

# **The Circuit Analysis, the Monetary Economy of Production and the Multisectorial Analysis**

## **Proposals for a S.N.A. built on income-value**

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In this paper we will explain how the French circuit analysis, built from the works of Bernard Schmitt, and the Keynesian monetary economy of production (MEP), leads to a new theory of value, the income-value theory.

The expression "monetary economy of production" has been used by Keynes in 1933, but this type of economy is already described in the 1930 Treatise on Money. In two major books published in French, *Monnaie, Salaires et Profits* (1966) et *l'Analyse Macroéconomique des Revenus* (1971), and one published in English, *Macroeconomic Theory* (1972), Bernard Schmitt has given revival to the MEP and let the basis of the French circuit analysis.

We will first describe a very simplified model of MEP (§ 1), we will qualify canonical. This model represents the developed economies of the present time. It considers the macroeconomic circulation of money and goods between three groups of agents, those creating money, the banks, those transforming raw materials and labour in goods, the firms, and the households. Money measures raw materials, labour and goods and assures their circulation. Firms and banks use a common language, called business accounting, which is very necessary for performing these functions. The canonical MEP sets at least two problems. The first one is the possibility of the retained profits for the firms taken as a whole. The second one is the adequacy of the model to more complex economies. Nowadays the economies are described by national accounts. So testing the adequacy of a model to an economy comes to test its adequacy to a set of national accounts.

We will see (§ 2) that the first problem is a false one. It comes from the wrong idea of the economists that profit is either a flow or a stock of money, when business or national accountants define it only as the result of a calculus. So the true problem is the economic meaning of that calculus. We will show that profit comes from the existence of two successive systems of prices, the prices in income-value (that Bernard Schmitt calls macroeconomic prices, and that may be compared to the Marxian value) and the selling prices (that Bernard Schmitt calls the microeconomic prices, and that may be compared to the Marxian prices of production). These two systems involve the profit, which is a transfer of purchasing power from households to firms. Its measure in income-value is given, on the macroeconomic level, by the equations of ebb and flow derived from the Fundamental Equations of The Treatise on Money.

The second problem, the adequacy of a model to a set of national accounts should be tested in numerous ways, since the economy is complex. For instance, can the model explain that there exist several banks, and not only a group of them? that banks perceive interests? that there exist financial flows between households and firms (that we call secondary monetary flows to distinguish them from the principal ones)? that banks lend to other agents besides firms? that government may play an important part in collecting taxes and distributing "collective goods"?... All facts that are not described by the canonical MEP, but, we think, do not modify its core.

In this paper we will concentrate on a problem linked to the first one : the existence of several firms involves that the transfer of purchasing power constituted by the profit be shared out between the firms. That is done through successive transfers. First, the firms selling consumption goods gain the whole transfer of purchasing power from households through the monetary flow of consumption ; then they

transfer a part of it to the other firms through monetary flows when purchasing fixed and circulating capital. We will call this preliminary stage, "formation of profit". At the end of the accounting period, the profit of every firm is calculated. Most economists make a confusion between the formation of the profits and the true profits, which are only the result of an accounting calculus, measure of the purchasing power got by each firm.

If our model is adequate it must be able to give a representation of the formation of the profit of every firm and its right measure. Now we have established that this right measure must be in income-value, whereas business and national accounts give measures in selling prices. So we establish (§ 3) a method for getting this profit in income-value and we apply it, not to every firm, but to every activity of the French I.O.T. for the year 1991.

## **1. Description of a canonical MEP**

The MEP considers collective exchanges between groups of agents, each group being taken as a whole. There are three groups : the banks, which are the institutions creating money ; the firms, which are the institutions producing commodities (including services) from other commodities and from natural resources (including work) ; and the households.

Between these groups of agents take place : 4 flows of debt : (1), (1'), (4) and (4') ; 4 principal flows of money or principal monetary flows: (1), (2), (3) and (4) and 2 flows of non-monetary objects (natural resources and commodities) or real flows : (2') and (3').

Flows (1) and (4) are both flows of debt and principal monetary flows.

These eight flows append successively during four phases, the two flows of each phase making a collective exchange between two groups of agents, each flow being the counterpart of the other. The phases 2 and 3, which append only between the firms and the households, are called the central phases. By convention the two flows, parts of the same collective exchange of the phase  $i$ , are called (i) and (i').

The four principal monetary flows of the four successive phases make a monetary circuit that we shall call the principal monetary circuit. This circuit starts from the banks, by the creation of money, and ends at the banks, by the destruction of money.

The expressions principal monetary flows and principal monetary circuit mean that it would be possible to consider secondary monetary flows forming a secondary monetary circuit. These flows would be the financial flows between the households and the firms, whose function would be to compensate the insufficiency of flow (3) due to savings (Vallageas 1988).

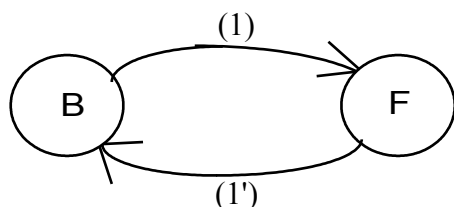
The two real flows of the two successive central phases make a real circuit beginning from the households by the contribution of the natural resources and ending at the households by the consumption of the produced goods.

We shall first expose the four successive phases constituting four collective exchanges of two flows each, then we shall expose the circuits. Finally we will suggest an interpretation for the Treatise on Money in terms of circuits.

## 1.1. The four phases of four collective exchanges of two flows each.

### 1.1.1. Phase 1. Creation of money. The exchange of flows of debts between banks and firms.

The banks and the firms exchange debts, the debt (1) of the banks to the firms (equally called the claim of the firms on the banks) and the debt (1') of the firms to the banks (equally called the claim of the banks on the firms) ; the debt (1) is called money by definition and is the first flow of money that we meet. This exchange can be represented by the following graph :



graph 1

It constitutes the following operation in the double entry bookkeeping system of the bank :

current account of firms		liabilities on firms	
	(1) \$x	(1') \$x	

accounts 1

It is also an operation in the double entry bookkeeping of the firms :

banks		debts to banks	
(1) \$x			(1') \$x

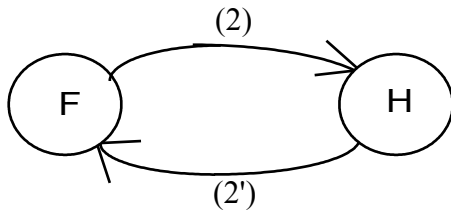
accounts 2

The two debts are by construction of equal value (\$ X), this value being counted in monetary units, the unit (\$) being itself defined by this operation. The debt of the banks, the money, is in theory payable on presentation, i.e. immediately reimbursable. In fact, as we will see below (cf. phase 3) it is never paid. The debt of the firm may have a time-limit or may not. In the latter case, it may be payable on demand or on advance notice depending of contract.

For the moment this first phase appears utterly useless, because it creates only two debts of equal amounts that quash one another. One can say that the money held by the firms at the end of phase 1 has no value, first of all, because it is not a true wealth for the firms, since they have debts of an equal amount, and secondly because it cannot buy commodities, that do not exist yet. Bernard Schmitt says it is a nominal money. The interest of this purely intellectual phase and of the money appear in the two following phases.

1.1.2. Phase 2. Production and distribution of income. The exchange of flows of natural resources and incomes between households and firms.

The households bear their work and other natural resources (flow (2')) to the firms that will use them to produce commodities. In exchange the firms give the households the money income (2). So, we see now the utility of the banks' debt (1) : it allows the distribution of (2). Moreover (2) gives a monetary measure of (2') ("the national money income measures the national product"). That can be represented by the graph :



graph 2

The situation of the banks accounts at the end of phase 2 is :

current account of households		liabilities on households	
	\$x	\$x	

accounts 3

and the firms' accounts are at the end of phase 2 :

banks		debts to banks	
null	null		\$x

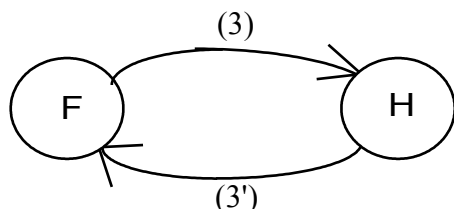
accounts 4

At the end of phase 2 the households hold money and contrary to the situation at the end of phase 1, when money was held by the firms and has no value, the money now held by the households has got a value : first of all, it is always a debt of the banks, but contrary to the firms, the households have no debt, so they own a true wealth ; and secondly because it can buy goods that now have been produced (Bernard Schmitt says this money is real).

This purchase constitutes the phase 3.

1.1.3. Phase 3. Spending and distribution of the commodities. The exchange of the spending of income and of the consumption goods between households and firms.

In law the banks should pay their debt to the households. But in fact (i.e. economically) it is absolutely impossible : the legal way to pay a debt is to pay it in money. Now the debt of the banks is already money, so, by construction, the banks cannot pay their debts<sup>1</sup>. The banks have nothing to give to the households in exchange of their money, the only things that the latter can get are goods from the firms. So they buy the goods from the firms. That can be represented by the graph :



graph 3

At the end of this purchase we have come back to the same situation that at the end of phase 1 : the firms have got the money back, but they have always a debt of equal amount to the banks, so they do not own any real wealth, the money has no more value (Bernard Schmitt says it is nominal) ; the households have nothing, since they have no more money, and they have consumed the goods they have bought. The accounts of the banks and of the firms are exactly the accounts they have got at the end of phase 1 (see accounts 1 and 2).

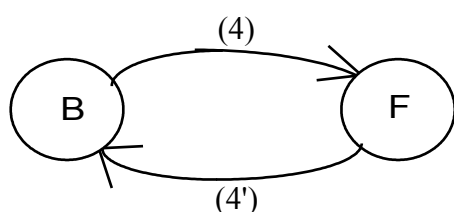
This purchase operation may legally be analysed as the circulation of a bill of exchange : the firms have a debt to the banks, and the latter have a debt to the former : so to pay off these two debts it is easier that the firms pay directly the households. This single payment cannot be made in money (and the households do not wish it), so it is made in commodities measured in money.

Then the money held by the households allows them to get the commodities, and it has got the value of the commodities that it can purchase ("the national money income measures the national product").

Since at the end of this phase we have come back to the same account situation as at the end of phase 1, the firms can reimburse their debts to the banks.

1.1.4. Phase 4. Destruction of money. The exchange of the money and of the banks' debt between the firms and the banks.

This phase can actually take place after the end of phase 3. It is represented by the graph :



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<sup>1</sup>If we consider several banks, then a bank can pay its debt with a money-debt issued by another bank : e.g. a commercial bank can pay its debt (materialised by an account) by banknotes, which are a debt of the central bank. This operation is not actually a payment but a change in the form of the money and from a macroeconomic point of view it does not matter at all.

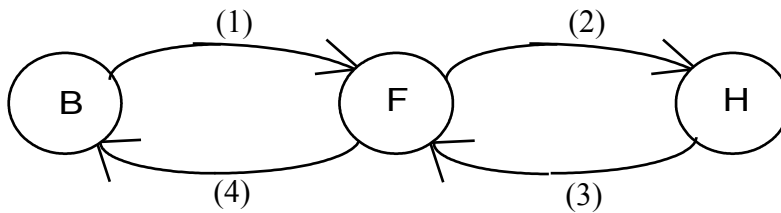
Then a new circuit can occur, beginning at the phase 1 and independent of the precedent.

### 1.2. The circuits

If we follow the traject of a monetary unit during the four phases, we get the principal monetary circuit, this unit going through the principal flows (1), (2), (3) and (4), between the banks, the firms, and the households on one way, and between the households, the firms and the banks on the way back. The circuit limited to the flows (2) an (3) is the central monetary circuit.

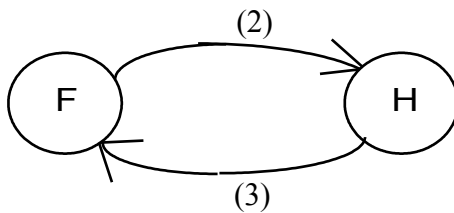
If we follow the traject of a non-monetary object going through the real flows (2') and (3'), we get the real circuit.

This notion of circuit corresponds very exactly to that one of the mathematical graph theory (MGT) (Andrásfai) (Diestel). This theory considers arcs going from one pole to another. A group of economic agents may be considered, as as a pole. So the arc (1) starts from the pole banks and goes to the pole irms. The graph theory calls circuit a succession of arcs starting from a pole going through different poles and ending back at the starting pole. It can be easily verified that all the circuits we have considered (i.e. the principal and central monetary circuits and the real circuit) are circuits in the meaning of the graph theory. More peculiarly let us give the graph representation of the principal monetary circuit :



graph 5

The central monetary circuit is a part of that graph :



graph 6

When considering either the principal monetary circuit or only the central part of it, it can be easily seen that no group of agents can accumulate money, i.e., at the end of a circuit, when all the money has flowed back to the banks, there is no money left in the circuit. This simple fact is the source of the profit problem. But before exposing it, we will give an interpretation of The Treatise on Money in circuit terms.

## **1.4. An interpretation of The Treatise on Money in circuit terms.**

The volume I of this book gives a description of the economy which corresponds approximatively to our description of paragraph 1.1. It makes a distinction between the banks, the firms and the households. Keynes calls community's money income a) "everything that is paid to employees including any payment made to unemployed or partially employed or pensionned employees" (We would say today any direct or indirect wages) ; "b) the normal remuneration of entrepreneurs; c) interest on capital ; d) regular monopoly gains, rents and the like." So he excludes of this enumeration the part of profit that he judges not normal, and he will call windfall profits.

We suggest a reinterpretation of Keynes' thought. It seems difficult, without an *a priori* theory of distribution, to say what is a normal profit, and correlatively what is a regular monopoly gain. So we suggest to adopt an objective classification by considering on one hand what is paid to the households, i.e. a) and c) (including dividends), and that constitutes flow (2), and on the other hand what is not paid to the households, i.e. retained profits, we will call more simply profits.

This is an essential condition for interpreting the Treatise in circuit terms, because it makes a distinction between what circulates and what does not, whereas the General Theory cannot be interpreted in circuit terms, because, in considering a complete profit, it cannot distinguish the flow (2).

But this leads to a new problem : what are retained profits? They are not a flow, since they do not circulate, so what are they?

## **2. The possibility and the nature of retained profits**

The existence of the dividends does not make any problem : the dividends paid by firms to other firms are monetary flows internal to the group of firms, and the dividends paid to the households are by construction part of the flow (2). Nevertheless in the circuit literature (see Marc Lavoie), the problem of the existence of a monetary profit, taken as a whole, is very often questioned. This problem follows the Marxian problem of the monetary realization of the surplus-value.

The problem concerns only the retained profits which, by construction, are not paid. So they cannot be a monetary flow. And they are either a stock of money, either something else which is evaluated in money (like goods or real flows have got a monetary evaluation but are not money).

It can be easily shown that the retained profits cannot be money stocks, for two reasons, the first one being purely a question of logic, the second coming from the double entry bookkeeping system.

### **2.1. The retained profits cannot be money stocks**

#### **2.1.1. In a canonical MEP firms cannot accumulate money stocks.**

If retained profits are money stocks, the profit of all the firms taken in their whole is null. This is an evidence when considering the central monetary circuit compounded of the flows (2) and (3) circulating between the firms and the households. As all the money coming into the households comes from the firms by (2) , the households cannot give back to the firms by flow (3) more money than they have received by (2).

Also in a canonical MEP firms cannot accumulate money stocks.

There are two ways to consider a non canonical MEP The first one is to consider foreign exchanges. We will see that these exchanges cannot lead to money stocks. The other one is to consider that

other agents besides firms can borrow to the banks. In that case the firms taken in their whole can accumulate money stocks, but these ones cannot be profits.

### 2.1.2. The foreign exchanges cannot lead to money stocks

The distinction of these exchanges implies there exist at least two different monetary zones, one internal with a pole of home banks creating monetary units called \$, e. g., and lending to home firms, and an other one with a pole of foreign banks creating other monetary units called £, e. g., and lending them to foreign firms. So in that answer, the foreign firms or the foreign households would buy to the home firms and would allow them extra money coming from the foreign banks, and allowing money stocks. But one can expect the profit (and the money stocks) of the home firms be in \$, and then they must come from the home banks (if a part of a firm makes profit in £ and not in \$, it belongs, by definition, to the the foreign firms and not to the home ones).

Also when a foreign agent, either firm or household, wants to buy to a home firm, it must exchange its £ for \$ by the home banks first. Of course the \$ created then are not borrowed, and apparently they can assure a money-stock for the home firms, who have not to repay them. But when depositing its £ by a home bank, a foreign agent withdraws them from the foreign circulation and occurs a problem of reimbursement for the foreign firms. So, when we consider all the firms, home and foreign, in their whole, we cannot have any money stock.

### 2.1.3. The lending of money to other agents besides firms allows the firms, in their whole, to have money stocks, but these stocks are not retained profits

Suppose that the households, or an other new agent, e.g. the government, borrows to the banks. With this money this agent can spend by the firms and all the spendings received by the latter exceed the value of flow (2). Now the firms own in full property money stocks that they have not to repay back. This situation can go on so long as the banks do not demand the repayment of their loans to the households or to the government, or so long as they accept to renew the loans.

This situation cannot occur when all the loans are done to the firms through the flow (1), because in that case, although the firms can have money stocks so long as the repayment is not demanded, these money stocks are not their full property, since they have debts to the banks for an equal amount.

So many economists, considering profit is monetary, think profits are these money stocks in full property, and, as this full property remains in the firms, they say they are the retained profits.

Their conclusion is that the existence of profit leads to the impossibility of a canonical MEP : it is necessary for that existence that other agents besides firms borrow to banks, and what allows the existence of profit is essentially the budget deficit.

It is evident that other agents besides firms can borrow and that money stocks in full property can exist in that case. But these money stocks are not profits. If we look to the balance-sheet of a firm, we see that the money stock is a current asset (in fact it is composed of two current assets, the cash and the current account at the bank) appearing in the assets column, while the retained profit appears elsewhere. In the same manner in the national accounts, the money stocks of the firms appear in their financial account, under the name currency and deposits, while the retained profit appears elsewhere too.

This leads to the questions : where do the profits appear in the accounts? what are their accounting and economic meaning?

## 2.2. The true nature of profits : the increase of firm's value

The definition of the firm's profit, as it is given by the business accounting system, is the increase of revenue reserves during the period, these reserves being the part of owner's equity not brought by the owners (e.g. with new shares) ; so the profit is the increase of equity due to internal reasons. This is why it appears on the balance-sheet, which is a view of the assets and liabilities of the firm. But the double entry bookkeeping system has been constructed in such a way, that it appears as the balance of the profit and loss account (PLA) (called income statement in U.S.) too. The national accounts use a sequence of accounts which is, for the firms, a decomposition of the PLA, so they get the same profit.

## 2.3. The profit, the canonical MEP, the business accounts and the equations of ebb and flow

We come back to the canonical MEP and we consider its principal monetary circuit. Following the business accounting system, we know that the profit is the increase of the firm's value during the period. To measure it, the accounting system constructs the balance-sheet and put the accumulated value of its assets, in one column, and of its debts in the other column.

First of all, we see that we must delimitate an accounting period. There is no reason, that, at the end of it, the flow back (3) of the money earned by the households by the flow (2) be finished. So at the end of the period, this money not yet flowed back is their savings,  $S_H$ . Let us call  $C$  the part of (3) achieved at the end of the accounting period and  $R'$  the value of flow (2)<sup>2</sup>, then we have

$$R' = C' + S_H \quad (\text{eq. 1})$$

A part of  $S_H$ , that we will call  $L$ , may have flowed back through a secondary monetary flow (i.e. a financial flow, a loan, or a subscription of new shares by the households to the firms) and then may have been reimbursed to the banks. The other part,  $H$ , is hoarded by the households, so it cannot be reimbursed yet and is always a debt to the banks. We see that :

$$S_H = L + H \quad (\text{eq. 2})$$

and that  $S_H$  is the total variation of the debt of the firms during the period.

As for the increase of the assets, we must consider the part of the production that at the end of the period is always the firms' property, namely the investment. The only measure we have for it, is its price cost since, the firms being taken in their whole, there is no transaction on investment and then no selling price. Here the price cost is limited to salaries and other payments (essentially interests and dividends) to the households and we will call it  $I'$ . If we call  $\Pi$  the profit, we have :

$$\Pi = I' - S_H \quad (\text{eq. 3})$$

and we get the variation of the balance-sheet during the period :

$\Delta$ assets	$\Delta$ liabilities
$I'$	$S_H$
	$\Pi$

account 5

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<sup>2</sup>we put the sign prime on the  $R$  to distinguish this revenue (not including the retained profit) of the one of the General Theory (including the whole profit).

Let us consider now the PLA. The income of the firms comes from the sale of goods to the households, i.e. the flow (3) limited to the end of the period and that we will call  $C$ , like consumption. The expenditures are those engaged for the production of the sales  $C$ , which here are limited to salaries and other payments to the households, and that we will call  $C'$ . As these payments are engaged to produce either investment or consumption,  $C' + I'$  is the whole of them, that we will call  $R'$ . So we have :

$$R' = C' + I' \quad (\text{eq. 4})$$

and  $R'$  is the exact measure of flow (2).

The combination of these equations leads to :

$$\Pi = C - C' \quad (\text{eq. 5})$$

As  $C$  is the income part of the PLA,  $C'$  being the expenditure part, this equation defines exactly the PLA which may be represented by :

expenses	incomes
$C'$	$C$
$\Pi$	

account 6

We see that the double entry principle is respected, since the equation (5) and the equation (3) of the balance-sheet define the same profit  $\Pi$ .

We must notice that in the bookkeeping practice another presentation is generally used. In it the value  $R'$  is accounted instead of  $C'$  in the expenses and  $I'$  is added in the incomes (under the name of production for oneself). Thus the PLA becomes :

expenses	incomes
$R'$	$I'$
$\Pi$	$C$

account 6'

Now as equations (4) and (5) may be derived from the Fundamental Equations of Chapter 10 of the Treatise (Vallageas 1996), we may say that the Treatise on Money is compatible both with the canonical MEP and the business accounting system.

But, beyond its accounting definition, the profit has got an economic meaning in the framework of the MEP.

#### **2.4. The meaning of the profit in the MEP : a reinterpretation of the Treatise on Money**

We have seen that the accountants define the profit on an accrual basis, as the increase of the firm's value due to internal reasons and that this basis corresponds to equations (3) and (5) of the MEP.

But what is the meaning of the increase of the firm's value for the MEP?

Its evaluation is  $I' - S_H$ . A central idea of the MEP is that the households (including the workers and the rentiers as well, or people being both workers and small rentiers) have the right to get the whole production, since this latter has been evaluated by the flow (2) in phase 2. But in fact the households get only  $C'$  for the price  $C$ . So they accept to leave in the firms goods of value  $\Pi = C - C'$ , these goods

becoming the property of the firms. In fact they leave in the firms, at the end of the accounting period, more goods than  $C - C'$ , since they leave  $I'$ . But as  $I' = \Pi + S_H$ , they have always a claim of value  $S_H$  on the firms. For the part  $H$  (hoarding) of  $S_H$ , they can claim immediately, but for the part which corresponds to financial loans, they must wait for the repayment of them, and for the part which corresponds to shares, they own the investment goods indirectly through these shares.

So  $\Pi$  represents a transfer of purchase power from the households to the firms. This power is measured in income-value, since  $\Pi$  represents a part of the goods  $I'$  themselves measured in income-value. This kind of evaluation is the most pertinent. Now the whole product has been evaluated by income paid to the households during phase 2. The creation of a price  $C$  for the consumption goods different of their income-value  $C'$  allows the transfer of purchase power to the firms, but that transfer does not create any new value, so it is logic that it be measured in income-value, and  $\Pi$  is this measure indeed.

We will see that when we will disaggregate the firm in different industries, the profit got by each industry and calculated with the usual rules of the business or national accounting (and that we will call accounting profits for that reason) are not income-valued but selling price-valued. We will propose a method to calculate them in income-value.

### 3. The disaggregation of the firm

To allow this disaggregation, we will adopt the input-output model, constructed on the Leontiev hypothesis, with industries being groups of production units making the same output. This choice will allow us to present an empirical application, since the S.N.A. has integreted these tables.

First we will remember the matrix representation of the input-output tables (I.O.T.). Next we will show that, in respecting accounting rules, the profit we get for every industry from these tables is measured in selling prices, whereas we would like to have profit measured in income-value. So, for that purpose, we will expose a mode of construction of I.O.T.'s in income-value. Then we will be able expose the processus of formation of the accounting profit in combining figures given by both tables in selling prices and income-value. At end we will see what corrections must be done to the accounting profit in selling prices to get the profit in income-value.

#### 3.1. A matrix representation of the I.O.T.'s.

Let us suppose now that we disaggregate the firm, and that there are  $n$  industries (called  $j$  with  $j$  varying from 1 to  $n$ ), each of them making a different product, which can be used either as fixed capital, or consumption, or may be unsold, i.e. may be part of an inventory.

The distribution of fixed capital is given by a square matrix  $\mathbf{Inv}$ ,<sup>3</sup> whose the element of line  $i$  and column  $j$  is the quantity of the commodity  $i$  (evaluated in selling price) bought by the industry  $j$  as fixed capital, so that the sum of the elements of the column  $j$  is the quantity of fixed capital bought by the industry  $j$  and the sum of the elements of line  $i$  is the quantity of product  $j$  used as fixed capital by any industry. So the structure of  $\mathbf{Inv}$  is the same as this of a Leontiev matrix. An element of the main diagonal (i.e. for which  $i = j$ ) does not correspond to any purchase since it is the quantity of fixed capital of the industry  $j$  in product  $j$ , i.e. in a product manufactured by itself. By convention it is evaluated by the market price of the product  $j$ .

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<sup>3</sup>In this matrix representation, all the matrices we will use are square with  $n \times n$  elements and are heavy typed, while the vectors have  $n$  elements, are noted with an arrow, and are either "horizontal", and in that case are preceded by the symbol of transposition "<sup>t</sup>", or "vertical".

Let us call  $\vec{u}$ , the "vertical" unitary vector of n elements (i.e. of n lines and of n elements equal to 1). The product  $\mathbf{Inv} \vec{u}$ , is the "vertical" vector  $\vec{I}$  of n elements, each of them being the sum in lines of the matrix  $\mathbf{Inv}$ . So this vector represents the distribution of the investment in fixed capital between the different products. In the same manner we have a "vertical" vector  $\vec{\Delta S}$  of n elements giving the distribution of the changes in inventories between the different products,  $\vec{C}$  giving the distribution of the consumption and  $\vec{X}$  giving the distribution of the exports.

The matrix  $\mathbf{IC}$  is a Leontiev matrix in which the element of line i and column j gives the purchase of the industry j in product i.

Let us call  $\vec{\Sigma}$  the vector giving the sums of the uses of each product. We have :

$$\vec{\Sigma} = \mathbf{IC} \vec{u} + \vec{C} + \mathbf{Inv} \vec{u} + \vec{\Delta S} + \vec{X} \quad (\text{eq. 6})$$

Let us call  ${}^t\vec{VA}$  the "horizontal" vector giving the distribution of the value added between the different industries and  ${}^t\vec{M}$  the "horizontal" vector giving the distribution of imports between the different products. We know that we can represent the economy by an I.O.T. of this form :

$$\begin{array}{ccccccccc}
 \boxed{\mathbf{IC}} & + & \boxed{\vec{C}} & + & \boxed{\vec{I}} & + & \boxed{\vec{\Delta S}} & + & \boxed{\vec{X}} & = & \boxed{\vec{\Sigma}} \\
 + & & & & & & & & & & \\
 \boxed{{}^t\vec{VA}} & & & & & & & & & & \\
 + & & & & & & & & & & \\
 \boxed{{}^t\vec{M}} & & & & & & & & & & \\
 = & & & & & & & & & & \\
 \boxed{{}^t\vec{\Sigma}} & & & & & & & & & & 
 \end{array}$$

table 1

The equation 6 corresponds to the "horizontal" additions beginning by  $\mathbf{IC}$  and continuing on the right. We have "vertical" additions too beginning by  $\mathbf{IC}$  and going on below. They can be summed up by the matrix equation :

$${}^t\vec{u} \mathbf{IC} + {}^t\vec{VA} + {}^t\vec{M} = {}^t\vec{\Sigma} \quad (\text{eq. 7})$$

It defines the value added of each industry and establishes that the resources are equal to the uses, the vector  ${}^t\vec{\Sigma}$  being the transpose of  $\vec{\Sigma}$ .

We will now see that the profit we can calculate from this table is measured in selling prices.

### 3.2. The accounting profit calculated from the I.O.T. in selling prices is measured in selling prices.

When there was only one firm, the profit, we calculated with equations 3 or 5, with the account 5 (balance-sheet), and the accounts 6 and 6' (PLA) was measured in income-value. Indeed it measures the increase of firm's worth, constituted of investment goods. Now, as there was only one firm, these investment goods were never sold, so they had no selling prices but only income-values, namely I'. So the profit could only be measured in income-value.

When there are several firms, there is a market for investment goods, which have selling prices then. The business rules prescribe to account assets in cost price. For a firm, the cost price is essentially the price that it pays to another firm, so essentially a selling price. The only exception is for investment produced by oneself. So profit is essentially measured in selling prices. Any-way it could not be measured in income-value, because to calculate this value a firm should know costs engaged by other firms, what is impossible.

The SNA prescribes to measure each item of investment by the market (then selling) price even when it is produced by oneself. We have taken this rule in account in the § 3.1. by setting that a product has only one price.

Let us look for the matrix equation giving the retained profit of every industry. We will first notice that we can only calculate a partial profit which we will call profit "on production" to distinguish it from the complete profit of each firm which includes profit on other operations besides production : profit on exceptional operations and profit on financial operations. These other operations are not included in the I.O.T.'s, and they could not, since they concern only firms and cannot concern industries. Any-way they do not matter for our purpose<sup>4</sup>. Moreover the profit which we will consider is gross of depreciation of the fixed capital.

Let us call  $t_{P_A}^{\rightarrow}$ , the vector whose elements are the accounting retained profits of every industry. Following the method of the PLA (which was, for a single firm, given by equation 5 and account 8'), we must make the difference between the resources ( $t_{\Sigma}^{\rightarrow}$ ) and the costs including the incomes paid to the households<sup>5</sup>, the purchases of intermediate consumption ( $t_{u}^{\rightarrow} IC$ ) and the imports ( $t_M^{\rightarrow}$ )<sup>6</sup>. For reasons that will appear later (cf. 3.3), we will call  $t_{V_A}^{\rightarrow}$  the vector representing the distribution of the incomes paid to the households by the different industries<sup>7</sup>.

So we have, for every industry, the profit on production measured in selling prices :

$$t_{P_A}^{\rightarrow} = t_{\Sigma}^{\rightarrow} - t_{V_A}^{\rightarrow} - t_{u}^{\rightarrow} IC - t_M^{\rightarrow} \quad (\text{eq. 8})$$

Following the method of the balance-sheet, this profit can be got as the difference between the increase of the assets of every industry and that one of its liabilities. The increase of the assets for every

<sup>4</sup>Especially the financial operations of the firms are outside the canonical MEP which considers only production.

<sup>5</sup>As we want to measure the retained profit, the incomes include, as usual in this paper, the interests and dividends paid to the households.

<sup>6</sup>By writing that purchase of imports is  $t_M^{\rightarrow}$ , we write that the industry j imports product j. That means in fact that industry j imports only products j and the totality of the products j imported. These imported products could be redistributed afterwards between the industries by means of the intermediary consumption.

<sup>7</sup>As for the flow (2) these incomes include every thing paid to the households, therefore interests and dividends. But now that we have several firms, firms pay to (and received from) other firms interests and dividends. As so far they concern the production these payments should be accounted to calculate the profit on production. The interests and dividends paid (or received from) abroad should as well.

industry during the accounting period is given by the vectoriel sum  $t_{\vec{u}} \mathbf{Inv} + t_{\vec{\Delta}} S$ .  $t_{\vec{u}} \mathbf{Inv}$  gives the purchases of fixed capital by every industry and  $t_{\vec{\Delta}} S$  the changes in inventories recorded at the end of the period. Let us call  $t_{\vec{S}_H}$  the vector giving the distribution of  $S_H$  between the industries and such as  $S_H = t_{\vec{S}_H} \vec{u}$ .  $t_{\vec{S}_H}$  gives the increase of the liabilities that the industries must subscribe either to the banks or the households because the flow (3) is not achieved at the end of the period.

So the accounting profit can be given by the equation of the balance-sheet :

$$t_{\vec{u}} \mathbf{Inv} + t_{\vec{\Delta}} S = t_{\vec{S}_H} + t_{\vec{P}_A} \quad (\text{eq. 9})$$

The assets being accounted in selling prices, the accounting profit measures in selling prices the part of them which is the property of each industry at the end of the period. So we can say that the accounting profit, i.e. the profit calculated with the business rules (which have been transposed in the SNA) is measured in selling prices.

To find a measure of the profit in income-value, one must first built an I.O.T. in income-value.

### 3.3. Construction of the I.O.T.'s in income-value

We want now to build an I.O.T. of the same form as that of table 1, but in which all the values are expressed in income-values instead of selling prices. We will keep exactly the same notations as in table 1 and the equations 6 and 7 (i.e. "horizontal" and "vertical" additions) will remain. To express the changing of evaluation from price to income-value, we will use the symbol prime (e.g. the matrix  $\mathbf{IC}$  in selling prices will become the matrix  $\mathbf{IC}'$  in income-value, or the vector  $\vec{C}$  will become the vector  $\vec{C}'$ ).

So the equations 6 and 7 become :

$$\vec{\Sigma}' = \mathbf{IC}' \vec{u} + \vec{C}' + \mathbf{Inv}' \vec{u} + \vec{\Delta}' S' + \vec{X}' \quad (\text{eq. 6'})$$

$$t_{\vec{u}} \mathbf{IC}' + t_{\vec{V}_A}' + t_{\vec{M}}' = t_{\vec{\Sigma}}' \quad (\text{eq. 7'})$$

As each product has got a unique price and a unique cost<sup>8</sup>, each element of the line of the product  $i$  of the I.O.T. in selling prices is multiplied by the same coefficient  $k_i$  to give its value in income-value.  $k_i$  is the inverse of the mark-up of the product  $i$ . Let us call  $\vec{K}$ , the "vertical" vector compounded with the  $n$   $k_i$  for  $i$  varying from 1 to  $n$  and let us call  $\mathbf{K}$  the diagonal matrix<sup>9</sup> ( $n,n$ ) for which the element of the line  $i$  and the column  $i$  is  $k_i$ . There we can verify that each term of the equation 6' is equal to the corresponding term of equation 6 pre-multiplied by  $\mathbf{K}$ . So we have :

$$\begin{aligned} \vec{\Sigma}' &= \mathbf{K} \vec{\Sigma} \\ \mathbf{IC}' &= \mathbf{K} \mathbf{IC} \\ \vec{C}' &= \mathbf{K} \vec{C} \\ \mathbf{Inv}' &= \mathbf{K} \mathbf{Inv} \end{aligned}$$

<sup>8</sup>we remember that the produce  $j$  used by the firm  $j$ , either as intermediary consumption or fixed capital is valuated with the same price as if it was effectively purchased, although it is not (cf. 3.1.)

<sup>9</sup>In a diagonal matrix, the elements other than those on the diagonal are null.

$$\begin{aligned}\vec{\Delta} \vec{S}' &= \mathbf{K} \vec{\Delta} \vec{S} \\ \vec{X}' &= \mathbf{K} \vec{X}\end{aligned}$$

For building the I.O.T. in income-value, it is necessary either to find n algebraic equations in  $k_i$ , or a matrix equation in  $\mathbf{K}$  or  $\vec{K}$ .

We will take the equation 7' with the unknown  $\vec{K}$ .

In this equation we can replace  $\mathbf{IC}'$  by its value  $\mathbf{K IC}$ .  ${}^t\vec{V}_A'$  is a datum. Indeed, as we are in a system of income-values, the income paid to the households is the measure of the product, so the value added in income-value is nothing else but this income, and  ${}^t\vec{V}_A'$  is the vector giving the distribution of the incomes paid by the different industries. To know  ${}^t\vec{M}'$ , we will suppose that the imported products have got the same mark-up, or the same coefficient  $k_i$ , as the domestic products. So  ${}^t\vec{M}' = {}^t\vec{M} \mathbf{K}$ .

To know  ${}^t\vec{\Sigma}'$ , we have to transpose  $\vec{\Sigma}' = \mathbf{K} \vec{\Sigma}$ . So  ${}^t\vec{\Sigma}' = {}^t\vec{\Sigma} \mathbf{K}$ , and since  $\mathbf{K}$  is a diagonal matrix, it is equal to its transpose and  ${}^t\vec{\Sigma}' = {}^t\vec{\Sigma} \mathbf{K}$ .

So it results from the equation 7' :

$${}^t\vec{u} \mathbf{K IC} + {}^t\vec{V}_A' + {}^t\vec{M} \mathbf{K} = {}^t\vec{\Sigma} \mathbf{K} \quad (\text{eq. 10})$$

$$\text{As } {}^t\vec{u} \mathbf{K} = {}^t\vec{K}, \text{ we have : } {}^t\vec{K} \mathbf{IC} + {}^t\vec{V}_A' + {}^t\vec{M} \mathbf{K} = {}^t\vec{\Sigma} \mathbf{K}$$

$$\text{or } ({}^t\vec{\Sigma} - {}^t\vec{M}) \mathbf{K} - {}^t\vec{K} \mathbf{IC} = {}^t\vec{V}_A' \quad (\text{eq. 11})$$

To solve this equation, it is necessary to eliminate the matrix  $\mathbf{K}$  to have only the vector  ${}^t\vec{K}$  in position of pre-multiplication as an unknown. For that purpose we will consider the diagonal matrix  $\mathbf{\Sigma}$  (n,n) of which the element of the line i and the column i is the total resource in product i, and the diagonal matrix  $\mathbf{M}$  (n,n) of which the element of the line i and the column i is the import of product i. Then we can observe that :

$$({}^t\vec{\Sigma} - {}^t\vec{M}) \mathbf{K} = {}^t\vec{K} (\mathbf{\Sigma} - \mathbf{M}), \text{ so we have :}$$

$${}^t\vec{K} (\mathbf{\Sigma} - \mathbf{M} - \mathbf{IC}) = {}^t\vec{V}_A' \text{ and we get the solution : } {}^t\vec{K} = {}^t\vec{V}_A' (\mathbf{\Sigma} - \mathbf{M} - \mathbf{IC})^{-1} \quad (\text{eq. 12})$$

We notice that the diagonal matrix  $\mathbf{\Sigma} - \mathbf{M}$  has got for elements the domestic resources produced by the different industries.

This solution enables us to build the I.O.T. in income-value, and the comparison between the I.O.T.'s in selling prices and in income-value will enables us to calculate the profit in income-value of every industry and to explain its formation. First of all we must decompose the accounting profit in seven components.

### **3.4. Decomposition of the accounting profit in seven components in order to explain its formation and to calculate the profit measured in income-value.**

Let us consider the definition of  ${}^{\vec{p}}_A$  through the PLA, i.e. equation 8 :

$$t_{P_A}^{\rightarrow} = t_{\Sigma}^{\rightarrow} - t_{V_A}^{\rightarrow} - t_u^{\rightarrow} \mathbf{IC} - t_M^{\rightarrow}$$

By replacing  $t_{V_A}^{\rightarrow}$  with its value from equation 7', we get :

$$t_{P_A}^{\rightarrow} = t_{\Sigma}^{\rightarrow} - t_{\Sigma'}^{\rightarrow} - (t_u^{\rightarrow} \mathbf{IC} - t_u^{\rightarrow} \mathbf{CI}' + t_M^{\rightarrow} - t_{M'}^{\rightarrow})$$

or by transposition :

$$\vec{P}_A = \vec{\Sigma} - \vec{\Sigma}' - (t_{\mathbf{IC}}^{\rightarrow} - t_{\mathbf{CI}'}^{\rightarrow} + \vec{M} - \vec{M}')$$

By replacing  $\vec{\Sigma}$  and  $\vec{\Sigma}'$  with their value given by equations 6 and 6', we get :

$$\vec{P}_A = (\mathbf{IC}_u^{\rightarrow} + \mathbf{Inv}_u^{\rightarrow} + \Delta^{\rightarrow} \mathbf{S} + \vec{C} + \vec{X}) - (\mathbf{IC}'_u^{\rightarrow} + \mathbf{Inv}'_u^{\rightarrow} + \Delta^{\rightarrow} \mathbf{S}' + \vec{C}' + \vec{X}') - (t_{\mathbf{IC}}^{\rightarrow} - t_{\mathbf{CI}'}^{\rightarrow}) - (\vec{M} - \vec{M}')$$

In grouping in an other way the different terms of this equation, we get :

$$\vec{P}_A = (\vec{C} - \vec{C}') + (\mathbf{IC} - \mathbf{IC}')_u^{\rightarrow} - (t_{\mathbf{IC}}^{\rightarrow} - t_{\mathbf{CI}'}^{\rightarrow}) + (\mathbf{Inv} - \mathbf{Inv}')_u^{\rightarrow} + (\Delta^{\rightarrow} \mathbf{S} - \Delta^{\rightarrow} \mathbf{S}') - (\vec{M} - \vec{M}') + (\vec{X} - \vec{X}') \quad (\text{eq. 13})$$

It appears that the accounting-profit is composed of seven components, that we have put in brackets. Their analysis will enables us to understand the formation of profit and the transition from the accounting profit to the profit in income-value.

#### **4. Analysis of the accounting profit. The formation of the profit. The corrections for getting a profit measured in income-value.**

Let us analyse the different components of  $\vec{P}_A$ .

##### **4.1. Analysis of the accounting profit.**

##### 4.1.1. Analysis of the first component $(\vec{C} - \vec{C}')$ : profit in income-value before any exchanges between industries.

It corresponds to the profit we had when there was only one firm. We noticed at that time that this profit was measured in income-value (since  $C - C' = I' - S_m$ , it was the part of investment  $I'$  measured in income-value and owned by the firm). Now that we have several industries,  $C$  and  $C'$  are divided between them and have become vectors. The selling prices of the totality of consumption is  $C = t_u^{\rightarrow} \vec{C}$ , its income-value is  $C' = t_u^{\rightarrow} \vec{C}'$  and the value of the global profit is  $\Pi = t_u^{\rightarrow} \vec{C} - t_u^{\rightarrow} \vec{C}'$ . So the term  $(\vec{C} - \vec{C}')$  gives exactly the same profit as the one we have calculated in 2.3 with the equation 5.

But with this first component we have not considered any exchanges between industries. So the distribution of the profit between industries given by  $(\vec{C} - \vec{C}')$  is the distribution which exists at the begining of the flow back  $\vec{C}$  from the households.

It is evident that further exchanges will modify the distribution.

4.1.2. Analysis of the second component  $(\mathbf{IC} - \mathbf{IC}')_{\vec{u}}$  : the values received by industries when selling intermediate consumption.

$\mathbf{IC}_{\vec{u}}$  is the sum in lines of the matrix  $\mathbf{IC}$ . So it represents the sales of the industries measured in selling prices.  $\mathbf{IC}'_{\vec{u}}$  represents the same sales but measured in income-value, so the difference  $(\mathbf{IC} - \mathbf{IC}')_{\vec{u}}$  represents the values gained by the industries when selling intermediate consumption.

4.1.3. Analysis of the third component  $({}^t\mathbf{IC} - {}^t\mathbf{IC}')_{\vec{u}}$  : the values transferred by industries when buying intermediate consumption.

$\vec{u}$  being "vertical", this third component is a "vertical" vector like  $\vec{p}_A$ . If we transpose it, we get the "horizontal" vector  ${}^t_{\vec{u}}(\mathbf{IC} - \mathbf{IC}')$ .  ${}^t_{\vec{u}}\mathbf{IC}$  is the sum in columns of the matrix  $\mathbf{IC}$ . So it represents the purchases of the industries measured in selling prices.  ${}^t_{\vec{u}}\mathbf{IC}'$  represents the same purchases but measured in income-value, then the difference  ${}^t_{\vec{u}}(\mathbf{IC} - \mathbf{IC}')$  represents the values transferred by industries when buying intermediate consumption. And its transpose, our third component,  $({}^t\mathbf{IC} - {}^t\mathbf{IC}')_{\vec{u}}$ , represents the same values.

As the total of the purchases is equal to the total of the sales, the sum of the elements of the vector representing the former (second component) is equal to the sum of the elements of the vector representing the latter (third component) (cf §3.2.)

It involves that the addition of the second component of equation 13 and the subtraction of the third component of the same equation to the first one  $(\vec{C} - \vec{C}')$  does not change the total value  $\Pi = {}^t_{\vec{u}}(\vec{C} - \vec{C}')$  of the profit but only its distribution between the industries.

So if we consider only the first component, we have the distribution of the profit in income-value just as it is at the beginning of the flow back ; if we add to it the second and the third components of equation 13, we get always the distribution of the profit measured in income-value, but after the exchanges of intermediate consumption between the industries. The other components will introduce the effect of the sale of fixed capital, of the effect of the valuation of inventories and of foreign exchanges.

4.1.4. Analysis of the fourth component  $(\mathbf{Inv} - \mathbf{Inv}')_{\vec{u}}$  : the values received by industries when selling fixed capital

This term is similar to the second one if we replace  $\mathbf{IC}$  by  $\mathbf{Inv}$  and  $\mathbf{IC}'$  by  $\mathbf{Inv}'$ . So it represents the values gained by the industries when selling fixed capital.

We notice that there is no term similar to the third one, i.e. there is no term representing the values transferred by industries when buying fixed capital. That comes from the way these purchases are accounted : for the business accounts, the purchase of fixed capital is not an item of the PLA, but an asset of the balance-sheet, so it is absolutely neutral on the gross profit<sup>10</sup>. The national accounts follow the same way, since the formation of capital appear in a capital account after the saving of the firms has been calculated.

At the opposite the selling of an item of fixed capital is a current operation which increases the profit and this increase is measured by the fourth component of equation 13.

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<sup>10</sup>of course this purchase diminishes the net profit, but this depreciation is charged on several years.

So the sum of the first four components of  $\vec{P}_A$  gives a profit larger than the profit measured in income-value. The adjunction of the fifth component will increase the profit still more.

4.1.5. Analysis of the fifth component  $\Delta \vec{S} - \Delta \vec{S}$  : the excess of the accounting measure of the changes in inventories on their measure in income-value.

At the end of the accounting period the value of the changes in inventories is accounted as if it were an income (in the PLA for the business accounts and in the production account for the SNA). As there is no sale the valuation may be difficult and the valuation methods are different in business accounts and in the SNA<sup>11</sup>. But any-way this valuation is larger than the valuation in income-value and it increases the profit above its income-value once more.

The last two components concern only the foreign exchanges.

4.1.6. Analysis of the sixth and seventh components  $(\vec{M} - \vec{M}')$  and  $(\vec{X} - \vec{X}')$  : net profits on the foreign exchanges

When selling abroad for  $\vec{X}$  goods of which income-value is  $\vec{X}'$ , the home firms realize an extra profit of  $\vec{X} - \vec{X}'$  in income-value. But in buying goods at the prices  $\vec{M}$ , whereas the income-value is  $\vec{M}'$ , they transfer a part of profit to foreign firms.

**4.2. The formation of the profit.**

The analysis of the accounting profit enables us to explain the profit formation. If we are in a closed economy, i.e. if we neglect the sixth and seventh components of equation 13, the profit appears first in income-value  $(\vec{C} - \vec{C}')$  with the relations between industries and consumers. This first exchange cannot create any new value, since the production has already occurred during the phase 1 of the circuit and that we are now in the phase 2 (distribution). So this first exchange involves only a transfer of value from households to industries selling consumption goods. Then the exchanges between the industries themselves either of fixed or circulating capital can occur. It is evident that these exchanges cannot, like the first ones, create any new value, but modify the distribution of profit captured by the first exchange between the different industries : the buyer-industries transfer profits to the seller-industries. The business and national accounts record that fact very well for the circulating capital since they include the second component of  $\vec{P}_A$  (values received by industries when selling intermediate consumption) and the third one (values transferred by industries when buying intermediate consumption). But they include only one component for the fixed capital : the fourth one (values received) and they have no element for the values transferred by purchase of capital. So it appears that the accounts give a measure of the profit above its income-value. The valuation appears further above when we add the fifth component of  $\vec{P}_A$  concerning the valuation of the changes inventories beyond any exchanges. As we have already seen in §3.2., the total valuation got is not arbitrary but in selling prices.

This analysis shows us the way to get a vector of profit measured in income-value.

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<sup>11</sup>normally the valuation is done with the cost prices for the former, and with selling prices for the latter (cf. 3.2.)

### 4.3. The corrections to be done for getting a profit measured in income-value

The analysis we have just done shows us the two corrections to be managed.

1. The fifth component does not correspond to any flow, to any part of the circulation of money leading to the formation of profit : it is only a way of calculus. In business, changes in inventories are just accounted at the end of the year. So this component must be suppressed.

2. One must put a supplementary component giving the transfer of value supported by firms when buying fixed capital. These transfers are given by the sums of the lines of the matrix  $\mathbf{Inv} - \mathbf{Inv}'$ , i.e. the "horizontal" vector :  $t_{\vec{u}}(\mathbf{Inv} - \mathbf{Inv}')$  or the "vertical" vector (its transpose) :  $(t\mathbf{Inv} - t\mathbf{Inv}')_{\vec{u}}$ . We will call this new element "fourth A".

After these two corrections we get a profit :

$$\vec{P}_V = (\vec{C} - \vec{C}') + (\mathbf{IC} - \mathbf{IC}')_{\vec{u}} - (t\mathbf{IC} - t\mathbf{IC}')_{\vec{u}} + (\mathbf{Inv} - \mathbf{Inv}')_{\vec{u}} - (t\mathbf{Inv} - t\mathbf{Inv}')_{\vec{u}} - (\vec{M} - \vec{M}') + (\vec{X} - \vec{X}') \quad (\text{eq. 14})$$

For the same reasons (economic and mathematic) as for the second and third components (cf. §§ 3.2. and 4.1.3.), the sum of the elements of the fourth component is equal to the sum of those of the fourth A component, thus we get a profit of which the global value is equal to :

$$P_V = t_{\vec{u}} \vec{P}_V = t_{\vec{u}}(\vec{C} - \vec{C}') - t_{\vec{u}}(\vec{M} - \vec{M}') + t_{\vec{u}}(\vec{X} - \vec{X}')$$

$$\text{Or } P_V = (C - C') - (M - M') + (X - X')$$

That confirms us  $\vec{P}_V$  is an income-value measure of profit.

An other way to verify it, it to see that the difference between the measures in selling prices ( $t\mathbf{Inv}_{\vec{u}} + \Delta \vec{S}$ ) and in income-value ( $(t\mathbf{Inv}'_{\vec{u}} + \Delta \vec{S}')$ ) of the assets is exactly the sum of the two corrections we suggest, i.e :

$$(t\mathbf{Inv}_{\vec{u}} + \Delta \vec{S}) - (t\mathbf{Inv}'_{\vec{u}} + \Delta \vec{S}') = (t\mathbf{Inv} - t\mathbf{Inv}')_{\vec{u}} + (\Delta \vec{S} - \Delta \vec{S}') = \vec{P}_A - \vec{P}_V$$

## 5. Application to the French economy for the year 1991

We have applied our model to the accounts published by the French C.S.O ("I.N.S.E.E.") for the year 1991. First we had to apply preliminary treatments for disposing of an I.O.T. conform to the model. The published table contains more columns than lines with a column for trade, and one called "fictive unit" which is supposed to consume the "financial intermediation services indirectly consumed"<sup>12</sup>. We had to suppress these both activities and to impute the trade margins and its intermediate consumption to the industries manufacturing the different products. In the same manner we had to reffect the margins and the intermediate consumption of the activity "trade and repair of motor vehicles" for their trade of spare parts. We had to eliminate the non-market output, the transfer of secondary products in replacing the output

<sup>12</sup>term used by the U.N. System of National Accounts. The French equivalent is "Production imputée de services bancaires".

produced by each activity by the output supplied, the deductible VAT, to have a unique system of prices. We had to eliminate the adjustments for the purchases abroad by residents and the purchases in France by non-residents.

Secondly to build the I.O.T. in income-value, we must have an estimation of  $\vec{t}_{VA}$ , i.e. of a distribution by activities of the salaries and other revenues paid to households. The published I.O.T. gives only salaries. For the other revenues we have used the intermediate system of accounts. But we have met some limitations : this system is limited to manufacturing activities, it does not record firms that do not produce their accounts to taxation authorities, it gathers firms by sectors and not by industries. Any way it would be necessary to include fictive salaries for the own-account workers to have a correct estimation of flow (2)<sup>13</sup>. After having established the I.O.T. in selling prices conform to our model, and after having estimated the vector  $\vec{t}_{VA}$ , we could build the I.O.T. in income-value. For that purpose we have resolved, through a spreadsheet, the matrix equation 12 giving the coefficients  $k_i$ . The results are below in table 2. And in combining both I.O.T.'s, we could calculate the vectors  $\vec{p}_A$  and  $\vec{p}_V$ . The results are below in table 3. In this last table we have a vector representing the profit done by the firms when selling fixed capital to government and non-profit organisations and which is of the same nature as  $\vec{C} - \vec{C}'$ . So in adding  $\vec{C} - \vec{C}'$ ,  $\vec{X} - \vec{X}'$ , that last profit on government and in subtracting  $\vec{M} - \vec{M}'$ , one gets the whole profit, measured income-value, that firms do when selling outside themselves. This sum has been calculated under the name "profit realised by sellers", since it is realised by the firms selling either to households, or to government and non-profit organizations, or abroad. Afterwards, we have the exchanges on intermediate consumption between the firms, and we get the "profit realised by makers" (always in income-value) i.e. with a distribution to the firms having manufactured the different products. Next, the adjunction of the fourth and fifth components enables us to calculate the accounting profit  $\vec{p}_A$ . The last columns contains the necessary corrections to get the profit in income-value  $\vec{p}_V$  after the exchanges of fixed capital.

## 6. Conclusions

The way we have calculated the profit, in income-value instead of selling prices as it is either in business or national accounts, enables us to understand its formation. Indeed we have two methods to calculate the profit in income-value of each firm at the end of the accounting period : either we apply the accountings methods, but we measure the assets of the balance-sheet in income-value. Either we study the different monetary flows which append all the year round, and which are the components of  $\vec{p}_V$  (cf. eq. 14). The first method gives us a profit, which is only the result of a calculus, a result measured in money, but which is not money itself (neither stock nor flow). The second method gives the same result with exactly the same properties, but it can explain how this calculus comes from true monetary flows happening during the accounting period. Any-way one must not confuse the profit, which is only a figure, for which the question of a monetary realisation has no meaning, and its formation which is not a figure, but a set of monetary flows through an economy, or through a graph, as would say the MGT.

The method cannot be applied by every firm, because it necessitates to know the income-values. To calculate them it is necessary to calculate vector  $\vec{K}$ , and for that one must know the whole I.O.T. in

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<sup>13</sup>To give an idea of the error due to the omission of these fictive salaries, we precise that for the manufacturing activities, the part in the production of the firms "that do not produce their accounts to taxation authorities" (that corresponds to the own-account workers approximatively) was 20,6 % in 1991.

selling prices. Nevertheless the method is exactly that followed inside a group to establish the consolidated accounts. Indeed the method of the consolidated accounts comes to eliminate the profits done inside a group by every firm upon the other, to get accounts as if there was only one firm. It is exactly what we have done for the whole economy with the purpose to be able to compare the situation when there are many firms to that one, when there is only one or to any intermediate situation.

The model we have presented is only a generalisation to  $n$  firms and  $n$  products of our canonical model and of the model presented by Bernard Schmitt in *Macroeconomic Theory* for only two firms and without any mathematical apparatus in the paragraph "Nominal money and real money". Nevertheless the Schmitt exposition was only an exercise of logic. As we have said in introduction, an economic model must prove its adequacy to a set of national accounts. We think that we have proved it, concerning the possibility to have many firms and products and to calculate what Schmitt calls the macroeconomic prices.

Our method consists to examine accounting concepts, to criticise them and to conceive new ones that we think more performing. This method is the same as the one used by certain specialists of firms' finance with the business accounts (Vallageas 1996). It is too early to tell what the measures in income-values will yield. We think that first of all it is necessary to calculate them for other countries and periods in order to do comparisons.

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