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**Input-Output Analysis:
An Appraisal**

Introduction

RAYMOND W. GOLDSMITH

INPUT-OUTPUT ANALYSIS, or the quantitative analysis of interindustry relations, has in recent years absorbed more funds and more professional resources than any other single field of applied economics. But, although expansion of scope and improvement of method have been rapid, input-output analysis has remained a controversial subject among economists. This is partly because researchers have not had enough operational information to assess the achievements, problems, and possibilities of this kind of analysis. There has been little communication between the practitioners, immersed in the detail of their operations, and the body of economists, interested in what the new approach might contribute to their own particular disciplines.

To open the door to this kind of communication, the Executive Committee of the Conference on Research in Income and Wealth decided to devote the 1952 meeting to a double task: (1) to acquaint Conference members and the economic profession with this new source of information and tool of research, and (2), on that basis, to make possible an assessment of the potentialities of the approach. A wealth of specific data was newly available for consideration by the Conference, since the Division of Interindustry Economics of the Bureau of Labor Statistics had just finished the most detailed input-output study yet attempted: the 200-industry table for 1947.

Both the speed of advance in input-output studies and the limited time at the disposal of the Conference imposed one important restriction on the agenda. The recent and sometimes elaborate attempts at "dynamization" of the conventional static input-output models as well as the development of such methods as "linear programming" or "activity analysis" had to be excluded from the program. The exclusion seemed warranted, since most of these new techniques were still in the experimental stage when preparations for the Conference were made.

Like most successful innovations, input-output analysis has developed from a basic idea of great simplicity: all transactions that involve the sale of products or services within an economy during a given period are arrayed in a square indicating simultaneously the sectors making and the sectors receiving delivery. More specifically,

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every row in an input-output table shows the sales made by one economic sector to every other sector, and every column shows what each economic sector purchased from every other sector. The nature of the table and the individual entries are obviously determined by the number and definition of the sectors distinguished. Most of the current input-output tables divide the commodity-producing sector (including transportation and service) very finely—in the most elaborate tables into more than 400 industries—so that interindustry relations, i.e. sales of intermediary products between industries, can be followed in great detail. By contrast, all other sectors, such as households, governments, and financial enterprises, are highly aggregated, and scarcely any interrelations among them are shown.

Nobody doubts that the preparation of input-output tables of this kind has significantly added to our knowledge of the industrial economy for those periods in the past covered by the tables—the most recent one being for the year 1947. Moreover, the need to fit data into a strict accounting mold and to fill every cell in the tables has led to the discovery of some gaps and deficiencies in our statistics, and in some cases has provided the impetus for significant improvements. To name only one example, major shortcomings in our generally accepted statistics of construction were disclosed as a by-product of the work on the 1947 input-output tables.¹

From here on opinions diverge. On the one side, we have the skeptical economists, who deny that input-output tables are anything but a convenient way of presenting information on transactions during a period gone by—a framework for classifying data. On the other, most of the people who have actually worked on input-output studies, and some users of their tables, claim that they provide an important new tool. They believe that, by basically simple though very laborious calculations made practicable only by the advent of high-speed electronic computing machines, the input-output tables can yield cost ratios indicating dollars of given inputs per dollar of given output that are much more than shorthand descriptions of transactions in a past period. Most input-output analysts would probably go so far as to say that the cost ratios derived from their input-output tables are applicable not only to the period covered by the basic tables but also, with appropriate adjustments, to adjacent periods up to a distance of several years, and possibly even a decade, from the original bench mark. Some would base the extension on the

¹ See paper by D. I. Siskind in "Input-Output Analysis: Technical Supplement," National Bureau of Economic Research, Multilithed, 1954.

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slowness with which these ratios change, others on the conviction that relevant changes can be detected and incorporated in the basic tables and their inversions.

This "great debate" dominates this volume. Wassily Leontief, W. Duane Evans and Marvin Hoffenberg, and, perhaps less unreservedly, Frederick T. Moore champion input-output analysis as a method basically able—even if at the moment imperfectly so—to provide an integrated picture of the industrial mechanism. They believe it can measure with fair accuracy the changes in inter-industry relations, particularly in requirements for materials, labor, and equipment, that would follow assumed changes in the "final bill of goods" to be produced. In practice, the most important change in the bill of goods is that called for by war or large-scale rearmament. It is hardly astonishing, therefore, that most of the development and application of input-output studies have been connected with industrial mobilization. Moore mentions a few of them, but others—possibly more significant ones—are hidden from appraisal by what seems to be an exaggerated policy of secrecy.

The "outsiders," on the other hand, represented by Carl Christ and by most of the discussants, are not yet willing to accept the claims of the champions of input-output studies and appear unconvinced by the results so far available for examination by the general body of economists and statisticians. They point to the lack of any clear "test" of the system of production functions derived from input-output tables. Several comparisons have been made between actual output in various industries and output values calculated from the input-output tables, but the comparisons have been far from exhaustive and seem open to different interpretations. No test of the 1947 input-output tables has yet been made public, and for reasons indicated in Ezra Glaser's comment it is doubtful whether any practicable comparison would permit an evaluation of the applicability of the production functions derived from 1947 data to, say, the output of 1953.

Apparently, many more years of work and experimentation with interindustry relations tables, and clear evidence that the approach produces results that can be checked against actual figures and cannot be obtained by simpler methods, are necessary to convince economists that input-output analysis actually does provide a reasonable approximation of a system of dynamized Walrasian equations for the midcentury American economy. When the Conference returns to this subject—in a decade, let us say—the editor of the pro-

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ceedings will, I hope, be able to report agreement on what an input-output approach can and cannot do. This is not possible at this moment. It will not be possible even ten years hence unless input-output studies—just now seriously endangered by the general retrenchment of statistical activities of the federal government—are continued on a scale that at least permits periodic revision of the tables, experimentation with improved methods, and comparison of calculated with actual figures.

Although the far-reaching claims of the champions of input-output analysis are still *sub judice*, there is no doubt that the approach has contributed greatly to social accounting. Up to this time, theorists and practitioners of social accounting have neglected the balance sheet and have directed most of their energies toward a rather special form of the national income account, a form in which, to use accounting terminology, the accounts of the few main sectors distinguished—households, enterprises, governments—are combined rather than consolidated. As a result, the national income accounts, as we now have them, disregard transactions among business enterprises, as does the moneyflow approach in its present form. It is precisely these transactions, the flows of payments from one industry to another, that constitute the core of input-output tables. An integration of input-output tables into a system of national accounts would, therefore, seem both possible and helpful.

How great both the theoretical and the practical obstacles to integration are will appear from the papers by Herman I. Liebling and Stanley J. Sigel. It is, therefore, a declaration of faith, rather than the enunciation of a generally accepted conclusion based on actual experience, to say that input-output tables should ultimately become part of a comprehensive, detailed, multipurpose system of national accounting.² Such a system of “universal” national accounting (which some of the discussants regard as quite utopian) must be flexible enough to provide the data needed for standard national income accounting, for moneyflow analysis, and for the very different requirements of input-output studies. It will also have to produce what is still missing—a national balance sheet and a perpetual inventory of national wealth. This is undoubtedly a big order, one that will not be filled until social accounting is adapted to machine book-keeping and the collection of basic data tailored more specifically than it now is to social accounting requirements. This stage of devel-

² This statement does not prejudge the question whether, in addition, the utilization of input-output tables can produce significant production functions.

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opment will not, of course, be reached for decades, even if the trend continues in the expected direction.

The papers read at the Conference fall easily into two categories. One group, written mostly by economists not associated with the Bureau of Labor Statistics, deals in rather general terms with problems of approach to input-output studies, or with the evaluation of methods and results. This group includes: the introductory paper by Leontief; the summary by Evans and Hoffenberg of the 1947 input-output tables and the Bureau of Labor Statistics approach; the general evaluations of the present status of input-output analysis and possible future developments by Christ, Moore,³ and John De Witt Norton; and the papers on the relation between input-output analysis and social accounting by Liebling and Sigel. These seven papers, together with Amor Gosfield's report on his input-output study of the Puerto Rican economy⁴ and comments by other participants, constitute the present volume. A ninth paper, by Ronald W. Shephard ("A Survey of Input-Output Research"), also belongs to this group, but this paper, although read and discussed at the meeting, is not included in this volume because it is being published separately.⁵

A second group of papers was presented to the Conference by members of the Division of Interindustry Economics of the Bureau of Labor Statistics. These papers describe actual compilation of input-output tables for different sectors of the economy. They may have less general interest, but they are indispensable to specialists who want to approach adequate understanding of the actual procedures used in building up input-output tables, or who want to evaluate the reliability of the tables. Even these long papers do not give their authors an adequate opportunity for exhaustive explanation of all steps involved in building up the tables. The full story will probably be forever hidden in the work sheets of the Bureau of Labor Statistics. Thus, the old problem of complete disclosure of sources, manipulations, and results of elaborate statistical inquiries

³ Moore's paper was not delivered at the meeting and hence not discussed, but was prepared after the meeting at the suggestion of the Editorial Committee.

⁴ Although the meeting was in principle limited to input-output studies dealing with the United States, the Executive Committee and the Editorial Committee felt justified in making an exception for Gosfield's paper as representing an interesting example of the application of input-output techniques to a less-developed economy.

⁵ This paper is expected to appear in a professional journal, but had not been published at the time this volume went to press.

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has not been entirely solved in this case either. The value of these papers has been considerably enhanced by the apparent inability of the Bureau of Labor Statistics, due to budgetary limitations, to publish as detailed a description of the input-output work as it had originally intended. These eleven papers have been assembled as a supplement to this volume.⁶ The Editorial Committee is greatly indebted to Philip M. Ritz, who acted as editor of this supplement, as well as to the members of the Division of Interindustry Economics who contributed papers or participated in the Conference.

⁶ "Input-Output Analysis: Technical Supplement," National Bureau of Economic Research, Multilithed, 1954.