

The Structure of Leontief's Economics

Like every great scholar, Leontief had a unique focus and style. He worked on a grand scale, encompassing macro and very detailed micro variables in his general equilibrium systems. He believed that economic analysis is worthless unless the variables can be measured. Thus he designed a system that could answer significant questions and still be implemented empirically.

Leontief's focus was radically different from that of his mainstream colleagues. Some even question whether what he did was truly economics or a different discipline entirely. Instead of explaining the market system and its optimizing properties, he simply described the interdependence of sectors in quantitative terms and explored the nature and the consequences of that interdependence. Recording what industries buy from or sell to each other, i.e., making an input-output table, may strike some as simple description. However, viewing interindustry sales and purchases as revealing a structure was a major creative leap. In Leontief's eyes, input-output proportions constituted a "recipe" for each sector's output, and Therefore the matrix of proportions (or input-output coefficients) for all sectors served as a map of the economy's structure.

Neoclassical economists see input-output ratios as the outcome of market processes, where prices mediate choice among a series of "given" technological options, sometimes represented by isoquants. Leontief recognized that economists had little or no systematic information on those "given" technological options, which limited the discipline to theoretical speculation. In this sense, Leontief and the Econometric movement in the thirties and forties were wrestling with the same difficulties. The econometricians focused on finding more sophisticated methods of inferring parameters from scant data. Since data on actual transactions reveal only a portion of technical options, parameters representing some alternatives cannot be observed directly. Leontief's strategy was to redraw the boundaries of the economic problem to exclude unobservable options. He did not try to explain choice of technique. Instead, he considered input-output coefficients to be exogenous, parameters determined by the state of the arts ("technology") or, in the case of households, custom and habit. Needless to say, many economists did not embrace this innovation. I still remember Fritz Machlup's reaction to a paper I (a Leontief student) presented on embodied technological change: "She doesn't know what a production function is!"

Leontief never argued that structure, i.e., technology or taste, was in reality fixed. He expected it to change significantly and even proposed ways of measuring structural change. However, he did not undertake the task of explaining the changes. Essentially, he narrowed the scope of the economic problem to exclude the process of technological or consumer choice. This brought him closer to his ideal of a more empirically grounded economics. It also produced a framework that was applicable to non-market economies.

If we call particle physics, where research is very costly, “big science”, input-output research is “big social science.” The work of gathering and manipulating masses of detailed data required many dedicated assistants and technical support staff, elaborate infrastructure and the funding to support them. This work style stood in marked contrast to that of the typical economist or even econometrician of his day, most of whom worked independently or in small groups. Fortunately government agencies have assumed major responsibility for data assembly and made significant analytical contributions. Over half a century the research afforded professional employment opportunities for many students and particularly for women economists even at times when such jobs were scarce. It also added significant fundraising and administrative responsibilities to Leontief’s scholarly agenda.

While Leontief did not represent technical choice in his input-output system, he sought deeper understanding of the nature of technological constraints on economic activity and felt some pressure to justify his research strategy. In its early days, his Harvard Economic Research Project (first called “Project on the Structure of the American Economy”) focused directly on the relation of engineering rules of thumb and demographic factors to input-output coefficients. Initially, the Project had three major lines of inquiry: detailed searches of the engineering and industrial literature for the roots of input-output proportions in selected sectors, study of budgets of different consumer groups, and the search for reliable data for “observing” capital coefficients.

Leontief hoped that, given time and resources, economists could some day root their analysis in a vast but transparent and orderly database of engineering information. If HERP had had a t-shirt, the back would have read “Ask an engineer!” These studies, largely reported in Leontief et al.,

Studies in the Structure of the American Economy, included the work of such later-to-be recognized economists as Chenery, Duesenberry and Solow. Unfortunately the territory proved murky, plagued by professional and terminological barriers. While interesting, these studies give little insight into how realistic it was to specify fixed coefficients. After the publication, these early colleagues and Leontief himself began to reach out in other directions. For Leontief, this meant developing applications and more elaborate extensions of the input-output approach. That, more recently, he and Faye Duchin established linkages between the Institute for Economic Analysis at New York University and the Engineering Societies indicates a continued interest in this area.

Leontief developed a very wide range of extensions and applications of input-output analysis. Multiregional models, the dynamic inverse and the intellectual interdependence of disciplines; specialization in international trade, pollution, economic development are only a few of these. Multiregional input-output models add a regional dimension to the 2-way sectoral map; the dynamic inverse adds a time, rather than a regional dimension. Despite the range of subject matter, they all reflect Leontief's distinctive style: simple frameworks, detailed sectoral specification, parameters that can be estimated by direct observation of transactions. With its emphasis on stocks and flows of material goods, Leontief's work is clearly designed for the economies of the 20th century. Informational transactions, likely to dominate the 21st century, seem harder to measure. But it would be unwise to assume that Leontief's pragmatic approach is obsolete or irrelevant. Always interested in the exchange of ideas among disciplines, *vide* his exchanges with scholars in many fields and his long term leadership of the elite Society of Fellows at Harvard, he recently recognized the potential of building a matrix of interdependence of ideas among the sciences using a citation index database. The similarity of this conception to that of the original input-output system is striking. The proposed system is simple (perhaps all too simple) and the citation, like the flow of money payments for goods, is a limited, one-dimensional representation of a complex phenomenon. Ironically, while the data were easily accessible in a modern computerized database, the source was a private one and would once again require significant grant money. Does Leontief's research itself have fixed coefficients?

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