



Review: [Untitled]

Reviewed Work(s):

The Use of Mathematics in Economics by V. S. Nemchinov
Roy Radner

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Statistical Methods; Econometrics; Social Accounting

The Use of Mathematics in Economics. Edited by V. S. NEMCHINOV; English edition edited and with an introduction by A. NOVE. Cambridge: M.I.T. Press, 1964. Pp. xxi, 377. \$12.50.

The reader of an expository book may hope to get (1) some understanding of the subject matter, (2) an idea of the range of topics encompassed by the field in question, and/or (3) some insight into the history of the subject, and (indirectly) about the characteristics of the readers for whom the book was intended. In the opinion of this reviewer, Western readers of *The Use of Mathematics in Economics* will find it most interesting from the last point of view.

This collection of six papers by V. S. Nemchinov, V. V. Novozhilov, O. Lange, L. V. Kantorovich, and A. L. Lurle was published in the Soviet Union in 1959; the English edition, with an Introduction by A. Nove, appeared in 1964 (Oliver and Boyd, and the M.I.T. Press). The editor, Nemchinov, has also provided a Preface and a "Postscript," and there is a short annotated bibliography of linear programming and related topics (from both the Russian and non-Russian literature) prepared by A. A. Korbut. This book and Kantorovich's *The Best Use of Economic Resources*¹ were the first major books on mathematical economics to be published in the U.S.S.R. since Stalin's death.

The six papers in this collection are almost entirely devoted to an exposition of the ideas of linear programming and input-output analysis, and their applications to economic planning at the enterprise and national levels. Nemchinov's paper, "The Use of Mathematical Methods in Economics," provides some historical remarks, together with a short introduction to the ideas of input-output analysis and linear programming, including some algebraic and numerical illustrations. In Nemchinov's presentation, topics appear to develop naturally from the ideas of Marx and Lenin.

The contribution of Novozhilov, "Cost-Benefit Comparisons in a Socialist Economy," is almost a little book in itself (158 pages). It may be viewed as a long and careful exposition, for nonmathematical readers, of the essential ideas of linear activity analysis, including model formulation, optimization, and (especially) the significance of shadow prices. These ideas are introduced and elaborated in the context of a series of examples, of increasing complexity, of problems of choosing an efficient program of production and investment to achieve given output targets. It is significant that there is practically no discussion of the measurement of "benefits"; the typical problem considered is one of minimizing the cost of achieving given objectives. (In this respect Novozhilov's contribution reminds one of so-called cost-benefit analysis of military programs in this country.)² Although Novozhilov's paper is organized

¹L. V. Kantorovich, *The Best Use of Economic Resources*, Cambridge, Mass., 1965 (English ed.). See the review by R. Dorfman, this journal, June 1966, 56, 592-97.

²Professor Gregory Grossman has pointed out to me that the translation of the title of Novozhilov's paper as given in the English edition is not really correct; a better translation would be: "The measurement of costs and their effects in a socialist economy." The

around the activity analysis framework, I have no doubt that in addition to introducing his readers to these analytical concepts and methods, he has also provided them with a valuable discussion of the problems of economic planning and management in a socialist economy.

The two contributions of Kantorovich, "Mathematical Methods of Production Planning and Organization" and "Further Development of Mathematical Methods and the Prospects of Their Application in Economic Planning," carry further the exposition of linear programming and its application to economic planning at the enterprise and national levels. The first paper is a reproduction, with minor changes, of the book by Kantorovich published in 1939, in which he introduced a number of the essential ideas of linear programming. The second paper is a continuation in which he reports on various developments by himself and his collaborators since that time. Both papers are more technical than the one by Novozhilov; still, the mathematics is elementary (except for a proof in one of the appendices), and the exposition is addressed to the general reader rather than to the expert in the field.

Lange's paper, "Some Observations on Input-Output Analysis," is a concise (34 pages) treatment of the formulation and elementary theory of input-output relationships. Starting from a "two-sector" linear model interpreting Marx's discussion of "simple" and "expanded" reproduction, he moves to a general multisector formulation, including a description of investment and its effect on growth.

The final paper, "Methods of Establishing the Shortest Running Distances for Freights on Setting up Transportation Systems," by A. L. Lurle, enters into considerable detail on a number of computational methods, and would be of less interest to the general reader than the rest of the book. Its inclusion in this volume is consistent with my own information that, at least until recently, serious practical applications of linear programming in the Soviet Union (if indeed there are any) have been primarily in the field of transportation and location.

In attempting to assess the significance of the book as a whole, I shall refer to the three points mentioned at the beginning of this review. Regarding effectiveness of exposition of the subject matter presented, the contributions must be of great value to Soviet readers. Although the styles of the three main contributors, Novozhilov, Lange, and Kantorovich, are quite different, each has considerable merit. However, the repeated references to Soviet institutions, problems, and economic thought—indeed the whole context of the exposition—will probably hinder rather than help Western readers, and any of the latter who wish merely to learn something about linear programming and its applications to economic analysis will find any number of Western books on the subject more efficient for this purpose. Nor will Western experts find much new from the technical point of view.

word "measurement" emphasizes Novozhilov's point that the costs of different (scarce) physical inputs can be measured in common units by using their shadow prices derived from the solution of the linear program, something that his more orthodox opponents denied as applying to all inputs.

As a survey of the uses of mathematics in economics the book points up two rather serious weaknesses in the Soviet habits of thinking about "economics." First, there is a notable lack of systematic study of the behavior of economic agents: consumers, producers, planners, etc. Thus it is not surprising that this volume presents us with no examples of mathematical economics comparable to the various theories of demand, production, investment behavior, general equilibrium, etc. with which we are familiar. One may wonder whether the very atmosphere of a "command economy" is antithetical to the objective study of economic behavior. In any case, Soviet economics is largely normative, rather than positive, and Soviet mathematical economics is essentially what we would call "management science." Curiously, the present volume shows only a part of what the Soviets themselves have done in the area of management science (or operations research); for example, it gives no hint of their considerable work in the theory of equipment reliability and maintenance, "mass servicing" (queueing or waiting lines), and computer simulation of industrial processes.³

Finally, as would be expected, there has been further work in the Soviet Union since 1959 on the topics treated in this volume. Two additional volumes with the same title and on the same theme have since appeared in Russian (1961 and 1965), as well as many other publications.⁴

Western readers may very well find the present volume most interesting for the light it sheds on Soviet economic thought, and on the conceptual framework and preoccupations of Soviet economists and planners. In his excellent, helpful Introduction to the English edition, A. Nove writes "At the time of its original publication [this volume] represented or symbolized an important turning point in Soviet economic thought. To appreciate its significance it is therefore necessary to refer briefly to the development of Soviet economics in the last two decades." Nove himself provides a brief history of that development in his Introduction.⁵ Further inferences can be made from numerous remarks of the authors themselves, and in particular from the paper and "Postscript" by Nemchinov.

This last document of eight pages will no doubt seem quite remarkable to most readers of this journal, who are probably not used to seeing an editor of a book attack his own authors so sharply! Lange, Novozhilov, and Kantorovich all come in for their share of Nemchinov's displeasure. Thus: "Lange has not sufficiently allowed for the economic conditions of the expanded-reproduction

³ See, for example, recent volumes of *Cybernetics in the Service of Communism*, Energia, Moscow and Leningrad; or B. V. Gnedenko and E. N. Kovalenko, *Introduction to the Theory of Mass Servicing*, Moscow 1966 (in Russian).

⁴ See, for example, A. Zauberman, "The present state of Soviet 'planometrics,'" *Soviet Studies*, 1962, 14, 62-74; A. S. Becker, "Input-output and Soviet planning: A survey of recent developments," Memorandum RM-3532-PR, The RAND Corp., Santa Monica, March 1963; *Problemy optimal'nogo planirovaniia i upravleniia proizvodstvom* (Problems of the optimal planning, projecting, and management of production), Moscow University, Moscow 1963; *Proceedings of a Conference on Mathematical Techniques and Soviet Planning*, University of Rochester, May, 1965, Research Analysis Corp., McLean, Va. (mimeographed) (papers by R. Judy, V. Treml, B. N. Ward, and J. M. Montias).

⁵ See also A. Zauberman, "Changes in Economic Thought," *Survey*, No. 64, July 1967, 159-68.

process and attributes excessive importance to the technological interconnections and the technical coefficients. He consequently reaches the wrong conclusion that under socialism the price-wage-surplus product ratios are entirely determined by the technological conditions of production" (p. 370). Or: "The term 'differential outlays,' extensively used by Novozhilov in his paper, is insufficiently precise: 'differential labor costs' would, in our opinion, be better. . . . This more accurate terminology obviates the erroneous conception based on regarding production costs as the input of production factors. This notion is upheld by bourgeois political economy, which maintains that the value factor (sic) is not only labor but also capital and land" (p. 373). Or: "The method of objectively determined valuations (i.e., shadow prices, R. R.) proposed by Kantorovich has a definite, fairly narrow, but important sphere of application. These valuations are characteristics (indices) expressing deficiency, limitation, and scarcity of available resources; they are applicable to the economic calculations involved in discovering how best to use resources so as to insure maximum fulfillment of a production program. Kantorovich often tends to foist a universal character on the method and there he is gravely at fault" (p. 373). Finally, Nemchinov shakes a finger at all mathematical economists with a criticism that many nonmathematical, nonsocialist economists have voiced: "The main danger in using mathematical methods in economics is that the qualitative nature of the economic phenomena under study may be forgotten. As Lenin said, attacking idealist theories in physics and mathematics, the role of mathematics is distorted, whether in natural or social sciences, when substance disappears and only equations remain. . . . We must forewarn the reader against this dangerous pitfall" (p. 373).

One should not conclude from these last quotations that Nemchinov is basically critical of the contributions of his authors, or of mathematical economics in general. On the contrary, he emphasizes the "undoubted theoretical and practical value" of the papers, and he affirms without reservation that "the immense problems of planning and running a socialist economy cannot be fully solved unless the technical and mathematical basis of planning is seriously developed and considered." Nor should the reader of this review conclude from my own critical remarks that Soviet work in mathematical economics should be ignored by all except specialists in the history of Soviet economic thought. I must agree with Nove when he says, "Some western readers may be tempted to neglect the work of the Soviet economists in this field because of the unfamiliar phraseology, or they may lose patience with the intricacies of the battle with the 'vulgar-Marxist' critics of the new approach. Such readers would be well advised to take the Soviet work seriously. The USSR has inherited a first-class mathematical tradition, which is increasingly being harnessed to the task of meeting the challenge posed by problems of rational economic planning."⁶

ROY RADNER

University of California, Berkeley

⁶ I would like to thank Professors Gregory Grossman and Richard Barlow for their help in locating references to, and about, the Russian literature on this subject.