

SOCIAL ACCOUNTING AND QUESNAY'S MODEL

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I. QUESNAY'S CONTRIBUTIONS TO ECONOMIC ANALYSIS

Early attempts of quantitative economic analysis may be found in the works of Petty, Davenant, King, Cantillon, Quesnay, Turgot, and others, from the end of 17th century up to mid-18th century. In their works they employed various kinds of approach, e.g. numerical analysis, statistics, income analysis, etc. to such a degree of elaboration that some of their results can be translated to modern economic techniques.

Quesnay's economics is the favorite of scholars of all times. The modern and most widely accepted interpretation of Quesnay's economic analysis has concentrated on the *Tableau Economique* and translated it to input-output tables. This modern tradition dates from Phillips' 1955 paper, greatly improved by Barna in 1975.⁽¹⁾ As Barna expressed "the interpretation of the *Tableau* ... has significantly advanced with the application of the input-output techniques developed by Leontief". The intensive and almost exclusive application of input-output techniques to Quesnay's categories has also served to show some drawbacks of current work: i) the possibilities of input-output techniques are not yet exhausted, especially static and dynamic Leontief models; ii) input-output ta-

¹ See references to Phillips (1955), Meek (1960), Maital (1972), Barna (1975) and Fernández López (1980, 1988).

bles could benefit from other national accounts in order to capture fully the riches of Quesnay's writings, especially when they are supplemented by other akin literature such as Mirabeau's publications.

Quesnay contributed to three distinct fields of economic analysis: the study of general interdependence of economic activities, income analysis and theory of capital. Fortunately these fields correspond to other three lines of modern research: input-output analysis, national income accounting and flow of funds. Since these lines of social accounting are related, we can reexamine Quesnay's writings -on the side of the so-called "object language"- without restricting ourselves to his several Tableaux Economiques; and on the side of the "metalanguage", one may have recourse to social accounts other than input-output tables.

II. THE TABLEAU ECONOMIQUE IN A SYSTEM OF SOCIAL ACCOUNTS

Let us avail ourselves of Quesnay's most widely known version of the Tableau² in order to build up a system of Physiocratic Social Accounts.

The economy is divided into two groups of individuals and institutions: the productive system and the consumption system. The first includes two kinds of productive units: farmers and artisans, called by Quesnay "productive" and "sterile" classes, respectively. The second includes the "class of land-owners".

Each class performs transactions with the others. The transactions may be arranged in production accounts, appropriation accounts and capital accounts, as it will be shown. The figures are expressed in "milliards" (in British usage) or "billions" (in American usage), i.e. $\times 10^9$.

² Quesnay's *Analyse du Tableau Economique* (June 1766). Reprinted as Appendix to this paper.

As a preliminary approach, our physiocratic system of social accounts will not contain sectors as "government" and "rest of the world". The analysis, therefore, should be carried out in terms of "firms" and "households". However, the class differentiation between productive and sterile classes, inherent to physiocratic thinking, would be lost after combining farmers and artisans in the single account "firms". So we shall consider them separately. The production account for the productive class is as follows⁽³⁾:

110. PRODUCTION ACCOUNT - *Productive class*

debit	credit
111. Materials produced for own use (114).....2	114. Sales of materials to the productive class (111).....2
112. Provisions for consumption of fixed capital (132).....1	115. Sales of materials to the sterile class (211).....2
113. Land rent (323) 2	116. Sales of food (321).....1
<u>5</u>	<u>5</u>

And the production account for the sterile class is the following:

210. PRODUCTION ACCOUNT - *Sterile class*

debit	credit
211. Materials purchased (115)....2	212. Sales of capital goods (131)...1
<u>2</u>	213. Sales of luxuries (322).....1
	<u>2</u>

There is no production account for land-owners, since their economic function is solely to receive a monetary payment as land-rent and to spend it as an exogenous final demand.

³ The meaning of the 3-digit denomination used for accounts and transactions is as follows: the first digit indicates "class" (1, productive class; 2, sterile class; 3, land-owners class); the second indicates "account" (1, production account; 2, appropriation account; 3, capital account); the third indicates each transaction. This notation is drawn from Balboa (1961).

It must be emphasized that fixed capital ("avances primitives") and its annual consumption are only taken into account in the productive class. The provisions for the consumption of fixed capital ("intérêts des avances de l'établissement") are subtracted from the farmers' own annual production. This point is explicitly dealt with by Quesnay in the "Analyse" (cf. Appendix).

The capital account (only for the productive class) is as follows:

130. SAVING-INVESTMENT ACCOUNT - *Productive class*

debit	credit
131. Capital goods acquired (212).1	132. Provisions for consumption of fixed capital (112)..... <u>1</u>
<u>1</u>	<u>1</u>

There are no appropriation accounts for both productive and sterile classes, since they record no appropriation of the economic surplus (what is performed only by the class of landowners) and therefore they have no consumption beyond the strict level of subsistence (and this level is registered as "materials" purchased or produced for own use) and no saving beyond the provisions for consumption of fixed capital.

Land-owners receive all the economic surplus of the economy under the form of land revenue, which enables them to perform the only exogenous consumption activity in the economy. This is shown as follows:

320. INCOME-EXPENDITURE ACCOUNT - *Land-owners*

debit	credit
321. Food (116).....1	323. Land rent (113).....2
322. Luxuries (213)..... <u>1</u>	<u>2</u>
2	2

On the basis of the above accounts it is easy to built up the National Income and Product account, the Saving and Investment account, and the Input-Output table. ⁽⁴⁾

COMBINED PRODUCTION ACCOUNT FOR ALL SECTORS

debit		credit	
Intermediate products (111+211)..4		Intermediate products (114+115)...4	
Provisions for consumption of fixed capital (112)..... 1		Consumption goods (116+213).....2	
Land rent (113)..... 2		Capital goods (212).....1	
		—	
Gross Domestic Production..... 7		Gross Domestic Production.....7	
Intermediate products..... -4		- Intermediate products..... -4	
Gross Domestic Income..... 3		Gross Domestic Product..... 3	
- Provisions for consumption of fixed capital.... -1		- Depreciation of fixed capital. -1	
Net Domestic Income..... 2		Net Domestic Product..... 2	

COMBINED SAVING-INVESTMENT AND INCOME-EXPENDITURE ACCOUNTS

debit		credit	
Consumption (321+322)..... 2		Provisions for consumption of fixed capital (132)..... 1	
Gross Investment (131)..... 1		Land rent (323)..... 2	
		—	
Gross Aggregate Demand..... 3		Gross Income and Saving..... 3	
- Depreciation of fixed capital -1		- Provisions for consumption of fixed capital..... -1	
Net Aggregate Demand(=Consumption) 2		Net Income (=Land rent)..... 2	

⁴ In Molinier (1958) may be found an alternative system of Physiocratic Social Accounts.

An input-output table could now be built up from the above entries, provided that these simple rules are followed: write every credit as the sector's row ('sales', 'incomes'); write every debit as the sector's column ('costs', 'expenditures'). The sole entry to be left out is that numbered (112) or (132), for it does not reflect a true transaction but a balancing account.

Recalling the above 3-digit denomination, each compartment of the input-output table is filled as follows:

	1	2	3
1	114 111	115 211	116 321
2	212 131		213 322
3	323 113		

Replacing Quesnay's figures for the code-denomination, the input-output table becomes: ⁵

	1	2	3
1	2	2	1
2	1	0	1
3	2	0	0

⁵ This is the 'amended' Phillips' input-output table, after correction by Maital (1972) and Fernández López (1980): land-owners column (i.e. No.3) is regarded as a column-vector of final demand, and land-owners row (i.e. No.3) is interpreted as the farmer's demand for the sole primary factor that exists in this economy.

The physiocrats underrated the functions of money and monetary institutions and, spite of the fact that all transactions in the Tableau are assumed to be moneyflows, Quesnay did not state clearly the exact amount of the money supply and who were its holders. Succeeding scholars' analyses pivoted round discrepant hypotheses. Oncken, e.g. assumed a money supply of 2 milliards, while Moog 3 m. and Marx either of them; Molinier (1958) assumed 3 m., of which 2 m. were held by the land-owners and 1 m. by the sterile class. We shall find useful to follow Tsuru (1942), who assumed "only for expositional reasons" that an amount of 2 milliards was held only by the productive class.

The "advances" (i.e. capital) play a crucial role in Quesnay's analysis and policy recommendations. Quesnay was also successful in discriminating stocks and flows, a distinction that 'first appeared in the "avances annuelles" and "avances primitives" of the physiocrats -wrote Bródy (1970, p.36)-. The former expressed the flow, the latter the stock aspect'.

The foregoing system of Physiocratic Social Accounts reflects only the real flows, ignoring financial transactions as well as financial and real stocks. In this connection we may take advantage of Tsuru's concise statement of Quesnay's reproduction scheme, in order to build up a *flow of funds system*. Tsuru branched off the circulation process into two separate situations, and his diagrammatical exposition is easily translated into two balance-sheets and the in between period's account of receipts and disbursements.

Let us designate by 0 the beginning of a certain period, and by 1 the end of it. At the moment 0 the whole of the harvest is in store at farmers' warehouses; the circulating capital used in production ("avances annuelles") has been wholly spent; and fixed capital in agriculture ("avances primitives") has a residual value of 90% of its original value, after the diminution caused by physical attrition. The balance sheet at the beginning will be:

BALANCE SHEET AS AT MOMENT 0 - *Productive class*

assets	liabilities
Cash on hand..... ..2	Rent payable.....2
Material stock (inventory).....5	Net worth.....14
Equipment..... 9	

Let us assume that after moment 0 begins a period of stock-adjustments and transactions among classes which endures up to the beginning of a new period of production (moment 1). Along this period the productive class makes disbursements for 3 milliards, inclusive of the payment of 2 m. as land-rent and the acquisition of 1 milliard of manufactures to the sterile class. For simplicity all agricultural units are taken as a single production unit, so that the production for own use does not give rise to monetary disbursements or receipts. The amount of money paid out is the same that is received for the sale of commodities (1 m. of food to land-owners, 2 m. of food and materials to sterile class), so that the net addition of cash is 0.

RECEIPTS AND DISBURSEMENTS - *Productive class*

disbursements (uses of funds)	receipts (sources of funds)
Added to material stock (avs.prim.)..1	Sales.....3
Land rent.....2	
Added to cash in hand.....0	

When the transactions come to an end, the stock of circulating medium returns to the productive class, who retains 2 m. of its own production in order to restore the "annual advances" for the period of production that is about to take place. Fixed capital also regains its original value, after partial restoration through acquisition of manufactures to the sterile class.

BALANCE SHEET AS AT MOMENT 1 - *Productive class*

assets	liabilities
Cash on hand.....2	Net worth..... 14
Equipment.....10	
Material stock..... 2	

It must be recalled that Material stock corresponds to Quesnay's "avances annuelles" (food and raw material). The sum of Equipment ("avances primitives") and Material stock correspond to Quesnay's "richesses d'exploitation". And finally, Cash on hand plus Material stock corresponds to Smith's "circulating capital".

It may be seen that the account *Receipts and disbursements* corresponds item-for-item to the *Production* account of the productive class, with the exclusion of "materials produced for own use".

The accounts for the other classes follow the same course of procedure, and for the sake of brevity they will be not written in detail. Perhaps the only new entry that is worthy of mention is the presence of the "avances foncieres" among the assets of the land-owners class, for an amount of 60 milliards (equal to a land-rent of 2 m. receivable during 30 years).

III. QUESNAY'S INPUT-OUTPUT MODEL

Quesnay's model is depicted by the following equations:

$$C_i = q_i - \sum a_{ij}q_j = m_i T \quad (\text{consumption of } i\text{-th good})$$

$$p_j = \sum p_i a_{ij} + r b_j \quad (\text{price of } j\text{-th good})$$

where $(q_i) = q$ is the vector of gross outputs, $(a_{ij}) = a$ the interindustry matrix, $(m_i) = m$ the vector of land-owners demand, r the price of a unit of land, T the total supply of land and $(b_j) = b$ the vector of land inputs.

Quesnay's Tableau is found to be isomorphic with the static Leontief matrix (Stone 1965):

$$A \equiv \left[\begin{array}{c|c} a & m \\ \hline b & 0 \end{array} \right]$$

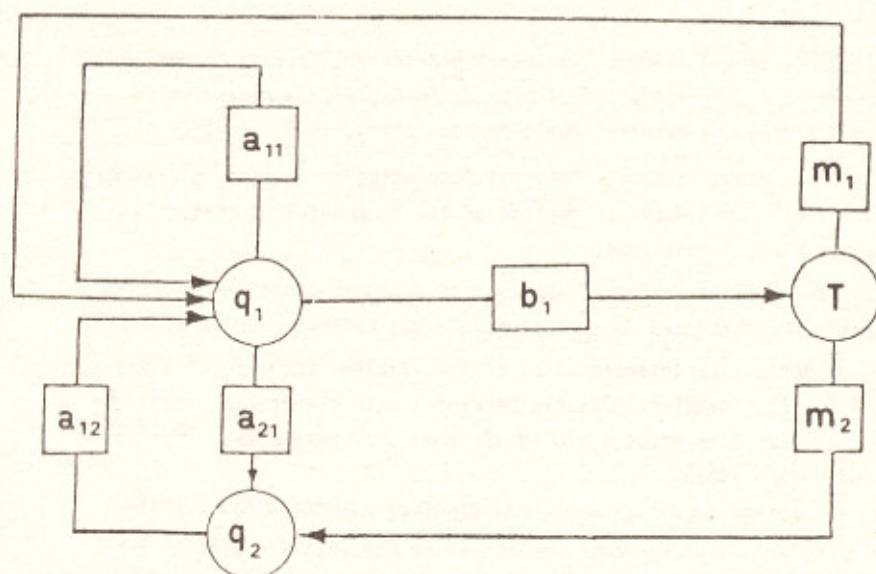
where the vectors $\underline{m}$ of final demand and $\underline{b}$ of non-produced land inputs are explicitly partitioned from the matrix $\underline{a}$. The system is solvable for the dual vectors (p, r) and (q, T) .

Quesnay's own numerical illustrations are depicted by the following equations:

$$\begin{bmatrix} a_{11} & a_{12} & m_1 \\ a_{21} & 0 & m_2 \\ b_1 & 0 & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ T \end{bmatrix} = \begin{bmatrix} q_1 \\ q_2 \\ T \end{bmatrix}$$

where the subscripts 1 and 2 of the q_i 's, the a_{ij} 's and the b_j 's refer, respectively, to productive and sterile classes, and m_i is the consumption of good i by the class of land-owners.

The above equations may be viewed as a closed-loop system:



The input-output model also avails to deal with stocks, notably fixed capital or "avances primitives". Without committing ourselves to a formal development in

this paper, let us recall the input-output quantity system with stocks as the most promising model:

$$q = A q + \lambda B q$$

where B stands for the matrix of stock coefficients [cf. Schwarz (1961), Bródy (1970)].

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APPENDIX

Quesnay's *Analyse du Tableau Economique* (June, 1766)

(Fragments)

Le *Tableau économique* renferme les trois classes et leurs richesses annuelles, et décrit leur commerce dans la forme qui suit.

CLASSE PRODUCTIVE.	CLASSE DES PROPRIÉTAIRES.	CLASSE STÉRILE.
AVANCES	REVENU	AVANCES
annuelles de cette classe, montant à deux milliards ⁽¹⁾ , qui ont produit cinq milliards, dont deux milliards sont en produit net ou revenu.	de deux milliards pour cette classe: il s'en dépense un milliard en achats à la classe productive et l'autre milliard en achats à la classe stérile.	de cette classe de la somme d'un milliard qui se dépense par la classe stérile en achats de matières premières à la classe productive.

Ainsi la classe productive vend pour un milliard de productions aux propriétaires du revenu, et pour un milliard à la classe stérile, qui y achète les matières premières de ses ouvrages, ci 2 milliards.

Le milliard que les propriétaires du revenu ont dépensé en achats à la classe stérile est employé par cette classe, pour la subsistance des agents dont elle est composée, en achats de productions prises à la classe productive, ci 1 milliard.

TOTAL des achats faits, par les propriétaires du revenu et par la classe stérile, à la classe productive, ci 3 milliards.

De ces *trois milliards* reçus par la *classe productive* pour *trois milliards* de productions qu'elle a vendues, elle en doit *deux milliards* aux propriétaires pour l'année courante du revenu, et elle en dépense *un milliard* en achats d'ouvrages pris à la *classe stérile*. Cette dernière classe retient cette somme pour le remplacement de ses avances, qui ont été dépensées d'abord à la *classe productive* en achats des matières premières qu'elle a employées dans ses ouvrages. Ainsi ses avances ne produisent rien; elle les dépense, elles lui sont rendues, et restent toujours en réserve d'année en année.

Les matières premières et le travail pour les ouvrages montent les ventes de la *classe stérile* à *deux milliards*, dont *un milliard* est dépensé pour la subsistance des agents qui composent cette classe; et l'on voit qu'il n'y a là que consommation ou anéantissement de productions, et point de reproduction; car cette classe ne subsiste que du paiement successif de la rétribution due à son travail, qui est inséparable d'une dépense employée en subsistances, c'est-à-dire en *dépenses de pure consommation, sans régénération de ce qui s'anéantit par cette dépense stérile, qui est prise en entier sur la reproduction annuelle du territoire*. L'autre milliard est réservé pour le remplacement de ses avances qui, l'année suivante, seront employées de nouveau à la *classe productive* en achats de matières premières pour les ouvrages que la *classe stérile* fabrique.

Ainsi les *trois milliards* que la *classe productive* a reçus pour les ventes qu'elle a faites aux *propriétaires du revenu* et à la *classe stérile*, sont employés par la *classe productive* au paiement du revenu de l'année courante de *deux milliards*, et en achats d'*un milliard* d'ouvrages qu'elle paye à la *classe stérile*. (...)

Des *cinq milliards* de reproduction totale, les *propriétaires du revenu* et la *classe stérile* en ont acheté pour *trois milliards* pour leur consommation: ainsi il reste encore à la *classe productive* pour *deux milliards* de productions; cette classe a acheté en outre pour *un milliard* d'ouvrages à la *classe stérile*, ce qui lui fait un fonds annuel de *trois milliards*, lequel est consommé par les divers agents occupés aux différents travaux de cette classe, qui sont payés par les avances annuelles de la culture, et aux diverses réparations journalières du fonds de l'établissement, qui sont payées par les intérêts dont on va parler.

Ainsi la dépense annuelle de la classe productive est de *trois milliards*, savoir *deux milliards* de productions qu'elle retient pour sa consommation et *un milliard* d'ouvrages qu'elle a achetés à la classe stérile.

Ces *trois milliards* forment ce qu'on appelle LES REPRISES de la classe productive; dont *deux milliards* constituent les avances annuelles, qui se consomment pour le travail direct de la reproduction des *cinq milliards* que cette classe fait renaître annuellement, pour restituer et perpétuer les dépenses qui s'anéantissent par la consommation; *l'autre milliard* est prélevé par cette même classe sur ses ventes pour les intérêts des avances de son établissement. On va faire sentir la nécessité de ces intérêts.

1° Le fonds des richesses d'exploitation qui constituent les avances primitives est sujet à un dépérissement journalier qui exige des réparations continuelles, indispensablement nécessaires pour que ce fonds important reste dans le même état et ne marche pas progressivement vers un anéantissement total qui détruirait la culture et par conséquent la reproduction et par conséquent les richesses de l'Etat et par conséquent aussi la population.

(1) Les avances annuelles consistent dans les dépenses qui se font annuellement pour le travail de la culture; ces avances doivent être distinguées des avances primitives qui forment le fonds de l'établissement de la culture, et qui valent environ cinq fois plus que les avances annuelles. (Note de l'original.)