

# CIRCUIT, MEASUREMENT AND VELOCITY OF VALUE, PERMANENT PROBLEMATIC AND RECURRENT CRISES OF ITS ACCUMULATION

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## INTRODUCTION

The vectors of value, that is, money and all units of accounts, reportedly satisfy two uses: value preservatives and parity exchange. The former is related to hoarding and to debt memory; the latter is related to the exchange for commodities. They involve two irreconcilable definitions of value because they lead to two relationships between value and prices that cannot coexist. “Debt memory” (and hoarding) value is borrowed capital. Changes in the general price level produce opposite changes in the purchasing power of account unit that affects the borrowed capital. Prices and value are strictly inversely related. On the other side, “exchange”, understood as parity, value lies simultaneously in the products and their marketing income. Changes in the general price level also involve opposite changes in the purchasing power of account unit, but this does not affect the entire “exchange value”. Unless there is a change in the currency definition (i.e. “inflation” or “deflation”), average prices and values are strictly directly related.

This is problematic because two variables cannot be simultaneously inverse and direct functions of each other ; the accumulated value is actually simultaneously a circulating one, and *vice versa*. Such a mathematical configuration could only be found in the case of duality. As it happens, accumulated value and circulating value should not be identical but dual of each other. That is, the two values should be conceptually split. It might be interesting to study thoroughly this hypothesis. However, for the purposes of this study, one “value” only is assumed. Based on this assumption, the capital value definition and the parity exchange value definition are irreconcilable. We must choose between them.

More often than not, and even nowadays, it is parity exchange that constitutes the reference for value definition. However, this choice, which is based on the market pre-eminence as a governor of human economy, fails to take account of the duration constraints, and as, such is probably the origin of the persistent theoretical powerlessness regarding value category<sup>1</sup>. Although Marx identifies the value associated with working time, he takes care of the conditions of production that exist at the very moment of an instantaneous exchange only, and not of the real duration that the products have been actually requested. The labour value, according to Marx, remains a parity “exchange value”<sup>2</sup>. This ambivalence weakens the reintegration of the economy into the process of production, which in other respects characterises his works.

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<sup>1</sup> “ L’accent mis depuis le IV<sup>e</sup> siècle avant le Christ, sur le bien d’échange et non plus sur l’unité de valeur est la cause d’un biais redoutable dans les études monétaires. ”

Jean Denizet : *Monnaie et financement dans les années 80*, p. 14.

<sup>2</sup> *Das Kapital*, Erster Band, Seiten 62-85.

For Marx, capitalism is a “production and exchange mode”. The purpose of the present working paper is to redefine capitalism as an “accumulation mode”. This change of definition results from the choice of capital value against parity exchange value. Ignoring this latter, we’ll seize one of the most powerful, although insufficiently explored, Marxist concepts, that is, the “period of production”<sup>3</sup>. This category is interesting because it is not specific to capitalism nor to any other system, and covers every epoch and every production mode : the products from work, and there are no others on earth, undergo a necessary gestation. This law precedes and supersedes exchange. It was and remains the most immanent rule of economic order. The circulation of value must be entirely dependent on it.

According to the assumption above, and to the repudiation of parity “exchange value”, the borrowing-refunding cycle supersedes the “market” so that it is not justifiable to the critics pointed towards Walrasian general equilibrium<sup>4</sup>, and it joins the “circuitist” point of view<sup>5</sup>. However, the present circuit theory departs from this latter by attributing the status of an explanatory variable to the period of production. We will develop this thesis according to the structural specificity of capitalist investment, besides slavery and neo-slavery, which lies in a constant search for contracting that gestation. And this in opposition to the Austrian Schools for which the “diversion of production” extends the gestation of final products, while in contradiction with this theorem the productivity rises<sup>6</sup>.

The paper comprises five chapters : circuit, measurement, velocity, accumulation and crises. The appendix gives empirical validations. Putting the “market” in perspective, we’ll consider the asymmetrical exchange, and not the parity one, as the only structural capitalist exchange mode. In conclusion, we’ll discuss the present-day necessity to choose between persisting in the tendentially null growth strategy and extracting the productivity from the economic field, as a source of profit, to appropriate it by the social field.

## 1. CIRCUIT

The borrowing-refunding cycle supersedes exchange, if its necessity is of a greater order than the necessity of the market. Historically, market exchange actually follows after the habitual advent of borrowing and restoration of stocks, in a cycle where the promissory note very soon intervenes. What introduces the notion of an account unit, the list of which progressively decreases to a single one (the silver sicle), which gives value to every commodity. Then, rejecting all material references, the “value” becomes abstracted and develops, before all commodities, into what the fruit is with respect to the determined fruits.

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<sup>3</sup> Exactly : period of production and period of circulation (*Das Kapital*, Zweiter Band, Seiten 31-350).

<sup>4</sup> Guitton H. : *De l'imperfection en économie*, pp. 210-211.

<sup>5</sup> Gnos C. et Schmitt B. : *Le Circuit, réalité exhaustive*, pp. 63-74.

<sup>6</sup> “ *Quand l'intervalle de temps moyen entre l'emploi des moyens originels de production et l'achèvement des biens de consommation augmente, la production devient plus “ capitalistique ”, et vice versa.* ”

F. von Hayek : *Prix et production*, pp. 100-101.

However, on the same page, the same “ *interval* ” is a given, and not an explicative variable:

“ *Il est commode de traiter la quantité de produits intermédiaires en un point de ce fleuve comme une fonction du temps  $f(t)$ , et, par conséquent, la quantité totale de produits intermédiaires dans le fleuve comme une intégrale de cette fonction sur une période  $r$  égale à la longueur totale du processus de production (...)* :

$$\int_x^{x+r} f(t)dt$$

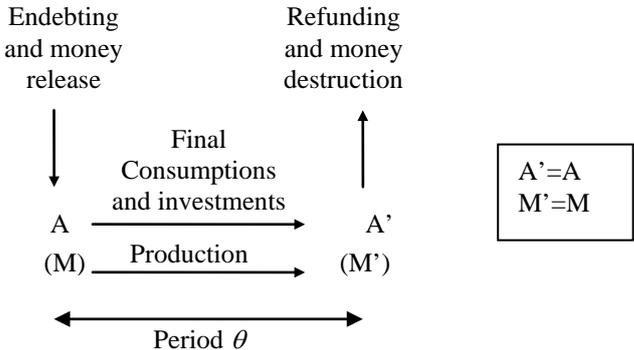
In the fourth millennium BC, the promissory note was issued by political and religious authorities, and consisted of a right of access to the stocks for the necessities of production and consumption of producers (and of the people for whom they were tributary). When the production cycle is achieved, and the stocks are restored, the clay-note was destroyed by the storekeeping officer or priest. The invention of writing originates from this habit, and not from the “exchange” (though essential for the Sumerian states-cities), attesting to the predominance of stocks and labour management in the economic life.

This management has its origin in the most fundamental economic exchange for all live species: the cycle of borrowings from, and restitutions, to the ecosystem, of which the stock mediation constitutes a negentropic organisation. Thus, we are lead to conclude that getting into debt, which is isomorphic to borrowing from stocks and the environment, is a primal necessity for the human economy.

During the borrowing-refunding cycle, the issued value is unalterably engraved or symbolised in the promissory note. Nowadays, this principle is conserved in double-entry bookkeeping where assets must balance liabilities. Therefore, even if the output from production is sold on the markets, an issued value “A” cannot be exceeded by the return “A’”, as postulated by the Marx’s circuit. Even assuming an additional injection of money in the course of circulation, the  $\Delta A$  must equally be found within A and A’, owing to the fact that every monetary or credit issue, apart from pathogenic manipulations, is somewhere simultaneously recorded as a liability and as an asset.

At this stage of the reasoning, we are facing a circuit of value that respects the most fundamental economic cycles: borrowing from and restitution to the stocks, working process, and monetary borrowing-refunding. The market mediation is part of it, owing to the fact that the remunerations, distributed by the production sphere, are the counterpart of the productive indebtedness. However, it is a second order mediation.

Nevertheless, at first sight, the circuit assumed above does not yet explain the profit, nor the growing accumulation of value. It involves a single variable only : the *period of production*.



As it is isomorphic of the stocks borrowing-restoration cycle, the period between borrowing and refunding is nothing more, theoretically, than the period of production. We say “theoretically”, because, in fact, the credit cycle is given rhythm from the seasonal and annual accounts. As much as production remains essentially agricultural, the period of production and the value cycle are identical. But when the spectrum of industrial production is stretched out, they diverge from each other. One becomes variable, while the other remains

conventionally constant. Now, on the precedent assumptions, value, as the memory of indebtedness, corresponds to the remunerations (salaries, dividends, interest and taxes) that must be advanced (borrowing from stocks), while the process of working replaces the equivalent of the absorbed consumption (i.e. restitution to stocks).

## 2. MEASUREMENT

The value cycle dependence on the period of production seems to enable value to be measured by working time. However, the value definition intervening in parity exchanges destroys this ability. It leads us to consider that the rises in productivity, by contracting the requested working time per unit of product, devalue the products. This is the logical consequence of the Marxist “exchange value”. Confronted by the paradox to which Marx’s identification of parity exchange value to working time leads, Marx must put his “law” in perspective by considering the requested working time in effect at the time of transaction. However, the social conditions of production constantly change, so that the working unit of measurement is not invariant, and this circumstance destroys its status of measurement unit. In fact, this contradiction results from the parity “exchange value”. If value is defined as the memory of indebtedness – and such is the definition we have adopted here –, the value of the product unit is a pleonasm. The only invariant is actually the unit of product, expressed in a monetary symbol, at the price level in a benchmark year. Therefore, that value can be measured by the actual working time requested in the benchmark year. Then, the exchange is not an instantaneous parity one, but is delayed and asymmetrical, as we’ll further see it.

If  $q_0$ , expressed at the price level  $\pi_0$ , is the total stock at the beginning of a production-consumption cycle, the distributed value that gives right to access is  $m$ , which is identically indebtedness (liabilities) and money released (assets):

$$m = q_0$$

At the time of the debt cancellation, price level has become  $\pi$ , and the purchasing power of the nominal value  $m$  has become  $q$ , such that :

$$q = q_0 \cdot \frac{\pi_0}{\pi} \quad \text{entailing a change in the purchasing power, opposite to the change in}$$

the price level :  $dq = -q \frac{d\pi}{\pi}$

Value cycles interpenetrate and stack, so that it is more convenient to measure the aggregates as flows. However, flows can later be split up in such a way to approach the production period through productivity. Let  $\nu$  be the number of producers who are mobilised during the while of a given year. Let  $\rho$  be their yearly average productivity. If  $Q$  refers to the volumetric production flow, then :

$$Q = \nu \cdot \bar{\rho}$$

Average productivity  $\rho$  can be expressed as an average individual production  $h$  within the period of production  $\theta$ :

$$\bar{\rho} = \frac{\bar{h}}{\bar{\theta}}$$

Within the time unit (a year), the average period of production recurs at a frequency  $\varphi$  (which can be less than 1). The latter relationship then becomes:

$$\bar{\varphi} \cdot \bar{\theta} = 1 \Rightarrow \bar{\rho} = \bar{\varphi} \cdot \bar{h}$$

Productivity of human economy depends on two sets of factors : a set of human and natural factors, and a set of artificial factors. The first set has no significant trend, except in the short term, for reasons of physiological and environmental limits. We associate the variable  $h$  to this set, which will then be treated in the long term as almost constant. The second set, on the other hand, depends on the artificial factors, and in the long term can accommodate the strict increase in the apparent productivity of work. We associate to this set the variable  $\varphi$ , to represent the strict increase that expresses the contraction in the period of production. Starting from these conventions, the result is, in the long term, that the rate of increase in apparent productivity of work is identical to the rate of increase in frequency of the period of production, that is:

$$\left. \begin{array}{l} \bar{\rho} = \bar{\varphi} \bar{h} \\ \bar{h} \approx cte \end{array} \right\} \Rightarrow \frac{d\bar{\rho}}{\bar{\rho}} = \frac{d\bar{\varphi}}{\bar{\varphi}} \quad \text{Equation 1}$$

This identity, let us say it again, implies that the rise in productivity depends exclusively on the artificial factors, and therefore, corresponds to the long-term changes. However, the variable  $h$ , according to the conventions above, represents the yearly duration of the working time per producer as well as the rate of use of the production capacities that are notably related to the “flexibility” and the “mobility” of workforce. Therefore, we must consider the case of an increase in productivity, in the short or medium term, essentially provided by a rise in  $h$  for a given frequency  $\varphi$  (see appendix).

When a rise in productivity entails a contraction in the period of production, it involves, as we are going to see, an acceleration of money velocity.

### 3. VELOCITY

The bookkeeping debt-refund cycle is no longer identical to the cycles of stock restoration. This is one of the reasons why to date the proposed statistical measurements of money velocity produces results that are not significant, and therefore, of no use. So the aggregate which is used to measure money velocity is a conventional turnover of the periodic remunerations. As such, the monthly deposits, at an arbitrary date in the year, are used in the evaluation of the aggregate  $M1$  so that the ratio to global monetary income can only give us the average periodicity of loans. Nevertheless, the conventions have no effect on the rhythm of creation-destruction of monetary signs which daily obey the real stocks and orders turnover in the production sphere. Therefore, we can consider that a monetary module  $m$  exists, the average turnover of which is given rhythm by the average period of production  $\theta$ , but which is paid in instalments.

Let us take the year as the time unit. Let us assume that the average conventional rhythm of remunerations is a renewal of  $N$  times a year. The monetary module  $m$  is then the sum of the  $N$  yearly renewals multiplied by  $\theta$  years (decimal number):

$$m = M1 \times N \times \bar{\theta}$$

From this we can extract:

$$M1 = \frac{m}{N \times \bar{\theta}}$$

If we no longer consider the period of production, but the yearly frequency  $\varphi$ , the relationship above becomes:

$$\bar{\varphi} = \frac{1}{\bar{\theta}} \Rightarrow M1 = \frac{\bar{\varphi} \cdot m}{N}$$

Let us consider now the flow  $M$  of the  $m$  returns in the time unit, or yearly “monetary income”. This is the result of the turnover of  $m$  at the frequency  $\varphi$  :

$$M = \bar{\varphi} \cdot m$$

Let us compare now  $M$  to  $M1$  :

$$\frac{M}{M1} = \frac{\bar{\varphi} \cdot m}{\varphi \cdot m / N} = N$$

This latter result is a purely conventional parameter. This parameter actually depends on the “banking management”, as it is described in school textbooks, although the banking management intervenes only for a part in its determination. As for the money velocity, it simultaneously appears in the numerator and in the denominator, and thus, it is omitted from the relationship.

A second reason for the money velocity miscalculation lies in the definition of the “Gross Product”. In actual fact, the variable commonly used in the relationship above is not the monetary flow  $M$ , which is only the flow of remunerations progressing towards final consumption and investments, but a redundant aggregate within which the yearly productive investments are counted twice : once in the prices of households and government final consumption and investments, and once more in the part of investments that corresponds to the purchases of firms from other firms<sup>7</sup>. So that there is no reason for this aggregate to figure

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<sup>7</sup> Let  $P$  be the conventional GP and  $I$  the fixed capital investment,  $M$  being the final consumptions flow :

$$P = I + M$$

Let's assume the marxist bisector model :

$$P_1 = I_1 + M_1$$

$$P_2 = I_2 + M_2$$

The first sector provides the second one with fixed capital, so that the fixed capital investment of sector 2 is equal to the product of sector 1 :

$$I_2 = P_1 = I_1 + M_1$$

in the Gross Product (GP) as a component of it, what it actually does, when the “intermediate consumption” do not. Intermediate consumption expenses are turnovers that already figure in the overall total sphere of production income. Therefore, intermediate consumption expenses must be, and are, omitted from the GP. Now the difference between productive investment and intermediate consumption is only the threshold of depreciation duration. For depreciation of less than one year, we have an intermediate consumption. For depreciation of one year and greater, we have a productive investment. That is all.

As a one-year period is the same as the time reference for GP and the boundary between intermediate consumption and productive investments, their respective depreciation modes seem to be different from each other. Intermediate consumption disappears entirely in the annual period so that intermediate consumption is explicitly counted as expenses of the firm in their annual accounts. As for the fixed capital, it is consumed within more than a year. Therefore, its consumption appears as sinking funds, under a waiting renewal heading. But the total of that annual depreciation accounts to which are added provisions, in firm savings, is not locked up in a piggybank, it is invested at interest. Thus, it participates, as a sort of mutual credit, in the renewals of the firms that have to replace their installations during the year considered<sup>8</sup>.

As it is the flow of  $m$  returns,  $M$  is the flow of the final consumptions and investments. Then, if  $P$  is the GP of national accounts and  $I$  is the investment in fixed capital :

$$P = M + I \Rightarrow P = M \left( 1 + \frac{I}{M} \right)$$

It is  $P$  that the monetarist economists compare, in fact, to  $M1$  :

$$\frac{P}{M1} = \frac{M}{M1} \left( 1 + \frac{I}{M} \right) = N \left( 1 + \frac{I}{M} \right)$$

Besides the historical and sociological change of  $N$  (progressive advent of the monthly payments, for example), the ratio above then reflects the proportion between the flow of productive investment ( $I$ ) and the flow of remunerations ( $M$ ). As  $I$  is a part of  $M$ , the ratio  $I/M$  expresses the proportion of remunerations in heavy equipment firms. It decreases in the recessions or stagnation phases and increases, on the contrary, during phases of business recovery. The sudden and brief changes in the ratio  $P/M1$ , that Friedman and Schwartz (who call it “money stock velocity”) have observed<sup>9</sup>, can now be explained. Out of these transitory

Fixed capital investment of sector 1 is self-providing so that it belongs to  $M_1$ . Finally, the conventional GP is :

$$P = P_1 + P_2 = 2M_1 + M_2$$

If we don't assume 2 but  $n$  sectors, the result is :

$$P = nM_1 + (n-1)M_2 + \dots + 2M_{n-1} + M_n$$

So redundancy is patent. It can only be explained by an ideological obstacle : the prejudice of the macroeconomic persistence of complementarity between saving and final consumption, which is the individual problematic.

<sup>8</sup> This means that the Keynes's “multiplier” is not more or less than 1.

<sup>9</sup> After having noticed, according their calculation mode, a 10% increase in “money velocity” between 1954 and 1957, M. Friedman et A. Schwartz add this comment :

“That percentage rise had been exceeded in peacetime during only three preceding expansions : 1932 to 1937, in reaction to the major decline during the Great Contraction ; 1946 to 1948, in reaction to the wartime decline ; and 1949 to 1953, in response to the Korean speculative boom. ”

phases, the ratio  $I/M$  decreases because the structural productivity increases. It is, in fact, natural that final consumption and investment flow per unit of consumed fixed capital increase, as the productivity rises.

M. Friedman makes an observation that seems to validate the quantity basis of his theory and which may be explained, in reality, by the regular renewal and then the “flow” nature and not the “stock” of the aggregate  $M1$ . That is, the “empirical evidence” according to which the general rises in prices would tightly follow the rises in “money stock”.

In order to establish this correlation, Friedman compares the supposed “money stock” to the real GP (GP at constant prices), then compares the rate of change of this ratio to the price index<sup>10</sup>. Now, this latter notion is the result of the ratio between two flows : current GP and real GP. If the ratio between a stock and a flow is close to the ratio between two flows, it is necessary that the turnover of stock is almost constant. This is Friedman’s conclusion. However, if the aggregate  $M1$  is itself a flow, and an almost monotonous function of the Product, then Friedman’s empirical result is nothing but a tautology.

Finally, the measurement of the money velocity equally suffers from the extension of the “money stock” to the “almost money”, that is, monetary liabilities that are realisable within a sufficiently short delay for being likely to participate to payments (M2, M3, M4). However, the matter here is one that offers support to monetary creation, without any consideration for the effective demand of money, that is, the gathering within which active and passive money intervene together. Now, this latter has no basis for phenomenal existence other than the legal freedom for the commercial banks of possibly creating money without having to require an intervention of the central bank. Its velocity is, therefore, null. If the passive money intervenes in the calculation, it delivers, at best, only one segment of information - that is, one of increase or decrease regarding active money, the only one that effectively exists as money.

If we consider the module of value  $m$ , issuing and coming back at the creation-destruction rhythm of monetary signs, the velocity of money is identically the frequency  $\varphi$  of the period of production. It structurally changes proportionally to the apparent productivity of work, as expressed by Equation 1. The empirical validation of that theorem will be proposed in an appendix.

#### 4. ACCUMULATION

In the first chapter, we have noticed that every additional injection of money is simultaneously recorded somewhere as a liability and as an asset. The result is that, as a whole, the accumulation of value always begins by a debt. However, a debt that is by no means a saving, since this latter cannot exceed the total value already issued from the banking system<sup>11</sup>. The enhanced reproduction of invested capital begins with an issue of a virtual value that is consolidated in accumulation only at the time of refunding.

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*A Monetary History of the United States*, p. 600.

<sup>10</sup> *Monetary Correction*, in *Monetarist Economics*, p. 23.

*L’inflation, mal incurable ?*, in *Inflation et systèmes monétaires* pp. 45 à 48.

<sup>11</sup> *General Theory*, p. 84.

This process, which was recognised by Keynes<sup>12</sup>, would have freed Marx from a contradiction, which haunted him in all his works : the one that opposes the thesis according to which the accumulation process would originate in the asceticism of the capitalists, to the assumption of a systemic mechanism of enhanced reproduction, beyond any behaviourist consideration<sup>13</sup>. However, Marx remained prisoner of the classic dogma of the precedence of profit and saving over investment, as well as the one of the complementarity between saving and consumption within income. Keynes freed himself from the former, but not from the latter.

Without any doubt, had it not escaped Keynes's mind that the reciprocal determinations of income, investment, and saving, as they are considered within a "period" understood as the yearly time unit (i.e. simultaneously), their relationship is a pure and simple one of identity, not only between investment and saving, but between income, saving, and investment. What implied a status of supplementarity, and not of complementarity, between saving and consumption. As we have already noted, the complementarity principle still presides over the definition of GP<sup>14</sup>. According to our conventions, investment, saving, and income of the production sphere as a whole are nothing but successive transformations of the same quantity of value during the period of production. Therefore, saving and consumption are not complementary, within income, but supplementary. That is, final consumption and investments (borrowing from the stocks) are not instantaneous, but are staggered over the period of production so that social savings progressively become social expenses. At the end of the borrowing-refunding cycle, the whole value created at the beginning must be returned in order to cancel the debt. Apart from hoardings, of course, which are only possible with substantial monies, the "cash holding" theoretician merges, for that reason, with the "liquidity-preference"<sup>15</sup>.

Then, within the flow of the value symbols, at the rhythm of their creation-destruction, there is no place for additional investment. This latter only originates in a pure creation of value, consolidated as accumulation at the time of its return. However, we have presumed in the chapter on the circuit, that this creation of value is nothing but a right of access to the stocks. Now, these latter, in their largest acceptance (including the productive installations and the productive potentialities where commodities can be stored, like final services), do constitute the material counterpart, "real", of the already accumulated value. This seems to conflict with an enhanced turnover process.

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<sup>12</sup> *General Theory*, p. 62.

<sup>13</sup> " *Man muß es nie vergessen, daß die Produktion dieses Mehrwerts – und die Rückverwandlung eines Teils desselben in Kapital, oder die Akkumulation, bildet einen integrierenden Teil dieser Produktion des Mehrwerts – der unmittelbare Zweck und das bestimmende Motiv der kapitalistischen Produktion ist. Man darf diese daher nie darstellen als das, was sie nicht ist, nämlich als Produktion, die zu ihrem unmittelbaren Zweck den Genuß hat oder die Erzeugung von Genußmitteln für den Kapitalisten.* " *Das Kapital*, Dritter Band, Seiten 253-254.

<sup>14</sup> See above pp. 6-7.

<sup>15</sup> " *The concept of hoarding may be regarded as a first approximation to the concept of liquidity-preference. Indeed. If we were to substitute 'propensity to hoard' for 'hoarding', it would come to substantially the same thing.* " (J. M. Keynes : *General Theory*, p.174).

Let us notice that for Keynes " money " means the solid species only, and this explains his support of the utopian project of a tax on hoarded money storages:

" (...) *those reformers, who look for a remedy by creating artificial carrying-costs for money through the device of requiring legal-tender currency to be periodically stamped at a prescribed cost in order to retain its quality as money, or in analogous ways, have been on the right track ; and the practical value of their proposals deserves consideration.* " (*General Theory*, p.234)

However, those " proposals " fell into disuse because the " liquidities " have essentially become bank writings.

Marx's theorem of "surplus-value" extracted from "unpaid overwork" resolves the contradiction. However, it comes up against the systemic bookkeeping identity between A and A'. Indeed, a worker returns more than he has consumed, but not more than the whole society has consumed. Marx's "surplus-value" is in fact a tribute; and people whose workers are tributary must consume, too, during the process of production that only renew the means which are necessary to final investments and consumption. It is already included in the productive investment and is by no means a "surplus-value". The individual accumulations of a part of that tribute, by the capitalists, should be considered as a relative accumulation, with the help of which capitalists concurrently share the legal co-ownership of invested capital. Therefore, the problem remains unsolved : where does the real counterpart of the additional invested value come from?

The thesis of saving, enabling the mobilisation of an additional workforce by transferring to it the corresponding rights to consume, seems to answer the question. However, it fails to identify the material resources that are necessary to raise the general level of production. In other words, the matter is not only one of mobilising an additional workforce and its support, but an excess of stocks of generic products that either do not exist within the economic boundaries of the system, or are not workable under the required conditions, technically or financially, of yield. Only an expansion of the production system outside its boundaries is able to resolve that problem. Six millennia of known history have given two versions of it : imperialist conquests and foreign trade. Both authorise an access to the  $\Delta q$  of stocks, which is requested at the beginning of enhanced production, thanks to the asymmetric character of the confrontation of manufactured products to the raw materials and the workforce which is required for their extraction<sup>16</sup>. In a few words, as Rosa Luxemburg had already understood more than eighty-five years ago, the keyword of the growing accumulation of the capital value is *expansion*<sup>17</sup>.

With the preceding proposed conventions and notations, we can now express the real additional investment  $dq$ , as a function of an additional labour force. Let  $v$  be the labour force of producers. The investment  $dq$  is consolidated as an accumulated value, when at the end of the period  $\theta$  the  $dv$  additional producers have realised an average production  $h$ . The rate of accumulation then is identically the rate of change of the mobilised additional labour force :

$$q = (v, h) \Rightarrow dq = \frac{\partial q}{\partial v} dv \Rightarrow \frac{dq}{q} = \frac{dv}{v}$$

The long term almost constant  $h$  is expressed in monetary units at the price level  $\pi_0$  of a benchmark year. The purchasing power of value unit is then equal to 1. However, at the end of the period, the purchasing power depends on the price level  $\pi$ , so that the initial additional indebtedness  $dm$  is unequally shared between  $d\pi$  and  $dv$  :

$$m = (v, h, \pi) \Rightarrow dm = \frac{\partial m}{\partial v} dv + \frac{\partial m}{\partial \pi} d\pi$$

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<sup>16</sup> We know now that the first recorded imperialist conquests (Akkad, 2400-2150 B.C.) were preceded, as early as the fourth millenium, by an economic and cultural hegemony of Sumer over the whole territory of the future empire, structured by an asymmetric foreign trade, directly managed by the political and religious administrations of the Sumerian cities (cf. Guillermo Algaze : *The Uruk World System*).

<sup>17</sup> " *Die Existenz nichtkapitalistischer Abnehmer des Mehrwerts ist also direkte Lebensbedingung für das Kapital und seine Akkumulation, insofern also der entscheidende Punkt im Problem der Kapitalakkumulation.* " Rosa Luxemburg : *Die Akkumulation des Kapitals*, S.314.

In order to find out the accumulation rate (i.e. profit rate) in real terms (at constant purchasing power of the value unit), we must subtract the price index from the nominal rate :

$$\frac{dq}{q} = \frac{dm}{m} - \frac{d\pi}{\pi} \quad \text{Equation 2}$$

## 5. CRISES OF VALUE

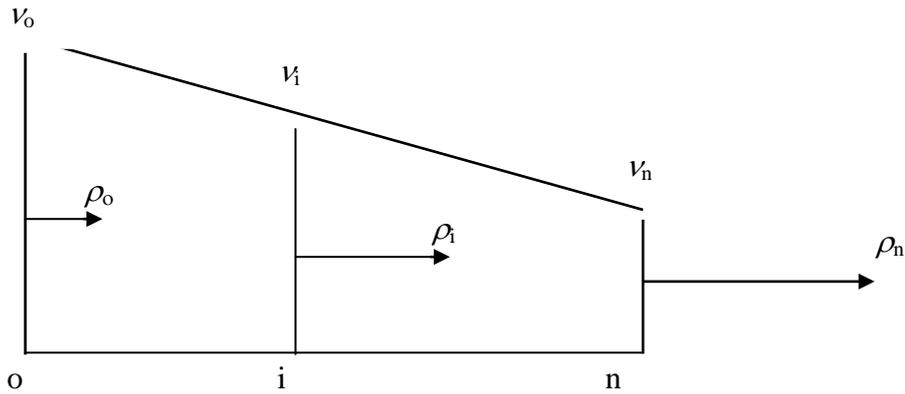
The intervention of the price index in the determination of the accumulation rate introduces a factor of fragility in the accumulation process. However, according to the relationship above, the real accumulation rate is completely insensitive to “inflation”. If nominal accumulation originates in an excess of currency circulation, it is simply neutralised by the rise in prices it causes. As it does not correspond to any real investment, that neutralisation does not show any critical features. On the other hand, a rise in prices, which is not imputable to a monetary inflation and destroys the profit expected from a real investment, constitutes an accumulation crisis. It is this syndrome that traditionally puts an end to the growth phases.

In a precedent study, it was established that the share of the rate of change of the current monetary income, between growth and prices, is by no means anticipated by the demand of money. It occurs *ex-post facto* in the course of circulation under the influence of an independent factor. Except in special economic situations related to the very “inflation” and limited by time (especially scarcity periods), this sharing out reaches a limit at which it equally distributes the rate of change of current income between growth and prices. In other words, the elasticity between rate of growth and price index then becomes structurally equal to 1.<sup>18</sup>

The theoretical expression of that limit is supported by an abstract multisectoral model involving  $n$  sequences that is structured by a spectrum of unequal productivities in a growing order from the upstream to the downstream of the economic chain. Every sector  $i$  of the chain is entirely defined through two variables only : the activity  $v_i$ , identified as the number of producers, and their mean productivity  $\rho_i$ . The model works under an external composition law of ordinal distribution of unequal productivities, and an internal composition law that consists of an assumption of tendentious adaptation of flows between the sectors so that the activity is the inverse of the productivities distributed along the chain. The model is shown by the following graph :

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<sup>18</sup> Romain Kroës : *Régulation de la demande de monnaie entre taux de croissance et indice des prix*, research paper of ART François Perroux, june 1998.

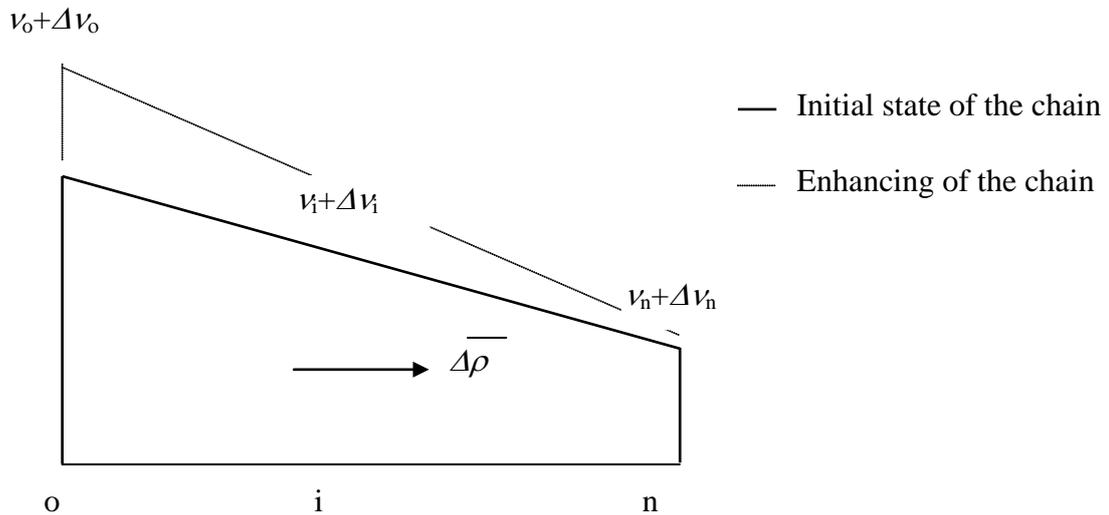


$$\left. \begin{array}{l} \rho_0 < \dots < \rho_i < \dots < \rho_n \\ v_0 \rho_0 = \dots = v_i \rho_i = \dots = v_n \rho_n \end{array} \right\} \Rightarrow v_0 > \dots > v_i > \dots > v_n$$

In addition to the above assumptions, it is assumed that the distribution of the productivity gains between the sectors follows a log-normal law according to a coefficient  $\gamma$  that is thought to be constant along the chain at the time  $t$ :

$$d\rho_i = \gamma(t) \cdot \rho_i \Leftrightarrow d\bar{\rho} = \gamma(t) \cdot \bar{\rho} \cdot dt$$

When a tension appears on the chain, due to a differentially distributed rise in productivity, the sectors react in such a way that they substitute the mobilisation of an additional labour force to their relative productivity gap, growing towards upstream:



If we neglect the change of activity at the sector  $n$ , the graph above shows the following relationship activity and productivity changes:

$$\Delta v = v \frac{\Delta \bar{\rho}}{\bar{\rho}}$$

Equation 3 <sup>19</sup>

The permanent problematic of accumulation is then the valorisation of productivity gains. The matter is of exchanging these later, on the longitudinal axis of the chain, against a proportional change of requested working activity. That is to say of buying “rarity” with productivity. Such is the quintessence of the asymmetric exchange, and such is the reason why the parity, which is implied in the concept of “exchange value”, has remained of no use.

However, the asymmetric exchange is only possible within an expansion process, since inside an integrated financial system all the firms must yield approximately the same profit and tribute per capital unit. Therefore, in such a system the gaps of productivity upstream must be compensated by changes in relative prices. If  $\pi_i$  is the monetary income per unit of product at the sector i, the relationship between two consecutive sectors i and j, in an integrated system, can be expressed as follows:

$$\pi_{ij} = \frac{1}{\rho_{ij}} \Rightarrow d\pi_{ij} = -d\rho_{ij}$$

If the expansion outlet of a rise in productivity is insufficient, the tension is absorbed both by an additional activity and a change in relative prices :

$$v_{ij} \cdot \pi_{ij} = \frac{1}{\rho_{ij}} \Rightarrow dv_{ij} + d\pi_{ij} = -d\rho_{ij}$$

However, if the process ended here, we should be watching a paradoxical asymmetric exchange where the downstream productivity gains would be captured by the less productive upstream sectors. In order to recover their expected profits, the downstream sectors must then restore the relative prices by increasing their own market prices. This is the so-called “inflation by costs” process, as demonstrated in a precedent working paper<sup>20</sup>.

Therefore, at the end of the “inflation by costs” process, the valorisation of productivity gains is shared between an expansion of activity and a rise in price level. The more general expression of Equation 3 is then:

$$\frac{dv}{v} + \frac{d\pi}{\pi} = \frac{d\bar{\rho}}{\bar{\rho}}$$

Equation 4

If the general price level has not changed, we recover the theorem of the proportionality between the mean gain of productivity and the additional labour activity against which it is exchanged on the longitudinal axis. On the other hand, if the value issued at the indebteding time is completely absorbed by a rise in price level, the change in activity is null. In the first case, the elasticity between prices and growth is equal to zero. In the second case, it is equal to unity. In other words, as soon as the elasticity between the price index and growth is not null, a factor of crisis is introduced into the value accumulation process.

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<sup>19</sup> Ibidem.

<sup>20</sup> Ibid.

At the indebted time, the issue of an additional value  $dm$  is a function of the expected mean productivity gain. The general price level is then given as<sup>21</sup>:

$$dm = \frac{\partial m}{\partial \rho} d\bar{\rho} \Rightarrow \frac{dm}{m} = \frac{d\bar{\rho}}{\bar{\rho}}$$

However, during the period between indebted and refunding, it is possible that final product prices may rise. Therefore, the exchange between productivity and labour can be reduced:

$$dm = \frac{\partial m}{\partial v} dv + \frac{\partial m}{\partial \pi} d\pi \Rightarrow \frac{dm}{m} = \frac{dv}{v} + \frac{d\pi}{\pi}$$

Capital reaction to lowering purchasing power of the accumulated value is double. On the one hand, it is the rise in interest rates upward price index, and, on the other hand, the hoarding in a safe value (gold, traditionally). Neither reaction can occur without the other. In order to be able to act on interest rates, one has to control the supply-demand ratio, that is, to allow the possibility of hoarding. Therefore, the financial capital ended the European growth period in the sixteenth century. In the nineteenth century, due to the growing credit secured on assets, and no direct credit growth in gold, it was necessary to use periodically a properly politic means every time a crisis of value threatened : that was, the discount rate of the central bank. Nowadays, due to the demagnetisation of gold, hoarding is only relative in the change from one money into another currency. However, the floating quotations of currencies leads to the destruction of that possibility. Only fixed or steady parities between currencies can restore it, but they are in the hands of the central banks and subject to political decisions. So it is, with interest rates which now depend only on the central banks strategies.

The problem we are now facing, according to the theoretical developments above, consists of a political choice between a tendentious null growth, which is the only capitalist way of arresting the crisis of value accumulation, and the recovery of productivity into the social area, removing it from now on from the economic field as a source of profit. Of either strategy, only the second one constitutes a steady solution. The first strategy does not actually exclude the necessity of extracting a relative profit (Marx's "surplus value"), which is no longer automatically multiplied by the growth rate. What can explain the unwillingness of firms to cut working time without lowering salaries. At first sight, such claims seem legitimate as they are supported by productivity gains. However, in the capitalist framework, the rise in productivity must be valorised. By remaining in this framework, the tendentious null growth imposes, one way or another, the lowering of salaries and/or the reduction of staff, the productivity gains will be valorised through drawing on the wage bill. To put an end to that endless spiral of exploitation it is indeed necessary that productivity stops being a financial target, and serves the social objectives of cuts in working time, and in extending "unprofitable" investments and realisations.

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<sup>21</sup> Of course, the credit cannot be released in anticipated prices, but at the present prices.

## Appendix 1

### PRODUCTIVITY AND “MONEY CELERITY”

#### 1 Empirical checking of the structural strictly growing “money celerity”

In chapter 5, we assumed that at the endebting time the additional issued value, or additional requested money  $m$ , essentially depends on the expected mean productivity gain :

$$dm = \frac{\partial m}{\partial \bar{\rho}} d\bar{\rho} \Rightarrow \frac{dm}{m} = \frac{d\bar{\rho}}{\bar{\rho}}$$

On the other hand, the monetary flow is the turnover of the module  $m$  at the frequency  $\varphi$  :

$$M = \bar{\varphi} \cdot m \Rightarrow \frac{dM}{M} = \frac{d\bar{\varphi}}{\bar{\varphi}} + \frac{dm}{m}$$

Merging the expression above with the precedent one, it comes :

$$\frac{dM}{M} = \frac{d\bar{\varphi}}{\bar{\varphi}} + \frac{d\bar{\rho}}{\bar{\rho}}$$

We have defined the productivity gain which is due to artefacts as being “structural”. We have then theoretically advanced that the rate of change of the mean productivity is identical to the one of the mean turnover frequency of the monetary module :

$$\bar{\rho} = \bar{\varphi} \cdot \bar{h} \Rightarrow d\bar{\rho} = \frac{\partial \bar{\rho}}{\partial \bar{\varphi}} d\bar{\varphi} \Rightarrow \frac{d\bar{\rho}}{\bar{\rho}} = \frac{d\bar{\varphi}}{\bar{\varphi}}$$

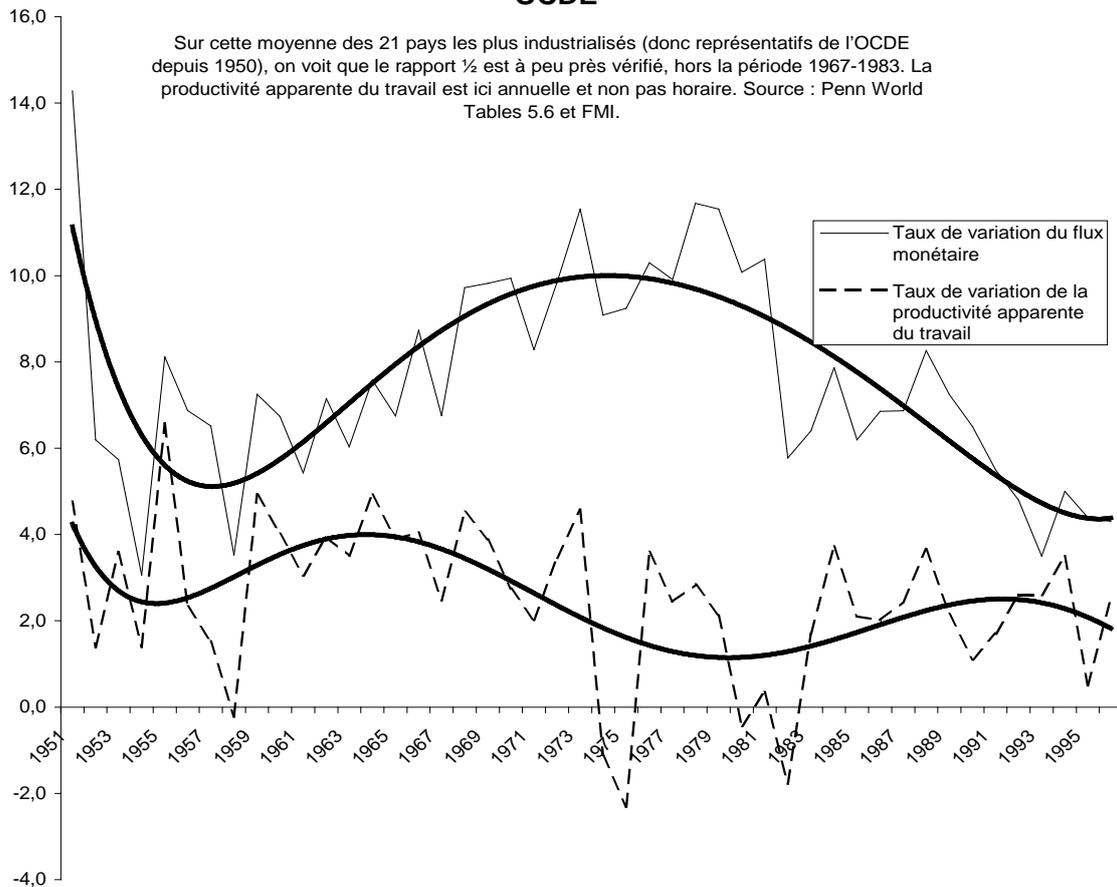
So that the requested money flow, or “monetary flow”, would be an almost monotonous function of the squared productivity, and identically of the squared money turnover frequency which is therefore strictly increasing :

$$\frac{d\bar{\varphi}}{\bar{\varphi}} = \frac{d\bar{\rho}}{\bar{\rho}} \Rightarrow \frac{dM}{M} = 2 \frac{d\bar{\rho}}{\bar{\rho}} = 2 \frac{d\bar{\varphi}}{\bar{\varphi}} \Rightarrow \frac{M}{M_0} = \left( \frac{\bar{\rho}}{\bar{\rho}_0} \right)^2 = \left( \frac{\bar{\varphi}}{\bar{\varphi}_0} \right)^2$$

These assumptions are both verifiable by comparing the rate of change of the yearly apparent productivity of work to the one of the monetary flow in which the former must be found twice. The verification of it is researchable on the following graphs that are representative of OECD 21 main countries.

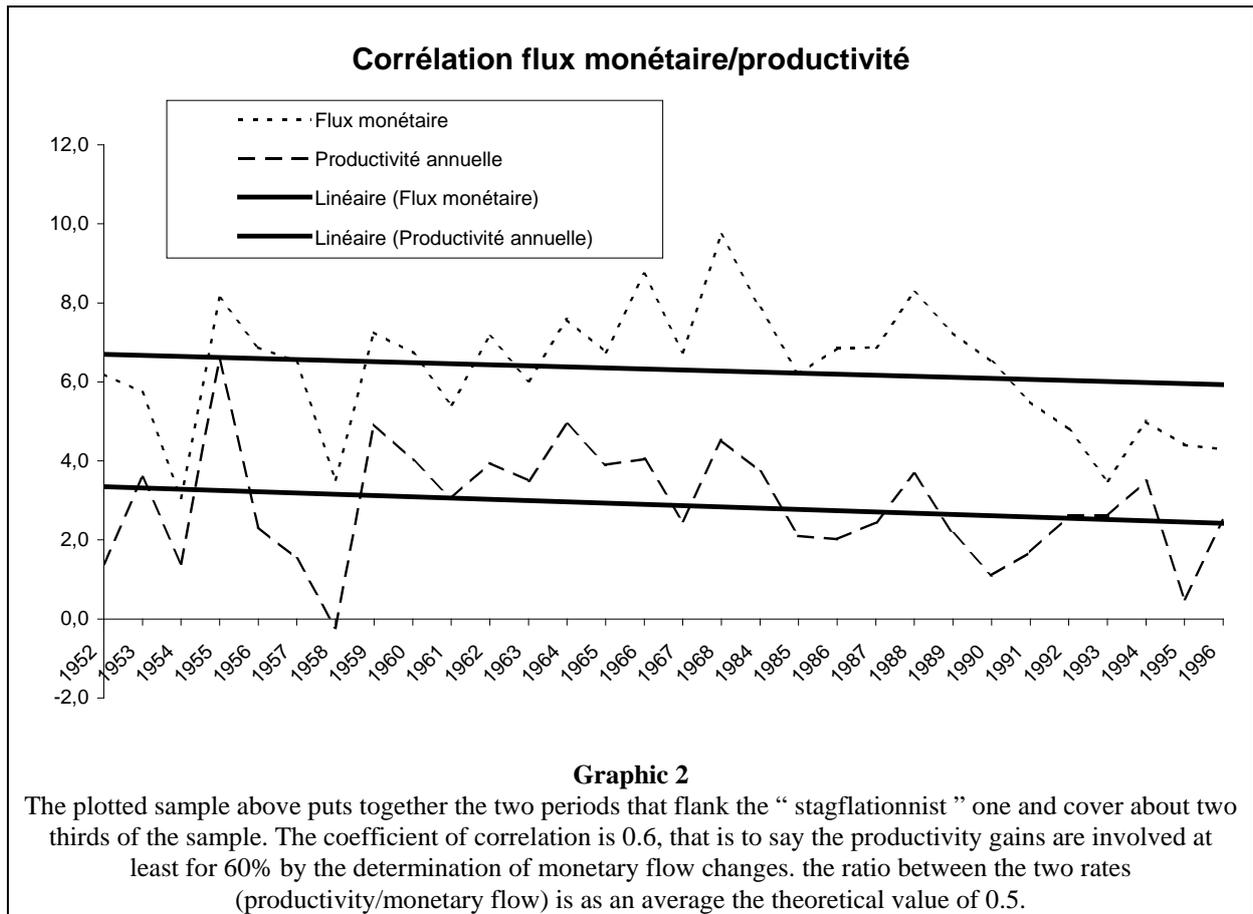
## Flux Monétaire et Productivité apparente du Travail OCDE

Sur cette moyenne des 21 pays les plus industrialisés (donc représentatifs de l'OCDE depuis 1950), on voit que le rapport  $\frac{1}{2}$  est à peu près vérifié, hors la période 1967-1983. La productivité apparente du travail est ici annuelle et non pas horaire. Source : Penn World Tables 5.6 et FMI.



**Graphic 1**

On this average sample of the 21 main OECD countries (representative of OECD since 1950), the ratio of  $\frac{1}{2}$  can approximately be observed, except in the “ stagflationist ” period. Here, the apparent productivity of work is an yearly one and not the hourly one. Source : Penn World Tables 5.6 and FMI.



Assuming proportional rates of change between the mean productivity and the mean money turnover frequency, and starting from the hypothesis according to which expected profit is proportional to the mean productivity gain, we are led to an equality between the mean profit rate and the rate of change of mean turnover frequency of investment  $m$  :

$$\left. \begin{array}{l} \frac{d\bar{\rho}}{\bar{\rho}} = \frac{d\bar{\varphi}}{\bar{\varphi}} \\ \frac{dm}{m} = \frac{d\bar{\rho}}{\bar{\rho}} \end{array} \right\} \Rightarrow \frac{dm}{m} = \frac{d\bar{\varphi}}{\bar{\varphi}}$$

As the monetary flow  $M$  is the stream of  $m$  turnovers, the relationship above leads to express the rate of change of monetary flow as being double of the rate of change of the yearly apparent productivity of work :

$$\left. \begin{array}{l} \frac{dM}{M} = \frac{dm}{m} + \frac{d\bar{\varphi}}{\bar{\varphi}} \\ \frac{dm}{m} = \frac{d\bar{\varphi}}{\bar{\varphi}} \end{array} \right\} \Rightarrow \frac{dM}{M} = 2 \frac{d\bar{\varphi}}{\bar{\varphi}} = 2 \frac{d\bar{\rho}}{\bar{\rho}}$$

What is attested by the graph 2. Reciprocally, if we start from the statistical result, we find again the identity between the rate of change of mean productivity and the one of  $m$  turnover frequency :

$$\left. \begin{array}{l} \frac{dM}{M} = \frac{dm}{m} + \frac{d\bar{\varphi}}{\bar{\varphi}} \approx 2 \frac{d\bar{\rho}}{\bar{\rho}} \\ \frac{dm}{m} = \frac{d\bar{\rho}}{\bar{\rho}} \end{array} \right\} \Rightarrow \frac{d\bar{\varphi}}{\bar{\varphi}} = \frac{d\bar{\rho}}{\bar{\rho}}$$

We are then allowed to consider the theorem of the structurally increasing turnover frequency of the monetary module  $m$ , in the capitalist accumulation process, as being empirically validated. But this validation is only concerned with the intervals where the rises in mean productivity are manifestly due to artificial factors, without any resort to the specifically human productivity.

Now, there can be periods of overproduction and or (and) of underemployment of the productive capacities, within which the yearly productivity of work decreases or slows down. On the other hand, the structure of productivity  $\rho$ , such as we conventionally defined it ( $\varphi \times h$ ), notably associates the real duration of the yearly working time with  $h$ . Therefore, when there is a trend of an increasing working time,  $h$  can no longer be treated as an almost constant, and its changes even can replace  $\varphi$  changes.

## 2

### Exceptions to the structural law

The period 1967-1983 was characterised by world-wide political events of first order : the Vietnam war intensification, then the two oil crises. To the rises in prices that resulted from them, were conjugated the first measures taken to dissuade the money demand, notably through the substitution of an erratic intervention of central banks on monetary markets, for the traditional discount mechanism. The result was a decreasing growth rate, but with maintained staff level, because the firms, far from envisaging a structural crisis, were waiting for an economic recovery. What is likely to explain the diminishing rates of rises in apparent productivity of work within that period.

At this case of exception, which can be observed in the OECD sample, we have to add the one of an encasing human productivity, either through an increasing working time or an improvement in the use of productive capacities, thanks to the staff “mobility” and “flexibility”. At the limit of such a scenario, it is even possible to observe a rise in productivity which is exclusively indebted to human work, while the weakness of investment tends to fade progresses from innovation. The rate of change of the money demand flow is then no longer double of the rate of rise in mean productivity, but simply equal to this latter :

$$\begin{array}{l}
 \bar{\rho} = \bar{\varphi} \cdot \bar{h} \\
 \frac{d\bar{\rho}}{\bar{\rho}} = \frac{d\bar{h}}{\bar{h}} \Rightarrow \frac{d\bar{\varphi}}{\bar{\varphi}} = 0 \\
 M = \bar{\varphi} \cdot m \\
 dm = m \frac{d\bar{\rho}}{\bar{\rho}}
 \end{array}
 \begin{array}{c}
 \text{U} \\
 \text{V} \\
 \text{W}
 \end{array}
 \Rightarrow \frac{dM}{M} = \frac{d\bar{\rho}}{\bar{\rho}}$$

What traps the sum of growth rate and price index within the boundaries of the rate of rise in productivity :

$$\begin{array}{l}
 M = (Q, \pi) \\
 \frac{dM}{M} = \frac{d\bar{\rho}}{\bar{\rho}} \\
 \frac{dQ}{Q} + \frac{d\pi}{\pi} = \frac{d\bar{\rho}}{\bar{\rho}}
 \end{array}
 \begin{array}{c}
 \text{U} \\
 \text{V} \\
 \text{W}
 \end{array}$$

Let us assume that such a case exists at the structural limit of elasticity between price index and growth rate. The relationship above then becomes :

$$\alpha = 1 \Rightarrow \frac{d\bar{\rho}}{\bar{\rho}} = 2 \frac{dQ}{Q} = 2 \frac{d\bar{\rho}}{\bar{\rho}} + 2 \frac{dv}{v} \Rightarrow \frac{d\bar{\rho}}{\bar{\rho}} + 2 \frac{dv}{v} = 0$$

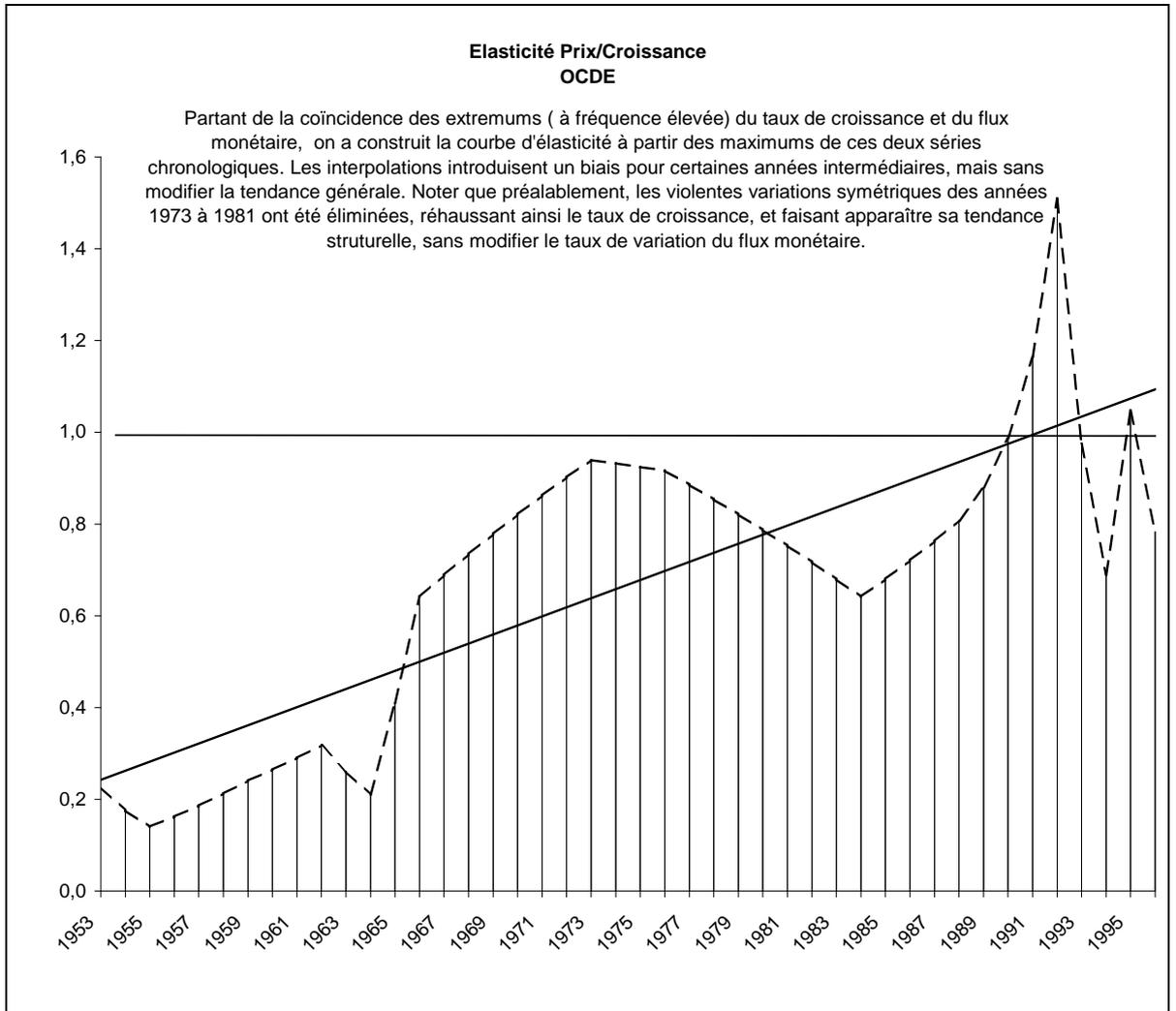
In this case, the theory is validated if the labour activity decreases proportionally to half the rate of rise in productivity :

$$\frac{dv}{v} = -\frac{1}{2} \frac{d\bar{\rho}}{\bar{\rho}}$$

But the increase in yearly human productivity, through the extension of working time or of “mobility” and “flexibility”, necessarily reaches a plateau at which, except in case of

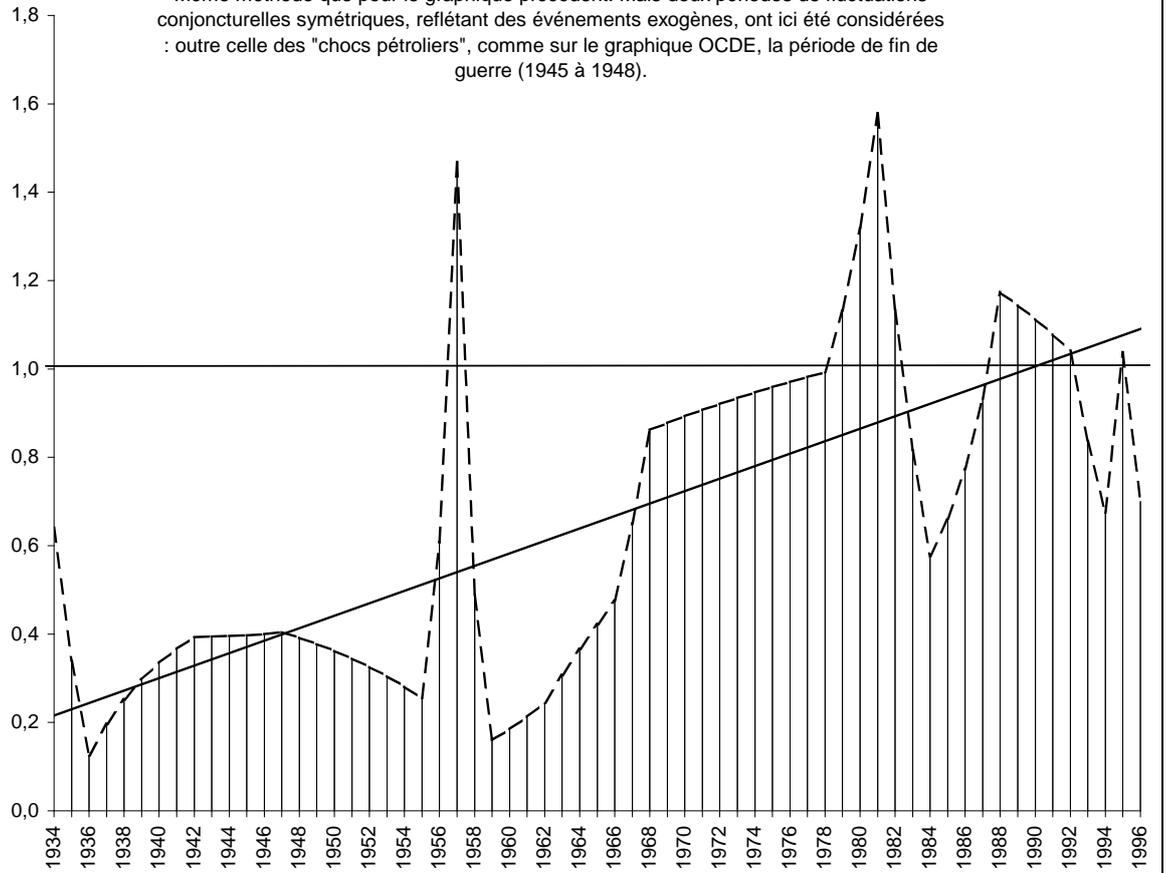
investment recovery, all the variables are null : rate of change of money demand, growth rate, price index and rate of rise in productivity.

## PRECEDENT RESULTS RECALLING



### Elasticité Prix/Croissance USA

Même méthode que pour le graphique précédent. Mais deux périodes de fluctuations conjoncturelles symétriques, reflétant des événements exogènes, ont ici été considérées : outre celle des "chocs pétroliers", comme sur le graphique OCDE, la période de fin de guerre (1945 à 1948).



## ***Bibliography***

- Algaze G. : *The Uruk World System*, Chicago : University of Chicago Press, 1993.
- Blaug M. et Walter Eltis, Denis O'Brien, Don Patinkin, Robert Skidelsky, Geoffrey E. Wood : *The Quantity Theory of money : from Locke to Keynes and Friedman*, Brookfield : Edward Elgar, 1995.
- Bloy E. : *Initiation à l'analyse financière*, Lyon : Presses Universitaires de Lyon, 1980.
- Böhm-Bawerk E. von : *Irving Fisher*, in *Positive Theorie des Kapitals*, Zweiter Band, Meisenheim/Glan : Verlag Anton Hain K. G., 4. Auflage, 1961, Seiten 269-319.
- Bordes C. : *Variabilité de la vitesse et volatilité de la croissance monétaire, le cas français*, Paris : Centre de Recherche de la Banque de France, 1989.
- Bottéro J. et Eléna Cassin : *Désordre économique et annulation des dettes en Mésopotamie à l'époque paléo-babylonienne*, in *Journal of economic and social history of the Orient*, Leiden : E. J. Brill, 1961.
- Brunhoff S. de : *La monnaie chez Marx*, Paris : Editions Sociales, 1976 (3<sup>e</sup> édition).
- Chaîneau A. : *Le bouclage du circuit économique*, document de recherche n°1995-07, Poitiers : Faculté des Sciences Economiques de l'Université de Poitiers, 1995.
- Chaîneau A. : *Mécanismes et politiques monétaires*, Paris : PUF, 10<sup>e</sup> éd., 1990.
- Denizet J. : *Monnaie et financement dans les années 80*, Paris : Dunod, 1982.
- Fisher I. : *Precedents for Defining Capital*, in *Quarterly Journal of Economics*, 18, 1904 (Bibliothèque virtuelle du CHPE, Paris I).
- Foley D. K. : *Understanding Capital : Marx's Economic Theory*, Cambridge Massachusetts : Harvard University Press, 1986.
- Friedman M. & Schwartz A. J. : *A Monetary History of United States*, Princeton : NBER, 1963.
- Friedman M. : *L'inflation, mal incurable ?* in *Inflation et systèmes monétaires*, Paris : Calmann-Lévy, 1976.
- Friedman M. : *Monetary Correction*, in *Monetarist Economics*, Oxford : Blackwell, 1991.
- Gnos C. et Schmitt B. : *Le Circuit, réalité exhaustive*, in *Economies et Sociétés*, février 1990.
- Guittou H. : *De l'imperfection en économie*, Paris : Calmann-Lévy, 1979.
- Hayek F. von : *Prix et production*, Paris : Calmann-Lévy 1975.
- Kalecki M. : *Theory of economics dynamics*, London : Allen and Unwin, 1954.

- Keynes J. M : *The General Theory of Employment, Interest and Money*, Cambridge : Cambridge University Press, 1973.
- Lelart M. : *L'émission de monnaie dans l'économie française*, Paris : Nouvelles Editions Latines et CNRS, 1966.
- Luxemburg R. : *Die Akkumulation des Kapitals*, Gesammelte Werke, Band 5, Berlin : Institut für Marxismus-Leninismus, 1975.
- Marx K. : *Das Kapital*, Erster Band, Berlin : Dietz Verlag, 34. Auflage, 1993.
- Marx K. : *Das Kapital*, Zweiter Band, Berlin : Dietz Verlag, 34. Auflage, 1989.
- Marx K. : *Das Kapital*, Dritter Band, Berlin : Dietz Verlag, 29. Auflage, 1989.
- Robinson J. : *L'accumulation du capital*, Paris : Dunod, 1977.
- Schumpeter J. A. : *On the concept of Social Value*, Quarterly Journal of Economics, volume 23, 1908-9, pp. 213-232
- Veblen T. : *Böhm-Bawerk's Definition of Capital and the Source of Wages*, in *Quarterly Journal of Economics*, 6, 1892 (Bibliothèque virtuelle du CHPE, Paris I).
- Young A. A. : *Increasing Returns and Economic Progress*, in *Economic Journal*, 38, 1928, pp. 527-542, (Bibliothèque virtuelle du CHPE, Paris I).