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The Theory of Money and Monetary Equilibrium in Socialist Economy

An Study in Political Economy of Socialism

Part I

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PERFACE
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The present work, on the basis of the Marxian "Political Economy", treats the problems of "The Theory of Money and Monetary Equilibrium". The author consider the analysis of these problems as a crucial and important in the development of theorizing the principles of the political economy of socialism. At the same time the author consider this analysis as a continuous study which was opened by Prof. Z. Fedorowicz (1959) and was developed in many of his other works (1962, 1967).

The work is divided into Introduction and Six Chapters. Both the Introduction and the first two Chapters are used as a general theoretical background, and are mainly concerned with describing and analysing the mutual relationships between the laws of political economy which govern the development of the society. The Introduction, therefore, is concerned with the role of the law of value in a socialist economy. The First Chapter discusses the relationship between the rational behaviour (and choice) of the society (the conditions of the optimum welfare state) and the organization system. The analysis is carried on the basis of the valuable study of Prof. A. Wakar and his collaborators. The Theory of the Direct Economic Calculation (DEC) which was introduced, in special, by Prof. A. Wakar and J. Zielinski and which will be considered as a theoritical base of our whole study, is given and discussed in details.

The second chapter contains what is called the "Optimal Formula" of economic organization and decision making. Both of the introduction and the first two chapters will appear is a separat part of the whole work which will appear in three parts.

Chapter three which will appear in the part II dis-cusses the theory of money in socialist economy.

Its main aim is to analyse two main points. The first point is the essence and the role of money in socialist economy in general and especially in the DEC. The second point is a theoretical discussion on the unsetteled problem concerning the neutrality of money. What concerns us here is the neutrality of money in a socialist economy.

The rest of the work (three Chapters) will consibtitute part III of the work. They are concerned with the conditions of monetary equilibrium in a socialist economy. Ingeneral it was accepted (following Prof. Fedorowicz) that there are three conditions of monetary equilibrium. (One may recall that in a capitalist economy it is accepted that there are, also three conditions of monetary equilibrium; Wicksell/1931/ and Myrdal /1935/.). Each of the three Chapters contains the analysis of a separate condition. Of course, it must be stressed that the three conditions are related to each other and cannot be separated.

I am deeply convinced by Prof. O. Lange statement that "progress in science is not made by throwing overboard old theories and thinking up new ones, but by painstaking working to enrich and perfect existing scientific knowledge" (in "Pisma ekonomiczne i spoleczne 1930-1960" - Papers in Economics and Sociology 1930-1960/1961/). I hope that I have done something in this direction.

My first acknowledgements are due to my Teacher, Professor Zdzislaw FEDOROWICZ, who sponsored the work, and without his creative suggestions, and without the time which he devoted to me, my study would have failed to achieve its goal.

C o n t e n t s

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I should like to express my thanks to the Members of the Seminar which is led by Prof. Zdzislaw Fedorowicz at the Department of Finance at the Central School of Planning and Statistics, who were kind enough to discuss and follow up my work.

I am particularly grateful to Dr. Urszula LIBURA and my colleague Mr. Mahmoud A. Hussien who were kind enough to read the whole work and to point out certain gaps and ambiguities in my presentation.

Cairo. October 1971.   Attia M. SOLIMAN

The basis of any scientific study in the political economy
of socialism is the assumption that there exist, in any socialist
society, objective economic laws. These objective laws, emerge
and operate due to the principle that the socialist society is subject
to and develops through contradiction[1]. According to the theory of
historical materialism there are two kinds of contradictions which
are the moving force of the social development[2]:

    1- first, the contradiction between the development of
        production forces (means of production) and the res-
        trictive character of the relations of production;

    2- second, the contradiction between the mode of produc-
        tion and the superstructure of organization and mana-
        gement of the economy.

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[1] Mao Tay Tong: "Quatre Essays Philosophiques", Pekin 1966.
This sentence must be understood dialectically. Marxism-
Leninism which regards social laws dialectically, sees
that they operate under the consciousness of the men; in
the sense that when saying that objective laws will ulti-
mately take effect, they do not mean that certain changes
will occur in society by themselves, but that sooner or
later social forces interested in the realization of those
laws, will arise, and these forces, by their struggle, will
put these laws into effect.

[2] O.Lange: "Political Economy of Socialism" - in "Problems
of Political Economy of Socialism", Editor O. Lange, New
Delhi, 1969.

These two basic contradictions arise in the course of development of a capitalist economy, as well as in the course of development of a socialist economy. But there is a basic difference between a socialist society and the one based on class domination (capitalist economy). This difference is that in societies based on class domination, the contradictions are related to the classes interests, and take the form of class struggle.

In other words the contradictions in these societies are being autagonistic in character. In a socialist society, based on the base of the social ownership of the means of production and is a classless in character, the contradictions are, generally, non-antagonistic in their character.

Beginning with this principle we shall proceed to discuss the problem of the law of value and its operation in the socialist society. The discussion of this problem is not intended to be comprehensive but rather a summing-up of the important results of the long-history discussion about this problem. In summing-up this discussion, it is possible to distinguish between the following trends:

1. The Classical Marxists (Marx and Engels)

In his notes on a book by Adolf Wagner in which he suggested that Marx's theory of value constituted the corner-stone of his socialist system, Marx unequivocally replied that his investigations into the theory of value had reference to the capitalist production relations, and not to the application of the theory to a socialist economy [1]. The economic category of "value" and the question of the manner in which the "law of value" operates, has relevance only

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[1] Marx: "Works", vol. XV, pp. 456 and 459.

to what Marx and Engels called " commodity production ". There is
no big doubt that Marx and Engels elaborated the law of value as
being uniquely associated with systems of commodity production,
coming into operation as commodity production developed and ceasing
to operate when commodity production ended [1].

At the same time, Marx and Engels, believed that the so-
cialist society will not be a commodity-production economy. " The
seizure of the means of production by society", said Engels, " puts
an end to commodity-production (relations A.S.)" [2]. To Marx and
Engels evidently socialism and commodity-production relations were
mutually exclusive terms. Socialism would necessarily destroy the
basis of commodity-production relations, and thereby enable the end
of the operation of the law of value to be brought about.

The second element in Marx and Engels view was the prin-
ciple that in socialist economy labour will be directly social
labour. Engels wrote "from the moment when society enters into
possession of the means of production and uses them in direct asso-
ciation for production, the labour of each individual however varied
its specifically usefull character may be, is immediately and direct-
ly social labour" [3], and consequently, labour will have a direct
social character.

2. The Trend among the Soviet Economists until the Publication
   of Stalin's Economic Problems"

This was the view of Marx and Engels on the law of
value and its operation in socialist economy. It seems that the

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[1] Engels:"Anti-Duhring", p.361; Marx: "Capital", Vol.I, Progress
    Publishers, Moscow, 1963, p.61.
[2] Marx: "Works", vol, XV
[3] "Anti Duhring", pp. 339-40.

reasons of advancing such a view was that they believed that the socialist revolution would come in a fairly advanced capitalist country which will enable the proletariat to take up all the means of production and to run the production of commodities on a direct base. This view of Marx and Engels has been accepted by many marxist economists in the Soviet Union after the October Revolution. In this period, wether inside the Soviet Union or outside it, there was a tendency to liquidate the science of "Political Economy" under socialism. The well-known advocator of this opinion was Bukharin in the Soviet Union and Rosa Luxemburg in Germany. In a planned socialist economy, since the leading categories of the Marxian Political Economy-commodity, value, profit, wages, etc., would have no relevance in an organized socialist economy, political economy would disappear [1].

This view was based on the idea that the economic laws which regulate the different economic categories will disappear and that the conscious planning of economic activity must replace these economic laws in socialism. This attitude towards economic laws was related to the trend of "apologisation" of political economy.

Prof. Lange defined this attitude as the "research in the field of political economy was hampered by dogmatism and a tendency to turn sience into apologistics. In the field of political economy, the distortion consisted in efforts to transform, Marxist analysis of the play of economic laws into an idealistic, voluntaristic conception of the course of the economic process in which the dialectics of the social forces are replaced by leadership,

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[1] Bukharin: "Economics of the Transition Period", Moscow 1920;
Meek, Roland: "Studies in the Labour Theory of Value",
London 1956, pp. 263-4.

these controverses, notably the notion that "the economic laws of socialism differe in kind from those of capitalism; the idea that the category of value might continue to exist in a different form in socialism". These ideas are one type of approach to study political economy, and were expressed in a textbook under the tittle "An outline of Political Economy"[1). In all societies, the authors of the book argue, the requisite equilibrium between production and consumption must be brought about somehow, i.e. the distribution of labour among the different branches of production must somehow be made to correspond with society's needs.

By this time the organization[2) of socialist economy shown all its weakness and negative sides. Lenin criticized this system of organization and appraised it negatively "experience had proved that we were wrong"[3). This experience was changed by the introduction of NEP/New Economic Policy/. The change which was considered (from the point of view of some economists) as a deviation from the road of communist construction of the new society, was nevertheless accepted as a necessity to solve the problems which had arose through practics. The discussion and the interpretations of exchange, prices, and money

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1)   Lapidus and Ostrovitianov: "An Outline of Political Economy", Engl. Transl. from Russ. in 1929, London.

2)   The base of this organization was to set up, immediately after the Revolution, a communist organization of production and distribution. This stage which was later called "war communism" was marked by the strictest centralism, which was believed to be true Communism. This communism was put into practice in industry by means of "glavkism, i.e. complete lack of enterprise independence, and strict centrally planned and controlled production and distribution. In agriculture, the system of "prodrazvertka" was used. This system means the approportion of all surpluses without compensation.

3)   V.I. Lenin: "Selected Works", vol. III, p. 696. Foreign Languages House, Moscow.

from above, exercised by outstanding individuals and bureaucratic
apparatus subordinated to them. According to the conception poli-
tical economy (of socialism; A.S.) was to become an apology" [1].
Beside this, there was an evident desire on the part of Soviet eco-
nomists to lay special empasis on the importance of the "differences"
between a planned socialist economy and the unplanned capitalist
economy.

3. The Trend of Scientific Research
    in the Field of Political Economy

        The struggle against the liquidation of the science of po-
litical economy of socialism and the attempt of transforming it into
a scheme of apologistics began early with Lenin's "Comments on Buk-
harin's book". But the true path towards the scientific research in
political economy was opened by the XX Congress of the CPSU. After
the congress, there was a lot of an opened discussion in the socialist
countries, new ideas were emerged and authors had ambitious plans.
Political economy was given its historical role which it should play
in the social development of socialist countries. Researches in po-
litical economy of socialism were then carried on a more profound
scientific methodology and were directed to investigate many problems
and topics which were neglected during the past period. One of these
neglected topics was the theory of money which will be the subject of
the present study.

        In evaluating this trend from the point of view of its de-
velopment, and the controverses which has taken place in the USSR dur-
ing the thirties and fourties, it is possible to note the emergence
of certain notions which were destined to play a distinctive role in

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(1) O. Lange: "Political Economy", vol. I, Warszawa 1963, pp. 338-39.

questions went up and down until the clear and detailed explanations (regarding the necessity of a market and of a commodity-production relations and that the law of value operates in the socialist economy) were given by Stalin in his treatise "Economic Problems of Socialism in the USSR" (1952).

These explanations of Stalin encouraged broad and deep discussions regarding the nature and the role of commodity-production relations and the law of value in the socialist economy. These discussions were further stimulated by the changes, in economic management that began to be introduced in the Soviet Union and other Socialist Countries after 1956. In particular the necessity to develop and promote commodity-money relations at the contemporary stage of the development of socialism was accepted. At the Twenty-Second Congress of the CPSU, it was cleary adopted "that in further "communist construction" commodity-money relations must be used to the full extent (italics are mine; A.S.) in conformity with the new content peculiar to them in the period of socialism"[1].

Sinece 1956, comprehensive discussions has been going on in most socialist countries regarding the "new model of the socialist economy", and concerning the different methods of liberating the productive forces from the administrative defeats, and the regulation of social-economic activities through the objective action of economic laws, especially the law of value. The discussion has also been characterized by developing and improving the theory and practice of socialist production. However, the development of commodity-money relations

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1) Programme of the CPSU (The Road to Communism), Foreign Languages Publishing House (FLPH), Moscow 1962.

has been conditioned by the need to improve the economic mechanism with a view to make it functioning more efficiently and to ensure the further development of productive forces.[1)]

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1) The Polish literature in these fields could not be maintained here, we may note only the important studies here:

(a) The Model: "Metoda kolejnych prób w gospodarce socjalistycznej", Pisma ekonomiczne i społeczne 1930-60, PWN, Warszawa 1961, pp. 96-108; Edward Lipiński: "Cele i granice decentralizacji", Teorie ekonomiczne i aktualne zagadnienia gospodarcze", PWN, Warszawa 1961; J. Zielinski: "Centralizeacje i decentralizacje" in "Życie Gospodarcze", no. 10-11, 1963.

(b) Law of vakye: W. Brus: "Prawa wartości w gospodarce socjalistycznej" in "Ekonomista" no. 5, 1966; Z. Fedorowicz: "O prawie wartości i rozrachunku ekonomicznym w gospodarce socjalistycznej", PWN, Warszawa 1956.

Chapter I.

THE SYSTEM OF ECONOMIC CALCULATION
IN SOCIALIST ECONOMY

1.1 Introduction

It could be mentioned that in most of economic studies, (during the First and Second Period; see the INTRODUCTION) money and monetary problems, either have been neglected at all, or they were analysed on the assumption of fixed prices, which in consequence eliminated these problems from the study. Another peculiarity of many studies on economic theory is the lack of any connection and integration between the monetary theory and the theory of price formation. Money, therefore, played a little role in the development of political economy of socialism, because it was believed that the socialist economy must be deprived from commodity money character. Production and distribution, as it was believed, could be directed and regulated according to direct decisions from the central authorities and the plan. Marxist literature for a long time, especially before the fifties was inclined to eliminate money as an economic category[1] from the analysis. Money, here, was accepted, mearly, as an instrument of accounting and aggregation. The system of direct central planning was believed to replace both money and the low of value.

According to the new approach of studying the problem of the law of value and money, the socialist economy has to be proved to have a commodity-money character. Starting from this fact, it was concluded

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1) For the definition of the notion of category see: Kotarbiński T.: "Elementy Teorii poznania, Logiki formalnej i metodologii nauk" ("Elements of the Theory of Knowledge, Formal Logic and the Methodology of Science"), Lwów, 1929, pp. 59-60, and Lange O.: "Political Economy", vol. I, Pergamon-PWN, London-Warszawa, 1963, p. 104.

that these laws which govern the process of production and distribution, such as the law of value and the law of money circulation also exist under socialism since, the socialist economy is to be a commodity-money economy[1]. The reasons why production in socialist economy is a commodity production, (and consequently) subject to the law of value and the law of money circulation) could be explained as follows:

Firstly: the adaptation of production to the needs of society is not an easy matter as it may seem in the theory. Theoretically it is possible to adapt the structure of production to the needs of society (e.g. by using the social preference function, and the techniques of market researches which give the direction and the structure of social and groups demand, for different commodities). But it, at the same time, necessitates the collection of a lot of different informations and data, which no planning organizations could master them. Consequently it is possible, when determining what are the needs of society, that divergences appear between the structure of the needs determined by the central planning authorities, and the actual structure.

Secondly: even if the plan is to be considered to be an ideal plan in the sense that there is no differences between the structure of production which is determined by the plan, and that what may be considered to be the actual structure of the needs, there is a possibility that the implementation of the plan will differe from the plan itself. This difference between the plan and its implementation is affected by many factors, some of them are "completely out of control" of the central

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1)   O.V. Kuusinen, editor, "Fundamental of Marxism-Leninism", 2nd
     edition, FLPH, Moscow 1963, pp. 575-77.

authorities (the exogenous factors) such as weather, foreign trade, etc.

Thirdly: that labour in socialism, inspite of the socially and centrally division of it between different branches is not completely social, in the sense that its products are not completely compatible with the needs of society. At the same time it had ceased to be a private labour governed only by the aim of maximum profit and market incentives. Prof. O. Lange explained this feature of labour in socialism, by referring to the fact that in a socialist economy production is a commodity production due to the existence of a multiplicity of owners of products, and that the method of distribution of the products passes these products, directly, into the private ownership of the consumers[1]. He added that, the second condition alone is a sufficient one; "even if there were only one form of socialist ownership of means of production for instance, socially, 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 labour not to be completely social.

From the above features of socialist economy it follows two main statements:

(1)   that the law of value operates in socialism, and that its operation affects the process of production and distribution.

(2)   and that money and monetary calculus are necessary in socialist economy.

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1)   O. Lange: "Political Economy of Socialism" in "The Problems of Political Economy of Socialism" - editor O. Lange, New Delhi 1965, p. 7.

These two statements have conditioned the further analysis of commodity-money relations in socialist economy, and have promoted the analysis and the searching for the most suitable forms of the socialist mode of production (which ensure the full utilization of the means of production and full statisfaction of the needs of society) and the most efficient means for eliminating the negative consequences that they inevitably entail. This essay is to serve for the deepening and enriching the analysis of these two subject of political economy of socialism.

1.2 The Role of Allocation and Production Maximum

1.2.1 The Definition of Production Maximum

The question of production maximum is, generally, related to the problem of the effective utilization of the available economic ressources, and the allocation of these resources between the different possible uses. This question is valid, almostly to every economy independently of the form of the ownership of the means of production[1]. The problem is consisted of three elements:

(i)   the technical conditions of production possibilities specified in linear form of fixed coefficients that making up a matrix;

(i i)   the ressources available to the economy specified as a vector of amounts of the primary factors;

(iii)   the objective of the production activities specified in terms of final commodities and services.

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1)   J. Zielinski: "Rachunek ekonomiczny w socjalizmie", 3rd ed., PWN, Warszawa 1967, p. 11.

The solution of this problem, by the method of linear programming, formally is considered as the technical aspect of the problem. Within this aspect it seems to be no place for a consideration of the function of the market or of the function of prices and profits. For the time-being we shall be conserned with this technical aspect of the problem.

Now the problem of production maximum is generally defined as to make "production as big as possible" with a given ressources (element ii of the problem) and under a given knowledge of production techniques (element i of the problem). The theoretical discussion of this problem is related to the discussion of "welfare maximum"[1], which means to give the people the highest possible welfare (at a given point of time and over a long period of time). Welfare maximum is determined not only by the "maximum production" but also by the "optimum distribution" of the produced goods among individuals.

Here, total production is to be defined, not as the sum of quantities of different commodities (measured in physical terms) in the form of a scalar quantity, but as a vector. Then total production may be considered as the vector:

$$X = (X_1, X_2, \ldots X_n) \tag{1}$$

where X is total production, and X_1, X_2, $\ldots$ X_n are different commodities and the $X_j = \sum_{i=1}^{n} x_j^{(i)}$

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[1] O. Lange: "Foundations of Welfare Economics", Econometrica 1942, p. 217.

According to the theory of "order vectors", a vector is said to be greater than the other vector when at least one of its components is greater than the corresponding component of the other vector, and none is less[1]. Thus a vector increases when at least one of its components increases and none decreases. A result of this definition, a maximum of total production occures when conditions cannot be changed so as to increase the vector (X). In other words the production maximum is achieved when it is impossible to increase the production of any commodity without decreasing the production of others.

Therefore

$$X = \text{max.} \tag{2}$$

when

$$X_i = \text{max.} \tag{3}$$

subject to

$$X_j = \text{const.} \tag{4}$$

Now if efficiency is taken to mean we shall get "as much as possible out of a given ressources", or we shall obtain "a given result (amount of production) with as small ressources (or costs) as possible", and by combining the definition of the production maximum, then, if production is at maximum in the adopted sense, production is said to be efficient[2].

1.2.2 The Rule of Allocation and Production Maximum

The definition of production maximum which has been adopted in the above section was firstly introduced by Pareto[3] and Barone in his

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1) O. Lange: op. cit., pp. 215-28.

2) R.G.D. Allen: "Mathematical Economics", 2nd ed., McMillan, London New York, 1966, pp. 588.

3) V. Pareto: "Course Economique Politique", vol. II, Lausanne 1897, p. 90, f.

"Ministry of Production in the Collectivist State"[1] and henceforth
has been accepted by other economists[2]. But it is known that by us-
ing Edgewoth Box diagram, that when we are on the "contract curve" it
is impossible to increase the production of one commodity without de-
creasing the production of others. From the point of view of produc-
tion maximum, it is, therefore, necessary to allocate the means of pro-
duction somewhere on the contract curve. This allocation of resources
is governed by what we shall call, "the allocative rule" requireing
that the value of any class of factors, at the margin, be the same in
all directions of production in which it is actually used. In conse-
quence, as it would be expected, the allocative rule is equivalent to
any one of the alternative statements of the optimum conditions[3]. As-
suming that the Central Planning Committee could eliminate the differ-
ences between the social and private preferences[4], and assuming also
that factor supplies are inelastic[5], the allocative rule appeare in

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1) E. Earone: "The Ministry of Production in the Collectivist State"
    in "Collectivist Economic Planning", edited by F.A. von Hayck,
    London 1953.

2) In socialist literature this concept of production maximum has
    been accepted by O. Lange ("The Practice of economic planning
    and the Optimal Allocation of Resources"; supplement to "Econo-
    metrica", vol. XVII, 1949, p. 166) and J. Zielinski ("Rachunek
    ekonomiczny w socjalizmie) Warszawa 1967, ch. I, p. 16).

3) To be stated after.

4) By using different instruments such as taxes, subsidies and in-
    come distribution (see Chap. II).

5) Under the condition of fullemployment the means of production are
    in fact inelastic, and the socialist economies are running under
    this assumption, what could justify the assumption in the text.
    For the mathematical representation of the case with limitations
    on the factors of production, see R.G.D. Allen, ibid, pp. 595-
    600.

the three aspects of optimum conditions:

(1) The exchange maximum (optimum): which requires that for each indivudual the rate of substitution between any two commodities is the same.

(2) The production maximum (optimum); which requires that for each product the rate of substitution between any pair of factors be the same. Once this condition is fulfilled, it is not possible to produce more of any commodity, without producing less of some other commodities.

(3) Constructing on these two "lower levels" optima, each of which is a locus of "efficient points" in the Box Diagram a "top level" optimum[1], which requires that the rate of substitution between two commodities common to all individuals (sometime called the "subjective rate of substitution"), be equal to the rate of transformation called the "objective rate of substitution") for all pairs of means of production.

In the following we shall analyse the conditions of production maximum to establish its relation with the system of economic calculation.

1.2.3   The Conditions of Production Maximum

We shall first try to illustrate what we call the "proportionality rule" for the marginal productivities, which may be formulated as: efficiency requires that, the ratios of marginal productivities

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1)   We may consider the problem in a rather different form and consider the problem of maximum total welfare in three stages: 1. maximizing the vector X (the vector of production) which is the material basis of the general welfare, 2. maximizing the vector U (the vector of individual utility of income); and the 3rd stage is to maximize the scalar function (the social-preference function). The maximum conditions in each stage include the maximum conditions of the preceeding one.
See: O. Lange, op. cit., p. 226.

(physical) for any two factors, i.e. the marginal rate of substitution between any two factors, by the same in all directions of production.

To prove this it is necessary to use   Edgeworth-Box Diagram. The geometric representation of the problem is illustrated by assuming that we have a given quantities of two factors (means) of production, to be distributed between two industries each one producing one of a two different commodities. We drawn then a diagram like diagram no.1, where the amount of the factors are measured along the two axes, factor no 1 on the X axea and factor no 2. on the Y axes resp. The total given quantity of factor no. 1 is

$$O_1 B = O_2 A$$

and that of factor no. 2 is

$$O_2 B = O_1 A$$

Each point in the diagram does then represent a possible allocation of the given factor quantities between the two industries. It is then assumed that the isoquants of each industry are to be numbered[1], (The Higher the isoquants, in the direction of North East; the higher is, the level of production).

Then the curves 1_1, 1_2, ... etc. are industry no. 1 isoquants; the curves 2_1, 2_2, ... etc. are industry no. 2 isoquants. Both sets of isoquants are assumed to be convex to the origin of the industry in question.

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[1] To show how the isoquants, or what is the same the indiference curves to be constructed, we comment R.G.D. Allen "Mathematical Economics", Ch. 19, and I.M.D. Little: "A Critique of Welfare Economics", Ch. I, London 1960.

Consider now, the resource-allocation represented by any point in the diagram, e.g. the point "B", will lead to a higher production of both commodities. The same reasoning applied to the point "B". In this way we can increase production of both commodities through real-location of the factors until we reach a point on the curve $O_1 O_2$. From a point on this curve it is impossible to increase production of one commodity without decreasing the production of the other commodity. Outside the curve $O_1 O_2$ production and factor allocation are ineffi-cient[1].

Now, the curve $O_1 O_2$ is the locus of all points where the marginal rate of substitution between the two factors is the same in the two industries[2]. But when the marginal rates of substitution are equal, the ratios between the physical marginal productivities of the two factors in the two industries will also be equal. That, this is hold true, is easily could be seen. Let the quantities of commodities produced be Q1 and Q2; the production functions are $Q_1 (q_{11}, q_{21})$, $Q_2 (q_{21}, q_{22})$. On the line $O_1 O_2$ we have:

$$\frac{dq_{11}}{dq_{21}} = \frac{dq_{12}}{dq_{22}} \tag{1}$$

1) See the definition of production maximum in the previous section.

2) Graf V.: "Theoretical Welfare Economics" (Cambrodge 1957, p. 19. Graf mentioned the case when the locus meets one of sides of the box (i.e. one of the industries will use only one factor). In this case an inequality will be obtained. In the following we suppose that each industry use both factors in production, which does not unset the main conclusions.

i.e. the marginal rates of substitution are equal; But from the fundamental theorem of differentiation of implicit functions[1] it follows directly that

$$\frac{\partial Q_1 / \partial q_{11}}{\partial Q_1 / \partial q_{21}} = \frac{\partial Q_2 / \partial q_{12}}{\partial Q_2 / \partial q_{22}} \tag{2}$$

which means that the marginal productivities of the two factors in the two industries are equal.

1.2.4 The Transformation Curve

It is now possible on the basis of the previous analysis to construct what is known as the "Transformation Curve" or the efficiency frontier[2]. The curve shows the maximum quantity of commodity (2) which can be produced given the production of commodity (1), and vice versa.

The efficiency frontier curve (Fig. No. 2) can be derived from the Edgeworth-Box in Fig. no. 1. If here we follow the curve $O_1 O_2$ from the South West corner to the North East corner, the production of commodity one, will increase from zero to a certain maximum as we move from isoquant to another in the given direction, while at the same time the production of the commodity No. 2 is falling from a certain maximum to zero. At any point of $O_1 O_2$ (the contract curve), the two isoquants touching each other at this point, will give the quantities produced of the two commodities at this level of factors allocation. In this may we construct the curve TT in Fig. No. 2. This curve has the above maintained maximum property, which easily could be proved.

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1) See e.g. T. Czechowski: "Rachunek różniczkowy i całkowy", pp. 232-4, Warszawa, PWN, 1966; see also Samuelson P.: "Foundations of Economic Analysis" Harvard, 1947.
2) See Samuelson P.: op. cit., Graaf, op. cit., p. 14 and J. Zielinski, op. cit. pp. 16-19.

The efficiency frontier curve has the following characteristics:

(a) that it is impossible to reallocate the means of production between different industries to reach a point North East of the curve,

(b) that any point under the curve is technically a feasible solution but not an optimal solution,

(c) that any point on the curve is both technically feasible and optimal solution,

(d) at the same time, when the proportionality-rule (1) is fulfilled then the proportionality (2) is also fulfilled and vice versa, and if the two rules are fulfilled then we are somewhere on the efficiency frontier.

If we draw a tagnent to PT, the slope of such atagnent will show the marginal rate of transformation between commodity No. 1 and commodity No. 2, which measures the amounts of commodity No. 2 which is to be given up in order to increase one more unit of commodity No. 1, i.e. dQ_2/dQ_1. When we speak about the marginal rate of transformation, we always have in mind movements along the efficiency frontier, i.e. that we always assume that 2.1 - 2.2 are fulfilled.

1.2.5 The Generalization of the Conditions of Production Maximum

In section 1.2.3 the total production was defined as a components of an ordered vector, which is composed from (n) elements, and (n) represent the number of commodities. In previous analysis we considered in fact the case when (n) was 2 in number, i.e. we dealt with two commodities, and two factors. Now we shall generalize the above analysis to the case where we have $n > 2$.
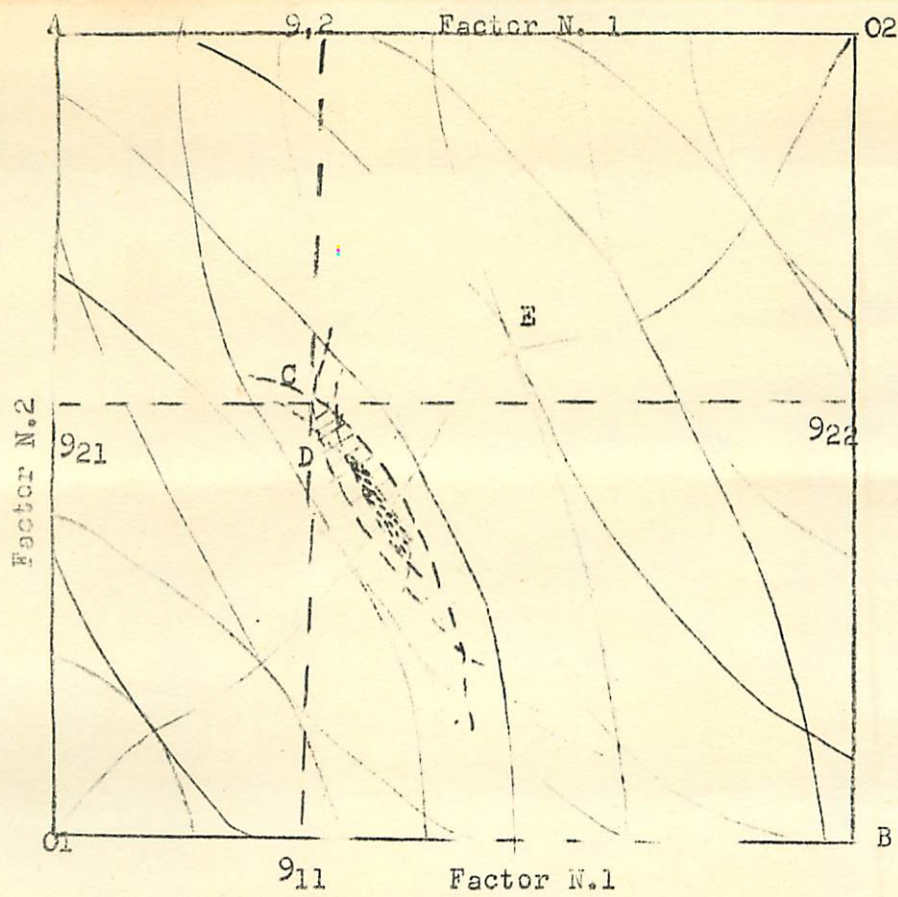
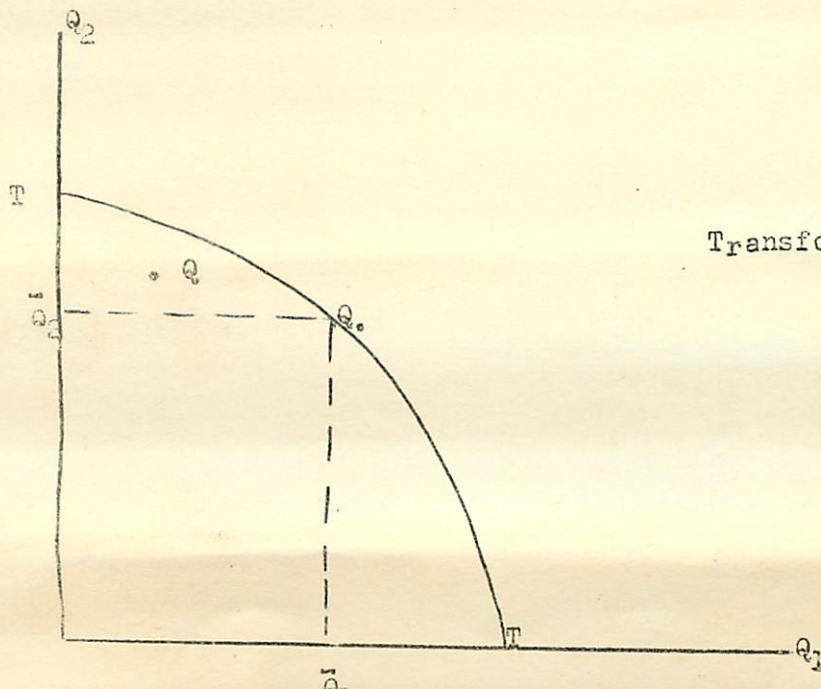Fig - N.1

Edgeworth - Box Diagram.

Fig. II

Transformation Curve.

The problem of production maximum depends only on the technological conditions which confront any economy. Thus the transformation function (production function) which was introduced in (1.2.2) may be refered to the whole economy. This is the strong oversimplification assumption which implay that the transformation functions of each firm are all the same. In reality, these transformation functions are different and each firm, even under the high centralized economy, is conforted by his own transformation function. In this case the condition of transformation (production) in the whole economy depends on how the transformation of commodities is distributed among firms. In other words the relation between total "outputs" and total "inputs" depends on how much "output" and "input" is done by each firm[1].

$$\text{Let } F^{(i)}(y_1^{(i)}, y_2^{(i)}, \ldots, y_n^{(i)}) = 0 \tag{1}$$

be the transformation (production) function of the firm No. (i) where $y_j^{(i)}$ is the quantity of jth factor it transforms; denote by $x_j^{(i)}$ the quantity of jth commodity which it produces. Under the socialist conditions of production, the amounts of commodities which any firm produces depends only on the amounts of factors it possesses. This is also true for the economy as a whole. Consequently, then we have that:

$$\sum_{i=1}^{n} x_j^{(i)} = \sum_{i=1}^{n} y_j^{(i)} \qquad j = 1, 2, \ldots, n \tag{2}$$

and now we have to maximize the total production

$$X = (X_1, X_2, \ldots, X_n)$$

1) O. Lange: "Fundamentals of Welfare Economics", op.cit., p. 223 and the follows.

where

$$X_s = \sum_{i=1}^{n} x_s^i = \sum_{i=1}^{n} y_s^i \tag{3}$$

and

$$X_j = \max \tag{4}$$

subject to the side relations

$$i - X_s = \text{constant} \quad (s = 1, 2, \ldots, j-1, j+1, \ldots, n) \tag{5}$$

$$ii - X_s = \sum_{i=1}^{n} y_s^{(i)} \quad (s = 1, \ldots, n) \tag{6}$$

and the tranformation function

$$iii - F^{(i)} (y_1^{(i)}, y_2^{(i)}, \ldots, y_n^{(i)}) = 0$$

$$(i = 1, 2, \ldots, n) \tag{7}$$

Using Lagrange Multiplier,
this will lead to the condition

$$\frac{F_j^{(i)}}{F_s^{(i)}} = \frac{F_j^{(n)}}{F_s^{(n)}} \tag{8}$$

which means that the rate of substitution between any two factors must be the same for all direction of production. In this case the efficiency frontier will be represented in (n) dimension scale.

1.3 Economic Calculation and Production Maximum

We know now, the efficiency frontier in both the special and generalized forms, on which all points of production are everywhere maximum. But this rule of allocation (the proportionality rule) does not lead to a choice between the points on the efficiency frontier. This incapability of the allocation rule to lead to an economic choice is due to the lack of an economic calculation which depends on the notion of prices.

The solution of the problem of economic choice which depends on the economic calculation may be one of three possibilities:

(1)   The first solution is to calculate (in physical terms) the allocation of factors which is necessary to reach the maximum point. This calculation is done by a central organization under complete centralization of production decisions. The Central Organization will then order the proucers to be have according by, and will divide the means of production between them in order to fulfil the production targets which are determined also by it.

The necessary condition to come out these calculation is that the central organization must has has a perfect and accurate knowledge of the Egeworth Box, and the tranformation curve for each pair of commodities and factors.

(2)   The second solution, under centralized decision making is the solution which is equivalent to Lange's solution in his "On the Economic Theory of Socialism". The Central Organization may try to reach the optimum point by trial and errer method. Here it is necessary to introduce prices. For the government will fix prices on commodity No. 1 and commodity No. 2 (generally every commodity of the set) such that the price ratio of any pair of these commodities is (numerically) equal to the marginal rate of transformation at the optimum point of production, i.e. equal to the slope of the tangent to TT at this point. The government not knowing the optimum point, may begin from any arbitrary initial position in the feasible area, and through small changes in the allocation of the means of production and the composition of production try to obtain an increase in total product evaluated at the given prices.

If a certain movement leads to an increase in the total product evaluated at these prices, the Central Organization should attempt a further move in the same direction. With the process of trail and error the optimum point of production will eventually be reached.

(3) The third solution is carried out through a completely decentralization of production decisions, which represents the basic features of the capitalist economy based on private ownership of the means of production and completely freedom in decision making. This model is out of the present aim of this study and will not be discussed here.

1.4 Economic Calculation in the Socialist Economy (Wakar-Zielinski School)

In many of their studies Prof. A. Wakar and J. Zielinski tried to answer the above mentioned question that is, what is the type of economic calculation which will facilitate to approach to the optimum point of production?. In the most recent study[1] they distinguished between two types of economic calculation:

1. direct economic calculation (DEC)
2. indirect economic calculation (IEC).

In the following we shall analyze these two types of economic calculation. Before carrying out this analysis, it is necessary to give answer to the following two questions:

1. What are the general characters of the Socialist economy?
2. What are the consequences of the general characters of the socialist economy, and the adopted meaning of the notion "Model"?

[1] "Zarys teorii gospodarki socjalistycznej", ed. A. Wakar, PWN Warszawa 1965.

1.4.1   The General Characterics of the Socialist Economy

In the theory of economic calculation we have to distinfuish between two different categories:

(1)   the description of the institutional character of a given economy,

(2)   and the mechanism of the economic activity (production and dustribution) and decision making.

In fact, both of these two categories represent a given "model" which comprises, the necessary data for economic calculation and before carrying out any kind of such economic calculation, it is necessary to give a specific description of the assumptions on which the analysis will be based.

Prof. Zielinski in his "Rachunek ekonomiczny w socjalizmie" analyzed the same problem of the principle assumptions of economic calculations. He distinguished between two concepts of the "Model" which are used in Polish literature:

1 -   the first concept of the "model" was introduced by Prof. C. Bobrowski which means "the whole complex of management and planning methods, or the economic policy applied in a certain concrete country in a certain concrete period"[1), and that, the fundamental principles of socialist economy can not be included among problems concerning the pattern "Model", that such questions as the principle of social ownership of the main means of production, and/or the principle of centralized planning do not belong to the sphere of themes connected with the "pattern",

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1)   Czeslaw Bobrowski: "Socialist Economic Patterns" in "Political Economy of Socialism", ed. O. Lange, p. 146, New Delhi.

2 -   and the second concept is that "Model" means the common defined
      assumptions about some facts. These assumptions contain the
      main essential characteristic features - from the point of view
      of the given problem under study - of reality.

      The difference between these two concepts of the "Model" is
that Bobrowski's model contains only the second type of the two cate-
gories which are necessary - as data - for economic calculation[1) for
the present type of analysis we shall use the second concept of model.

      Within this concept the common principle features of the socia-
list economy are the follows[2):
(1)   the social ownership of the means of production,
(2)   the central control over economic activity,
(3)   all economic activities *are* carried on for "the satisfaction of
        the needs of society",
(4)   the free choice of consumption goods,
(5)   the free choice of jobs and works,
(6)   the existence and using of money.

      The interrelations of these principle features will constitute
the institutional framework of any model of analysis for the socialist
economy. There are opinions that these institutional assumptions about
the socialist economy are not sufficient to carry out a rational econo-
mic calculation, such as those of A.L. von Mises and many others econo-
mists at the beginning of this century. But it is agreed now that from

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1)   This definition of the "Model" when it is related to the theory of
     money in socialism may reveales the comprehensive character of
     monetary theory. In other words that money within the common cha-
     racters of the socialist economy plays a defined role which does
     not depend on the degree of centralization. See Chap. III.

2)   J. Zielinski, op. cit., pp. 44-5.

the theoretical point of view - within the present state of information systems and computer machines - it is possible to carry out such rational economic calculation even if there were not a private ownership of means of production and in the absence of the market (in the institutional sense)[1].

But on the other side, it is believable that, all these principle assumptions are necessary - and at the same time sufficient - for any economic calculation. To prove that they are necessary we may drop, e.g. the last assumption - the existence of money and consequently monetary categories. In this case as we mentioned before to obtain the optimum point of production on the "frontier curve" it will be necessary to know all data about this curve and the indifference curves of production, which seems impossible at least in the present state of information system[2].

1.4.2   The Mechanism of Functionning the Socialist Economy

The assumption about the functionning of the socialist economy are these principles about how the economy is organized and how it operates. They represent a scheme of the essential features of the economic mechanism and the relevant principles of its functionning. Within the assumptions about the principles of the institutional framework of the socialist economy, the problem of functionning of the economy is shown to have several solutions. The range of these solutions begins from the highly "centralized" model which solution is called "a mathematical solution" to a complete "decentralized" model using markets or

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1)   The proof of this statement which ended the long-history discussion about the capability of socialist economy to undertake an efficient and rational economic calculation was due to Proof. O. Lange's contribution. O. Lange: "On the Economic Theory of Socialism", Review of Economic Studies 1936-1937.

2)   For a detailed discussion see. J. Zielinski, op. cit., ch. I, pp. 47-54.

(quasi markets) with a solution called a "competitive solution". In fact both of these two models are characterised by various degrees of combiantion of self-regulating, and regulated subsystems with different types of transmition links between them[1].

The problem of functionning of the socialist economy to some extent was related with the discussion of centralization and decentralization models of decisions making and exonomic management. The idea of the possibility of implementing different institutional solutions within the framework of a planned economy posed many basic questions usually reduced to the scope of centralization and decentralization. This approach would be accepted under the condition that not only the purely organizational aspect is considered, but - and on a full scale - also the economic side, first of all the interrelations between plan and market mechanism[2].

It seems that the reduction of the problem of functionning of the socialist economy to the scope of centralization and decentralization has improved a little to the analysis of the problem. However, there is another approach, which seems - especially from the point of view of monetary analysis - more appropriate - that is to link this problem with the problem of planning the socialist economy. Here we shall not reproduce the whole discussion and arguments of this approach. What is, however, necessary is to mention the following points:

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1)   Josef Steindl: "Servo-Mechanism and Controlers in Economic Theory and Policy" in "On Political Economy and Econometrics" Essay in Honour of O. Lange, PWN, Warszawa 1964, pp. 545-55.

2)   W. Brus: "Ogolne problemy funkcjonowania gospodarki socjalisty-cznej", Warszawa 1963.

(1) that the socialist economy is necessary to be a planned economy
if we want to direct, consciously, the development of the eco-
nomy and to eliminate the economic waste of using the available
resources. This is the second character of the socialist eco-
nomy.

(2) that planning the socialist economy must be "active planning"[1];
by active planning it is understood that "planning does not
consist only of coordinating the activities of various branches
of the national economy. It is something more, namelly that it
is an active determination of the main lines of the development
of the national economy.

(3) concerning the scope of the active planning there are two essen-
tial kinds of problems which must be determined by the central
plan. The first is to determine the general rate of economic
growth through the division of national income between consum-
ption and capital accumulation, and the second is the determina-
tion of the direction of growth through the division of the ac-
cumulation fund between different sectors of the economy. In
addition to these two types of the problem, the central plan
must also be concerned with coordinating the activities of the
various branches of the economy. This could be implemented by
means of economic balances of the different activities.

(4) concerning the methods of implementing the plan, there are two
main possible methods, the administrative orders and allocation
of resources, and the method which use the "economic means";
namely of settling up a system of incentives which indues the
economic units to do exactly what is requireed by the central
plan.

1) O. Lange: "Role of Planning in Socialist Economy" in "Political
Economy of Socialism", ibid., p. 21.

(5)   that wither the active planning is administrative or "parame-
        tration" the central plan must observe some fundamental eco-
        nomic laws, such as laws concerning the proportions of produc-
        tion, the law of value, and the laws which result from the
        operation of the system of economic incentives.

(6)   and lastly that the central plan must be based on correct eco-
        nomic calculation of costs and benefits, and consequently a
        correct price system is indispensable.

From the above mentioned points, the last one, i.e. the econo-
mic calculation as a necessary base of the plan, is the more relevant
to the analysis. In the follows the analysis will be devoted to this
problem.

1.5 Waker-Zielinski-Propositions and the System of Economic Calculation

Economic calculation could be defined as a system of measuring
the expenditures and the effectiveness of various economic activities
to insure their correct social evaluation, and to facilitate making the
optimal decision which would lead to the maximum effectieness[1]. Prof.
Zielinski defined economic calculation as the measurement of expendi-
tures and the effectiveness of the different alternatives of distribu-
ting the means of production[2]. Both of the two definitions suffer to
some extent from the shortcomings. The definition which will be used
in the following analysis may be formulated as follows:

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1)   Waclaw Wiczynski: "Formy rachunku ekonomicznego w mechanizmie
     gospodarki socjalistycznej", Ekonomista, No. 3, 1963.

2)   J. Zielinski, op. cit., p. 20.

By economic calculation it means a system of measuring the ex-
penditures and the outcomes (in monetary form / of different process
of production (from the social point of view) in order to make a right
choice between different possibilities of production which would lead
to the optimal (maximum) production point on the frontier curve of pro-
duction. The discussion about economic calculation in socialism (its
possibility and types) has its long history which began with the famous
attack by Ludwik von Mises that as a consequence of the social owner-
ship of the means of production and the elimination of capital market
in socialism, it will be impossible to carry out any rational economic
calculation. (Since the production of goods will not be subject of ex-
change, the determination of their values in monetary form will be im-
possible. Money will not be able to fullfill its functions in socia-
lism as it could in the competitive economy, concerning the determina-
tion of the value of commodities. Calculation in money form will be
impossible[1].

Langes' and Lerners' contributions[2] to the discussion has tur-
ned out the problem from discussing the possibility of economic calcu-
lation under socialism to the searching for the rules of behaviour
which could be formulated under their model of socialism which is known
as the "competitive Model". Their solutions were, in fact, interes-
ting as a challenge to the supporters of the capitalist private enter-
prise. Both of them mentioned that the only chance of getting full

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1) Ludwik von Mises: "Collectivisit Economic Planning", London 1935.

2) O. Lange: "On the Economic Theory of Socialism", Review of Eco-
nomic Studies 1936-1937.
A.P. Lerner: "The Economics of Control", New York 1946.

benefit of the advantage of perfect competition is to establish an appropriatly designed socialist economy. (The description and the detailed discussion about their models will not be repeated here)[1].

The recent discussion about the economic calculation in socialism, especially among the socialist economists, is wide and much deeper than the discussion of the theirties and the fourties. This is understandable if we take into consideration the development of the socialist economy which became a fact in many countries on one hand, and the development of techniques of analysis in the discipline of economics (the introduction of mathematical models, the creation of econometrics as a discipline of science, the use of new mathematical branches, e.g. linear and non-linear programming, the invention of computing machines, and lastly the création of the cebernetique). All these factors have actually affected the trend of the discussion about the economic calculation in socialism.

The discussion which has been raised among the Polish economists during the last 10 years about this subject is of a special interest. As a consequence of the discussion about the type of the socialist model and the relationship between the market and the plan on one hand, and the discussion about the existence and the behaviour of the law of value and the method of price calculations; there have been two different trends of thought in the discussion. These two trends of thought have been known as the direct and indirect types of economic calculation. In the following a detail analysis will be carried for the first type of

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1)   A survey of the discussion about the problem is given by A. Bergson "Socialist Economics" in A Survey of Contemporary Economics", ed. H. S. Ellis, Homewood 1952.

economic calculation, i.e. the Direct Economic Calculation[1].

1.6 The Method of Direct Economic Calculation

The terms of direct and indirect methods of economic calculation has been introduced into the economic literatures by Prof. Aleksy Wakar and Prof. Janusz Zielinski. For a long and deep analysis they have presented the two types of economic calculation in full precisions and detailes. In what follows the analysis will be devoted to represent Prof. Wakar-Zielinski's theory of economic calculation. We shall begin with the Method of Direct Economic Calculation (DEC).

1.6.1 The Model of DEC

The Model of DEC is a theoretical model which is based on the actual economic system in the socialist economy. It represents in a theoretical form, what is, or may to be understood by the mechanism of functionning of the socialist economy within the accepted type of economic calculation.

It is understandable that every society, independently of the form of social institutions and organizations, is faced with the necessity to solve the economic problem which arised from the conflict between the limited means of production, and the unlimited needs of the people. This in fact consitutes what is known with the term "economic activity"[2]. After the development of commodity production, and commodity-money exchange, production and distribution (which together form

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1) The reason why we did not give an analysis of the second type of economic calculation is that the following analysis of the theory of money and monetary equilibrium will be done only within the framework of the DEC system. The description of IEC system is given in details in A. Wakar ed.: "Zarys teorii gospodarczej", Appendix I.

2) O. Lange: "Political Economy", Part I, London 1963, p. 148, 150.

the economic activity) has been devoted to different aims, such as di-
rect satisfaction of the needs of individuals or the integrated form
of aim which is the realization of money income in capitalist economy,
or the satisfaction of the needs of the whole society as in socialism.
This development of commodity production and commodity-money exchange
makes it possible to change the economic activity from the traditional
form into a gainful, rational activity[1] based on reasoning and under-
standing. The transition from the customary and traditional economic
activity to rational gainful activity, i.e. the rationalization of eco-
nomic activity was made gradually in keeping with the development of
commodity and monetary relations. This transition of economic activity,
led to the quantitative measurability and communsurability of the end
and means of economic activity[2] A quantification of the end and the
means is expressed in a uniform units of measurement, in monetary units.
It is then possible to compare the ends achieved and the means used, and
to express the result of this comparison in monetary form (units). This
type of comparison finds expression in what we call "calculation". By
calculation it means, the monetary recconing of all the components of
expenditure and income. Calculation is the expression of fully developed
rationality in the sphere of economic activity, since it consists in the
quantitative comparison of all the components of income and cost (both
on the enterprise level as well as the national level).

After this analysis of the concept of calculation, it is worthy
to mention that this concept has been developed entirely within the fram-
ework of the capitalist enterprise, but it was inherited by the socialist

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1)   O. Lange: op. cit. p. 157 and follows.

2)   O. Lange: op. cit. p. 161.

society, which makes it possible to apply the economic principle[1] in individual enterprises, and to provide the base for searching for the optimal plan for the economy as a whole.

This concept of calculation is said to be direct in the socialist economy, if the type of calculation is done by computing and coordinating directly, either in physical or monetary magnitudes[2]. In this type of calculation the supply of any commodity is related to the material conditions of its production (existing capacities and other material and technical conditions). In other words the supply of a given commodity is said to be a function (direct) of the given conditions of production. The demand of this commodity is also a product of the material conditions and is a result of technical calculations (input norms multiplied by the volume of production), when the final demand is defined. In this type of calculation, i.e. DEC, three basic elements are coordinated directly; they are:

(1) existing material and human power which constitute two types of balances, i.e. the material balance and the manpwoer balance,

(2) desired final products in accordance with the preferences of the central authority,

(3) technical coefficients of production which is known as input-output analysis.

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1) The economic principle asserts that the maximum degree of realization of the end is achieved by produceeding 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. O. Lange, ibid., p. 197 and footnote.

2) Wakar A., Zielinski J.: "Socialist Operational Price Systems", A.E.R. vol. LIII, March 1963, p. 1963, p. 115 and the footnote No. 3, also for the same authores: "Rachunek ekonomiczny bezpośredni" in Ekonomista 1961, vol. 61, pp. 17-43.

It is generally recognised that the DEC method fulfill the
following advantages:

(1)   that it solves, at least, theoretically, two of the three pri-
ncipal problems which face any economy, i.e. the determination
of growth path and direction in accordance with the social pre-
ferences and the realization of equilibrium of the balances
system. While concerning the third problem, i.e. the choice
of techniques of production, at least in Wakar-Zielinski opin-
ion, the DEC method is not capable to solve this problem[1].

(2)   that it gives a certain degree of certainity to the central au-
thorities in implementing the plan targets (quantitatively and
structurally) and the social products.

(3)   and that within the DEC method, price and cost calculation may
raise some "Marginal faults" which in any case will not affect
the economic activity in a harmful manner.

It is the opinion of both Prof. Wakar and Prof. Zielinski that
the daily problems which stand against the normal functionning of the
DEC method in practics, are not due to some defects in the theoretical
model of this system. Within this system of economic calculation which
covers the plan construction and the plan implementation, it is possible
to improve the system of planning and organization in such a way to
reach to the maximum degree of effectiveness either in resource utili-
zation or in decreasing the economic waste.

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1)   Wakar A., Zielinski J. and others: "Zarys teorii gospodarki socja-
listycznej", PWN, Warszawa 1965, p. 86. Prof. Brus stands against
the statement that the weakness of the DEC method lies on its in-
capability to varify the choice of techniques on the basis that the
theory of DEC was wrongly formulated and due to the misunderstand-
ing for the concept and the conditions of rationality. Brus W.:
"Ogolne problemy ...", p. 311.

In the DEC method we generally use such categories as prices, costs, wages, etc., but they do not play an active balancing role. In other words, these categories do not affect the method and degree of coordinating between different elements (see above). Both the demand and the supply of any commodity is not - ceteris paribus - a function of the price of the commodity, but a result of a technical conditions of production. Prices in the framework of DEC method are three kinds[1]:

('1) Price used in plan construction. This type of prices is divided between two other types:

a . aggregative prices, which are used in plan construction to show the method of aggregation and to fullfuill the internal consistency of balance system. This type of prices do not constitute any base for economic choice. Allocation decisions are the result of direct coordination between the material-technical conditions and possibilities and the social needs (in the form of material balances and/or inputs-outputs tables. They are not the result of price-cost relation. In the practices of planning in the socialist economies this kind of prices is represented by using the "constant prices" as a given prices used in plan construction.

b . Programming prices or the so-called accounting or shadow prices or in Kantrowicz terminology the objective determined valuation o.d.v. - which are used for a paritail economic rationality in plan construction process. This type of prices is frequently used in investment effectiveness researches and the effectiveness of foreign trade.

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1) Zielinski J.: "Rachunek ekonomiczny w socjalizmie", p. 198.

The difference between this type of prices and the
aggregative price system is that the last type is
not used for alternative choice. This type of prices
is only used as an aggregative method in plan cons-
truction [1].

(2) Prices used in plan implementation. These prices are called
also the operative prices. These prices are related directly
with the individual enterprises as an index which facili-
tate the implementation of the plan. They constitute a
part of what is called the "formula" by which Prof. Wakar
and his followers means "the system of stimulating produ-
cers" and constitutes of three parts: incentives, prices
(operative), and method of calculating costs. This type of
prices fullfill the following functions:

a. they play a role as an information source about the
changes in the relations of the scarcity degree of
the means of production and about the preference of
the central authorities. The degree of realizing
this role depend to a great extent on the methods
used in formulating operative prices.

b. that they are an element of the stimulation system
which is used in the plan realization, consequently
the degree of the effectiveness of the enterprise
activity is calculated by using the operative prices.

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[1]
In "Zarys teorii" Prof. Wakar and the authors used "pro-
gramming prices" to mean the aggregative type of prices.
Prof. Zielinski alone correctly differentiated between
these two types of prices mentioning that programming
prices are different from the aggregative prices on the
base which is given in the text.

c. that they constitute an instrument for distribu-
ting the means of production between enterprises
and the state, through the system of different
prices for sellers and buyers (the difference is
transferred to the state budget). At the same
time they also play a role as a redistributing
instrument due to the fact that they serve in
calculating the success indicators (such as the
standard of production - the standard of degree
of effectiveness of enterprise activity, etc.),
which determine the flow of the means of produc-
tion to the enterprise (e.g. wage funds or invest-
ment fund).

The main character of the DEC system is that, the operative
prices, within this system, are one of the information sources[1].
At the same time we find many types of this kind of prices,i.e.
operative prices, used simultaneously to fullfill the above
mentioned functions. In the DEC system, the operative prices
are not, by any case "equilibrium prices". They are used -
formaly in distributing the means of production. This fact
limits any possibility for using these prices as a base of
"alternative choice" for the enterprises. This fact is the
result of the method which is used in formulating these prices.
Since these prices are not equilibrium prices, and since they
do not express the real relationships between the different
means of production (the scarcity relationship - the rate of
substitution, etc.) and at the same time they do not express

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[1]See the example of other types of information sources in Prof.
J.Zielinski:"Rachunek ekonomiczny...", pp. 100-102, and the
"Zarys teorii...", ed. Prof. Wakar, p.88

the preferences of the central authorities, any possibility for giving this kind of prices an "active role" as a base of alternative choice must be limited[1].

Prof. Zielinskie mentioned that there is a theoretical possibility for building an operative price system which at the same time is an equilibrium price system. Then this new price system could be a correct base for "alternative choice" for the enterprise and could be used as an instrument in the hands of the central authorities in controlling and directing production. But this optimistic statement is followed by a comment which asserts the practical difficulties in building and using this new price system within the DEC system[2]. This problem will be touched in full details after.

(3)   The last type of prices which is used in the DEC system is the consumer goods prices. They play, beside the policy of nominal incomes, an essential role in realizing the consumption plan. This type of prices has to equalize supply and demand for consumer goods, and to influence consumption patterns in the direction which is seen by the central

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[1]   Prof. W.Brus stand against this opinion. According to his point of view in the DEC on the macro-level when determinning the targets of production and the methods of production, determining at the same time the general proportions between the supply of the main factors of production and the demand for these factors and hence determine the general proportions of scarcity of these factors. Consequently the argument that the scarcity degree is determined by some technical coefficients and that these coefficients are determined only by a given system of prices lose its sense. W. Brus: "Ogólne problemy ...", p. 315.

[2]   Prof. J. Zielinski: "Rachunek ekonomiczny...", p. 102.

authorities as the socially desirable direction[1].

1.6.2. Methods of Production (Choice of Techniques) in the DEC System

One of the most important principle features of DEC system is the external character of methods of production. Within the framework of this system there is no mechanism for economic verification of technical coefficients (methods of production)[2]. Technical coefficients are assumed (in both input-output methods and material balances) to be constant and given. The required input per unit of output is technologically determined and is considered as a structural given parameter. When the technical inputs coefficients are treated as independently given parameters, it is then assumed that they are independent of the prices of the means of production, and consequently the "substitution effect" is eliminated from this type of general equilibrium models[3];

As a consequence of this fundamental feature of DEC system the methods of production are not verified economically within the system of DEC. The best methods of production (not optimal) for a given output can not be chosen within this system of economic calculation, but they are taken from outside

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[1] For more details see J. Zielinski: "An Attempt to Construct a Realistic Theory of Socialist Economy", Economics of Planning No.2, July 1962, also "The Consumption Model and Means of its Implementation" in "On Political Economy and Econometrics", Essays in Honour of O.Lange, Warszawa 1964, pp. 629-641.

[2] A.Wakar ed.: "Zarys teorii...", p.96

[3] W.Leontief: "Econometrics", Survey of contemporary Economics vol. 1, ed. by H.S.Ellis; Homewood 1952, pp. 388-411.

it and constitute unverified data. The source of these
methods of production is either the "traditional" methods
of production, i.e. these methods which are in use, or the
"advanced methods of production" (also called " the engi-
neering methods") usually taken from the practice of more
advanced countries, or the result of technical researches.

It must be mentioned that the external character of
the methods of production will lead to the arbitrary choice
or that any economic evaluation of these methods is comple-
tely impossible. It is natural that within the framework
of DEC system the "predetermination" of the methods of pro-
duction is consciously made, and that for any rational
choice (from the point of view of the Central Plan) of these
methods, the economic analysis and evaluation is necessary.
The aim of this economic evaluation of the methods of pro-
duction within the framework of DEC system is to choose these
methods which insure the following two criteria:

1. the realization of the warranted scheme of the
   structure of the employment of labour force, and
2. the realization of the structure of the final pro-
   ducts (investment and consumption goods) in relation
   to the available resources, and at the same time
   to ensure the highest degree of resource utiliza-
   tion.[1]

It could be added that the assertion that " in the
external character of the methods of production lies the

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[1] These two points are analysed with a great details in
"Zarys teorii...", ed. Wakar, pp. 97-99.

weakness of the DEC system"[1] is not completely correct.
Under certain circumstances with certain assumption it could
be shown that the choice of production technique (methods of
production) for each product is independent of other planning
decisions concerned particularly with the structural of final
product[2]. It is generally true that a model's usefullness
in choosing a production technique depends upon the ratio of
the number of the decision variables sought to the number of
the constraint conditions. When the model contains (n) ba-
lancing equations for (n) products, it is impossible within
the structure of this model to choose the methods of produc-
tion and they must be treated as given data. In other words
the choice of methods of production within the framework of
DEC system depends upon the degrees of freedom of the model.
If alternative methods of production are included in the
model (i.e. the number of unknowns is increased) and when the
preference function which determine the criterium of choice
(e.g. minimum cost) is formulated without increasing the
number of the constrained conditions; then it is only possible
to choose the methods of production outside the model and to
include them in the system of balancing equation (the DEC
system). The result will be similar, i.e. one method of pro-
duction for each product, providing that not just any method
of production is chosen, but the one that insures minimum
costs[3].

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[1] J.Zielinski : "Rachunek ekonomiczny ...", p.96

[2] R.Dorffman, P.Samuelson, R.Solow,: "Linear Programming and
Economic Analysis", New York 1968, p.252

[3] See R.G.D.Allen:" Mathematical Economics", 2nd ed.,ch.10,
London 1966.

1.7. The Formula of the DEC System and the Discussion of the Theory of Management in the Socialist Economy

The most important part of the DEC system is what is called the "formula". The formula in fact is not only related with the DEC system. It is a general method of describing the structure of the functionning system (including to some extent the organizational and management structure) of a given economy. In socialist economy the formula is related, as it was represented by its formulators, to the implementation of the plan. The problem of plan implementation is not its deciphering, i.e. giving concret contents to the general indices, but it depends on the direct and actual proceeders which are taking by the direct producers and consumers. These proceeders, i.e. the way in which direct producer or consumer implementing the plan, has to be affected and directed through a system of stimulation which is called here the "formula". The formula which is connected with the DEC system is called the "direct formula".

1.7.1 The Components of the Direct Formula

The direct formula contains three integrated and complementary parts of elements.

1.- incentives - material as well as non-material incentives,
2.- calculation system (together with costs calculation),
3.- and prices.

The assertion of the integral character of the formula means that "the incentives, prices and the calculation methods constitute a unity and should appear as a whole both in theory and practice of management of the socialist

economy[1]. But there are many attempts to liquidate the formula from its integrity and to change its elements independently. These attempts - if they will continue - will transfer the integrated elements of the formula to something like "slogan" which does not contain any economic meaning. E.g. incentives would have a concrete economic meaning only when they are related to the price system and the calculation methods[2].

The other main feature of the formula is that it is characterized by an empirical approach of analysis. The empirical approach of the formula will appear clearly in adapting the formula which is compatable with every given conditions. The empirical approach of the formula is embraced in all its elements. As a consequence of this feature of the formula the elements have to be used only as a tool which will lead to fulfilling the targets stated. Both the empirical and the integrity features of the formula state that the formula must be consistent, and that there must be no contradictions between its elements. Between the three elements of the formula there exist a quantitative relationship which will determine the integrity and complementarity of the formula. Every type of incentive is related to a given system of prices which is not in contradiction with these incentives. At the same time there exists an objective and quantitative relationship between prices and costs, prices should be related to costs in a certain way (the base of prices may be average costs plus profit margin or marginal costs may used as a base for prices determination, etc.).

1) A.Wakar: „Prices,Incentives and Calculation Methods" in "Political Economy nd Econometries". Essays in Hon.of O.Lange, p.620 and in "Zarys...",p.106
2) A.Wakar: op. cit., p.621

1.7.2 The Optimum Formula and its Features

In the present state of the DEC system, there is a wide varitey of formula which could be adopted and used. Prof. A. Wakar and his followers mentioned that the empirical character of the formula asserts that "there is no, perse, optimal formula"[1]. In fact this this is a wrong deduction, since that the optimal formula is an empirical formula. Here the optimal formula is used to mean that it is the best formula for organizing and managing the given economy. Moreover the optimal formula is characterized by following features:

(1) there are new elements not to be included in the formula but they are necessary to formulate the optimal formula;

a . the first element to be considered in the dynamic aspect which is needed in order to deal with the existence of time lags. Time-lags appear both in production function and in the process of using information. The formula here is required to take into consideration this fact and the elements of the institution (which are required for the stabilization of fluctuations which may arise from the time-lag in the form e.g. of the well known cobweb theorem and other cycle forms) will be considered as an element of the formula, they may be the price element.

b . Since economic activity (both at the macro and micro levels) could be divided into a multiplicity of economic events, it is necessary to register these events, and to transorm the information about them from one place to another. These events are registered according to a given rules (methods of accounting). The transformation

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1) A. Wakar: "Prices, Incentives and Methods of Calculation", p. 627, see also: "Zarys teorii ...", p. 118.

and the distribution of informations about these events is called the information system. Information as understood here, will be of two types at least: factual information about the economic events which have been happened within a given period of time (week, month or year) and information on possibilities or what will or may happen within a future period (data about production, demand and supply of different goods, possibilities of production techniques).

Both of the two types of information will be carried out by a set of different institutions (gathering and distributing) which will cause a certain level of cost (depending on the organizational and the multiplicity of the information institutions). The optimal formula is characterized by a system of information which will cost the minimum cost.

(2) Under this assumption the problem which is to be solved by the formula is to reach an optimum[1] (defined as production maximum and distribution optimum of the Pareto's type with the constraint of a social preference function); then organizational element of the formula must be consited of a set of institutions which together make for a maximum welfare. The optimum found will then be interpreted to represent:

1 . a set of institutions each of them is characterized by their behaviour or directives for use of .....

_____

1) See Section 1.2.1 and 1.2.2.

2 . the instruments of policy or action parameters at their
disposal. Sometimes these instruments are direct direc-
tive and orders from the central institutions (the plan-
ning board e.g.), sometimes these instruments are more
complicated functions of the coefficients in the social
welfare function and the production or cost functions.
This type of complicated instruments may be representated
by the system of two-levels of prices which is used in
planning practics in socialist countries and also by the
system of turnover (indirect) taxes.

This interpretation of the optimum found of the set of insti-
tutions could be called the direct interpretation. Direct interpre-
tation of the optimum set of institutions is carried out under the
assumption that these institutions do not show or cause any cost.
This in fact is not the case. Any set of institutions will be per-
formed only with a cost (wages of the employees in these institutions,
cost of building, electricity, etc.). In this factual case direct
interpretation is not sufficient and it is necessary to interpret the
optimum found indirectly. The indirect method of interpretation con-
sists of considering a number of alternatives (i.e. sets of institu-
tions) and finding out which of these is conductive with the optimum
welfare. However, even the case when the institutions show a cost,
it is possible to use the direct method. The way to arrive at a sol-
ution consists of introducing, as unknowns parameters, the frequencies
of a number of alternative sets, each has its constraints (costs) and
treating these parameters in the way of the other unknowns, i.e. to
put the partial derivatives of the welfare (preference) function plus
the terms corresponding to constraints (costs), (each multiplied by
Lagrangian multiplier), equal to zero. The solution of the problem
of the optimum set of institutions will show the set which will cause
the minimum cost. This will facilitate the formulation of the optimum
formula of DEC system.

As a consequence of these features of the optimal formula, which is a modification of the original formula of the DEC system, there is a need to proceed the analysis on the subject of this optimal formula in order to improve the existence state of theoretical analysis of the formula as it was given by Prof. A. Wakar and Prof. J. Zielinski. This will be the subject of the following chapter.

Chapter II

THE THEORETICAL MODEL OF THE OPTIMAL FORMULA

2.1. Centralization and Decentralization

In the first chapter we have discussed the model of the formula and its elements in connection with the DEC system. The result of this analysis was that the notion of the optimal formula which is to be used in planning and implementation. In fact the theory of the optimal formula must be related to the throry of management (directing, by economic means, the different types of economic events and activities of different economic units, producers and consumers). From this point of view it is generally agreed to distinguish between two types of economic management that are possible (under the given type of the ownership of the means of production) to be used in any socialist economy.

1. The centralized model based on a system of organization which comprises a number of units using a given system of information (about the situation) and taking decisions) or recomendations to carry out activities that will realize and influence the objective situation). In this model of economic management the relation between the different units at the different levels is as follows: orders are given from the highest level to the second in the hierarchy in economic management and from the second to the first level. On the other hand information run in the opposite direction. This model of economic management is said to be strictly centralized in the field of decisions making if the highest unit only takes decisions and gives orders, and that the units between the highest and lowest levels could be eleminated as they are only of a purely relay type and only pass orders.

The model is said to be strictly centralized in information
if all informations come only from the lowest level to the highest
one, and the intermediate units could be eliminated due to they
relience character[1]. The model is said to be strictly centralized
in both orders and informations if the two above principles are
applying.

Within the framework of this centralized model there are many
"process of adjustments" generating a sequence of proposed actions of
the firms and households. These process of adjustment can give an
organizational definition of the model of the centralized economy.
Defining the primary resources endowments and the present state of
technology, as well as the society's tastes and the basic date which
may be called the economy's "environment", we may say that these
"environments" are changing overtime[2]. Following these changes
of environments, each of them will be preceded and followed by se-
quence of "iterations" occurs. These iterations could be classified
as follows:

> (i) The first iteration requires transformation of the
> collected data from the different units about the new
> environments to the central authority (Planning Board).

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1) See O. Lange: "Niektore zagadnienia centralizacji i decentra-
   lizacji w zarzadzeniu" in the "Material for Studying the Po-
   litical Economy of Socialism", ed. W. Brus and others, war-
   szawa, 1964, pp. 749-56.

2) This changing may be according to a probability law which may
   be known to the planner.

(ii)   Once the information is gathered at the center, sub-
       sequent iterations take place within the center, in
       order to define the successive proposed value of the
       actions which will be undertaken by the units at the
       lower level, according to and in correspondence with
       the new environments.

(iii) The third process is to transform the proposed values
       of actions into physical orders to the economic units.

(iv)   The last is the implementation of the orders received
       from the center by the units.

The three last points [1] compose the procedure used in the
adjustment process, in which each units proposed action at any point
of the iteration system will be a known function (to the planner)
of its information, knowledge of the current environment and of the
previously proposed action of all units.

The period in which every iteration is completed will depend
on the scope and efficiency of the economy's information processing
facilities, and the human (persons engaged in data collecting and
processing) and mechanical (computers and calculating machines used
in data collecting and processing) equipments.

The basic principle of the functionning of this model is
what is called the "hierarchic structure of ends" [2].

---

[1]   It is necessary to note that each step takes a "period" of time.
      The "time lage" in decision making may introduced here. It is
      known also that the lapsing of time may change the environments
      whose data was collected, and then the Central Planning will face
      a new situation.

[2]   O. Lange: "Political Economy", Vol. I, p. 179. For more detailed
      study in this principle see e.g. P. Sulmicki:"Some Notes on Hier-
      archy in Economic Planning" in "On Political Economy and Econometrics"
      in Hon. of O. Lange. pp. 571-90, Warszawa 1964.

"The integration of the aims of the activity of socialist entreprise by a common and established in social economic plan leads to a hierarchic of ends"[1]. From this principle it follows that it is possible to construct as many plans as there are levels of economic authority" there may be plans at various lower levels, there may be provincial plans, district plans, as well as plans for particular groups of enterprises"[2]. Each of these plans should contain the kind, level, place and time of activity which are proper for the decision maker. Another consequence of this principle is that in this model tehere exist only one authority which makes decisions. Decisions (concerning either consumption or production and concerning the product-mix) taken by units of the first level are no longer the result of evaluations made only by its decision maker (under its own constraints and conditions of information and knowledge). Under the conditions of this model they are the result of the instructions of the higher levels both with respect to targets and the means of their implementation.

2. The Decentralized Model

If the organization system is not strictly centralized, it is then said to be decentralized to some extent. "This decentralization may be only apply to certain kinds of informations or only to some kind of decisions, or again, only certain units. This is the field presenting a great variety of possibilities"[3].

To speak about the strictly decentralized model of management, it is the basic principle of this model that it lakes the hierarchy in decision making. All decisions (either production or consumption, or the product-mix) are taken at the first level of organization system. In this model there is no possibility of the existence

[1] O.Lange, op. cit., p. 179.

[2] Ibid.

[3] O. Lange: "Niektore zagadnienia centralizacji decentralizacji ....", ibid., p.751.

of any central authority [1].   Then the manager of each unit of the
first level will decide
(1) the choice of production (what ativity should be carried),
(2) choice of technology (i.e. deciding on the application of
     technological processes and of raw material),
(3) choice of consumption.
(The last choice is carried by those who are the consumers.) [2]

        Within this model there are also many "process of adjust-
ment" and has its own "environments". As a consequence of the chan-
ging of these environments there will be a sequence of iteration
process.

        In the socialist economy (which is based on the principle
of the social ownership of the means of production and the central
determination of the aims of society) there is no possibility to
speak about the existence of such a model which assumes the absence
of the central organ and the elimination of the social determination
of the aims of society. At the same time, the historical experience
showed that the central authority, in general, is not able to collect
the necessary informations about tests, technology and resources, which
are the environments of the system. On the other hand the central
authority cannot operate through units of the first level for the
simple reason that there are too many of them for all to be considered
in the calculation (data processing) by which the optimal decision
(plan) is evolved.

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1) One of course can imagine the existence of a central authority,
   but generally if it exists then it will be completely a passive
   agency. Of course the statement in the text must not mean to exclude
   the existence of hierarchy in management, within the unit itself.
2) Within the framework of the strictly decentralized model the prob-
   lem of distribution of national income will be solved as a result
   of spontaneous contacts of individual partners on the market.

Much has been said and written about the advantages and disadvantages of both of the two systems, that it is not necessary to repeat them here again. It is only necessary to stress that in the actually existing and functioning model of the socialist economy it is easy to observe that this model contains different degrees of both centralized and decentralized models. The existing model of the socialist economy is known now as a "mix-model" which incorporates aspects of both of the two models. The problem is to look for such a combination of these aspects in order to achieve the greatest possible effects of aggregate activity, measured by the relation or the net effect of inputs and outputs.

As Prof. O. Lange put it that we must " consider organization (system:A.S.) comprising many organs and strictly centralized", and to search for "what conditions make it possible to replace strict centralization by various kinds of decentralization in the operation of a system of organization, without changing the effects of its operation (if not to improve it - A.S.)"[1]. This will be the aim of the next section.

2.2. The Model

The model of the optimal formula is intended to answer the above mentioned question that is what are the optimal proportions of the different degrees of centralization and decentralization in economic management and planning?. The main criteria of this analysis is that the introduction of any degree of decentralization in economic management will aim to improve the existing model of functioning of the socialist economy, and that the new mix-model will be, at least, "equivalent" to the strictly centralized model in assuring the implementation and realization of the socially determined aims of the society. The analysis is based on the following assumptions:

1) O. Lange: "Niektore zagadnienia centralizacji...", ibid., p.573.

(i) that the system of accounting (including cost accounting) is given and is not to be in contradiction with the other elements of the formula [1],

(ii) that the system of incentives is of a synthetic type. [2] they compose a part from a more comprehensive incentive system. It will be assumed that within a given constraints the synthetic incentives are the main determinant of the enterprise strategy and tactics (investment and production decisions). There is a possibility to construct different synthetic incentives which could be used consequently or even simultaneously [3].

(iii) that the central authority is supposed to have the possibility of choosing and imposing its choice, between directly ordering each producer and/or consumer to undertake (to implement) certain activities (producing and/or consuming commodities); or by using indirectly a financial system of prices, taxes and subsidies, and an incentives system, to direct the units at the first level to undertake certain activities which will maximize its own preference function subject to a budget constraint based upon by the two systems mentioned, and, at the same time will optimize the central preference function considered as the social preference function. This assumption will imply the possibility of introducing

1) Wakar A. and others: "Zarys teorii...", p. 30

2) This must not mean that there is no any possibility to use other types of incentives, e.g. the "specialized" incentives which are used for specified and determined aims, or the "recognition" incentives used to some extent in socialist economies. For more details see A.Wakar:"Morfologia bodźcow ekonomicznych",Warszawa 1963.

3) J.Zielinski:"On the Theory of Success Indications",Economics of Planning, vol.7, 1967, No.1, p.4.

a certain degree of decentralization[1].

(iv) that the central authority has its own preference function. It has to elaborate a plan which optimizes its own preference function (which is given and known), by using a mix of orders and financial stimulus activities. It is also assumed that each unit at the first level of the system of organization will have its own function to be optimized.

(v) that there exist a contradiction between the preference function of both the two levels of the system of organization. The aim of the model is to eliminate such contradiction in a way that the activities which are undertaken by the units of the first level (and optimize their preference functions) are at the same time in accordance with the instructions (physically and financially) which are given by the higher organ (in order to maximize its own function).

(vi) that an activity which is implemented by an order will be different from that activity implemented by a means of finance [1].

The problem is then reduced to solve the contradiction between the overall optimum and the partial optimum and to show the means by which this solution (coordination) is achieved.

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1) For comparison purposes, it would be worthy to mention the study of Tom Kronsjo on the subject of "The Optimal Proportions", see his "The Formulation of a Linear Economic Plan for Implementation by the Optimal Combination of Command and Financial Stimulus", Economic of Planning, vol.7, No.1, 1967, which the author has benefited it to a great extent in this study.

2) This assumption is assumed for some mathematical conveniences.

2.2.1. The Central Model [1)]

Let the structure of the system be considered as a composite which comprise j units j= (0,1,2,...,n) where the 0th of them is the central authority, and the others being consumers and producers. Each of these units will have its own vector of activities with the element X_{jk} (k=1,2,...,n_j). The central authority activities which are undertaking by orders will be represented in its vector X_o, and that activities which are implemented by financial stimulus will be contained in the vectors of ~~the vectors of~~ the other units. E.g. the activities undertaken by the jth producer or consumer (j=1,...,n) acting under the system of financial stimulus will be given in the vector X_j (j=1,...,n).

The fourth assumption (about the central authority preference function) may then take the general form of any social prefernce function of the form

$$F = (X,Y) = Max.$$

For simplicity (without loosing concretness) the function will be assumed to be a linear function of all activities (X), and a positive linear function of any further improvement (Y) in the preference function of ith consumer or producer. The function then may be written in the form:

$$\sum_{j=0}^{n} C_j X_j + \sum_{i=1}^{n} b_i y_i = Max \qquad (1)$$

where $C_j \geq 0$ and $b_i \geq 0$

if any of the C_j takes the value 0 (zero) this will mean that the activity X_j will not be undertaken.

---

1) The model used here is based on the model which was introduced by Tom Kronsjo in his "The Formulation of a Linear Economic Plan for Implementation by the Optimal Combination of Command and Financial Stimulus",ibid.

The first part (on the left hand side) of equation
(1) is considered here to represent the central plan (or the offi-
cial program) worked out on the traditional methods (non-mathemmatical
methods) to meet the requirements of the central economic policy
on a definite level. Further it may be assumed that this official
program is not the optimal one. From this assumption, it will be
worthwhile to give preference to the plan proposed here as against
the official program, providing that the later is dominated by the
former.

This is easily seen from the following. Let the offi-
cial program be X^{offic} and the optimal program will be denoted by
X^{optim}, then we have

$$
\begin{aligned}
X_1^{offic} &\leq X_1^{optim} \\
&\vdots \\
&\vdots \\
&\vdots \\
X_n^{offic} &\leq X_n^{optim}
\end{aligned}
$$

with

$$
X_i^{offic} < X_i^{optim}
$$

is valid for at least one of X_i [1].

This means that in equation (1) it is necessary that
$\sum\limits_{i=1}^{n} b_i y_i$ to be positive

The preference function of any of the (n) units in the
society, due to the interrelations[2] between them, will be "na-
turally" affected by the rest of units activities. Consequently

1) See the definition of the production maximum (ch. I, pp. 12-14)

2) These interrelations will comprise not only the technical
relations, but also the financial relations.

the preference function of i-th producer or consumer (excluding the central authority) is

$$\sum_{j=0}^{n} B_{ij}\ x_i \qquad (i=1,2,\ldots,n) \qquad (2)$$

and B_{ij} is a row vector with elements B_{ijk} $(k=1,2,\ldots,n_j)$.

According to the central Plan every unit in the economy must achieve a certain level of activity [1] (producing or consuming). In fact every unit in the economy will receive what is called "plan figures" by which it is meant a central plan target that is regarded as a variable. There are three types of plan figures set for the producing units and one type for the consuming units:

(i) The center determines the i-th units task of providing a certain quantity of product for domestic requirements within the plan period (for the producing units).

(ii) The center assigns to the i-th unit a certain quantity of the raw materials and means of production (a minimum level).

(iii) The center makes a certain labour force available to the i-th unit to be used during the plan period.

---

[1] This limit may be determined physically, e.g. the production of a certain quantity of the commodity No. i, or even could be set quantitatively and qualitatively at the same time. For consumers it may be limited to a certain amount of commodities and services to be consumed (may be in value as well as in physical term). This will be achieved by determining the level and the structure of the wage fund.

(iv) For the consumers the center will determine the level
and the structure of the wage fund, and the level of
the supply of consumer goods.

As it has been mentioned above the center will also determine
the minimum level of activity for each of the units. Let this limit
(the minimum level of the units preference function) be z_i. Any improve-
ment in the preference function of the units over this limit will be
accepted and will be given the priority by the central authority.
(This corresponds with the welknown "overfulfillment plans" in the
practice of the socialist economies). This improvement will be repre-
sented by a variable y_i in the central preference function. It could
be written as follows:

$$z_i = \sum_{j=0}^{n} B_{ij} x_j - y_i \quad (i=1,2,\ldots,n) \quad\quad (2)$$

The economic activity of all units (including the central plan)
has to fulfill, the material, technological and political constraints

$$\sum_{j=0}^{n} A_j x_j \leq R_j \quad\quad\quad (3)$$

Where the matrix A_o denotes the coefficients of the central
planning authority directed activities including all the command
activities (in fact the matrix A_o will be the central plan). While
the matrix A_j $(j=1,2,\ldots,n)$ denotes the coefficients of that activities
which are carried only by the i-th producer or consumer behaving under
the constraints of the central plan (both financial and command system).

The rest of constraints in the model is that all activities of
the economic units are non-negative

$$x_i \geq 0 \qquad (j=1,2,\dots,n) \qquad (5)$$

$$y_i \geq 0 \qquad (i=1,2,\dots,n) \qquad (6)$$

The problem is then reduced to the general mixed form of a linear programming problem summarized as[1]

$$Bx - y = z$$
$$Ax \geq 0$$
$$x \geq 0, y \geq 0 \qquad (7)$$
$$\underset{x,y}{\text{Max}} \ (Bx + by)$$

with the optimal solutions x^*, y^*

and the dual

$$vB + pA \geq C$$
$$-v \qquad \geq b \qquad (8)$$
$$v \text{ unrestricted, } p \geq 0$$
$$\underset{v,p}{\text{Min}} \ (pz + pR)$$

With the optimal solutions v^*, p^*,

The optimal solutions of the activities x_j^* $(j=1,2,\dots,n)$ would give, using the assumption that the activities to be implemented by directed orders or by financial system could be actually carried on, the optimal combination between order and financial activities of the central plan [2].

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[1] Simonnard M.: "Linear Programming". Transl. by Jewell W.S. Engle-wood   Cliffs, New Jersey, 1966.

[2] This will be discussed in more details later.

2.2.2. The Sector Partitioning

Using the following assumptions about the financial framework of the sector system that:

(i) The jth (j=1,2,...,n) producer or consumer is free in taking his decisions (about investment, production and consumption) within the constraints of the central plan figures[1] or the "physical constraints which has been mentioned before and taking the form

$$C_j \; X_j - Z_j$$

to insure that the activity of the j th unit will reach at least the minimum level determined by the plan that

$$\sum_j a_i x_j \; a$$

which means that the using of production means will not be beyond the available resources assigned by the central plan for the producing units and that

$$\sum_i p_i x_j \leq I$$

which means that the total expenditures of the jth consumer unit will not be more than his income (I) either from wages and/or subsidies.

Then every unit will try to maximize its preference function by using its activity vector x_j (j=1,2,...,n) which contains the elements x_i (l=1,2,...,n)/for the producing units these elements are composed of the production, investment, export and import activities/. This

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[1] To show how the jth unit behave within the constraints of the central plan see Kornaj: "Mathematical Programming of Structural Decisions", Publishing House of Hungarian Academy of Science, Budapest 1967, Ch. 24 & 25 and the Apend. No. H.

may be formulated as follows:

$$B_{jj_i} x_j \longrightarrow \text{Max.} \tag{9}$$

with B_{jj} is a row vector contains the elements B_{ijl}

$(l=1,2,\ldots,n)$.

(ii) The second assumption is that the activity x_j of the jth unit will affect (in positive or negative amounts) the activities of other units by the amount

$$B_{ij} x_j \qquad (i \neq j) \tag{10}$$

(iii) The last assumption is that every producer or consumer is subject to (moreover than the above mentioned constraints) another set of consyraints which will be called the "financial constraints" based on his revenues (evaluated at current prices). A central subsidy (tax) coefficients posed upon his activity (x_j) at the level of the social preference C_j minus the net losses to other units which result from his activity $\sum_{i \neq j} v_i B_{ij}$, a lumb tax (subsidy) g_j, and possible receipts (outlays) from a share (h_j) in the ownership of the total social resources (requirements)[1]. It is possible to put his (the jth) budget constraints in the following form:

$$(C_j - \sum_{i=j}^{n} B_{ij} v_i - A_j p) x_j + p h_j - g_j \geq 0 \tag{11}$$

where

$$\sum_{j=1}^{n} h_j = h \tag{12}$$

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[1] O. Lange: "On the Economic Theory of Socialism", Ibid.

Using these assumptions the jth producer or consumer
$(j=1,2,\ldots,n)$ will try to solve his own linear program problem (the
sector program) (9), (10) and (5). The program is summarized as
follows:

$$
\begin{array}{l}
\underset{x_j, y_j}{\text{Max}} \left[(b_j y_j \right. \\[2mm]
B_{jj} x_j - y_j = z_j - \sum_{i \neq j}^{n} B_{ji} x_i \\[2mm]
(-C_j + \sum_{i \neq j}^{n} B_{ij} v_i + p A_j) x_j \leq u h_j - g_j \\[2mm]
x_j \geq 0 \quad , \quad y_j \geq 0 \qquad \left. \right] =
\end{array}
\tag{13}
$$

the dual problem

$$
\begin{array}{l}
= \underset{v_j, d_j}{\text{Min}} \left[(v_j (z_j - \sum_{i=j}^{n} B_{ji} x_i) + d_j (p h_j - g_j) \right. \\[2mm]
v_j B_{jj} + d_j (-C_j + \sum_{i \neq j}^{n} B_{ij} + p A_j) \geq 0 \\[2mm]
- v_j \geq b_j \\[2mm]
v_j \quad \text{unrestricted,} \quad d_j \geq 0 \qquad \left. \right]
\end{array}
\tag{14}
$$

Assuming that the tax (subsidy) system has been determined
so that the improvement in the level of the preference function of
the jth unit after the determination of the maximum level of its
activity (z_j) may be achieved, the same x_j solution will be obtained
by solving the program problem (13) and the dual problem (14), with
respect to a positive scalar b_j times y_j, where y_j represents the
amount by which the preference function of the jth unit (producer or
consumer) concerned including the terms (constraints) beyond his control

will exceed the minimul level z_j of his activity.

The problem for the central plan will then be to find the price system (p), a lumb tax (subsidy) system (g), and subsidy (tax) factor $(C_j - \sum_{i=j}^{n} v_i B_{ij})$ together with a system of interpersonal or interfirms comparison (v) [1], which will be used with the activities (x_j) and will stimulate the producers and consumers to undertake the activities x_j, y_j (j = 1,2,...,n) which are considered to be the optimal from the view point of the central plan, and could be implemented by using financial incentives.

2.3   The Conditions of the Solvability of the Model

Let us assume that the central linear programming problem (7) and the dual (8) is solvable, i.e, that an optimal program exist, i.e. that

$$x_j^* \neq 0 \qquad (15)$$

It is known that there will also exist an optimal price system such as:

$$p_i^* \neq 0 \qquad (16)$$

This could be proved by using the fundamental theorem of duality which is divided into an existence theorem and a proper dual theorem [2], and by using Minkowski-Farkas Lemma, that "for every

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[1] This system of inter-comparison is belong to the wellknown problem of external economies and diseconomies in the theory of welfare economics, and need not to be developed here.

[2] A. I. Goldman and Tuker: "Theory of Linear Programming" in "Linear Inequalities and Related System", ed. by Kuhn & Tuker, Princeton (New Jersey) 1956, pp. 60-61, and Simonnard: "Linear Programming", op. cit., p. 99.

matrix A and vector z, one and only one of the following statements is true:

    a)   the system of linear equations

$$Ax = z$$

has a non-negative solution $x^* \geq 0$

    b)   the system of linear inequalities

$$pA \geq 0$$
$$pz < 0$$

has a solution p^* [1].

In addition it is necessary to use the Simonnard's corollary that for every matrix (A) and vector (d) one and only one of the following two statements is true:

    a)   the system of linear inequalities (where A_1 has m rows)

$$A_1 x_1 \leq z$$

has a non-negative solution.

    b)   the system of linear inequalities

$$pA_1 \geq 0$$
$$pz < 0$$

has a non-negative solution.

Moreover the maximum value of the preference function of the central planning authority in the primal version and the minimum value of the function of it in the dual version are equal. Their

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[1] For the proofs of the theorems see Simonnard, ibid., p. 378.

common value is the optimum ϕ of the preference function such that

$$\phi = \underset{x}{\text{Max}} \quad C_j x_j = \underset{p}{\text{Min}} \quad pz = Cx^* = p^* z \tag{17}$$

The argument of the central planning program could be used to prove the solvability of the sector program (13), (14).

It is possible after prooving the solvability of the program to conclude the following theorem:

Theorem:

The price, tax and subsidy systems which would insure the implementation of the central plan (optimal x_j, y_j / $j=1,2,\ldots,n$) using the financial system in inducing the producers and consumers to carryout should be:

(i) The price system

$$p = p^* \tag{18}$$

Special attention should be taken of the method of working-out the computational "optimal price" system and to the use of these optimal prices within the framework of the model described above. It should not be proper to overestimate the importance and significance of such a system of optimal prices. At the same time it should be emphasized that the significance of these prices depends in a great degree on the structure of the model and on ~~the structure of the model and on~~ the structure of the preference function of the central planning authority. In any model even if it reflects correctly the realistic and objective bounds of the economic system, optimal prices will be affected by other factors. To mention only

some of these factors such as the subjective character of setting the elements of the preference function which will deprive the optimal prices from their "objective" character[1]. Moreover the quantification of the economic policy targets, some arbitrariness and simplification of mutual relationships will be inevitable. The model will tend to disregard some economic phenomena and to simplify others. All these factors will necessitate to treat the optimal prices with due reservation both from the theoretical viewpoint, as regard to their role and character, and from the practical viewpoint as regard to their use in decision making.

E.G. the fact that some of the optimal prices of the dual programming problem may be equal to zero (those prices of the terms which their available quantities exceed the demand for them), must mean that the condition in the program has no effect on the solution and the therefore a minor changes in the limit would not influence the result. But it is faulty to interprete this result (that some prices will be equal to zero) in the way that in practice the price will be zero[2].

In general the optimal prices could be interpreted in four different methods, every one corresponds to a general theory of prices. They are:

---

[1] Optimal prices are called by kantrowicz the "objectively determined evaluations". See Kantrowicz: "The best Use of Economic Resources", Pergamon Press, London 1965, p. 70

[2] This interpretation of the optimal prices has a bad influence on the choice of techniques in developing countries with surplus labour, and played a significance role in the discussion about the optimum techniques in both developed and underdeveloped countries.

1. The Marginal Case

   Optimal prices may be interpreted within the framework of the marginal theory where the price of any commodity is equal to the marginal rate of its utility (or productivity in the case of the means of production)[1].

2. The Linear Case

   Where optimal price of any commodity (or factor) is the sum of the input coefficients of necessary commodities inputs plus inputs of the labour (represented by wage units).

3. The Labour Value Theory

   Where optimal prices equales to:

$$c + v + v\,\frac{M}{V} \; ; \; \text{or} \quad c + v + M\,\frac{w}{W} \; ; \; c + v + M\,\frac{c + v}{C + V}$$

Where:

   c — expenditures for the means of production,

   v — wages

   M — total surplus product,

   V — total wage fund,

   w — value of fixed and variable means
       of production in a given firm,

   W — total value of fixed and variable means of
       production in society.

---

[1] P. Samuelson: "Foundations of Economic Analysis". This trend of thought has its advocats in socialist countries. The trend is based on the notion of marginal costs as a basis of price determination. See e.g. W. Brus: "Ogólne problemy..," op. cit., ch. IV.

4. The Modified Labour Value Theory

where the price is to be based on the labour theory of
value modified in such a way that the classical theory
of labour is to be a special case from a general theory
based on some marginalistic trend.

The detailed study of these theories is beyond the
range of the present study. However, it is worthy to
mention that the optimal prices gained from the solution
of the given model do not belong to any of these theories
in a specified form. They could be interpreted in one
theory or another and could be modified to be compatible
with the desined theoretical form which will not affect
the solution of the model [1].

(ii) The second system of indices which the central plan has
to find is the subsidy (tax) system which is comprised
from the factors $(C_j - \sum_{i=j}^{n} v_i B_{ij})$, which are to be

imposed on the activity levels x_j based on the interper-
sonal (interfirms) comparison factors

$$v = v^{*} \tag{19}$$

(iii) And Lastly a lumb tax (subsidy system)

$$g_j = (C_j - \sum_{i=j}^{n} v_i^{*} B_{ij} - p^{*} A_j) x_j^{*} + p^{*} h_j$$

$$(j=1,2,..,n) \quad (20)$$

---

[1] Since the author is not in agree with the marginal trend in poli-
tical economy the second and the third version of optimal price
interpretation may be commented. Moreover, they be recommended
also from the practical viewpoint and the experience of the
socialist economies.

Which will lead to net givernment income after the deduction
for outlays for subsidies to the activities x_j^* equales to

$$= \sum_{j=1}^{n} (g_j - (C_j - \sum_{j \neq i}^{n} v_i^* B_{ij}) x_j^* \qquad (21)$$

And by using the complementary slackness theorem[1], the net
government equals to

$$= p^* (A_o x_i^* - h_o) \qquad (22)$$

The argument above concerning the interpretation of optimal
prices system is valid to the points (ii) and (iii).

Let it be assumed that

$$x_j = x_j^* \quad \text{and} \quad y_j = y_j^*$$

are feasible solution (program) to the primal and dual
problem of optimization at the unit level (13), (14) of
the jth unit (producer or consumer). This assumption is
a result of (7) / the primal problem at the central level
from which it follows using the fundamental theorem of
duality[2] that:

$$B_{ij} x_j^* - y_j^* = z_j - \sum_{i \neq j}^{n} B_{ji} x_i^* \qquad (23)$$

and from (13), (19), (20) and (21) and the duality theorem
it follows that

$$(-C_j + \sum_{i \neq j}^{n} v_j^* B_{ij} + p^* A_j) x_j^*$$

$$P^* h_i - (C_j - \sum_{i=j}^{n} v_i^* B_{ij} - P^* A_j) x_i^* - P^* h_j \qquad (24)$$

---

[1] Simonnard M.: "Linear Programming", pp. 100-101.

[2] Simonnard M.: op. cit., p. 96.

From (7)

$$\text{and} \quad x_j^{\#} \geq 0 \quad , \quad y_j^{*} \geq 0 \tag{25}$$

it follows

$$\lambda_i \, y_j^{\#} \leq \text{Max} \quad \lambda_j \, y_j \tag{26}$$

This result states that the value of the preference function of a feasible solution is less than or equal to the optimal value of the preference function, which at the same time (from the duality theorem) provides it as a lower bound for the minimization of the dual problem (14) of the jth unit.

The values $v = v^{\#}$ and $\lambda_j = 1$ are feasible solution to the optimization problem (14) of the jth unit. This is a result of the following arguments.

Using the strong theorem of complementary slackness [1], and its corollary and supply them to the primal and dual problems (7) and (8), the following formula could be written

$$x_j^{\#} \geq 0 \rightarrow \sum_{i=1}^{n} v_i^{\#} \, B_{ij} + p^{\#} A_j = C_j \tag{27}$$

$$x_j^{\#} = 0 \rightarrow \sum_{i=1}^{n} v_i^{\#} \, B_{ij} + p^{\#} A_j \geq C_j \tag{28}$$

and

$$y_j^{\#} \geq 0 \rightarrow - v_j^{\#} = \lambda_j \tag{29}$$

$$y_j^{\#} = 0 \rightarrow - v_j^{\#} \geq \lambda_j \tag{30}$$

---

[1] Simonnard: "Linear Programming", p. 100.

but from (7) it follows that

$$\sum_{i=0}^{n} B_{ji} x_i^* - z_j = y_j^*$$ (31)

In the case where the above conditions are fulfilled, it follows that the constraints of the minimization problem (14) must be satisfied by the given values of v_j and d_j under these given conditions.

The corresponding value of the dual preference function at the central level will be inserting (20):/

$$= (v_j^* z_j - \sum_{i \neq j}^{n} v_j^* B_{ji} x_i^* + p^* h_j) - (C_j \sum_{i=j}^{n} v_i^* B_{ij} - p^* A_j) x_j^* - p^* h_j$$ (32)

But using (27) it follows that

$$C_j - \sum_{i=1}^{n} v_i^* B_{ij} - p^* A_j) x_j^* = 0$$ (33)

then the x_j^* must therefore equal to

$$-v_j^* B_{jj} x_j^*$$ (34)

and (32) will be equal to

$$= v_j^* z_j - \sum_{i=0}^{n} v_i^* B_{ji} x_i^*$$ (35)

and by using (31) equals to

$$= -v_j^* y_j^*$$ (36)

it is obvious that if $y_j^* > 0$, then by using (29) it follows
that

$$v_j^* = - \lambda_j$$

and if

$$v_j^* = 0 \qquad (37)$$

then the value of v_j^* is irrelevant to the solution and therefore
could be arbitrary given the value $- \lambda_j$ and consequently (36) is

$$= \lambda_j \; x_j^* \qquad (38)$$

Then it follows that $\lambda_j y_j^*$ (using the fundamental theorem
of duality) provides and upper limit for the maximization of the
primal problem of the central plan (1).

Then using the optimality vondition (17) that when the lower
limit is equal to the upper limit then the program is an optimal one.

2.4. The Interpretation of the Model of the Optimal Formula

The model which has been discussed above in order to solve the
problem of the degree of centralization and decision making in socia-
list economy, is not completely a new model. The mathematical idea
of the model has been discussed in great details [1], and the investi-
gations of the proof of the existence of a solution for the model has

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[1] W.J. Baumol, and T. Fabian: "Decomposition, Pricing for Decentraliza-
tion and External Economies", Management Science 11 (1964), pp. 1-32;
Dantzing & P. Wolfe: "The Decomposition Algorithm for Linear Pro-
grams", Econometrica, 29(1961), pp. 767-778; Gale David: "The Theory
of Linear Economic Models", New York, McGraw and Hill 1960; Karlin
Samuel: "Mathematical Methods and Theory in Games, Programming and
Economics", Vol. I, Addison 1959; Kornaj & Liptak: "Two-levels
Model of Planning", Econometrica (33), 1965 and Moeseke Paul & Guy
de Ghellenck: "Decentralization in Separable Programming", Econometrica
37, 1968, pp. 73-78.

reached the point that there is no any doubt about the solvability of the model. Nor the economical basis of the model are new. A similar model of planning has been discussed by Kornaj ad Liptak "Two Level Planning", and Kornaj "Mathematical Planning of Structural Decisions". The aim of these mathematical and economical analysis is to prove that the decentralized optimization may achieve the same optimal solution as that of the model of the central plan (see for example, Kantrowitch:" The Best Use of Economic Resources" and Appendix A, and Porwit:" Central Planning; Evaluations of the Variables", ch. 2, who concentrated only their analysis of the problem of optimizing the central plan).

It seems that the notion of "decentralized optimization" needs some explanations. It must be understood that this notion does not mean that every unit in the economy is "completely" free in taking its decisions. In the model discussed above, it was explicitly assumed that "under the constraints" of the central plan the jth unit will try to maximize its preference function. The processes of planning may be given as follows. The central authority begins by constructing[1] the central plan which will be optimum. Then it gives instructions (financial as well as orders, i.e. parameter and non-parameter indices of the central plan) to the different units in the economy. And then begins the second phase of planning, every unit in the economy will try to choose its level of activity, as well as the structure of this activity, which will lead to the maximum point of its preference

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[1]

   The construction of the central plan is based, of course, on the informations which has to be gathered from below.

function. According to the principle of cintinuity of planning process the central authority will change, if necessary, the indices of the central plan according to the new informations about the behaviour of the different units, and may, or may not, give a new set of indices compatible with the new set of informations.

In doing this the central authority has the possibility to choose between the orders or financial parameters.

Now, the question about the relation between the model of the optimal formula and the direct system of economic calculation may be answered . It should be mentioned that the above analysis was taking in the framework of the DEC system. Its aim was to improve, as possible, this system. The improvement of the DEC system depends, to a great extent, on developing and using the notion of "operational prices" functioning within the price-accounting methods – incentives formula, which will lead to the great effectiveness of the economy (the maximum program of activities)[1].

Replacing the notion of "prices" by the notion of "parameters" which may include, beside prices, the system of subsidy (tax) and the system of lumb tax (subsidy), and the notion of the "method of accounting" by the notion "non-parameters", in the strictly centralized model the parameter part of the formula is generally constant, where the different units of the economy are directed solely by means of the non-parametric part of the formula. And conversly, in the strictly decentralized model the non-parametric part is considered constant, where the apparatuses

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[1]
See Ch. I, section 1,5, p. 32 and J. Zielinski": Rachunek ekonomiczny ...", pp. 153-57.

which implement the plan are directed only by means of parameters. In the model discussed above (the model of the optimal formula) both parts of the formula are considered variables.

In fact, in both the strictly centralized and decentralized models, the formula has only two variable parts. In case of the former model the non-parametric and incentives (based on recognition), and in case of the second model, the parametric and incentives (synthetics) are considered variables. In case of the optimal formula model, the formula retained its three parts as variables.

From the above discussion the following results, which are to be stressed in order to avoid any misunderstaning, that the research in the direction of the development of the DEC system and the development towards decentralization are not connected functionally. The development in the DEC system is a necessary condition for improving both of plan construction (the attaining of the internal consistency as well as the optimality of the central plan) and of the means of its implementation (the optimal structure of the management formula). But it is not neither necessary nor sufficient for decentralization. The both are two different categories that it is not logically to include one into the other. The condition for decentralization are generally social conditions which has no effect, in a direct way, on the degree of the optimality of the economy. It must be stated that decentralization does not imply an improvement in the degree of the optimality it may affect it; and the identification of decentralization with optimality is fautil idea which has dangereous consequences.

In reality, neither the strictly centralized nor the strictly decentralized models can be found anywhere. The socialist economy is not (and perhaps was not) completely centralized economy. Factually

economic decisions are taking place on more than "one level". Consequently, reality will be more adequantely represented by a model where exists more than one level of decision making. This may be "two level" model of the type of Kornaj's model, or even a "multi-level" model, which has not been investigated and studies till now[1].

1)

This type of models was proposed as a future possibility of mathematical planning by Kornaj. See Kornaj: Ibid.,