A SYNOPTIC LOOK ON THE CONTRIBUTIONS OF W. LEONTIEF TO ECONOMIC SCIENCE

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ABSTRACT

Professor Wassily W. Leontief, Nobel Laureate (1973) is the founder of input – output analysis contributed to many areas of economic research throughout his illustrious career. His efforts towards the development of an empirical approach has facilitated both national accounting and applied equilibrium analysis. Leontief’s operational framework is presently used throughout the discipline and all over the world. The present paper outlines all his contributions in relation to mainstream economics repeatedly focusing on interrelationship of different sectors of the economy. His outstanding creation has fundamentally influenced the evolution of economic analysis and other economic relationships. A brief survey of inventions and their wide applications presented in this article demonstrates Leontief’s devotion and dedication to his work until his death.

INTRODUCTION

W. Leontief was born in St. Petersburg on 5th August 1906. HE was able to gain admission to the University of Leningrad (formerly St. Petersburg) at the age of fifteen. In 1925, he was awarded an advanced degree (the degree of Learned Economist). After Ph. D in 1928, he was appointed at the Institute of world Economics at the University of Kiel. In 1929 he stayed in China for a year where he was an advisor to, Ministry of Railways. Already the author of several research papers, he accepted in 1931, an appointment to the staff of National Bureau of Economic Research in New York. In 1932 Leontief moved to Harvard. Initially serving as an instructor there, he was successively promoted to advanced ranks until he was professor (from 1946) and holder of the Henry Lee Chair (from 1953).

In 1975, Leontief relocated to New York University where he was professionally active until his death on 5 February 1999. Leonief, a notable productive scholar throughout a lengthy academic especially for his creation of a major new kind of economic quantification. He was a member of numerous honorary societies in the untied states and abroad and president of the American Economics Association in 19701.

Leontief was awarded the Nobel Prize in economics in 1973 for the development of the input-output analysis and for its application to important economic problems. Japan, the world leader in the use of input-output analysis presented Leontief with its highest civilian honor in 1984.

Professor Leontief was one of the most creative economists of the twentieth century. He considered himself a theorist, but he felt strongly that the purpose of theory was to provide a simplified picture of real systems. For him, theory follows as an instrument that helps explain facts. According to him, explanations of economic systems must be grounded in facts. So he opposed the growing tendency among economists to formulate theories without a firm foundation in observable reality. He believed that any abstract theoretical work which has no foundation in reality become unfit for empirical testing and ultimately lack applicability and reliability. With this understanding, Leontief dedicated his preference for what can be observed rather than what can be imagined along with an insistence on practical applications. This approach guided him towards his greatest achievement namely, the invention and innovation of input-output model.

He emphasized on the need for detailed data to support theory just like any scientific method that underlies the physical sciences. He is concerned with study of a system which is exceedingly complex. According to him, the existing stock of factual information becomes obsolete in future in the absence of constant inflow of new data. The experiments and measurements in physical sciences end with constant parametric values and secure universal approval and acceptance for ever. Whereas, in the case of abstract and speculative economic theory the emphasis becomes unusual the moment it gain widespread acceptance. This ultimately led Leontief to devote considerable attention to economic statistics.

Though Leontief taught theoretical economics more often than input-output techniques throughout his career, he is much committed to empirical evidence. He seems to emphasize data more than theory because theorizing without facts in an empirical science is very dangerous. All his work has generally been attached to firm empirical observations. The words by W. Leontief on the importance of reliable data are still existent. According to him, efforts need to be directed not only to hybrid methodologies but also to developing and updating basic data and to good case studies. When a methodology requires the data that cannot be supplied in a necessary quality for an analysis it can at best be an intellectual exercise. In his input output analysis Leontief was more been on primary data from industries rather than database. Hence, in the early stages of input-output analysis he collected primary data on inputs and outputs of an industrial process by himself by visiting industries and interviewing process engineers.

INPUT – OUTPUT METHOD

Leontief is the sole and unchallenged creator of input-output technique. This technique is purely an empirically useful method highlighting the general interdependence of various sectors of production. The tool of input-output analysis explains how and in what measure the
constituent parts or sectors, of an economy interact. More than a tool of analysis, it can also reveal what combination of resources (raw material, labour, capital) called inputs is required to achieve desired production goals called outputs. The input – output analysis, therefore plays a central role in planning and even in prediction. Most of the countries and countless business consultant input-output tables to guide them in making economic decisions.


An input – output table is a model of the inter-industry relationships in a economy. The structure of the table is a matrix that lists economic sectors, in the same sequence, both vertically and horizontally. Any sector can be analysed in terms of the direction and ambient of its production or the origin and amount of its intake. Leontief derives coefficients or ratios of the quantitative relationship of one sector to another. The coefficients are fixed by the current technology by using these coefficients, it is possible to project how changes in input or output of individual sectors will affect all other sectors because for input-output relationships. As technology changes, coefficients also change.

Leontief’s input output analysis is closely related in one way or another to the work of Richard Cantillon (1680-1734), Francois Quesnay (1694-1774) and Leon Walras (1831-1910). Through input-output research Leontief established a mission to explore the potential applications of the analysis. His contributions further include review of fundamental concepts of input-output analysis. He even examined the possibilities of dynamic versus static models and showed how interregional analyses could be conducted. He further threw light on the potential of the input-output paradigm for analysis of capital structure, consumption and final demand, aggregation and specific industries.

Since the early 1960’s Leontief applied his analytical tool to problems such as the economic effects of disarmament and military spending, the costs of pollution, the depletion of non fuel mineral resources, the impact of automation on workers and projections of the world economy to the year 2000. A study of the future of the world economy by Leontief shows how and in what measure aid to developing countries might be most efficiently distributed. Thus, Leontief’s efforts towards refining and elaborating input – output analysis sought to analyse and solve many practical problems.

ECONOMIC ACCOUNTING

In the United States, the major economic accounts produced by the Bureau of Economic Analysis use the input output accounts as an integrating principle or as an analytical tool. The System of National Accounts uses input-output accounting as a framework for coordinating and checking the conceptual and statistical consistency of the accounts and for providing a detailed basis for analyzing industries, products and other economic relationships. Leontief developed his first input-output tables in US in order to facilitate his study of the effects of technological change on the American economy. He also applied the technique to defense analysis to facilitate the planning of post-war demobilization. Other applications include construction of environmental satellite accounts, transport, and travel and tourism satellite accounts. The input-
output accounts are the primary source of data for the national income and product accounts. From the forging discussion, it is understood that Leontief has devoted considerable attention and his career as well to expanding the applications of input-output analysis.

While prompting such varied applications, input-output analysis enable more efficient economic administration overall. The national planning however could easily be misconstrued, for under it plan goals apparently could be fixed democratically and it would be largely left to the market to implement them. Such a scheme has been plausibly compared to the ‘indicative planning’ that the French sought to practice; after World War II.

By providing illuminating perspective generally, the analysis invites many more applications. The input-output technique extensively used in many fields especially, in forecasting and planning in quite different types of economic systems such as centrally planned economies and decentralized economies. The technique has also been applied in studies of how cost and price changes are transmitted through various sectors of an economy. The wide usefulness of the technique extend to topics like the sectoral import of defense cuts on the output, cost of pollution abatement and trade liberalization and the income gap between rich and poor nations. Leontief was among the few pioneers in the 1970s who were concerned about the generation of pollutants and its abatements by industrial processes in an economic model.

In his Nobel Memorial Lecture (1974) on “Structure of the World Economy: Outline of a Simple Input-output Formulation”, W. Leontief described a few blocks of linear equations that extend a static, one-country, input-output model to many regions. The motivation for the model is to analyse scenarios but not to prove theorems or test hypotheses. He believed that the model would help the world community to make decisions regarding future development and environmental policies in a rational manner. He considered an input-output perspective as a ‘framework for assembling and organizing the mass of factual data needed to describe and understand the world economy’.

But his interests were not limited to input-output analysis alone. Leontief is also known for numerous thoughtful and illuminating contributions on quite diverse topics. His article (1933) on “The use of indifference Curves in the Analysis of Foreign Trade is widely cited as a fundamental contribution to neoclassical theory. In the same article, Leontief developed the geometric representation of the production and consumption of two goods in two countries and the trade between them. Along with his predecessors Marshall, Edgeworth, Pareto, this presentation earned him a reputation shared with Haberler, Lerner and Mead as a major contributor to neoclassical theory. He graphed production possibility frontiers and social indifference curves based on assumptions and conventions which were current at the time. Leontief tries this for two countries simultaneously on a single graph. According to him, two countries with equal absolute cost of production will exchange their products if their systems of indifference lines or their relative demands are different. It indicates the interchange of commodities between countries with similar industrial structures.
LEONTIEF PARADOX

Under the regime of economic reforms the global trade services have occupied a prominent place in developing and developed countries of the world today. The expansion of world trade therefore has received so much attention and attraction largely due to its impact on the factor markets of countries involved. In this regard, the Heckscher-Ohlin theorem (HO theorem) is still a mainstay of international economics. As per HO theorem, the country will export commodities that are intensive in the country’s relatively abundant factors and will import items that are intensive in the country’s relatively scarce factors. Though the prediction of the HO theorem is conceptually convincing its empirical applicability is in doubt. In simple, the earliest empirical finding namely Leontief paradox questions the practical validity of the HO theorem.

Another application of particular interest to economists is the “Leontief Paradox” representing controversial demonstration of the fact that US imports are more capital intensive than US exports. In 1953, Leontief published the numerical results that established popularly called ‘Leontief Paradox’. The United States in 1947 is, as revealed by the factor contents of its trade, to have abundant supply of labour but scarce capital. Leontief however, empirically tested the contemporary interpretation of the Heckscher-Ohlin theory of comparative advantage.

He observed that the data on factor content of an export and import bill of goods showed United States was indeed richly endowed with labour and not capital. However, Leontief was criticized by other economists to have failed to take into account other factors of production or non competitive imports. But his example stimulated many empirical studies that examined the factor contents of imports and exports for different countries and time periods.

Though the Leontief paradox is not observed in the US trade data, it appears in many other countries. When assuming factor price equalization, developed countries such as Japan, Germany, France, Denmark, Belgium, Italy and Spain are all found to be labour exporting countries with the capital-labour ratio embodied in exports smaller than the capital-labour ratio embodied in imports. Whereas developing countries such as Indonesia, Mexico, Colombia, Costa Rica, Egypt and Zimbabwe are found to be capital exporting countries with the larger capital-labour ratio of exports than that of imports. In the absence of factor price equalization assumption, both the capital-labour ratios of capital exporting and labour importing countries increase significantly. In other words, only when factor intensities are differentiated the exchange of commodities takes place internationally and not under similar factor intensities conditions.

CONCLUSION

The models and the methodologies advocated by W. W. Leontief have proven viable result in the inter-industry and inter-sectoral equilibriums of determining the relationship of inputs and outputs with some mathematical expositions in the context of observed data frame.

One of the noticeable features of Leontief paradox in the US economy preferably in 1920s of international trade which largely exposes factor price equalization and which was largely acclaimed by later economists like J M Keynes and Arthur Douglas.
applications of the input-output model based on various sectors of the economy facilitate the understanding and manipulating the economy of a country or a region.

REFERENCES


