Investment Planning and the Input-Output Model in Postwar Europe

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Abstract

As economic planners sought to rebuild Europe in the unstable postwar period, economic expertise was called upon to help in the drawing of national budgets and to inform economic and planning policies. A tool that circulated from academia to economic administrations was the input-output framework that had been developed by Wassily Leontief since the 1930s. As Leontief came into contact with other economists and with the goals of economic administrations, his framework was repurposed to give answers to the questions of economic planners. Statisticians and economists in Western Europe worked to integrate the input-output framework with the developing national accounts. Looking at their work with a particular focus on investment and development policies, I bring new insights on the role of experts, by showing that the input-output model had little impact on the actual coordination of economic policies.

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> If the classical economists declared that the world was governed by 'blind' economic and social forces, it was because they themselves were unable to see into the future. Thanks to the convergent progress of biological, historical and natural sciences, we can perceive today the close relationship between past and future.
> Pierre Bauchet (1964: 9)

In 1958, a group of French academics and planners were the first westerners invited to visit the Gosplan or State Planning Committee of the Union of Soviet Socialist Republics, along with a number of planning institutions throughout the Soviet Union (ISEA, 1959). In the years around this visit, French planning itself attracted the interest and curiosity of countries around the world, and a plethora of books were published to present and make sense of the French experience (Bernard, 1964). Pierre Bauchet, a French academic working on input-output methods in the Law Department of the University of Nancy, published in 1958 *L'expérience française de planification*, in which he presented the Plan as "the act of a State which strives to adapt behaviors to the future that has been mapped out" (Sellier, 1959: 857). Bauchet's book was revised in 1962 to take into account the Fourth Plan, and translated into English in 1964. In his book, he argued that technological changes and automation would lead to uncertainty, instability and unemployment in a system without conscious design, making it necessary to plan these changes in advance, to forecast consumer demand, and to plan industrial investments. He argued that the men in charge of planning the economy had made great progress in the art of forecasting: civilizations, men and industries now "have their place in history, determined by previous events, while before them lies a future they are shaping and can control" (Bauchet, 1964: 9).[2]

After the war, the desire to organize the economy was widespread in Europe to solve the problems of economic reconstruction, inflation and full employment. The organizing *zeitgeist* of

[2] Sellier's quote from Bauchet's original book was "l'acte d'un Etat qui s'efforce d'adapter les comportements en fonction de l'avenir tracé". The participants in the Russian visit included Etienne Hirsch, the *Commissaire au plan*, Claude Gruson, the director of the *Service des études économique et financières*, and Raymond Barre, future prime minister and the "best economist in France" ("meilleur économiste de France"), as he became colloquially known.

the 1930s, the rejection of free markets and competition, viewed as the sources of coordination problems, anarchy and crisis, were all widespread ideas in postwar Europe, including England (Caldwell, 2020: 722-730). To many European economists and politicians, it was necessary to plan the economy in order to avoid the instability which characterized the 1930s. The solutions proposed took different forms. In the Netherlands, a "plan of labor" was already proposed in the 1930s to organize the economy around corporatist lines (Dekker, 2022: 692-697). After the war, the Central Planning Bureau, created in 1945 and directed by Jan Tinbergen, was meant as an advisory body leaving room for individual economic activity, but still having as an initial goal to "shape the course of the economy" (Dekker, 2021: 228, see also Wellisz [1960]). Those goals proved hard to realize and the Central Planning Bureau remained in a strictly advisory capacity, with limited control over the drafting of the plan (Dekker, 2021: 229). The Bureau's task was to help in drawing the budget and in producing economic studies, and this role was in fact so reduced that Bauchet argued against the idea that there was any kind of central planning in the Netherlands, in particular because the planning bureau had no means by which it could implement its plans (Bauchet, 1964: 22). Dutch "planning" is a good illustration of one side of the planning spectrum in the postwar: a completely advisory institution, at odds with the ideals of production planning that circulated in the 1930s, when engineers, scientists and other experts sought to reorganize the economy by placing into the hands of experts the decision-making power (Dekker, 2022: 695).

Moving along the planning spectrum towards a more hands-on approach, we find France, where there also were reflections on planning during the 1930s, especially among the engineers of X-crise, but little actual planning policies in the interwar (Fischman and Lendjel, 2000). During the war, the Vichy regime inaugurated an economic administration dedicated to

controlling prices as a way to manage inflation, a strategy leading to the emergence of widespread black markets (Grenard, 2008). After the war, the desire to organize the economy was widespread, and the administration of price controls continued for a few years (Chelini, 2013). The nationalization of several key industries, including the banking sector, offered the tools to lead an active policy in the economy through energy pricing (Yon, 2020) and a very active credit policy (Monnet, 2018). A *Commissariat général du Plan* was established in January 1946 to coordinate the general economic policy, along with several *Commissions de Modernisation* which debated the objectives of the Plan. While rules of thumb and discussions in the *Commissions de Modernisation* dominated the original Plan and its immediate successor (Fourquet, 1980: 161-162), the third plan (1958-1961) was the beginning of an effort to "rationalize" the approach by systematically using national accounting, modern econometric tools and mathematical economics. It was for this purpose that the *Service des études économique et financières* (SEEF) was created in the Ministry of Finance in the early 1950s, to inform the drawing of the plan and the discussions of the *Commissions de Modernisation*, and assist in the elaboration of annual forecasts (the service became the "direction of forecasting [*prévision*]" in 1965). The construction of economic policy in postwar France thus became the product of an interaction between business and industry leaders, the economic and financial administration and parliamentary politics. Other studies have presented the balance between these different forces and the way in which the Plan was drawn up and implemented (Hackett and Hackett, 1963; Bauchet, 1964; Drèze, 1964).

Beyond the variations in planning, there was a common thread throughout all these experiences: the search for new tools to make planning the entire economy possible. In the rest of this paper, I will focus on this common thread, by examining a tool that spread throughout

Western planning agencies, Wassily Leontief's input-output model. This process of diffusion is documented in archives, in conference presentations and in Government documents which show how quickly and widely input-output spread, as it offered an answer to the questions asked by economic planners. Built in the input-output approach were indeed a way to address questions of investment policy and industrial planning which were at the core of the European reconstruction.

The treatment of investment in the input-output model was also at the center of the evolution of the input-output model from the 1930s to the 1950s, an evolution which corresponded to its use by planning and government agencies. The first model developed by Leontief was ill-suited to tackle practical questions of investment, which was treated as a residual variable. Leontief's collaboration with the Bureau of Labor Statistics (BLS) led to important changes in the way in which investment was conceptualized, as it became part of the final demand whose repercussions in the economic system could be observed through the input-output framework. This was the approach that spread throughout economic administrations concerned with drawing up national accounts in the postwar period. Leontief continued to develop his model, in particular through a dynamic extension of the static input-output framework, in which investments to build capacity were the driver of dynamic change. The dynamic model was built both in answer to criticism from the academic community, but also as a practical tool for planning agencies grappling with questions of investment allocation and capacity in the economy, but it received little attention compared to the static model.

Although Leontief was successful in spreading his tool to economic planning agencies, when we examine the actual record of using the model to plan investments and organize the economy, there is surprisingly little actual use that was made of the input-output model. Input-output itself continued to spread in many different areas from regional economics to environmental

economics through computable general equilibrium and agricultural economics. But its use by central planning bureaus of the type set up in France or the Netherlands was clearly a dead-end, as the "men of science", wont to plan the economy according to mathematical models, faced the problems of concrete action in a world of imperfect knowledge and power struggles. In France, planning happened outside of the technical services of the ministry of finances, and in spite of the recurring calls to use input-output to plan the economy, the power of those technical services remained limited to national accounting and forecasting activities.

I. Investment in the Input-Output Model

While the roots of input-output analysis can be traced back to the 1920s in Leontief's PhD dissertation or to the "balance" approach of planners in the USSR, input-output research really began to take hold after Leontief was brought to Harvard in the early 1930s (Bjerkholt, 2016). Once there, he dedicated most of his time to the project of gathering data into a framework of interindustrial equilibrium, with his first publications on the subject in the second half of the 1930s (Leontief, 1936; 1937). In those early endeavors, Leontief's model was a closed system where households were considered as a sector supplying labor as output and receiving commodities as inputs. The approach took off in the early 1940s as Leontief began a collaboration with the BLS, which contributed to the transformation of input-output into a tool for economic policy by opening the model to examine the effect of changes in final demand on the interindustrial network (Kohli, 2001). After his successful collaboration with the BLS, Leontief became more interested in what his model could say about economic policy, and took a further step by creating the Harvard Economic Research Project, where he recruited collaborators and staff doing the work-intensive labor of collecting data for the input-output

tables. Input-output was enlarged to address other questions in regional economics, capital accumulation, international trade and transportation problems, and spread in academia and economic administrations. Throughout this process of scientific, institutional and policy construction, the role of investment in the model was transformed, from a marginal element to a component of final demand, to a pivotal part of the model responsible for building production capacity and creating changes in the economy.

A. Investment and savings in the closed model

The theoretical model of input-output analysis starts from the interindustrial relationships embodied by the flows of goods and services between different parts of the economy and an equilibrium relationship between these flows, measured in monetary terms. In a closed model, the total output of one industry is equal to the total of the inputs produced for the consumption of other sectors of the economy.

These flows are described in a square matrix where the rows represent the output of each industry to other sectors of the economy, and the columns the inputs in the same industries (cf figure 1). In other terms, the same equilibrium equation can be written as a proportional relation between the global output of one sector and the need for input of another sector, by introducing the production or transformation coefficients. The third “balancing equation” of the model is the “value equation”, satisfying stationary equilibrium conditions such that the total value of an industry is equal to the value of its inputs.

The term “industry” or “sector” should be interpreted broadly here, as it can include international trade or households, which furnish labor as output and receive as input the commodities produced in the economy (Leontief, 1941: 41, “Households as an industry”). This mechanical conception of households was criticized by other economists early on, but Leontief

saw in this approach "nothing more … than the existence of an obvious connection between the expenditures of an individual and the amount of his earnings" (Leontief, 1941: 42).

(*The unit for figures not in parentheses is one million dollars; figures in parentheses represent production, consumption and investment coefficients.*)

Distribution of Outlays (Input) of Classes Listed at Top of Table	Class Number	Distribution of Output of Classes Listed at Left of Table										
		Agriculture and Foods	Minerals Industry	Metals and Their Products	Fuel and Power	Textiles and Leather	Transportation (Steam Railroads)	Foreign Trade (Exports)	Industries n.e.s.	Undistributed	Households (Consumption)	Net Output
Class Number		1	2	3	4	5	6	7	8	9	10	
Agriculture and Foods	1	(−0.9377)	(0) 0	(0) 0	(0) 0	(0.1361) 1420	(0) 0	(0.5150) 4063	(0.0296) 391	(0.0354) 1364	(0.2739) 11920	19158
Minerals Industry	2	(0.0023) 48	(−0.8595)	(0.0724) 1157	(0.0022) 16	(0.0001) 1	(0.0025) 15	(0.0271) 214	(0.0558) 734	(0.0159) 612	(0.0045) 194	2991
Metals and Their Products	3	(0.0381) 778	(0.0241) 84	(−0.9199)	(0.0830) 614	(0.0162) 169	(0.2581) 1529	(0.1809) 1427	(0.0813) 1073	(0.1690) 6513	(0.0539) 2520	14707
Fuel and Power	4	(0.0065) 133	(0.1284) 447	(0.0249) 398	(−0.8317)	(0.0121) 126	(0.0871) 516	(0.0638) 503	(0.0173) 228	(0.0326) 1257	(0.0585) 2545	6153
Textiles and Leather	5	(0.0060) 122	(0) 0	(0.0113) 181	(0) 0	(−0.9294)	(0) 0	(0.0973) 768	(0.0068) 90	(0.0400) 1541	(0.1607) 6993	9695
Transportation (Steam Railroads)	6	(0.0460) 940	(0.0940) 327	(0.0164) 262	(0.1208) 894	(0) 0	(−0.9488)	(0.0179) 141	(0.0262) 346	(0.0380) 1464	(0.0286) 1246	5620
Foreign Trade (Imports)	7	(0.0558) 1140	(0.0428) 149	(0.0056) 89	(0.0035) 26	(0.1519) 1584	(0.0002) 1	(−0.5324)	(0.0293) 387	(0.0067) 257	(0.0132) 572	4205
Industries n. e. s.	8	(0.0395) 807	(0.0092) 32	(0.0108) 174	(0.0157) 116	(0.0149) 155	(0.0211) 125	(0.0918) 724	(−0.9515)	(0.1620) 6240	(0.0963) 4191	12564
Undistributed	9	(0.1752) 3580	(0.3583) 1247	(0.4100) 6554	(0.3777) 2794	(0.2958) 3085	(0.1172) 694	(0.0063) 50	(0.3724) 4918	(−0.9409)	(0.3064) 13335	36257
Households (Services)	10	(0.6306) 12883	(0.3431) 1194	(0.4486) 7172	(0.3971) 2938	(0.3730) 3891	(0.5138) 3043	(0) 0	(0.3815) 5038	(0.5005) 19288	(−1.2742)	55447
Net Outlays (Input)		20431	3480	15987	7398	10431	5923	7890	13205	38536	43516	

Figure 1: 1937 input-output table for the closed model

In his early papers published in the *Quarterly Journal of Economics* (Leontief, 1936; 1937), and brought together in a book published in 1941 (Leontief, 1941 [1951]), Leontief also introduced investment and savings. Because there weren't any external variables in the original model, investment and savings were defined as the positive (respectively negative) "difference between the aggregate expenditures of a household or an enterprise (or a group of households or enterprises) and its aggregate revenue" (Leontief, 1937: 114). The cost equations were modified

to introduce a "saving coefficient"; when this coefficient was less than one, there was net investment in the particular industry, and when it was greater than 1, the industry was saving. A proportionality factor was selected to take into account technological shifts. In his original book, Leontief described changes in savings and investment coefficient by observing the change in magnitude of the coefficients between the 1919 and 1929 tables (Leontief, 1941: 113-115).

Leontief presented an analysis over ten consolidated sectors between 1919 and 1929, showing that the proportionality factor had risen between those years, so that savings were encouraged, while some industries were shown to have increased their willingness to invest. Figure 1, drawn from Leontief (1937) and reproduced in the two editions of his first book, is the input-output table of these ten consolidated sectors; on the diagonal, the numbers in parenthesis are the investment / savings ratios corresponding to the ratio between aggregate output and aggregate expenses; a number greater than one in absolute value means a financing capacity, while a number less than one in absolute value means an investment need.

This approach to investment in the original closed model was highly simplified, a problem noted by the reviewers of the book (Boulding, 1942: 125; Neisser, 1941: 609). One reviewer argued that this device "obscured" the fact that "problems of variations in total output are not seriously faced" (Rothbarth, 1943: 214). In his application of input-output to the Lorraine region, Bauchet emphasized that this original system was static and dependent on an "arbitrary" choice of a constant coefficient of investment for an entire industry (Bauchet, 1955: 17). Bauchet pointed out that this move to suppress investment flows was the first step of an evolution that led Leontief to open his model by considering investment and consumption as exogenous variables, forming part of the final demand in the economy.

B. Investment as a component of final demand

In the early years of the war, Leontief began a fruitful collaboration with the BLS, which helped him collect data on the economy for the 1939 table and expand his analysis to policy questions. Marvin Hoffenberg, who worked as the national accounts expert in the BLS, sought to reconcile the scheme with the construction of those accounts which integrated investment flows, leading him to create a new column for gross private investment (Kohli, 2001: 201-202). This can be seen for instance in the 1939 table used in Leontief (1946), where the last column corresponds to the amounts "Used in Investment" (Figure 2).

(14) Con-uction	(15) Trans-portation	(16) Trade	(17) Foreign Countries	(18) Businessand Consumer Service	(19) Government	(20) Unallocated	(21) Households	Used In Investment	Net Total
159	...	...	415	...	10	439	3,249	...	9,790
...	...	...	248	1	1	370	11,309	...	12,624
564	67	...	159	1	11	372	1	1	2,602
230	...	1	379	...	1	1,238	1,907	1,130	4,930
,010	181	3	510	22	112	1,391	826	1,824	6,807
108	...	...	158	5	10	455	20	2	1,277
,167	13	2	60	2	3	147	160	40	2,037
108	730	501	488	88	243	1,638	3,546	...	9,154
347	15	...	191	33	17	588	919	9	3,192
766	8	225	123	1,305	64	1,006	1,262	263	5,595
2	...	8	149	22	28	386	4,857	54	5,873
3	26	13	34	28	13	229	222	45	890
11	23	39	56	254	3	243	696	111	1,573
...	828	189	...	251	4,207	...	3,151	(10,089)	10,089
...	...	4	103	...	96	474	1,964	...	7,414
636	47	...	244	103	43	948	11,651	...	15,134
140	15	37	...	80	32	311	1,262	...	3,750
4	73	686	2	...	25	2,151	15,684	...	20,167
71	800	1,755	...	2,389	...	1,259	3,700	...	15,300
630	...	5,390	...	3,430	...	...	...	...	23,767
,869	4,667	9,268	...	12,121	8,343	6,148	5,242	...	73,676
,750)	(1,980)	(5,680)	...	(4,130)	(3,880)	...	(1,410)	...	(30,352)
,825	7,493	18,121	3,319	20,141	13,262	19,793	71,628	3,479	235,641

Figure 2: 1939 table with a column for investments (Leontief, 1946)

In addition to considering investment as autonomous rather than as a difference between global output and global outlays, the move from a closed to an open model was made by detaching the household "sector" from the rest of the interindustrial relationships. In this respect, investment and household consumption became part of a final demand or "bill of goods", which opened the way for a discussion of policies aimed at increasing this spending either through increased consumer spending or direct investment. The mathematical form of the model was such that the sum of each goods produced was now equal to the sum of a final demand and a demand for intermediary goods. This allowed Leontief to examine the direct effects of a rise of final demand on the production of a good, and its indirect effects through the demand for intermediary goods.

Leontief shared Bauchet's concerns with automation and the possibility of technological unemployment (Akhabbar, 2019: Chapter VII). In a paper published in 1944, he suggested that his system could help to inform a policy aimed at increasing employment in the economy, by showing the final effects on output of an initial spending increase, once both the direct and indirect effects of the investment were taken into account (Leontief, 1944: 293-294). His concern to build a model informing policy choices was apparent when he refused to close it by an endogenous determination of the demand for investment goods, arguing that this was "[o]nly a system containing one or more free, independent variables opens opportunities for comparative appraisal of alternative courses of purposeful action" (Leontief, 1944: 298-299).

Leontief's collaboration with the BLS during the war had led him to reconsider the practical purposes of the input-output approach, and in a 1943 paper he suggested that "[t]he economic problem of postwar adjustments is, to a large extent, a question of an orderly reallocation of national productive resources—reallocation which should lead to a continuous full employment

of the available labor force" (Leontief, 1943: 160). This concern with full employment after the war was widely shared, and Leontief referred to the ongoing study led by the BLS to establish the level of final demand necessary to guarantee full employment in the American economy, viewed through an input-output table.

BLS economists based their study of full employment on projections for 1950 on the 1939 input-output table (Cornfield et al., 1947a,b), with a disaggregation of final demand between government, consumer, and investment demands, at the level of each industry. Their study, one of the first large-scale forecasts using the input-output model, led them to suggest that an additional demand of 50 billion dollars of capital goods was needed to reach full employment in 1950 (Cornfield et al., 1947b: 423-424). Until 1941, Leontief had mostly used the model to compare between two tables the changes in structure of the economy, or to observe what a change in production or productivity was entailing for the system as a whole. With the integration of final demand, the questions changed. The model became used to make projections as in the BLS study, and this led input-output researchers to the problem of the best way to make the system's coefficients evolve to correspond to a new year.

As conferences and seminars were starting again in the postwar, Leontief and the BLS economists defended the input-output framework in front of other economists, econometricians and statisticians. This led Leontief to a series of debates with economists working on statistical inference, macroeconomics and linear programming (Boumans, 2009; 2016; Akhabbar, 2005; 2021; Biddle, 2017; Carret, 2022). One of the most consistently criticized assumptions made by Leontief concerned the constancy of the coefficients of production; he defended this hypothesis on practical and theoretical grounds, but also by expanding his model to take into account the dynamic problem of technological and structural change via productive investment.

C. Investment as the building of capacity

In the late 1940s, Leontief turned toward the dynamic analysis of investment processes. In his answers to a series of questions asked by a journalist, he explained in May 1948 that "For over a year now, I am concentrating my work on the more involved type of problem in which stocks of commodities, investments in plant, machinery and inventories of finished goods and raw materials are considered simultaneously with the flows of inputs and outputs. This is essentially a dynamic problem involving in its computational phase treatment of large systems of linear differential equations."[3] These questions came at the same time that Leontief was finalizing the program outline of his new research center, the Harvard Economic Research Project (HERP), which was funded by the Rockefeller Foundation and the Ford Foundation. In the program of the HERP, he clearly connected investment with the problem of economic development, contrasting it with other studies treating investment as a component of effective demand meant to offset savings.[4]

Switching to the dynamic model was important for at least two reasons: the first was to establish the level of capital investment needed to obtain a certain level of production; the second was that a number of criticisms addressed to Leontief concerned the stability of the coefficients of production used in the static input-output matrix. It was recognized by almost everyone that these coefficients were not static, which led to the necessity of adapting them when a table from a previous year was used, and the construction of a model integrating technological change through capital requirements was a way to deal with this problem, by having the capital stock influence the level of production.

[3] Leontief to Harvey, May 16, 1948, Box 4 folder "C", Leontief Papers, Harvard University.
[4] Draft of the Program Outline, circa March 1948, Box 3, Folder Drafts, Research Project Papers, Leontief Papers, Harvard University.

In September 1950, the same themes were presented by Leontief when he concluded his presentation during the first international conference on input-output, and argued that "[a]long the introduction of new techniques of production, accumulation of capital constitutes the other basic aspect of economic development" (Leontief, 1953a: 17). The numerical form of the input-output matrix "would make it possible to answer various types of questions arising in connection with the explanation of the behavior of the economic system over time," and he clearly saw such questions as central to the reconstruction of Europe:

> Western Europe, for example, is striving to accomplish an investment program which in a certain number of years would make it independent of the negative 'outside demand', i.e. of the outside supplies which it currently receives from the United States. Had the necessary factual information been available, one could determine the rates of the import surpluses of various commodities which would be required in order to increase Europe's own outputs from their present level to a desired higher level in, say, five years from now. (Leontief, 1953a: 18)

At the end of his speech, Leontief mentioned the work undertaken by HERP to build a matrix of capital coefficients for the American economy in 1939, and presented the basic model which integrated a number of differential equations relating the stocks of an industry with its rate of output (Leontief, 1953a: 21-23).[5]

The activity of the HERP, including the work on the dynamic model, was published in the *Studies in the Structure of the American Economy* (Leontief, 1953b). Leontief's chapter on structural change and the dynamic model formed the first part of the book, completed by an empirical application of the model using the 1939 table in a chapter by Robert Grosse. Grosse was supposed to present his results during a Conference on Technological Change organized at Princeton in April 1951, but he was delayed in his work after joining a government job in the Division of Statistical Standards, and eventually informed the organizers that he would not be

[5] Leontief (1953a: 23) mentions 1937 but this is clearly a misprint as the table that was published was for 1939.

able to present his work. Leontief saved the day by sending his own chapter on "Structural Change" in March 1951.[6]

The dynamic Leontief model was based on the idea that the total demand for each goods was now equal to its final demand, its intermediary demand, and another demand for investment purposes, supposed to be proportional to the rate of expansion of output in other industries (Leontief, 1953a: 22). This introduced dynamics through an accelerator relationship, but this also meant that an entire new set of coefficients had to be collected for the capital coefficients, that is, the coefficient expressing the proportional relationship between the rates of change of each sector's output and the new investment in a particular industry. Leontief argued that this model was well suited for the analysis of economic change, and was for him a step forward compared to time-series analysis which based future evolution on past changes:

> Dynamic theory thus enables us to derive the empirical law of change of a particular economy from information obtained through the observation of its structural characteristics at one single point of time. This possibility, methodologically rather obvious, and practically very important, has unfortunately been obscured by the fact that most of the recent attempts to determine the structural characteristics of actual economic systems have been based on some kind of statistical time-series analysis, thus giving rise to the erroneous impression that the empirical laws of change necessarily must be derived from direct observations of past development. (Leontief, 1953b: 53)[7]

This dynamic model with final demand was still an open model, even though it gave a solution for the different levels of production as a function of time. It was still possible for Leontief to use such a model to appraise different trajectories related to different "bills of goods": "In dynamic as in the static input-output analysis, consideration of the national economy as an open system offers an analytical tool particularly well suited to the making of appraisals of

[6] Webbink to Hurwicz, March 30, 1951, Box 230, Folder "Course Content, Correspondence about Several Conferences", Leonid Hurwicz Papers. See also Dorfman (1954: 128 ff.) on the dynamic model and other ways to dynamize input-output analysis, and Parys (2021) on Hawkins' similar model.

[7] Leontief's quote is somewhat cryptic, as the estimation of capital coefficients necessitated the collection of proportionality coefficients for rates of change between two dates, and not "at one single point in time". I thank Kevin Hoover for bringing my attention to this point.

the material implications of alternative decisions" (Leontief, 1953b). The problem of such an approach was that it implied the collection of a second set of coefficients, at a time when collecting enough data for the flow relationships was already a long and difficult enterprise.

In the early 1950s, Leontief was disappointed with his reception by academic economists who turned towards problems of optimal allocation and macroeconomic planning rather than the collection of the industrial data necessary to use the input-output model. He perceived the efforts put into statistical inference and macroeconomic planning as fruitless, and turned his attention towards government administrations, where there existed a demand for rationalizing the planning process. The new Eisenhower administration also cut off the funds for its civilian agencies to research by input-output methods, and Leontief had to turn elsewhere to spread his approach. He was more successful in persuading European planners to build and use input-output tables. This success was in large part due to the specific questions asked of economic planners in postwar Europe, where large scale nationalizations, and the *mots d'ordre* of reconstruction, modernization and development put investment problems at the center of attention.

II. The Diffusion of Input-Output in Planning Agencies

After his collaboration with the BLS, Leontief continued to work for other government agencies in the United States, and international agencies such as the Organization for European Economic Cooperation (OEEC) and the United Nations. This advisory work came to such proportions that, in a letter to Gerhard Colm, who was at the time head of the Council of Economic Advisers, Leontief complained that the demand for his counsel in Washington was growing in "geometric progression" although he wasn't getting paid for his effort.[8] I will not describe this work here,

[8] Leontief to Colm, November 24, 1948, Box 4 folder "C", Leontief Papers, Harvard University.

nor the debates with other American economists in the late 1940s (see Carret [2022] on this). What is more interesting for our purpose of tracing the role of input-output in economic policy is how the tool was spread in government agencies after the war, and used in the planning process.[9]

In the early 1950s, Leontief led an effort to spread input-output in Europe, at the same time that planning agencies were being set into place to administer Western European economies. He was invited to one of the first general conferences on national income, organized in Cambridge, England in the Summer of 1949 by the International Association of Research in Income and Wealth, an affiliate of the International Statistical Institute (Gilbert, 1951). Before the conference, Leontief was contacted by Odd Aukrust, a colleague of Ragnar Frisch in Norway, working for *Statistisk sentralbyrå*, the national statistical office. Aukrust invited him to another technical conference on planning and national accounting, to be held in Oslo after the Cambridge conference, but Leontief, who was already supposed to attend the Cowles Commission conference on linear programming during this summer, was unable to attend because he fell ill.[10]

Leontief suggested asking the Rockefeller Foundation for funding to organize a larger conference to discuss the use of input-output, first to Aukrust in January 1949, then in a formal letter to Frisch in October 1949. He explained to the Norwegian economist that the Rockefeller Foundation asked him to gauge the existence of "a real and active interest" in a conference on input-output among European economists, before they engage any funds for its organization. Frisch answered favorably and wheels were set in motion with the help of the Central Planning Bureau of the Netherlands and the Netherlands Economic Institute, to organize a conference on input-output methods in the Fall of 1950.[11] The Rockefeller foundation supported some traveling

[9] On the diffusion of input-output in Europe, see also Akhabbar et al. (2011).
[10] Leontief to Aukrust, January 19, 1949, Ragnar Frisch Archives. See Carret (2022) for the months leading up to the linear programming conference and Leontief's last-minute illness.
[11] Leontief to Frisch, October 20, 1949; Frisch to Leontief, November 2, 1949, Ragnar Frisch Papers.

expenses, as well as the publication of the proceedings of the conference.[12] In addition to the 12 Dutch participants, 15 international participants coming from half a dozen western countries were able to attend the Driebergen Conference; they were about evenly split between academia and administration, although this division was also geographic; most of the American economists present at the conference were from academia, while most Dutch participants came from the Central Planning Bureau.

Leontief opened the conference with a defense of input-output and its simplified representation of the economy, an "admittedly crude attempt to combine facts and theory" in order to fill "the 'empty boxes of economic theory' with relevant empirical content" (Leontief, 1953a: 1). He gave several examples of analyses made possible through input-output tables, and finished his address by explaining the dynamic extension on which he had been working on for the past few years. Leontief mentioned that his group had recently completed the table of capital coefficients used for the dynamic model, and that "the solution of the corresponding system of differential equations is about to be undertaken" (Leontief, 1953a: 23). This was the model that was presented only a few years later, in the *Studies in the Structure of the American Economy*, published at the same time as the proceedings (Leontief, 1953b). The rest of the conference was divided between application and theory, with administration economists presenting their experiences with input-output in Norway, the United Kingdom, and the Netherlands.

Aukrust presented the Norwegian experience with input-output, where extensive war planning and government controls on prices, exports and imports had called for detailed knowledge of the industrial structure and the setting up of some "partial" input-output tables (Aukrust, 1953: 111; see also Bjerkholt [1995]). The postwar focus of his office was however on integrating input-output with national accounting, as it was used to draw up economic budgets where capital

[12] Leontief to Tinbergen, October 24, 1951, Box 12, Folder 'T', Wassily Leontief Papers.

formation was separated from the consumption of "raw materials" (Aukrust, 1953). Tibor Barna presented for the United Kingdom the input-output table he drew up for 1935 while he was at the London School of Economics and Nuffield College, Oxford in the 1940s. He remarked that "[w]hat I regarded above as the second part of the study, namely, the use of the model of the economy to give answers to certain questions, has not so far been started" (Barna, 1953: 125). G. F. Loeb, an economist of the National Budget Division of the Dutch Central Planning Bureau, explained his office's work on input-output and budget planning, but recognized that "[a]s the Government has loosened its control over production, consumption and investments, the question was raised whether any detailed planning was still necessary at all" (Loeb, 1953: 173).

Aside from the conferences organized by Leontief and other economists preoccupied with planning, another channel of diffusion for input-output were the institutions in charge of the distribution of Marshall Plan aid. Hollis B. Chenery, a collaborator of Leontief at the HERP, was working in 1950 for the Economic Cooperation Administration (ECA), the American agency in charge of enacting the Marshall Plan in Europe, in collaboration with its European counterpart, the OEEC. Shortly after the Driebergen conference, he wrote to Leontief about the results of his "conversations with Tinbergen and his group." Chenery seemed optimistic on the prospect of input-output for the organization of the European reconstruction, stating that

> [w]e have made considerable progress in getting the Input-Output idea accepted, although the scale of the proposed operation to be undertaken initially has been reduced. The first memorandum was generally accepted in ECA as a basis for further discussion.The Dutch, as you will notice, were considerably more pessimistic but did agree that this was at a minimum a useful way to organize existing data and should be tried out in the OEEC.[13]

Chenery also planned to spread the word in Italy where he was being transferred. It is clear from his letter that Leontief had been advising the OEEC on the possibility of using input-output, and that discussions among the planners of the European reconstruction were under way. This

[13] Letter from Chenery to Leontief (November 14 1950), Box 4, Folder "C," Leontief Papers.

led to the publication a few years later of the first input-output table at the scale of the European economy (Kirschen, 1958).

Chenery remained for a few years in Italy as the Chief of the Program Division of the Special Mission to Italy for Economic Cooperation run by the Mutual Security Agency (MSA), the successor of the ECA. He was joined in this work by Paul G. Clark, another HERP economist who published in the *Studies* a chapter on investment in the telephone industry (Clark, 1953). In 1953, they published a report of their efforts to use interindustrial analysis to inform economic policies for the Italian reconstruction, a study conducted jointly by the MSA and a group of Italian economists and statisticians led by Vera Cao-Pinna, who undertook the construction of an Italian input-output table for 1950 (MSA, 1953).

The study relied on an input-output table with 56 sectors and 200 products, and the final demand was separated between exports, household consumption, government expenditures, gross private investments and inventory changes. The application of the table presented in chapter IV of the study was concerned with "the probable structural effects of attainment of the 25% increase in GNP from 1951 to 1956 which the OEEC countries are trying to achieve." Although the model was not dynamic, the questions addressed in this study made by Clark were problems of the investment and capacity needed to obtain the 25% GNP growth target of the OEEC program in Italy, and the role of government expenditures in this respect (MSA, 1953: 56ff.). The conclusions of the study was that an expansion of investment and government expenditures in the order of 41% was needed, along with increases of 40% for exports and 29% for consumption (MSA, 1953: 67, 81). The usefulness of input-output analysis in this respect was to show that a certain level of GNP was obtainable only with massive investment and increases in capacity, superior to the increase in GNP, because of the interrelated character of the

economy, and to indicate which sectors should expand their production capacities to meet future demand and avoid bottlenecks and inflationary pressures (MSA, 1953: 78-80). Clark noted, without suggesting a solution, that this did not solve the problem of adopting or implementing such policies: "Further consideration of the practical administrative problems in exerting effective encouragement is of course also required" (MSA, 1953: 73).

While Italy was building this input-output table in the framework of the OEEC, the absence of French economists from the Driebergen Conference deserves to be noted. In the letter quoted above, Chenery mentioned his difficulty in establishing a contact with the French: they were in fact following a specific path that will be presented in the next section. The only French economist present at the Driebergen Conference was François Divisia, a professor at the École Polytechnique and leader in French econometrics, and he did not present anything.[14] However, a French economist working for the Ministry of Finance presented during the second international conference on input-output the progress of French planners on their construction and use of an input-output table (Blanc, 1955). This second conference was held in Varenna, Italy, in June-July 1954. More countries were represented at the conference, and the national experiences of input-output planning were a specific topic of discussion, with presentations from Denmark, France, Italy, the Netherlands, Norway and the United Kingdom.

The Danish study was led at the national statistics institute by Kjeld Bjerke (1953), who mentioned that research had been undertaken by the Institute of Economics in the Graduate School of Business in Copenhagen to use the tables assembled by his team to model the effects of price changes on inter-industrial relations, but no government use was mentioned. The French case will be studied in more detail in the next section; Vera Cao-Pinna, the leader of the Italian

[14] Divisia, who had been involved in the founding of the Econometric Society in the early 1930s, was in contact with Leontief since that time (see e.g. Leontief to Divisia, January 20, 1933, Box 2, Folder "General Correspondence 1932-1941", Leontief Papers, Harvard University).

staff for the MSA project led by Chenery, presented the work that had been done in Italy. A National Committee for Economic Research had been established by the Italian Government to pursue the work done on input-output, along with the Central Institute of Statistics. Cao-Pinna presented the joint work with MSA, and argued that this research was still aimed at "testing the validity of the Leontief method as a tool for general economic analysis and policy" (Cao-Pinna, 1955: 282). In the Netherlands, both the Central Bureau of Statistics and the Central Planning Bureau built input-output tables in their advisory capacity to the government's general economic policy (Sandee, 1955: 289). The speaker, a member of the Central Planning Bureau, noted that the time it took for the tables to be gathered was often too long to make them relevant, and by the time the 1947 matrix was finished, "interindustry budgeting was already on the decline," in large part because of the changes in the national economic situation, that is, the end of shortages and controls (Sandee, 1955: 290). In Norway, Per Sevaldson, a colleague of Aukrust at the Statistical Institute, presented the relationship between national accounts and input-output, but he ended his presentation with the remark that "[s]o far no use has actually been made of input-output studies to decide practical policy problems in Norway" (Sevaldson, 1955: 310). Finally, in the UK, the most comprehensive study was done in the 1940s by Barna, who worked outside of the government and prepared a table for 1935 with the support of the London School of Economics and Nuffield College, Oxford (Berman, 1955: 315). But this research was apparently not used in the government's forecasts, which used rough input-output tables with eight or ten industries (Berman, 1955: 332-334).

In addition to the national experiences with input-output, Chenery summarized during the conference the relationship between interindustrial analysis and programs of economic development, the common aims of those programs being "to raise the level of capital formation

and to ensure the use of investment resources to best advantage" (Chenery, 1955: 379). Chenery examined the consistency of sectoral investment programs, and the establishment of investment priorities, using the example of the Italian economy. He argued that input-output analysis had shown in which sectors the investment priorities where located to ensure that capacity would meet the targeted increases in GNP (Chenery, 1955: 382). Chenery's account might lead a reader to think that the analyses produced by his team in Italy were used in the actual planning and the decision of investment priorities. But as he made clear in another article published in 1953, in all the field studies he had done in Greece, Turkey, Portugal and southern Italy, "[n]one of the Governments mentioned has an adequate mechanism for assessing the economic impact of its investment operations, for setting up investment priorities, or for allocating investment resources among various fields. There is therefore no investment 'program' in the sense of an over-all plan" (Chenery, 1953: 78). Chenery thus proposed to create a "central coordination agency" which would use the investment formula he suggested in his paper to allocate investment funds, instead of the current planning process, "done largely on a political basis" (Chenery, 1953: 95).

Chenery became a leader in development economics, which was also becoming the new focus of input-output studies, as evidenced by the third international input-output conference, held in Geneva in 1961, and attended by many economists from developing countries (Barna, 1963). Non-western countries had been involved in the development of input-output since the early 1950s. Leontief had followers working in Japan, such as Shinichi Ichimura who studied at the Massachusetts Institute of Technology and went on to build an input-output table of the Japanese economy for 1951 that was finished in early 1955.[15] Closer to home, a big project in which Leontief had a hand was the input-output study of Puerto Rico, run by Amor Gosfield (Gosfield,

[15] Ichimura to Leontief, March 18, 1955, Box 13, Folder I, Wassily Leontief Papers.

1955). Leontief also traveled around the world to advise planning boards in India and Pakistan,[16] and to establish contacts in Brazil and Greece.[17]

In the United States, the diffusion of input-output remained stalled during the 1950s; the National Bureau of Economic Research did organize a conference on "Input-output: an Appraisal" in October 1952, in which Leontief participated along with the economists from the BLS, the economist in charge of the input-output study of Puerto Rico, and others friends as well as opponents including Milton Friedman (NBER, 1955). But his project did not make much more headway into the Council of Economic Advisers or other government organizations in charge of economic policies. On the other hand, a country such as France saw during the same period its economic administration develop around the conception and implementation of a "Plan" which was the object of much curiosity and debates at the turn of the 1950s-1960s. Input-output was used to prepare forecasts during the planning process, especially starting from the third plan. The peculiarities of French planning are also interesting, and explain why Chenery was more pessimistic about the prospects of input-output in this country.

III. A Focus on French Indicative Planning and Investment

As early as November 1944, the French Government adopted an ordinance attributing to the Ministry of National Economy large powers over the entire economy, to lead and coordinate policies of prices, wages, rents and housing, transports, industrial production and investments (Ordinance of November 23, 1944; see also Antonelli, 1966). Organizing the economy proved difficult. Two years later, Jean Monnet, a French businessman who had worked with the United

[16] Leontief to Weaver, June 6, 1955 Box 14, Folder Rockefeller, and Leontief to Viner, February 2, 1955, Box 15, Folder V, Wassily Leontief Papers.
[17] Gilboy to Valavanis-Vail, May 25, 1954, Box 15, Folder V, Wassily Leontief Papers.

States during the war, led the creation of the *Commissariat Général du Plan*, a flexible structure outside of the traditional administration and the Ministry of Finances (Margairaz, 2021).

The Monnet Plan found wide acceptance as a way to convince American authorities that the aid from the Marshall Plan would be used productively. The first Monnet plan was elaborated through the *Commissions de Modernisation*, in a few months leading to the publication of a report in November 1946, focusing on six key sectors to redirect investment and coordinate their production (Bauchet, 1964: 66). Limited data were available to inform the plan, and even more limited means of implementation after economic controls were restricted to construction permits. But the nationalization of key industrial sectors in energy and industrial production, as well as the nationalization of the banking sector and the centralization of credit policies, offered new tools to manipulate the economy in an effort to reach the targets set in the medium term. What was the role of the input-output model in coordinating these efforts?

A number of French economists answered the call to action quickly. Most of them had been cut off from international research during the war, and François Perroux took the first step of actively seeking foreign economists to have them present their research to a French public.[18] In addition to several journals publishing international research, Perroux created and ran the *Institut de Science Économique Appliquée* (ISEA) which played an important role in bringing together academic economists and the new administration in charge of guiding the economy. Another center of academic research on planning, econometrics and mathematical economics was the *Séminaire d'économétrie* run by Allais and Divisia at the *École Polytechnique*, who formed the engineers involved in national planning and running the nationalized industries.

[18] See the first issues of *Économie Appliquée*, with papers by Joan Robinson, John Hicks, Nicholas Kaldor, F. A. Hayek, Gottfried Haberler and Paul Rosenstein Rodan: http://www.ismea.org/ISMEA/eapp.arch.html.

One of Divisia's students, Pierre Maillet, became a link between the French community of econometricians, Leontief's input-output model and French planning agencies. Maillet had been a student of Divisia at the *École Polytechnique*, after which he joined in 1946 the *École des Mines* where he attended Maurice Allais' lectures on general equilibrium. Maillet was part of a network of successful young French economists, and in 1949 he participated with them in the Salzburg Seminar in American Studies, a recruiting ground for Fulbright scholarships. He was selected for a scholarship, and went to the Cowles Commission in Chicago in 1949-1950, where he worked on econometrics and input-output. In May 1950, Divisia asked Leontief if he could receive Maillet in Boston before coming back to France.[19]

Coming back from the United States, Maillet joined Divisia's "econometrics laboratory" in the École Polytechnique, and published a summary of input-output techniques in the *Revue d'Économie Politique* (Maillet, 1950). Maillet presented the transition from the closed to the open model in Leontief's work, emphasizing the usefulness of the input-output model to predict employment, prices and profits, and to analyze the effect of changes in investment on production (Maillet, 1950: 682). Maillet noted the developments related to the dynamic model, and the problem of having sufficient capacities in the economy to realize a given level of final demand:

> In the case where the a_{ik} coefficients are calculated for the purpose of the forecast, the latter is only valid if the production volumes found for the various industries are feasible, i.e. if the capacities are sufficient. We thus see the introduction of the need, alongside the study of flows, of a parallel study of equipment and production capacities. Maillet (1950: 683)

This question of capacity was related to the problem of bottlenecks that was of concern to economists in the postwar period; Maillet noted that the input-output system had to respect a number of inequalities between the total production of a sector and the capacities of production,

[19] Divisia to Leontief, May 30, 1950, Box 4, Folder "D", Leontief Papers, Harvard University. The summary of Maillet's career is drawn from Malinvaud (2003). Leontief was himself a guest at the Salzburg Seminar in the Summer of 1948 (Leontief to Frisch, June 5, 1948, Ragnar Frisch Papers).

and that exploring those inequalities in relation to an increase in demand could help identify bottlenecks (Maillet, 1950: 689). When capacity was reached, Maillet recognized that the simple Leontief system, even in its dynamic form, was unable to give an account of the ensuing adaptations, substitutions and price changes. To solve this problem, he suggested using a rectangular matrix where several production processes could be represented and chosen from, a solution he attributed to Tjalling Koopmans (Maillet, 1950: 691).

While he was working with Divisia, Maillet was called upon by Claude Gruson at the *Service des études économique et financières* (SEEF) to join the new group of economists at the Ministry of Finance. The group was still a loose collection of individuals in the early 1950s (Terray, 2017), with Gruson as its uncontested leader. His 1950 "Note sur l'établissement d'une comptabilité nationale et d'un budget économique" became the source of much of the work of this service at the time. His note was much larger than simply about the drafting of budgets; it was a manifesto of the new economic administration on the role of economic policy. Gruson argued that it was "a fact, attested by the experience of the last one hundred and fifty years, explained by contemporary scientific thought, that economic life is unstable when left to its own reactions"; this instability led, for him, to the necessity of an economic intervention: "the essential elements of economic activity, employment, the level of prices can and must be stabilized by deliberate action by public authorities" (Gruson, 1950: 517).

There is in Gruson's note much the same spirit that was still permeating Bauchet's analysis of the Plan a decade later: the future can be known and controlled by a sufficient centralization of information and a policy of demand management, ensuring the stability of the economy. Bauchet had a wide view of how the government could ensure adherence to the plan through its financial, fiscal and monetary policy, and through large investment projects and the control of nationalized

industries. Gruson suggested a model of a "network" of industrial, monetary and financial "poles"; his main problem was to centralize knowledge of the economy in order to know the repercussions of different policies and predict their effects, and it led him and his service to elaborate an interindustrial model for this purpose. Maillet was tasked with the construction of an input-output table in relation with national accounts in the early 1950s. Perhaps as a consequence of Maillet's interest with Koopmans' linear programming, the SEEF decided to build a rectangular matrix between products and industries, a choice that led to a number of complications and in general to the impossibility of using it.

This approach was nevertheless defended by members of the SEEF, including Louis-Pierre Blanc, who presented the French experience of interindustrial analysis during the second international conference on input-output analysis (Blanc, 1955). Blanc later admitted that his presentation was received poorly by the participants, attributing it to the fact that the SEEF methodology was different from that of Leontief (Fourquet, 1980: 172-173). In 1953, René Mercier, another member of the SEEF, published in *Econometrica* a summary of the French experience of National Accounts and "Tableaux Économiques" (Mercier, 1953). Mercier explained that the SEEF was in charge of drawing up economic budgets, which he defined as "numerical forecasts showing the main economic flows expected for the coming year" (Mercier, 1953: 371). He also argued that the standards set up by the UN and OEEC were "insufficient" for the French economists, and the team brought together by Gruson "strived to go back to the basic principles leading to the establishment of national accounts" (Mercier, 1953: 371). The methodology described by Mercier was along the same line as that drawn up by Gruson in his 1950 note, and he remarked that their elaborate methodology could be reduced to the "classical

Leontief table" under certain conditions (Mercier, 1953: 389). However, this remained only a methodology, unimplementable because of its intricacies and the lack of available data.

The failure of the French strategy has been documented elsewhere (e.g. Fourquet, 1980: 161ff. and 418-422). In the middle of the 1950s, two economists from the SEEF visited the United States on a mission to understand how Evans and Hoffenberg had developed their input-output tables. When they got back, the difficulty of gathering the data almost sank the budding service in the Ministry of Finances, according to its own agents (Fourquet, 1980: 163), and the first real input-output table for France, drawn up for 1956 with 65 sectors, was only published in 1960. In spite of all their connections with and knowledge of input-output, the French planners had preferred to follow their own path to produce their national accounts, a move that has been viewed as the source of the autarkic features of macroeconomics in France (Desrosieres, 2013).

The failure of the SEEF to incorporate an input-output table in its national accounts during the 1950s did not prevent them from taking more importance in the planning process. In the middle of the decade, Gruson and his group became the technical arm of the *Commissariat du Plan*, and they contributed to the elaboration of the third plan for the years 1957-1961 (Hackett and Hackett, 1963: 106). Henri Aujac, who joined the SEEF in the middle of the 1950s, described half a century later how "[t]he government tentatively entrusted the SEEF with the task of establishing a preliminary forecast for 1961" and how he used the input-output table for this purpose (Aujac, 2004: 72-74). Ironically, the Third Plan was completely abandoned as France went through a major political, economic and monetary crisis in 1958, leading to a major regime change and the drawing of an "interim" plan readjusting the targets. While the Fifth Republic offered more power to the planners, the process also became more politicized with the

Government forcing out "politically embarrassing inflation projections" and rewriting entire portions of the Plan to serve a political program (Hall, 1980: 150-151).

Conclusion: instability, investment and planning

Reflecting on the ongoing economic crisis, Nixon's chairman of the Council of Economic Advisers, Herbert Stein, argued in late 1973 that "[m]aybe we need an economic planning agency like the Japanese or French" (Golden, 1973). Leontief jumped on the occasion to argue "For a National Economic Planning Board" in *The New York Times* (Leontief, 1974a). His plea was that if instead of the "powerless and understaffed Council of Economic Advisers we had had a well‑staffed, well-informed and intelligently guided planning board, the mess in which the country finds itself today could have been avoided" (Leontief, 1974a). He went on to explain how the National Planning Board could be able to coordinate the activity of different sectors in the economy, and avoid over- or under-investment by using interindustrial data. In an interview published in *Challenge* the following summer, Leontief furthered his points and argued that "[p]lanning is a technical problem" which could be solved efficiently in a country such as the United States (Leontief, 1974b: 38).

The Planning Board was not created in the 1970s, and input-output did not make the comeback hoped for. Leontief's enthusiasm, and his faith in the collection of data to coordinate economic activities, was widely shared by most of the participants in our story, and yet they never obtained the decision-making power they were hoping for. In spite of all the successes of input-output in academia, in spite of how fast it was spread throughout planning agencies, there was a conspicuous failure in the primary objective of organizing the economy along "rational", that is, "scientific" lines. This failure came in part from the requirement in data and the

computational problems underlined by most of the practitioners, and in part from the theory which lacked a solid dynamic grounding. But it was mainly a failure in objectives: the goals of coordinating the whole activity of an economy through the expertise of a handful of economists and statisticians were clearly out of sync with the realities of economic policies and the problem posed by the centralization of knowledge.

Contrary to what Leontief argued in 1974, the planning problem was not purely technical but heavily political, and neither politicians nor populations were ready to let the experts decide where to invest, where to divest and how much. In the 1940s, the ambition to centralize knowledge to have all the information available to plan the economy was denounced as a scientistic hubris by F.A. Hayek, who argued that where the centralization of knowledge failed, the price mechanism was able to coordinate economic activities, and was the only "rational" principle on which to base economic action (Hayek, 1945; Caldwell, 2020). In 1976, Hayek derided the "new confusion about planning" and expressed his "bitter" disappointment in Leontief, and the way in which he entertained an ambiguity on what planning was, and who should do the planning (Hayek, 1976: 4-5). Hayek concluded that "[t]he source of belief in the value of input-output representations is the wholly wrong idea that the efficient use of resources is determined mainly by technological and not by economic considerations", and would lead to the creation of a corporatist economy, as had indeed been the case in France to ensure that the "targets" were met. The cartelisation of the economy was actually something on which economic planners such as Bauchet (1964: 80) were in full agreement and encouraged (Hall, 1986: 149): the problem of coordinating the activity of a multitude of firms, seen as the source of economic instability, was solved when each sector was consolidated around one firm responsible to meet

the production target. One has to look somewhere else than in input-output to understand what planning really meant, to find the real planning decisions, and to understand their bases.

In the end, it is surprisingly hard to pin down exactly what economists using input-output from inside the administration were doing, in comparison to their colleagues in academia, which they were wont to see as out of touch with economic realities. Many input-output tables were drawn up by statisticians working for their governments or in academia. They built tables which they themselves did not use; their applications were left to the discretion of other academic or administration economists using the tables as forecasting tools, and not to organize production. The contrast between discourse and reality was emphasized by Fourquet in very clear terms: "national accountants seem to share with professors this illusion that mastery of concepts gives its possessor mastery of reality" (Fourquet, 1980: 348). This delusion was the source of their failure to influence decisively economic policies; but the desire to give answers in unstable times explains why the same solutions recurrently appear in the public debate, to this day.

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