

# Introduction: the History of Input–Output Analysis, Leontief’s Path and Alternative Tracks

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The term ‘input–output analysis’ is, for well-known reasons, closely associated with the name of Wassily Leontief, widely considered as being the founder of the subject. Leontief’s input–output analysis may be seen as epitomized by one of the most frequently repeated equations in the economics literature, namely  $\mathbf{x} = \mathbf{Ax} + \mathbf{y}$ . Many students of Leontief and practitioners of input–output analysis may have reflected upon the almost paradoxical fact that such a general and wide ranging approach as input–output analysis represents, with a strikingly simple and transparent analytic structure, has been so exclusively associated with the work of a single scholar. In his pioneering contributions Leontief paid homage to François Quesnay but gave few clues as to other predecessors who might have inspired his work.

To place input–output analysis in the context of the history of economic thought requires careful consideration of the development of the ideas constituting input–output analysis. An important step in this direction was made in an earlier special issue of *Economic Systems Research* (Vol.12, No.2, 2000) on input–output analysis and classical economic theory.

At the Fifteenth International Conference on Input–Output Techniques, held in Beijing, 27 June–1 July 2006, a special session, organized by one of the guest editors of this issue, was devoted to the theme ‘History of Input–Output Analysis.’ The present volume contains the revised versions of four of the papers presented in the special session. The common feature of these papers is that they deal with attempts undertaken independently of, and partly prior to, those of Leontief to come to grips with problems for which input–output analysis provides a suitable framework and powerful tool of the analysis. They may thus all be said to discuss ‘alternative tracks’ to the path Leontief followed. In addition, there are included two valuable source documents on the background and early life of

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Wassily Leontief, originally published in Russian in the early 1990s. They have been translated into English for publication in this special issue. The two articles pertaining to the life of Wassily Leontief come first in this special issue, followed by the four papers discussing the alternative tracks.

Svetlana A. Kaliadina and Natalia Iu. Pavlova write about the family of Leontief in Russia based on thorough original research by the two authors. The interview of Leontief, undertaken by Svetlana A. Kaliadina in Leningrad (now again St. Petersburg) in 1990 and published in Russian in 1994, on the repressions of the 1920s in the Soviet Union, adds to and enhances the information in the family article. The publication of both papers have benefited greatly from meticulous checking, editing and annotation by Claus Wittich, to whom we are most grateful. We thank Svetlana A. Kaliadina for giving permission to have the two articles translated and published by *Economic Systems Research*. The translation has been done by Claus Wittich with inputs from Tatiana Babaskina and Maria Shikalova, both students at the University of Oslo. We thank them all.

The background for undertaking the study of the Leontief family is not stated explicitly in the article but it may reasonably be assumed to be an outcome of Gorbachov's call for *glasnost*, reinforced by the fall of the Soviet regime in 1991. Wassily Leontief, raised and educated (at least partly) in St. Petersburg/Petrograd/Leningrad, became an international scholar of the highest rank within economics but remained relatively unknown in the Soviet Union. Leontief's contact with the Soviet Union was limited after he left the country in 1925. He did not visit the Soviet Union again until the 1960s. His last visit to St. Petersburg was in 1993. During a visit in 1990 Leontief met with Svetlana Kaliadina and was introduced to her research on the Leontief family. After his return to New York, Leontief announced to his associates that his birth year should be 1905 instead of 1906. While Leontief's 80th birthday had been taken notice of during the Eighth Input–Output Conference in Sapporo in August 1986, his 90th birthday was celebrated in 1995. The annotations of the family article provide the complete and correct information about Leontief's birth year (1905) and place (Munich). Leontief's grave in Connecticut, alongside that of Joseph Schumpeter, has the correct birth year, but states wrongly the birth place as St. Petersburg.

While Leontief's birth data are of no importance for input–output analysis, these documents provide valuable information about the formative years of Wassily Leontief before he left the Soviet Union for Germany in 1925, such as the names of his teachers, his readings, his difficulties with the political authorities resulting in a prison term, his exposure to censorship, etc. Leontief also spoke about these events in other in-depth interviews and in personal communication, but we believe the details are more complete and correct in the annotated documents presented here than in any other sources. While these documents provide some clues about Leontief's path and intellectual environment from the time he entered St. Petersburg University as a 16 year old young man until he arrived in the USA in 1931, the other papers in this issue deal with efforts by other scholars to solve problems that can be classified as falling within the field of input–output analysis.

Gilbert Abraham-Frois and Emeric Lendjel introduce for the first time in English the works of Father Potron (1872–1942), a Jesuit priest, who lived and worked in Paris, but had no training in economics. They show that Potron, who among other things had studied mathematics, in pursuance of the ideas of fair price and fair wage according to a Thomist conception of justice, developed an analytical structure with a close affinity to input–output analysis. Potron's work in this direction originated in 1911 and was

revived during the depression in the early 1930s. Potron is said to have been the first to apply Perron–Frobenius theorems to his Leontief-type models in an attempt to prove the existence of an economic equilibrium.

Heinz D. Kurz and Neri Salvadori compare the early works of Leontief and Piero Sraffa (1898–1983). The attention focuses on Leontief’s PhD thesis in Berlin in 1928 and Sraffa’s work in Cambridge in 1927–1928 as reconstructed from Sraffa’s archival remains. Both Leontief and Sraffa showed that relative prices and the rate of interest can be determined exclusively in terms of the observable amounts of commodities that are respectively produced and used up during a year – without any reference to demand and supply. While Sraffa continued to elaborate an objectivist alternative to the marginalist theory of value and distribution, Leontief’s interest shifted towards applying the new tool of input–output to practical problems.

Olav Bjerkholt and Mark Knell deal with a contribution by Ragnar Frisch (1895–1973), prominently published in *Econometrica* in 1934 but not much discussed in the literature. Frisch’s aim was to find remedies for fighting the depression, which led him to develop an analytical structure that exhibits remarkable similarities with Leontief’s closed model. The paper discusses in some depth the core of Frisch’s construction and the uses to which he put it. While there are clear family resemblances between the approaches of Leontief and Frisch, the latter’s claim to have anticipated the principles of input–output analysis as laid out by Leontief cannot be sustained.

Christian Lager’s contribution is devoted to the treatment of fixed capital in various authors. He compares Leontief’s approach in the dynamic input–output model elaborated in the early post-war period with the approaches to durable instruments of production by Léon Walras, John Hicks, Piero Sraffa, John von Neumann and Nicholas Georgescu-Roegen. It is argued that the von Neumann-Sraffa treatment is the most general one, of which the others are special cases that cannot adequately deal with crucial problems encountered by the presence of fixed capital in production. Given the importance of fixed capital in industrially advanced economies, the author pleads for a reconsideration of the ways in which it is dealt with in empirical studies.

We should like to thank the editor of *Economic Systems Research* for kindly inviting us to edit the special issue, the contributors for their collaboration, and various colleagues for assisting us with the refereeing process. We hope that that the contributions in this special issue will encourage further interest in and research on the fascinating history of input–output analysis and the wider philosophical concerns at issue.

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