

Social technology and political economy: the debate on the soviet origins of input-output analysis.*

(draft - *do not quote*)

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History of Economics Research Group Second Workshop

“Audiences for the history of economics”

21 December 2006 – Nanterre University

Abstract

While the American making of input-output analysis is well known, the analysis of the Russian origins of input-output leads historians of economic thought to contradictory *stories* and to controversial statements. Such an inquiry leads to a strange confusion. This paper aims to identify the different elements of the debate about “the soviet origins of input-output analysis” and to identify the stakes of such a debate. We see how in different times and different contexts opinions about the “soviet origins of input-output analysis” change and stories are contradictory. Then the question raised is to know how history of economics can lead such an inquiry without loss of “objectivity”.

* This presentation is based on a paper presented at the ninth summer university in history and methodology of economic thought held at Lyon last summer (A summary available online www.insee.fr is to be published in *Le courrier des statistiques*).

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“The game of who has the priority in the development of ideas is, really, not a particularly useful one”

Herbert S. Levine [1964], p.355

Is Walras an analytical mask?

Input-output analysis is a term invented during the Second World War by the war federal administrations in the US. This term aimed to identify the collective work of the Bureau of Labor Statistics and the Harvard teacher Wassily Leontief².

In fact the main part of this work was already available in Leontief’s statistical and theoretical studies dealing with the “*interindustrial relationships*” published in [1941] in *The Structure of American Economy*. This book was a collection of former papers. Indeed, the first input-output table was published by Leontief in [1936] in the *The Review of Economics and Statistics*, and the first mathematical input-output model in the same review in [1937]. We make a clear distinction between the statistical side of input-output analysis and its theoretical side.

The statistical side is the famous input-output table representing interindustrial flows of inputs and outputs between industries (generally expressed in monetary units). According to Leontief, the input-output table is close to Quesnay’s *Tableau économique*. The table permits the calculation of the quantitative requirement of a commodity i to produce one unit of the commodity j , noted a_{ij} . This ratio is called a technical coefficient.

² Wassily Leontief was born in 1905 in Munich. His family was a Russian intellectual and bourgeois family. Leontief grew up and lived in Russia till 1925. After several imprisonments he went to the Weimar Republic in 1925. In Berlin Leontief got a PhD in 1928: he was Sombart’s assistant and Ladislaus Bortkiewicz was his PhD director. Leontief worked at the research centre in economics of the University of Kiel between 1928 and 1930. He quitted Germany in 1930 and got an occupation at the NBER in New-York. In 1931 Leontief got a teacher

The theoretical side of this approach is the model of Leontief. This model is constituted of three sets of equations describing a national economy producing n commodities: (1) the n requirement equations (quantity of commodity i employed in the economy equals the available quantity of i); (2) the “production function”: it is the set of technical coefficients as $a_{ij} = \frac{x_{ij}}{X_j}$ (the input requirement x_{ij} is linearly proportional to the production of the industry X_j); (3) Finally, n price equations: current prices are decomposed in cost and value added. The fundamental theoretical assumption concerns technical coefficients, supposed to be constant.

The constancy assumption implies that the production function has constant returns to scale and complementary factors of production (there are no substitutions between factors). As a consequence the marginal productivity theory is abandoned and the repartition between wages and profits is a data of the model.

Leontief called this model a “simplified walrasian model” as technical coefficients and most of the equations of the model are almost formally similar to Walras’ equations in the *Elements d’économie politique pure*.

One of the major inventions of Wassily Leontief was to translate Walras’s equations into matrix algebra. The model is written, with d the column vector of final demand for each commodity (data³), A the matrix of technical coefficients (so-called structural matrix, data), X the vector of outputs(unknown), P the price vector (unknown), R the value added vector (wage and profits) and I the identity matrix:

assistant occupation at Harvard University. Thanks to Harvard funds he collected data and constructed the first input-output table between 1931 and 1936.

³ If final demand is not exogeneous but an unknown of the model then the model is said to be closed. Otherwise it is an open model of Leontief.

$$(I-A)X=d \quad \text{and} \quad (I-A)'P=R$$

This combination of the input-output table and the model of Leontief is the clue of the success of input-output analysis after World War II (first in the US and then worldwide).

According to Leontief this project was imagined during his research stay in Kiel and theoretically ready soon in the thirties. Indeed, in Kiel Leontief worked on econometric estimations of marshallian demand and supply functions⁴. This work seemingly conducted him to admit the theoretical superiority of general equilibrium approach to partial equilibrium analysis. As a consequence Leontief built an operational version of general equilibrium theory that was latter called input-output analysis.

The question that arises is to know whether the walrasian reference is a way not to speak of the soviet and Marxian-classical influence on the table and the model of Leontief⁵. Indeed, the previous story is coherent but Leontief always played down or held back the soviet influence on his own work.

Leontief gave many interviews where he always claimed that soviet economists didn't inspire his work:

“My readings were not influenced by the revolution. My scientific works are not influenced very much by the current state of political affairs” noticed Leontief (in Rosier [1986], p.78). However, he remembered that during his frequent imprisonments he could have *“long discussions about Hegel, Marx and the Russian philosophy”* (Ibid., p.79). More surprising is Leontief's answer to Duncan Foley's question: *“-Foley: Was anyone at that time thinking about a statistical basis for planning in the Soviet Union? -Leontief: No. The first*

⁴ Leontief was known for this econometric work (and his controversy with Ragnar Frisch).

thing which had some relation to it was essentially a national income analysis. Like all national income analyses, it was not very disaggregated. Everything gives you one figure, while I thought that to understand the operation of the system, one figure is not enough” (Leontief in Foley [1998], p.118). Finally, when Foley asked him about Marx’s influence, Leontief answered: *“No. Not really. No. Marx was not a very good mathematician. He was always mixed up in math, and the labor theory of value didn’t make much sense”* (ibid.).

These are three purely negative statements about the influence of statistical and theoretical soviet works and Marxian-classical theory on the making of input-output analysis.

It is easily understandable that in the thirties it was certainly easier to get funds from the Harvard scientific comity for an empirical work on general equilibrium structural relations than for a statistical soviet project! For instance, after WWII, many attacks in journals denounced the use of federal money to construct a “communist technology”. In the US, input-output analysis was clearly suspicious: it was denounced as a social technology adapted to planned economies but irrelevant for a free market economy. Leontief lost his governmental financial supports from public administration and from the US Army first just after the war (1945-1947) and latter during McCarthyism years (financial supports ceased between 1954 and 1959). Paradoxically, Leontief found constant supports from private firms (like the Westinghouse Company). May be as a consequence of these political tensions, Leontief didn’t participate in the socialist calculation debate, while general equilibrium theorists like Tjalling Charles Koopmans and Oscar Lange did⁶. Even though evidences of Leontief’ interest on socialist calculation were found in his archives, he never discussed the theory of socialism.

⁵ For a purely analytical account of the « classical roots » of input-output analysis, see (Kurz and Salvadori [2000]).

However the interviews previously quoted date from the 1980's and the 1990's. At that time Leontief was awarded with the 'Nobel Prize' and he had left Harvard for New-York University. To conclude one must admit that Leontief's personal strategy (psychological and academic strategy⁷) was to deny any soviet influence on his work.

According to him there is nothing to be found about the origins of input-output analysis in the soviet economics of the twenties (when Leontief was in USSR). According to him, that was the failure of marshallian analysis (to represent the economic system) that led him to the empirical application of general equilibrium. To Duncan Foley⁸ he said: "*I would interpret [input-output analysis] as an outgrowth of neoclassical theory*" (*ibid.*, p.129).

The Russian claims for the invention of input-output analysis

The role of soviet economics and statistics was first evoked at the end of the fifties that is to say just after McCarthyism in the US and, in the USSR, after Stalin's⁹ death in 1953. We may understand the appearance of the "soviet origins of input-output analysis" as a consequence of the political situation in the USSR. Indeed, after Stalin's death, economists of the pre-stalinian period were published again. Most of these economists (Kondratieff, Bukharin, etc.) were murdered during Stalin's numerous purges. These economists were those of the twenties, before Stalin's complete appropriation of power in 1929. After that time Stalin rejected, harassed and prosecuted those who believed in rational and transparent

⁶ In fact Koopmans and Dantzig build a much more powerful tool for planning than Leontief: linear programming widely used by USAF. But Leontief found it dubious. About the relationships between Leontief, Koopmans and linear programming, see Akhabbar [2005].

⁷ One may remind Paul Lazarsfeld's political activities change after he came the US in 1933.

⁸ Duncan Foley is not a main-stream economist.

⁹ Stalin (1879-1953) is elected general secretary of the central comity in 1922. Progressively he concentrated political and military power in his hand until he became the indisputable master of the USSR at end of the twenties, after Trotsky's eviction.

organization of social data¹⁰ and in the theoretical and mathematical analysis of economic systems. This was the consequence of a strategy developed since 1921.

Indeed, after the October revolution, Lenin had to face the economic and social consequences of World War One, of the civil war and of the production disorganisation due to collectivisation. In 1921 the future of the revolution was very fragile: the agricultural production decreased by one third in 1921¹¹ and the industrial output was 13% of that of 1914. Because of super-inflation, it was a barter economy and no more a monetary economy. Cities were abandoned by inhabitants (Petrograd lost two third of its population).

After the sailor of Kronstadt's unsuccessful rebellion in March 1921, Lenin decided at the 10th Party's Congress to adopt a "New Economic Policy" (NEP). The NEP was a progressive return to market organization of production notably for agricultural production and small firms and industries¹². Even Ford built a firm in Gorky and the capitalist methods of rational organization of work were mimicked (see Berliner [1957], Granik [1955] and, Pisier [1982] p.300). In State firms, centralized allocation of resources is abandoned and workers could choose their work. The NEP got quickly good results and the revolution was saved: in December 1922 the Union of the Soviet Socialist Republics is created (USSR).

But when Lenin died in 1924, the question of the political and economic strategy to follow was unclear. At the left of the party Trotsky (at the head of the red army) argued in favour of the revival of the October revolution while Stalin (at the head of the Party) stood up for Lenin's NEP. In 1925 Stalin, helped by the right wing of the party, forced Trotsky to resign as People's Commissar of Army. In October 1927 Trotsky (and Zinoviev) was expelled from the Central Committee. He was exiled in 1928 and expelled from the USSR in 1929.

¹⁰ Schwartz [1958] noted that it was possible to know the true population statistic of the USSR only in 1958.

¹¹ Russian agriculture was a non-surplus production in 1914.

During that time serious questions arose at the Central Committee concerning the economic development strategy of the revolution. Especially three points were under discussion:

The first concerned the nature of the NEP: at the left of the Party it was defended that the NEP was the betrayal of the revolution (and the wealth of nepmen was denounced¹³); at the right of the Party, especially with Bukharin, it was said that destruction of market relations would be a mistake.

The second debate concerned the relationships between the agricultural sector and the industrial sector: at the left of the Party, Trotsky and Preobrajensky considered that a forced saving had to be taken from the agricultural sector¹⁴ while at the right, Bukharin noticed that such a tax would lead to a decrease of the agricultural production because of the lack of incentives¹⁵.

The third debate concerned the relationships between the national sector and the rest of the world: paradoxically, the left defended the integration of the national economy into international trades¹⁶ while at the right an autarkic development was defended (see Chavance [2000]).

Joseph Stalin first supported Bukharin's position to eliminate Trotsky. Once Trotsky expelled, Stalin denounced Bukharin's political positions and the right wing of the Party. Finally, independently of all the debates, ideological and scientific, in 1928 Stalin replaced the NEP by the centrally ordained "five-years plans". With no seed capital, little international

¹² See also Liebich [1999]

¹³ See Alan Ball [1987].

¹⁴ This is the « teleological » view of the unequal exchange between agriculture and industry.

¹⁵ This is the « genetic » view focused on the actual situation: underproduction.

¹⁶ According to Trotsky, the goal of such a strategy was to export agricultural products in order to import industrial capital goods. This position was linked with the forced saving one that's why it was rejected by Bukharin.

trade, and virtually no modern infrastructure, Stalin's government financed industrialization by both restraining consumption on the part of ordinary Soviet citizens, to ensure that capital went for re-investment into industry, and by ruthless extraction of wealth from the peasants. This was more or less Trotsky's program violently executed.

This program was executed as if previous debates between the right and the left had never existed. It was also executed without help of economists and statisticians who worked during the twenties to find technical solutions to the questions of strategic development. Indeed, Stalin prosecuted, expelled, and murdered most of them. Groman was murdered, Kondratief died in the Gulag, Feldman and Vainshtein were put in jail, Preobrajensky was put in jail in 1935 and killed in 1937, Bukharin was expelled from the Party in 1937 and executed in 1938, Trotsky was murdered in Coyoacan in Mexico in 1940, Zinoviev was expelled from the Party in 1934 prosecuted and executed in 1936 etc.

As a consequence, most of the economists of the twenties were not published and taught in the universities until the end of the fifties. Stalin's death led to a revival of these economists and also to a partial revival of their scientific style: statistical research and mathematical economics.

This revival is a first explanation of the sudden claim to the original invention of input-output analysis: soviet economists of the late fifties saw in these soviet works the real origins of input-output analysis (Nemchinov [1959], Hardt [1967], Treml [1972], Jasny [1962], Spulber [1964a] [1964b]). During a controversy opened by Jasny and Nemchikov this invention was attributed for instance to V.G Groman [1926], P.I Popov [1926] and L.N

Litoshenko [1926]¹⁷ and also Barengolt [1928]¹⁸. For instance, Naum Jasny argued that Groman invented input-output analysis but Jasny was interested in showing that input-output analysis was a Menshevik invention and not a Bolshevik one!

Later, others like Tretyakova and Birman [1976] thought that these origins were to be found in Dimitriev's works at the beginning of the century (but Belykh [1989] gave evidence that this is wrong).

An academic dispute?

The Russian claim for the invention of input-output analysis was grounded on analytical and historical reasons. Oscar Lange, a friend of Leontief, proposed a short account of the Russian story of input-output analysis:

“In the USSR, during the period of constitution of the first five-year plan (1928-1932), economists began to deal with the problem of the theory of reproduction and accumulation in relation with the economic planning and the preparation of socio-economic tables (...).

Under the socialist regime, socio-economic balances began to play a similar role to the one played in the capitalist countries by economic national [accounting] which makes possible the control and gives a basis to new decisions (...). The development of accounting in this shape in the capitalist countries was indubitably provoked and influenced by the balance-sheets constructed in the USSR.

V.Leontief, an American economist of Russian descent, is generally considered as the founder of the modern input-output analysis. In 1941 he published a study, The Structure of American Economy 1919-1939, in which he employed and developed the method of input-output analysis for the production. The ideas underlying this analysis were conceived in

¹⁷ This is the point of view of Spulber and Dadkhah (1964) (1975).

¹⁸ Position defended by V.S Nemchinov (1958).

relation with the studies of the balance sheet of the national economy of the USSR. Leontief who was yet in the USSR, published in 1925 a paper entitled “the balance of the national economy of the USSR (Balans narodnogo khozyaistva SSSR)” in the journal Planovoe khozyaistvo. In this paper he presented the idea of input-output analysis.” (Lange [1969], p.44).

In other words, according to Lange, input-output analysis has nothing to do with western national accounting and Walras but was invented in the USSR by Leontief who was inspired by the works of soviet economists on balance sheets of the national economy. The story Lange told is fascinating but in fact completely false. In order to build his argumentation Lange associated true elements in a wrong way. It is true that balance sheets were build in the USSR¹⁹, and that Leontief invented input-output analysis²⁰, it is true that a five-year plan was prepared²¹ and that Leontief published a paper on soviet balance sheets²² but all the relations Lange made between these elements are wrong as we will show later.

Moreover this story works on simple oppositions: socialist regime/capitalist regime; socio-economic balance/national accounting; economic planning/economic control; ... This analytical schema was a result of the cold war: to think bipolarity, diffusion and contamination.

These propositions were also a way to give a simple interpretation of input-output analysis: this not political economy, this is a planning model, a *social technology*. As a

¹⁹ But those who were prepared for the five-year plan have nothing in common with input-output tables. Moreover economists who worked on the theory of accumulation and reproduction had nothing to do with the five-year plan as showed earlier.

²⁰ But certainly not in his 1925 paper.

²¹ But as we said earlier, the five years plans were prepared without reference to theoretical and statistical matters and techniques.

²² But he was not in the USSR. Leontief first published this paper in german and then translated it in Russian.

consequence it was not an alternative way to make economics and Leontief's methodological critic of economics was of no importance.

However there is a simpler interpretation of Lange's story and in general soviet's position: V.S Nemchinov tried at the end of the fifties to import input-output analysis in the USSR in order to improve planning methods. Around Nemchikov numerous economists agreed with the necessity of a macroeconomic and monetary view of planning, instead of partial view with quantity-balances. Compared with soviet techniques, input-output analysis appeared as a rigorous analytical scheme using mathematics, statistics and computer science to produce precise plans and forecasts. However, during the cold war importation to the GOSPLAN of American techniques of social control, if ironical, was not workable for self-evident reasons. As a consequence it was a profitable strategy, in order to convince GOSPLAN, to show that in fact input-output analysis was a soviet approach. The only way to import input-output analysis was to underline its soviet roots. This is probably one of the most important explanations of the sudden rise of the soviet claim. But when Nemchikov tried to prove Bolshevik's origins of input-output analysis, Naum Jasny (in the US) tried to prove its Menshevik's origins. That was the origin of a controversy between Jasny and Nemchikov (but in the USSR it was more or less admitted that Russians invented input-output analysis).

However, we find in western literature the same story as Lange's independently of any direct political stake. Joan Robinson after underlying the fact that Leontief was an orthodox economist noted that "*the model that made Leontief's name deservedly famous is a breakaway from neoclassical orthodoxy [...]. Certainly by importing it from the USSR, Leontief made an important contribution to western economic analysis*" ([1968], p.432). This was certainly an unfriendly remark whose consequence would have been damageable during the fifties but

which was here a strategic move not in the cold war but in the conflict between the two Cambridge since Sraffa's 1960 book²³. Robinson's statement was clearly to be understood as a petty-squabbling as she doesn't give any rational argument.

Answers to the soviet claim

We discussed earlier in the text Leontief's late answer to this controversy. According to him, there is no link between Russian economists and his input-output analysis. This was declared by Leontief after the cold war and also at a time when he quit Harvard and had won the 'Nobel Prize'.

In the 1960's, an American economist close to Leontief answered to the Jasny-Nemchikov controversy. Indeed, Herbert Levine published his reaction in the *American Economic Review* [1962] and in *Soviet Studies* [1964] (the same review where Jasny published his answer to Nemchikov). Levine noted: "*It is Dr. Jasny's contention that the Russians did indeed invent Input-Output and furthermore that the one who invented it _V.G Grossman_ [was a Menshevik]*" (Levine [1964], p.352).

According to Levine, "*The USSR Balance of the national economy is not an input-output study and never was*" (*ibid.*, p.353). He added that "*the importance of Professor Leontief's contribution does not lie only in his successful construction of a statistically meaningful table. It lies in his theoretical approach to the question of inter-sectoral technical relations [...] and his application of certain mathematical methods to derive total relationships between inputs and outputs*" (*ibid.*, p.355).

Finally Levine concluded that "*it can be seen from Leontief's own writings (see, e.g. his doctoral dissertation completed in 1927) that he was greatly influenced by Walrasian general*

²³ *Production of Commodities by means of commodities.*

equilibrium analysis [...]. If one were forced to choose the influence which could in some sense be said to have been dominant, the choice from the evidence available would almost have to be Walras and his mathematical, general equilibrium approach to economic analysis” (ibidem.).

Levine’s answer is very ambiguous: on the one hand he stated like Leontief that soviet works had nothing in common with input-output analysis but he added on the other hand that this soviet work “*was (and still is) both more and less than an input-output study*”; that is to say that the statistical analysis were close but different from input-output analysis and that, after all, what is important is not the table but the model...

In fact it seems that the debate was not structured in a way to make demonstrations and to present evidences. It is a purely discursive game whose stakes were not history of economics.

As Levine wrote “*the game of who has the priority in the development of ideas is, really, not a particularly useful one*” (Herbert S.Levine [1964], p.355) but one may find almost four payoffs: (1) analytical conflicts between two schools (Robinson); (2) political stakes in a cold war conflict : (a) Jasny’s will to prove Menshevik origins, (b) Nemchikov’s (and many others’) will to prove Bolshevik origins ; (3) manipulation for concept emigration (Nemchikov and Lange to make the GOSPLAN use input-output analysis); (4) scientific strategy in a political context (Levine, Leontief) etc. This is a way to understand this game.

After that we feel that Levine, Jasny and other players of the controversy-game didn't intend to bring evidence and to prove their statements but to adopt numerous strategies to avoid ripostes:

- (A) By multiplying references: One should indeed check numerous sources: (1) the Russian balances of the national economy (but it is not completely clear which ones? Those of stalian era or those before?); (2) Russian economists like Barengolt and Grossman; (3) Walras' *Elements d'économie Politique Pure*; (4) Leontief's PhD dissertation; (5) Soviet five-years plan etc. This huge amount of statistical, theoretical and mathematical material finally leads to any inter-subjective interpretation.
- (B) Multiplication of languages: French, English, Russian, German.
- (C) Change of the definitions of terms (input-output analysis or national accounting for instance).
- (D) Unclear or inexact origins of information.

Etc. ... The consequence of that is to try to build a "specialized" debate where anyone proves anything in order to let the reader choose not according to arguments but to the ideological position defended. To understand such a controversy theory of strategic games and communication is more useful than epistemology.

Another question is to know if any economist is able to escape any of these rules of game? Is anyone indifferent to one of the payoffs of the game²⁴?

At that time, between all the participants only one tried to construct a rigorous demonstration: Nicholas Spulber (and latter with Kamran Dadkhah). The latter first published and translated in English the Russian economists concerned by the controversy (Spulber [1964b]): Popov, Litoshenko, Grossman, Leontief, Banregolt etc. During the controversy Spulber noticed that *“Popov and his collaborators (...) built a new statistical tool [...] offering important possibilities as it appeared after that the professor Wassily Leontief employed a similar analysis and generalized it and gave it its appropriate algebraic form. Popov and Litoshenko failed to reach the level of sophistication that today’s input-output analysis has reached thanks to the use of matricial algebra; however it does not mean that they should be denied the title of pioneers”* (Spulber [1964a], p.48-49). In his book Spulber identified a clear historical material, Popov’s book [1925], but there is no evidence, only results.

More than ten years later, Spulber and Kamran Dadkhah published a paper where they denounced the ideological stakes of the controversy on the “soviet origins of input-output analysis”. They argued that *“meanwhile, from the standpoint of modern economics, no documented evaluation of analytical merits of the Balance, conceptual shortcomings, and statistical procedures and findings has been undertaken.”* (Spulber and Dadkhah [1975], p.27). However, in their paper they did not give evidence of the Russian origins of input-output analysis and only told a story and built an input-output table *based* on Popov’s work. This is an enlightening reconstruction but the work remains to be done (or clearly formulated), that is to say to compare directly Popov’s work and Leontief’s input-output analysis.

²⁴ Analytical controversies, political controversies etc.

Popov and Litoshenko, founders of input-output analysis: a rational reconstruction.

It is argued here that it is possible for the historian of economic thought to give an account of the “soviet origins of input-output analysis”. To do so we use the deductive method largely spread in current economics. To avoid temptation of the numerous payoffs and the different strategies of the controversy game previously listed, one should follow a deductive methodology: first to define terms to be used, second to formulate assumptions in the terms defined previously and then to test assumptions and deduced sentences.

The first step of such a work is a definition work. We defined at the beginning of the paper what input-output analysis is: the combination of an input-output table and a mathematical model. The input-output table represents monetary flows of inputs and outputs according to a double reading: a row-reading (equality of total employment and total output) and a column-reading (expenditure of the industry plus value added). The model of Leontief is composed of three sets of equations: quantity equations, production function and price equations. The fundamental assumption concerned constancy of technical coefficients.

The second step of the work is to formulate the assumptions to be tested:

(1) Did Popov and his collaborators in his [1926] book invent the input-output table and the input-output model?

(2) Did Leontief present the input-output table and the input-output model in his [1925] article?

The third step is to examine facts. As noticed Spulber and Dadkhah, on July 21, 1924, a supreme Soviet organ the “council for labor and defense” (STO), ordered the Soviet Central

Statistical Administration (TsSu) to construct a “Balance of the National Economy” for 1923-1924. Twenty economists under the direction of Popov started to work on the Balance. Their preliminary results were published in 1925 and the final work in 1926.

Their goal was to make a balance of the soviet national economy for “*practical as scientific ends*” (Litoshenko [1926], p.26). That is to say that they aimed to determine the economic laws of the national economy as a whole. A first step was to build an “*image*” of the soviet economy following the methodology of “*national economic accounting*” (*ibid.*, p.21): “*When bookkeepers prepare a balance sheet, they equilibrate debit and credit. Applied to a study of the national economy, the balance signifies a statistical operation intended to show how the social economy is reproduced in specific conditions*” (Popov [1926b], p.5).

Application of private accounting to a national economy is a first important social innovation. Here the idea that the economy should be seen as a unique firm (Litoshenko) is not a theoretical statement but a cognitive strategy. Litoshenko and Popov didn’t refer to the well known Klautsky theory of the socialist economy as a unique firm, but to a specific point of view: to look at the economy *as if* it was a unique firm²⁵.

At the same time Popov and Litoshenko insisted on the fact that national accounting should not lead to forget that what matters is not the whole but the relationships between the whole and the parts: “*to take the total output as a whole would limit excessively the practical significance of the balance sheet, which would then show only the total volume of the national economic process and turnover of goods without imparting any information on the share of even the large individual sectors*” (Litoshenko, *ibid.*, p.25).

The economic system is represented in a specific manner: “*the balance sheet covers the national economy as a whole, taking into account the objective results of the economic activity of the individual economic atoms*” (*ibid.*, p.21).

Popov and Litoshenko decided to construct a multi-sectoral table. They divided the economy in numerous sectors producing “*more or less homogeneous goods*”. Six main branches of the economy were selected: agriculture, industry, construction, transport, trade, and final consumption (“unproductive demand”); and also numerous under-sectors like farming and pasturage, animal husbandry, forestry, hunting and fishing etc.

The national balance is constructed following a simple concept of equilibrium between total output and uses. In order to match Marx’ reproduction schemas, Popov distinguished between “production commodities” and “consumption commodities” (but not between a sector of production commodities and a sector of consumption commodities).

In conclusion, the national Balance was built in monetary terms in order to permit a macroeconomic view of the economy. Indeed, Litoshenko underlined that “*the physical balance sheet does not enable us, in the first place, to compare the branches of production to one another. We cannot add coal and calico, grape wine and grain products. Each sector of the national economy remains locked inside its physical balance sheet and the total national balance sheet breaks down into an infinite number of unconnected horizontal lines*” (*ibid.*, p.45). At that time it was not a Bolshevik idea to use value balances as the ideal economy should be a non-monetary one. **But the principle of a multisectoral balance and a value balance permitted Litoshenko and Popov to invent the principle of the row and column lecture of interindustrial relations.**

²⁵ In the twenties the greatest part of the Russian economy was market economy...

Indeed, we find in the soviet Balance the principle on which Leontief based his own table. The following table is the (partial) reproduction of the balance and *we underline the row-column data on interindustry relations (see next page).*

The lecture of the underlined table (bold type) is done as follow: row-reading means “the sector *i* supplies to sector *j* the amount *x*”; and column-reading means “sector *i* uses as an input the amount *x* of sector *j*”. For instance, the third line indicates that the industry supplies 355.1 millions of gold rubles of industrial products to agriculture; the third column indicates that industry uses 1240.9 millions of rubles of agriculture and 2344 millions of rubles of industrial products etc.

It is not the goal of this paper to make exhaustive comparison of input-output tables and the soviet balance, but the result of such a comparison (see Akhabbar [2006]) is that Popov and Litoshenko didn’t invent the input-output table but the principle on which the input-output table was based: the row-column representation of interindustry flows. This is the first important relation between input-output analysis and soviet works.

It remains to know whether Leontief or Popov exposed the principles of the input-output mathematical model. In fact, it is clear that none had the idea of any of the equations in the model (quantity equations, technical coefficients, price equations). But Popov had the idea to combine the balance with a mathematical model: Marx’s reproduction schemas.

Balance of the national economy of the USSR

(1923/24)

Branches of the economy	Production (Credit) In Millions of gold rubles	Distribution of products (Debit) In Millions of gold rubles						
	Agriculture	Construction	Industry	...	Non-productive consumption	...	Total of output
Agriculture	...	3285,9	145,4	1240,9	...	5590,9	...	10738,1
Construction	...	201,6	–	95,5	...	541,2	...	853,3
Industry	...	355,1	316,6	2344	...	4628,4	...	9717,5
Publishing	...	–	–	–	...	19,5	...	19,5
Total	...	4300	462	3681,2	...	10797,7	...	21410

This is the second important relation between input-output analysis and soviet works: to combine an accounting table with a mathematical model. However, Popov's model had nothing in common with Leontief's model and Popov rightly noticed that *“the balance is not yet a theory, that is, not a total conceptual system which exhaustively explains the processes*

of a national economy” (Popov [1926a], p.6). It was Leontief who successfully gave his final shape to the interindustry table and then found the associated theory. However, Leontief’s presentation of input-output analysis is not to be found in his 1925 paper but in his 1936-1937 papers. Indeed in 1925 Leontief published, first in German and then in Russian, a review of Popov and his team’s work on balance sheets. Leontief’s short review was nothing more than a critical review without any comments on inter-industry tables and relations.

Conclusion

This paper is a modest contribution to a vast field of historical research: history of input-output analysis. An important job remains to be done especially on archival resources. The much narrowed question I asked about the “soviet origins of input-output analysis” was, in the history of economics, first raised from a political background. It was argued that such a historical question could find a historical answer thanks to a deductive method.

After the inquiry we get two results:

- (1) Popov and Litoshenko didn’t invent the input-output table but the principle on which the input-output table was based: the row-column representation of interindustry flows (in monetary terms).
- (2) Neither Leontief nor Popov had the idea of the input-output model in the 1920’s but Popov had the idea to combine an accounting table with a mathematical model, which was one of the major methodological advances of input-output analysis.
- (3) Popov and Litoshenko created a scientific scheme where making political economy was not contradictory with the making of social technologies.

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