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Notes on the Relationship Between Political Economy of Socialism and Mathematics

Owing to its particular ability to disclose a great variety of interdependencies and of bestowing logical consistency on judgements, the mathematical and cybernetic apparatus is prescribed as an essential tool also for investigations in the field of political economy.

There is a widespread opinion according to which economic sciences are at present undergoing a powerful process of reorganization, of mutual penetration and enrichment. It is equally obvious for marxist economists that this process is also more conspicuously emphasizing the role of political economy, whose mission is to discover the meaning of the major economic phenomena, to ascertain the objective laws governing them, to describe — by means of an adequate system of categories — the contents, the typical forms of expression and the implications of production relations.

The ever increasing importance of this science is even more obvious in socialism, owing to the new relationsh ips created between the economic and political aspects, as well as due to the need of a conscious organization and management of economic activities, of tackling each sequence or separate aspect of economic development on the background of the demands and attributes characterizing its general mechanism. Under the new social system, the feedback needs an extensive investigation, not so much in order to disclose the factors giving rise to existing phenomena as especially in view of the prospective estimation of interconnected outcomes of the changes taking place in economy, thus securing a stronger foundation for the economic decisions. Even the name of the science rouses a new and down-reaching echo, as political economy is invested with the significant social function of contributing to the theoretical substantiation of the courses chosen for building up an efficient socialist economy.

THE QUALITATIVE AND QUANTITATIVE UNITY OF ECONOMIC PROCESSES

However, in confronting the level of theoretical research on socialist economy with the present and long-range problems raised by socio-economic construction, with the methodologic requirements of special and branch economic sciences, with the tremendous amount of information stored by these sciences, a certain gap is evidenced: it is the consequence of a number of causes, among which two main causes deserve to be pointed out. In the first place, we cannot overlook the circumstance that, for various reasons, the theoretic studies on socialist economy were prevailingly expository and much less predictive and active in character before now. Secondly, the methods used — mainly descriptive — did not allow the tackling of economic processes as a whole, including their manysided interaction; in this particular instance, the fact that political economy of socialism was not able to take full advantage of the facilities offered by mathematical methods and by the investigation fundamentals developed by cybernetics, also played an important part. Unfortunately, the effects of the tribute paid for the opinions artificially dissociating the qualitative from the quantitative analyses of economic phenomena, are still felt, the natural contact between political economy of socialism and mathematics being thus delayed and becoming more difficult to be achieved; actually, as is now generally recognized, neither is mathematics exclusively a science of quantities, nor is political economy only a science of qualities.

Economic relations cannot be conceived as bare social forms; they are created in the framework of production, distribution, circulation and utilization of use values, and are necessarily conspicuous through prominent quantitative features that cannot be neglected in theoretical research. These features result, first of all, from the indestructible unity of production relations and productive forces, from the considerable and, as a matter of fact, increasingly important role played by technical and economic relationships in the process of reproduction; it is clear, for instance, that the exchange of activities in society cannot be interpreted — particularly in the socialist economy, which is a planned economy — beyond the limits of the system of proportions securing the general economic balance.

There is still another reason for the high significance bestowed on the quantitative aspects in the investigation of socio-economic relations. Indeed, in order to reflect as accurately as possible the economic reality, economic categories and laws must be examined and considered in the context of their close interdependency. When some phenomenon is taken separately and considered as a unique entity, its qualitative features and its descriptive attributes are — as would be expected — asserted; however, as soon as as a correlation with other economic phenomena is made, in other words, if it is related to the entire economic apparatus, it is unavoidable for the quantitative problems to stand out. It goes without saying that in this context we do not mean the purely numerical aspects, but those having validity as a law and which cannot be precluded from the object of political economy. The truth according to which any process is more or less accurately defined with respect to other processes, this fact increasingly emphasizing its qualitative and quantitative unity, is entirely applicable to the economic field as well.

Any attempt to acknowledge at present the concept of the unadaptability of the analytical and conceptual apparatus of mathematics and cybernetics to research in political economy, could only rouse wonder, as this apparatus is an essential growth factor for the "productivity" of theoretic investigations. Even the high level processing of economic data, by means of mathematical methods and the modern computation technique, exhibits an undeniable scientific interest, as being able to more accurately point out economic regularities in a more synthetic form. The correlation analysis, capable of pointing out not only the type of economic connections, but their degree of stability as well, makes available for research a material of inestimable value for practice generalization, for the detection of new trends or of trends already under way.

The mathematical apparatus could at the same time have a high efficiency for the rigorous and more thorough formulation of concepts and conclusions already developed, as well as in the statement of working assumptions for the exploration itself of new regions of reality. This apparatus greatly facilitates the efforts of checking the agreement of new assumptions with the entire set of theses previously demonstrated.

Moreover, the hypothesis-model makes possible the achievement of theoretical "experiments", through the successive modification of its parameters, according to the scientific goal aimed at. Owing to their particular ability of disclosing a great variety of interdependencies and of bestowing logical consistency on judgements, the mathematical and cybernetic resources are prescribed as essential tools, also for investigations in the field of political economy.

We must, nevertheless, permanently keep in mind the well-known Latin maxim "est modus in rebus", by constantly taking into account the peculiarities of economic laws, especially 1) their social, historical and tendency character, as well as 2) the fact that they reflect contradictory processes. The first of these peculiarities does not deny, as a rule, the applicability of mathematical methods to political economy, it being only a limiting factor in this respect; indeed, the qualitative correlations derived on the basis of certain economic laws have to be considered in terms of their historical effect and with a relativity degree dictated by the specific character of this effect. As to the second peculiarity, a self-evident observation is that the mathematical apparatus is not capable of expressing any kind of contradictions of the economic developmet. A broad range of diversified possibilities is available, in turn, for the analytical and conceptual apparatus of cybernetics, in order to convey and to detect the contradictions of complex systems, including the economic ones.

It is absolutely necessary to secure a one-to-one correspondence between the configuration of mathematical-economic models and the structure of the theory on socialist economy. It would be entirely mistaken to admit that in order to "translate" political economy of socialism in a mathematical language it is enough to resort to the existing mathematical models, no matter what their theoretical premises are. The application of mathematical and cybernetic methods to the theoretical suverys on socialist economy can be efficient only through models designed to accurately convey the peculiarities of this economic system and its qualitative features.

THE UTILIZATION OF THE MATHEMATICAL APPARATUS IN SOME OF THE MAIN LINES OF ECONOMIC RESEARCH

A. A first chief line of scientific research, where the mathematical apparatus can prove to be particularly useful is given by the close interdependency of economic phenomena and economic departments, thus securing and even prescribing the description of a part, or of the whole set of its relationships, as systems of interdependent functions.

The following question rises frequently: is it or not true that the subject matter of political economy also includes functional relationships? These relationships are not to be confused with the causality relationships, as they also express some other peculiarities of the economic mechanism, such as: interconditioning, structural relationships, simultaneous variation relationships under the impact of common determining factors, etc.; the reversibility between function and argument may even lead to a blurring of the true causal connections of economic life. The fact that functional analysis is not in itself ensuring its scientific conclusiveness is convincingly illustrated by the progress of that trend of econometrics which overbids this analysis, thus completely or nearly completely giving up socio-economic analysis. It would, however, be harmful for political economy, if the two types of analyses — functional and socio-economic — were absolutely opposed; functional analysis is fully effective only if based on the elucidation of causal factors, while causal analysis grows and is enriched, coming ever nearer to economic reality, in its entire complexity, through the performance of laborious functional analyses. Political economy is certainly not studying the whole set of functional relationships prevailing in the economic field, but first and foremost those referring to social reproduction and reflecting interaction of economic laws and categories, as well as the trends having general strength within the given system of production relations.

The considerable advantage exhibited by a representation of economic connections as a system of interdependent functions lies in the possibility generated in this way of detecting imperceptible or only vaguely perceived connections. Through the instrumentality of such a system, the limits and the contents of the disseminated economic effect could be more precisely defined, the latter reflecting the multiplicative role of the functional relationships in spreading the influence exerted by some variable economic parameters.

The exploration of the correlation between the disseminated effect and the initial change of the factor determining it enables the development of some valuable concepts on the strength of connections prevailing in economy. We must already emphasize some praiseworthy scientific results. The studies regarding the economic substratum of the inverse matrix of coefficients of the interbranch balance have induced a sensible progress in the investigations referring to the disseminated effect of interbranch or inter-zone exchanges.

The cybernetic properties of this balance have proved to be particularly valuable also in the theoretical research on currency, specifically in the study of the correspondance between the disseminated effect of monetary flows and the rate of monetary rotation. They are equally to be applied to the study of the national income redistribution coefficient, as a synthetic ratio of the aggregate incomes, no matter the range of their origin, to the quota of

the newly created value. We could also mention some other attempts made in order to estimate the disseminated effect on a scale commensurate with its generating source, but even if the list of relevant examples were to be extended, the chief inference would remain unchanged, namely: the problem of the strength of economic connections, viewed under their numerous and manifold expressions is not completely solved, although it has extensive implications, highly interesting from the scientific viewpoint. However, the solution to this problem could be simplified and facilitated through the representation of certain economic areas, or of economy as a whole, in systems of equations and inequalities.

B. The expression of economic phenomena as functions of one or several variables, allows the development of a dynamic economic research, through turning to account the analytic characteristics of differentials and integrals. The dynamic consideration of economic processes is relevant for reproduction correlations, as well as for the separate economic categories.

Thus, by considering the consumption fund as an integral defined with respect to the progress of the accumulation fund changes, the limited and relative meaning of the assertion on their inverse proportionality, derived from the statistical analysis of these funds, stands out. Viewed at the limit, that is during an infinitesimal time increment, the gross social product (i.e. the total amount of primary, intermediary and finished use values), on the one hand, and the finished social product (i.e. the total amount of finished use values), on the other, are apt to be mutually confused, while if interpreted as definite integrals, they are qualitatively and quantitatively well delimited. Partial derivatives are particularly useful in emphasizing the influence of determining factors on resulting economic phenomena and processes. In this context we must mention the brilliant investigation made by Marx on the possible changes profit rate might undergo, the whole survey being largely developed on pure mathematical bases and constituting an application of partial derivatives to the examination of an economic phenomenon. Since the resulting processes in the specific case of the socialist economy must be rationally directed, as to their rhythmicity as well as their direction, a special importance is bestowed on the study of their variation and on their factorial decomposition. The means made available by mathematical analysis are extremely valuable also for emphasizing the organic connection between structural and dynamic parameters of economy, without which the design of the complex models of reproduction would be inconceivable.

C. By considering economic development in terms of optimal programming, the results obtained are particularly fruitful for the progress of political economy of socialism. To be sure, the need of determining optimal solutions rises in a great number of practical activity areas; it appears, however, also at the level of political economy, in the form of the macroeconomic optimum. In this case, theoretical research is requested to scientifically substantiate the function-objective, as well as the restrictive circumstances in which the extremum problem is raised. The optimizing criterion of national economy development will, undoubtedly, be explained in terms of the immediate purpose of socialist production , that is the uninterrupted growth of the living standard of society, but its quantitative formulation is by no means simple and still causes many debates. Nor are the restrictive circumstances easily established,

as among them are occuring not only the given economic resources, with the role of extreme limit for the economic activity as a whole, but also several requirements related to the specific character of the new social relationships, to the development stage of each individual country, to its position and outlooks as to the international division of labour, a.s.f.; hence, socialist economy optimum is preeminently a quantitative and qualitative problem, a political and economic problem.

The paramount significance of examining economy in terms of optimal programming has found an impressive corroboration in the specification of some concepts and in the crystallization of some other ones. The concept of "cost of feedback" could thus be defined, precisely by first considering the optimum problem on the background of the limited character of some economic factors and of the mutual dependency of national economy links; moreover, it is worth mentioning that the delimitation of the following categories: absolute partial optimum and relative partial optimum, is necessary in order to make a discrimination — at the level of a given sector of economic activity — between the maximum potential efficiency and the efficiency corresponding to the most favourable distribution of resources, from the general social point of view. More complex examples could also be quoted, such as "the objectively determined estimations", which still give rise to lively theoretical controversies.

As a result of the need of securing the economic optimum, economic activity planning and development represent a sequence of problems, among which we may cite some, such as: the rational utilization of material and labour potentialities; their assignment among the various existing objectives aimed at; the correlation to be established between accumulation and consumption; the synchronization of production flows, a.s.f. A paramount importance is obviously conferred upon a clear, accurate and non-contradictory formulation of terms, parameters, and statement of these problems, which cannot possibly be achieved without previously performing a thorough quantitative analysis, sensibly facilitated through the application of the mathematical apparatus; at the same time, the algorithm used in solving these problems must be designed with particular care.

The algorithm determined through the theoretical analysis of economic problems may be called theoretical algorithm; it is obtained by inference and assumes political economy to become highly axiomatic. The same problems, however, in more or less direct forms, are raised and solved in the course of the economic activity, on the basis of an algorithm framed in practical experience, i.e. a practical algorithm. The comparison of both sorts of algorithms is a prerequisite for the manysided interpretation of actual facts, thus being possible to avoid empiric descriptiveness, as well as abstract formalism in economic research.

D. A special scientific and practical interest is undoubtedly exibited by socialist reproduction correlations, as conceived on the background of the optimization of the whole economic development. However, political economy cannot be limited only to the examination of these correlations, as it is designed to study the operating mechanism of socialist economy, through which and within which reproduction correlations are achieved or tend to come into

being. Several essential aspects are characteristic of this mechanism, namely: (*a*) vertical relationships, acting on the hierarchical scale of organization and economy management; (*b*) horizontal connections, established among economic units in the absence of mutual subordination relations; (*c*) the whole set of factors providing for the achievement of objectives related to economic optimal development, such as directive tasks, material incentives, etc.; and (*d*) the mode and form of adjusting production and circulation according to changes taking place in the field of economic resources and demands.

A great number of peculiar aspects of the constituents of the economic mechanism, have on the whole been cleared up. Thus, extensive, theoretical debates took place, finally resulting in actual profits for the economic science, on topics such as socialist planning, democratic centralism in economy, the value character of activities exchange, proper economic administration, socialist allocation, a.s.f. Economic theory has, however, been blamed for the insufficiently thorough study of the mechanism determining the operation of socialist economy; the blames are fully justified, as this mechanism has been only very roughly and fragmentally considered, as a sum of dissociate elements and aspects and only too little has already been achieved in order to tackle it as a unitary and coherent system.

The subject matter emerging at the intersection of these elements and aspects is as difficult as it is important for the elucidation of some basic questions of the economic theory on socialism. The sole way for its fruitful research is undoubtedly the detailed study of practical experience. The attempt to derive the optimal operating mechanism of socialist economy straightforwardly and exclusively based on its most generalized features, i.e. on the basis of its "postulates", cannot be but unfruitful, no matter how sophisticated and excellent the theoretical contrivances and the mathematical models resorted to, may be.

On the other hand, we must also mention that political economy of socialism would be seriously damaged if we would overlook the particular usefulness, for this science as well, of modern concepts on the operation of complex systems. A number of recent investigations, including several studies performed under the sponsorship of the Centre of Economic Computation and Economic Cybernetics — Bucharest, pointed out the prominent cognitive functions performed by cybernetic principles in the analysis of economic processes, in stressing the numerous interference points existing among them. The tackling of these aspects of economy operating mechanism in the context of their close inner connection is already foretold as liable to be a promising investigation path for the specification of some economic categories, and even for a more detailed and accurate reflection of the features characterizing this mechanism.

A survey of theoretical research carried out lately reveals that the poor utilization of mathematical methods in political economy results not so much from the fact that this science deals only with the study of qualitative aspects of economic processes, as especially from the insufficient development of qualitative analysis itself. We mention, for illustration purposes, that such an important problem, having numerous theoretical and practical implications, as the ascertainment of the labour costs, cannot yet be fully solved, precisely because of the lack of a rigorously substantiated criterion for the reduction to

the same denominator of works with varying degrees of complexity. In other words, a broader use of the mathematical apparatus does not only mean a "quantification" of the qualitative investigations conducted up to the present, but also prescribes a much more extensive development of these investigations.

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CONSIDERATIONS SUR LE RAPPORT ENTRE L'ECONOMIE POLITIQUE DU SOCIALISME ET LES MATHEMATIQUES

L'auteur part de la constatation que les sciences économiques connaissent à l'heure actuelle un processus intense de réorganisation et de diversification, d'interpénétration et de fertilisation réciproque.

Les relations économiques ne peuvent pas être conçues en tant que simples formes sociales puisqu'elles prennent corps dans le cadre de la production, de la répartition, de la circulation et de l'utilisation des produits, étant nécessairement définies par des traits quantitatifs importants. Un exemple est donné, à savoir, que les échanges d'activité dans la société ne peuvent pas être interprétés — surtout dans l'économie socialiste — en dehors du système des proportions qui assure l'équilibre économique dans son ensemble.

L'appareil mathématique et cybernétique s'avère être aussi un instrument indispensable dans les recherches économiques en raison de sa capacité d'imprimer au raisonnement une conséquence logique.

D'autre part, l'interprétation du développement économique dans les termes de la programmation optimum se révèle être particulièrement fructueuse pour l'économie politique, vu que l'optimum est une question quantitative et qualitative par excellence.

НЕКОТОРЫЕ ЗАМЕЧАНИЯ О СООТНОШЕНИИ МЕЖДУ ПОЛИТИЧЕСКОЙ ЭКОНОМИЕЙ СОЦИАЛИЗМА И МАТЕМАТИКОЙ

Автор исходит из того, что в настоящее время экономические науки переживают интенсивный процесс перестройки и диверсификации, процесс взаимного обогащения и проникновения. В этом смысле, экономические отношения не могут быть представлены голыми социальными формами, потому что они складываются в рамках производства, распределения, обращения и потребления потребительных стоимостей, неизбежно отличаясь важными качественными характеристиками. В качестве примера приводится тот факт, что обмен деятельностью в обществе не может быть объяснен, особенно в социалистической экономике, вне системы пропорций, которые обеспечивают общее экономическое равновесие.

Кибернетический и математический аппарат становится незаменимым инструментом и в исследованиях в области экономических наук, благодаря его способности придавать рассуждениям логическую последовательность. Объяснение экономического развития в терминах оптимального программирования оказывается особенно плодотворным для прогесса политической экономии, исходя из того, что оптимальность является исключительно проблемой количества и качества.