it would not leave any room for manoeuvre in shifting men and equipment from one point of the city to another. Thus, the problem is to arrive at some optimal organization, both sufficiently centralized and decentralized. There is a certain similarity here to the functioning of automatic industrial equipment. In this kind of equipment there appear the same problems: the length of time required for the flow of information and the reaction of particular elements of this equipment as well as the problem of the capacity of the steering mechanism in the equipment. All this indicates that cybernetics can help considerably in arriving at the optimal organization of the socialist economy.

### *Precision in Economic Thinking*

When the problem of balancing in the input-output analysis of production is formulated precisely in mathematical terms, a certain degree of precision is also achieved in our economic thinking; we have to distinguish between objective actual data, postulates, plans and the

unknowns which we want to determine; we have to recognize the existence of such problems as the number of the degrees of freedom given by the balance sheet and the proper role of particular parameters, e.g. technical norms in making up the balance sheet. The development of the theory of programming has enabled us also to formulate precisely a number of conceptual problems in national economic planning. In consequence, the application of mathematics improves the methods of planning and management also where no mathematical equations and computers are used. In cases when the circumstances of the problem, e.g., its simplicity, enable us to use the traditional methods of common sense and intuition, the knowledge of mathematical methods contributes to greater clarity and precision in thinking. Therefore, as last but not least, I rank the indirect importance of mathematical methods for developing common sense and enriching intuition which are both always indispensable in management and in national economic planning.

## THE COMPUTER AND THE MARKET

OSKAR LANGE

## I

Not quite 30 years ago I published an essay *On the Economic Theory of Socialism*.† Pareto and Barone had shown that the conditions of economic equilibrium in a socialist economy could be expressed by a system of simultaneous equations. The prices resulting from these equations furnish a basis for rational economic accounting under socialism (only the static equilibrium aspect of the accounting problem was under consideration at that time). At a later date Hayek and Robbins maintained that the Pareto-Barone equations were of no practical consequence. The solution of a system of thousands or more simultaneous equations was in practice impossible and, consequently, the practical problem of economic accounting under socialism remained unsolvable.

In my essay I refuted the Hayek-Robbins argument by showing how a market mechanism could be established in a socialist economy which would lead to the solution of the simultaneous equations by means of an empirical procedure of trial and error. Starting with an arbitrary set of prices, the price is raised whenever demand exceeds supply and lowered whenever the opposite is the case. Through such a process of *tâtonnements*, first described by Walras, the final equilibrium prices are gradually reached. These are the prices satisfying the system of simultaneous equations. It was assumed without question that the *tâtonnement* process in fact converges to the system of equilibrium prices.

Were I to rewrite my essay today my task would be much simpler. My answer to Hayek and Robbins would be: so what's the trouble? Let us put the simultaneous equations on an electronic computer and we shall obtain the solution in less than a second. The market process with its cumbersome *tâtonnements* appears old-fashioned. Indeed, it may be considered as a computing device of the pre-electronic age.

## II

The market mechanism and trial and error procedure proposed in my essay really played the role of a computing device for solving a system of simultaneous equations. The solution was found by a process of

† The Review of Economic Studies, London 1936 and 1937. Reprinted in O. Lange and F. M. Taylor, *On the Economic Theory of Socialism*, edited by B. E. Lippincott, Minneapolis 1938.

iteration which was assumed to be convergent. The iterations were based on a feedback principle operating so as to gradually eliminate deviations from equilibrium. It was envisaged that the process would operate like a servo-mechanism, which, through feedback action, automatically eliminates disturbances.†

The same process can be implemented by an electronic analogue machine which simulates the iteration process implied in the *tâtonnements* of the market mechanism. Such an electronic analogue (servo-mechanism) simulates the working of the market. This statement, however, may be reversed: the market simulates the electronic analogue computer. In other words, the market may be considered as a computer *sui generis* which serves to solve a system of simultaneous equations. It operates like an analogue machine: a servo-mechanism based on the feedback principle. The market may be considered as one of the oldest historical devices for solving simultaneous equations. The interesting thing is that the solving mechanism operates not via a physical but via a social process. It turns out that the social processes as well may serve as a basis for the operation of feedback devices leading to the solution of equations by iteration.

### III

Managers of socialist economies today have two instruments of economic accounting. One is the electronic computer (digital or analogue), the other is the market. In capitalist countries too, the electronic computer is to a certain extent used as an instrument of economic accounting. Experience shows that for a very large number of problems linear approximation suffices; hence the wide-spread use of linear programming techniques. In a socialist economy such techniques have an even wider scope for application: they can be applied to the national economy as a whole.

It may be interesting to compare the relative merits of the market and of the computer in a socialist economy. The computer has the undoubted advantage of much greater speed. The market is a cumbersome and slow-working servo-mechanism. Its iteration process operates with considerable time-lags and oscillations and may not be convergent at all. This is shown by cobweb cycles, inventory and other reinvestment cycles as well as by the general business cycle. Thus the Walrasian *tâtonnements* are full of unpleasant fluctuations and may also prove to be divergent. In this respect the electronic computer shows an unchallenged superiority. It works with enormous speed, does not produce

† Cf. Josef Steindl, 'Servo-mechanisms and Controllers in Economic Theory and Policy', in *On Political Economy and Econometrics, Essays in Honour of Oskar Lange*, Warsaw 1964, pp. 552-554 in particular.



fluctuations in real economic processes and the convergence of its iterations is assured by its very construction.

Another disadvantage of the market as a servo-mechanism is that its iterations cause income effects. Any change in prices causes gains and losses to various groups of people. To the management of a socialist economy this creates various social problems connected with these gains and losses. Furthermore, it may mobilise conservative resistance to the iteration process involved in the use of the market as a servo-mechanism.

#### IV

All this, however, does not mean that the market has not its relative merits. First of all, even the most powerful electronic computers have a limited capacity. There may be (and there are) economic processes so complex in terms of the number of commodities and the type of equations involved that no computer can tackle them. Or it may be too costly to construct computers of such large capacity. In such cases nothing remains but to use the old-fashioned market servo-mechanism which has a much broader working capacity.

Secondly, the market is institutionally embodied in the present socialist economy. In all socialist countries (with the exception of certain periods when rationing was used) consumers' goods are distributed to the population by means of the market. Here, the market is an existing social institution and it is useless to apply an alternative accounting device. The electronic computer can be applied for purposes of prognostication but the computed forecasts have later to be confirmed by the actual working of the market.

An important limitation of the market is that it treats the accounting problem only in static terms, i.e. as an equilibrium problem. It does not provide a sufficient foundation for the solution of growth and development problems. In particular, it does not provide an adequate basis for long-term economic planning. For planning economic development long-term investments have to be taken out of the market mechanism and based on judgement of developmental economic policy. This is because present prices reflect present data, whereas investment changes data by creating new incomes, new technical conditions of production and frequently also by creating new wants (the creation of a television industry creates the demand for television sets, not the other way round). In other words, investment changes the conditions of supply and demand which determine equilibrium prices. This holds for capitalism as well as for socialism.

For the reasons indicated, planning of long-term economic development as a rule is based on overall considerations of economic policy

rather than upon calculations based on current prices. However, the theory and practice of mathematical (linear and non-linear) programming makes it possible to introduce strict economic accounting into this process. After setting up an objective function (for instance, maximising the increase of national income over a certain period) and certain constraints, future shadow prices can be calculated. These shadow prices serve as an instrument of economic accounting in long-term development plans. Actual market equilibrium prices do not suffice here, knowledge of the programmed future shadow prices is needed.

Mathematical programming turns out to be an essential instrument of *optimal* long-term economic planning. In so far as this involves the solution of large numbers of equations and inequalities the electronic computer is indispensable. Mathematical programming assisted by electronic computers becomes the fundamental instrument of long-term economic planning, as well as of solving dynamic economic problems of a more limited scope. Here, the electronic computer does not replace the market. It fulfils a function which the market never was able to perform.

---

## Name index

---

- Aquinas, Thomas 162  
Aristotle 98, 161–2
- Baran, P. 182  
Barone, E. 253, 255–6, 361  
Bauer, Otto 170, 182, 332  
Bazharov, W. 176  
Bebel, A. 332  
Bernstein, E. 169  
Böhm-Bawerk, E. 5, 171  
Boisguillebert, P. 163  
Brentano, L. 173  
Bücher, K. 173  
Bukharin, N. 170, 175, 332, 334
- Cassel, G. 290  
Chamberlain, E. 182  
Chamberlin, E.H. 275  
Clark, J.B. 26, 171  
Clark, J.M. 273  
Cole, G.D.H. 262  
Commons, J.R. 173  
Crum, W.F. 52  
Crusoe, Robinson 6, 17, 285
- David, E. 169  
Dickinson, H.D. 255, 332  
Dobb, Maurice 175, 182, 298, 332
- Engels, F. 137, 166, 175, 286, 332,  
334–5, 341, 348
- Feldman, G. 176
- Galbraith, J.K. 179  
Grossman, H. 170
- Haberler, G. 53  
Harrod, R.F. 53, 243  
Hayek, F.A. 175, 253–6, 266, 298, 332,  
361  
Hegel, G. 166  
Herskovits, M.J. 86  
Hildebrandt, B. 173  
Hilferding, R. 169, 175  
Hitler, Adolf 300  
Hobson, J.A. 174  
Hodgskin, T. 165
- Jevons, W.S. 44, 171  
Juglar, J.C. 50, 52
- Kahn-Clark 234  
Kaldor, N. 53  
Kalecki, M. 53, 182  
Kantorovich, L. 185  
Kautsky, K. 166, 169, 286–9, 332  
Keynes, John M. 52, 179–80, 189, 191,  
197, 199–201, 210, 233, 275, 278,  
283, 291  
Kitchin, J. 52  
Knies, K. 173  
Kondratief, N.D. 52  
Kotarbiński, Tadeusz 123–4, 185  
Kowalik, T. 299  
Kruger, Maynard 302  
Krzywicki, L. 169, 333  
Krzyżanowski, A. 161  
Krzyżanowski, G. 176  
Kugelmann 285
- Lange, O. 175, 291–5, 300  
Laplace, P. 288  
Leichter, O. 175  
Lenin, V.I. 116, 169–71, 174–5, 177,  
183, 289, 332, 334, 341  
Leontief, V. 184  
Lerner, A.P. 269, 295–7, 332  
Luxemburg, R. 169–70, 175, 182, 334
- Malthus, R.T. 164, 189, 202, 223–5  
Mao Tse-tung 333  
Marshall, Alfred 5, 35, 161, 172, 266,  
275, 284  
Marx, Karl 3, 5, 8–15, 50, 53, 88, 105,  
108–10, 115, 118, 165–8, 170, 173,  
175–7, 181, 254, 270, 285–6, 289–90,  
331–2, 334–5, 340  
Menger, K. 171  
Mill, John Stuart 174  
Mises, L. von 175, 252–5, 262, 286,  
290, 332  
Mitchell, W.C. 173  
Montchrétien, A. de 161, 163  
Mun, T. 163
- Nemchinov, V. 185

- Ostrovitianov, K. 332
- Pareto, V. 5, 44, 172, 253, 290, 361
- Petty, W. 161, 163
- Pfaff, J.F. 158
- Pierson, J.H.G. 253, 286–7
- Pigou, A.C. 57, 67, 182, 273–4
- Plekhanov, G. 169
- Preobrazhensky, J. 175, 332
- Proudhon, P. 174
- Quesney, F. 163
- Ricardo, David 3, 10, 13, 164, 166, 172, 217, 223–5, 286
- Robbins, L. 255–6, 266, 277, 361
- Robertson 275
- Robinson, J. 179, 181–2, 275
- Roscher, W. 173
- Russell, Bertrand 289
- Say, J.B. 217
- Say's law 213, 216–18, 220–23, 225–32
- Schmidt, C. 169
- Schmoller, G. 173
- Schumpeter, Joseph A. 50–53, 173
- Shibata, Kei 3
- Sismondi, J.C. 164, 174, 189
- Skarbek, F. 161
- Slutsky, E.E. 52
- Smith, Adam 75, 163–4, 166, 279
- Sombart, W. 173
- Spiethoff, A. 50
- Sraffa, P. 181
- Stafford, W. 324–5
- Stalin, J. 176, 289, 332, 334–5
- Strumilin, S. 176, 332
- Sweezy, P. 182
- Taussig, F.W. 267
- Taylor, E. 161
- Taylor, Fred M. 255, 265
- Taylor, Sedley 285
- Tinbergen, J. 53
- Trotsky, L. 288
- Tuhan-Baranowski, M. 50, 169
- Varga, J. 182
- Veblen, T. 173–4
- Walras, L. 172, 198–201, 214, 258, 275, 361
- Walras's law 214, 216, 218
- Weber, Max 87, 173, 332
- Wicksell, K. 26, 42, 179, 230
- Wicksteed, P.H. 253
- Wieser, F. 5, 171
- Wilhelm II, Kaiser 344
- Xenophon 162

## **Economists of the Twentieth Century**

Monetarism and Macroeconomic Policy

*Thomas Mayer*

Studies in Fiscal Federalism

*Wallace E. Oates*

The World Economy in Perspective

Essays in International Trade and European Integration

*Herbert Giersch*

Towards a New Economics

Critical Essays on Ecology, Distribution and Other Themes

*Kenneth E. Boulding*

Studies in Positive and Normative Economics

*Martin J. Bailey*

The Collected Essays of Richard E. Quandt (2 volumes)

*Richard E. Quandt*

International Trade Theory and Policy

Selected Essays of W. Max Corden

*W. Max Corden*

Organization and Technology in Capitalist Development

*William Lazonick*

Studies in Human Capital

Collected Essays of Jacob Mincer, Volume 1

*Jacob Mincer*

Studies in Labor Supply

Collected Essays of Jacob Mincer, Volume 2

*Jacob Mincer*

Macroeconomics and Economic Policy

The Selected Essays of Assar Lindbeck, Volume I

*Assar Lindbeck*

The Welfare State

The Selected Essays of Assar Lindbeck, Volume II

*Assar Lindbeck*

Classical Economics, Public Expenditure and Growth  
*Walter Eltis*

Money, Interest Rates and Inflation  
*Frederic S. Mishkin*

The Public Choice Approach to Politics  
*Dennis C. Mueller*

The Liberal Economic Order  
Volume I Essays on International Economics  
Volume II Money, Cycles and Related Themes  
*Gottfried Haberler*  
Edited by Anthony Y.C. Koo

Economic Growth and Business Cycles  
Prices and the Process of Cyclical Development  
*Paolo Sylos Labini*

International Adjustment, Money and Trade  
Theory and Measurement for Economic Policy, Volume I  
*Herbert G. Grubel*

International Capital and Service Flows  
Theory and Measurement for Economic Policy, Volume II  
*Herbert G. Grubel*

Unintended Effects of Government Policies  
Theory and Measurement for Economic Policy, Volume III  
*Herbert G. Grubel*

The Economics of Competitive Enterprise  
Selected Essays of P.W.S. Andrews  
*Edited by Frederic S. Lee and Peter E. Earl*

The Repressed Economy  
Causes, Consequences, Reform  
*Deepak Lal*

Economic Theory and Market Socialism  
Selected Essays of Oskar Lange  
*Edited by Tadeusz Kowalik*

Trade, Development and Political Economy  
Selected Essays of Ronald Findlay  
*Ronald Findlay*

**General Equilibrium Theory**

The Collected Essays of Takashi Negishi, Volume I

*Takashi Negishi*

**The History of Economics**

The Collected Essays of Takashi Negishi, Volume II

*Takashi Negishi*

**Studies in Econometric Theory**

The Collected Essays of Takeshi Amemiya

*Takeshi Amemiya*

**Exchange Rates and the Monetary System**

Selected Essays of Peter B. Kenen

*Peter B. Kenen*

**Econometric Methods and Applications (2 volumes)**

*G.S. Maddala*

**National Accounting and Economic Theory**

The Collected Papers of Dan Usher, Volume I

*Dan Usher*

**Welfare Economics and Public Finance**

The Collected Papers of Dan Usher, Volume II

*Dan Usher*

**Economic Theory and Capitalist Society**

The Selected Essays of Shigeto Tsuru, Volume I

*Shigeto Tsuru*

**Methodology, Money and the Firm**

The Collected Essays of D.P. O'Brien (2 volumes)

*D.P. O'Brien*

**Economic Theory and Financial Policy**

The Selected Essays of Jacques J. Polak (2 volumes)

*Jacques J. Polak*

**Sturdy Econometrics**

*Edward E. Leamer*

















3 9001 03379 9936



