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THE CLASSICAL LEGACY AND BEYOND*

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RÉSUMÉ

L'HÉRITAGE CLASSIQUE ET AU-DELÀ

Cette étude est un plaidoyer pour une nouvelle évaluation et un développement de l'héritage des classiques (Smith, Ricardo et Marx), qui souligne l'importance du traitement du déséquilibre. On construit un cadre d'analyse dans lequel la stabilité des économies capitalistes peut être étudiée. Cette analyse est illustrée par l'exemple des États-Unis depuis la guerre de Sécession. La première partie rappelle les aspects principaux de l'analyse classique de l'équilibre et de la concurrence. La seconde partie est consacrée à la présentation du modèle (en particulier la modélisation des comportements dans le déséquilibre, la "micro-économie de déséquilibre"). La troisième partie donne la définition de l'équilibre classique et traite de sa stabilité à deux points de vue: 1) La valeur relative des variables (prix, quantités produites et stocks de capital), c'est-à-dire ce que nous nommons la *stabilité en proportions*, 2) Le niveau général d'activité, c'est-à-dire la *stabilité en dimension*. La quatrième partie traite du cycle industriel et inclut un certain nombre d'exemples factuels. La dernière partie discute sur l'exemple de l'économie américaine, la relation entre tendances historiques (les mouvements à la baisse du taux de profit) et stabilité.

ABSTRACT

THE CLASSICAL LEGACY AND BEYOND

This study is a plea for a reassessment and development of the classical legacy (Smith, Ricardo, and Marx), stressing the importance of the treatment of disequilibrium. A framework of analysis is built for the study of the stability of capitalist economies which is illustrated by the example of the U.S. economy following the Civil War. The first part briefly recalls the main aspects of the classical analysis of competition and equilibrium. The second part presents the model (in particular of the modeling of behaviors within disequilibrium: "disequilibrium microeconomics"). The third part defines classical equilibrium and discusses its stability in two respects: 1) The relative value of the variables (relative prices, proportions of outputs and capitals among industries), *i.e.*, the stability in proportions, and 2) The general level of activity *i.e.*, what we call stability in dimension. The fourth part is devoted to the analysis of the business cycle, with a number of empirical illustrations. The last part, using the example of U.S. economic history, discusses the relationship between historical tendencies (the long-term movements of the profit rate) and stability.

MOTS CLEFS : Classiques, Modèle Dynamique, Concurrence, Cycle Industriel, Taux de Profit, Tendances Historiques

KEYWORDS : Classics, Dynamic Model, Competition, Business Cycle, Profit Rate, Historical Tendencies

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INTRODUCTION

In the pre-Walrasian stages of the development of economic theory, more than one century before the Keynesian revolution, a *classical* approach to economic theory had reached a pinnacle of maturity in the works of Adam Smith and David Ricardo. This classical perspective was later prolonged and, in some important respects, transformed by Karl Marx. In spite of significant differences, they shared references to labor in the theory of value, very similar analyses of competition and equilibrium, and a common interest in the investigation of the historical tendencies of capitalism. Although the modern business cycle appeared only after 1820 in England, Ricardo already displayed some interest in these states of "distress", in his words, that the system periodically confronted. Later the issue of crisis became crucial in Marx's analysis of the workings of capitalism.

The perspective adopted here is not that of the history of economic thought. The present study must be understood as a plea for a reassessment of this early stage of economic knowledge. In particular, we believe that the work of the classics embodies specific conceptions of *equilibrium and disequilibrium* which must be restored and developed. (By disequilibrium we mean a situation in which markets do not clear, *i.e.*, involuntary inventories or rationings exist, resources are not allocated properly, etc.)

It is possible to build *disequilibrium microeconomics* of classical inspiration, which are distinct from neoclassical microeconomics, and provide the foundations for the analysis of the stability of equilibrium, in a realistic framework. Moreover, these same disequilibrium microeconomics lead to a new approach to business cycle theory, *i.e.*, to problems usually considered as belonging to macroeconomics. Thus, one can avoid the Walrasian revolution as well as the Keynesian revolution which the former rendered necessary as a result of its exclusion of disequilibrium from economic theory.

This article is divided into five parts. Part I briefly recalls the main aspects of the classical analysis of competition and introduces the notion of *disequilibrium microeconomics*, *i.e.*, a description of the behavior of economic agents in situations of disequilibrium, reacting to the observation of disequilibrium, based on *adjustment*. Part II presents the model which lies at the basis of our analysis. Part III defines classical equilibrium and discusses its stability in two respects: 1) With respect to the relative values of the variables (relative prices, proportions of outputs and capitals among industries), *i.e.*, what we call the stability in *proportions*, and 2) With respect to the general level of activity, *i.e.*, what we call the stability in *dimension* of capitalist economies. Part IV is devoted to the analysis of the business cycle. A few empirical illustrations are given using the example of the U.S. economy. Part V briefly sketches the nature of the relationship between historical tendencies (the long-term movements

of the profit rate and other variables, since the Civil War) and stability. In this last part we also introduce a few remarks concerning the labor market. Other sections of this study assume a given rate of wages and the availability of labor.

I - THE CLASSICAL ANALYSIS AND OTHERS

The classical analysis of competition is presented in section A. It is then compared with the Walrasian and Keynesian analyses in section B.

A - THE CLASSICAL ANALYSIS

The analysis of competition by the classics is concentrated in three chapters of their respective works (SMITH A. 1776, Ch. 7, RICARDO D. 1817, Ch. 4, and MARX K. 1894, Vol. III, Ch. 10). These chapters are devoted to the formation of prices of production, *i.e.*, long-term equilibrium prices which guarantee a uniform profit rate between industries. The central idea is that unequal profit rates render investment more or less attractive in the various industries. Capitalists seek the maximum profits on their advanced capitals, and accumulate at a higher rate in industries with higher rates of profit. This migration of capitals creates a tendency toward a uniform profit rate among industries:

> *"This restless desire on the part of all employers of stock to quit a less profitable for a more advantageous business has a strong tendency to equalize the rate of profit of all..."* (RICARDO D. 1817, p. 48)

We will consider successively the classical conceptions of equilibrium (subsection 1), disequilibrium (subsection 2), and their general view concerning the determination of the general level of activity (subsection 3).

1. The Definition of Equilibrium

The uniform profit rate is obtained for a given set of prices called "natural prices", or "prices of production", as opposed to disequilibrium prices, called "market prices". When the profit rate is uniform, no inducement toward further movement exists. In a growth model, this is equivalent to stating that the proportions of accumulation among industries are maintained, *i.e.*, the economy follows a balanced growth path.

It is well-known that this situation is never actually reached. The economy instead "gravitates" around this target. This does not change the fact that this position should be referred to as an *equilibrium*, which is the explicit notation used in Marx, in the sense that this equilibrium requires a mobility of capital, which is always a slow movement.

The model that the classics have developed is a "general" model in the sense given to this term in the expression "general equilibrium". All variables are interdependent. The activity in one industry conditions the demand of certain inputs. Consumption, as well as accumulation, flow from income, etc.

The dependency of supply on prices, through profitability, is a crucial element in the classical analysis of competition. The dependency of demand on prices is also part of their analysis. Marx is no exception in these respects, quite the contrary. For example, the consideration of well behaved demand functions is explicit in Marx:

> *"As far as demand is concerned, this is self-evident, since this moves in the opposite direction to prices, expanding when it falls and* vice versa. *But the same is true of supply..."* (MARX K. 1894. p. 292)

Outputs are also involved in the determination of the classical long-term equilibrium. Smith uses the terms "effective demands" to refer to the outputs associated with the prevalence of natural prices. Marx calls these quantities produced: "Social needs".

It is explicit in the classical analysis of competition that, when equilibrium is reached, supplies are equal to demands, *i.e.*, no involuntary inventories exist. Capitals are allocated properly, *i.e.*, capital stocks are used at full, or rather "normal" capacity utilization rates (*cf.* II.B.1 below).

The initial endowments in reproducible resources do not play any role in the determination of this equilibrium. (The analysis of nonreproducible resources such as land is treated separately by the classics.) The required amounts of circulating inputs, stocks of fixed capital, and consumption goods are produced in appropriate proportions, which are determined endogenously. Moreover, prices do not depend on equilibrium outputs.

In all cases, the proportions of demand in an equilibrium are functions of prices.

2. Disequilibrium in the Competitive Process

The term "disequilibrium" in the works of the classics should be taken in its natural sense of the absence of the clearing of the commodity market (with inventories or rationings), of unequal rates of profit, misallocation of capital (thus, possibly, with capacity utilization rates different from normal), etc. Unemployment is another expression of disequilibrium, although the classics do not consider this variable in their analysis of competition (but in other parts of their works).

An important characteristic of classical analysis is its emphasis on disequilibrium and its reference to *adjustment*: what we call "disequilibrium microeconomics". Capitalists respond to profit rates differentials by modifying the allocation of their capital: 1) Unequal profit rates are an expression of disequilibrium, and 2) The inflexion of the allocation of capital reflects the adjustment of the variables in relation to this observation of disequilibrium. The general scheme underlying adjustment and

disequilibrium microeconomics is the following:

$$\cdots \rightarrow \begin{pmatrix} \textit{evidence of} \\ \textit{disequilibrium} \end{pmatrix} \rightarrow \begin{pmatrix} \textit{modification of} \\ \textit{behavior} \end{pmatrix} \rightarrow \cdots$$

The difference between supply and demand (another sign of disequilibrium), *i.e.*, at the individual level of a firm's excessive or deficient inventories, leads to changes in prices. The extent of these variations depends on different conditions. Smith writes, for example:

> *"When the quantity brought to market exceeds the effectual demand, it cannot be all sold to those who are willing to pay the whole value of the rent, wages, and profit, which must be paid in order to bring it thither.* [...] *The market price will sink more or less below the natural price, according as the greatness of the excess increases more or less the competition of the sellers, or according as it happens to be more or less important to them to get immediately rid of the commodity."* (SMITH A. 1776, p. 50)

This basic chain of disequilibria and adjustments can be represented as follows:

$$\cdots \rightarrow \begin{pmatrix} \textit{supply} \\ \neq \\ \textit{demand} \end{pmatrix} \rightarrow \begin{pmatrix} \textit{changes} \\ \textit{of} \\ \textit{prices} \end{pmatrix} \rightarrow \begin{pmatrix} \textit{changes of} \\ \textit{rates of} \\ \textit{profit} \end{pmatrix} \rightarrow \begin{pmatrix} \textit{movements} \\ \textit{of} \\ \textit{capital} \end{pmatrix} \rightarrow \begin{pmatrix} \textit{new supply} \\ \textit{and} \\ \textit{demand} \end{pmatrix} \rightarrow \cdots$$

3. The General Level of Activity

An important point on which the classics are not explicit concerns which forces insure the full or "normal" utilization of resources in a capitalist economy at a macro level. The notion of this full or "normal" utilization is obviously involved in their analysis of long-term equilibrium, but the actual mechanism is not clearly set out.

Their conception is basically that of accumulation, in the sense that profits realized in the previous period are destined for the development of production. The actual use of this surplus is considered as normal, but is not automatic. Marx harshly criticized Ricardo on his adhesion to Say's Law. However, even for Ricardo, the use of the surplus is subject to the condition of a certain level of profitability:

> *"It follows from these admissions, that there is no limit to demand — to the employment of capital while it yields any profit..."* (RICARDO D. 1817, p. 197)

In spite of such remarks, important problems remain to be solved, related to monetary phenomena (hoarding and dishoarding, credit, and issuance of money). These mechanisms are central in the analysis of the stability in *dimension*, but can be set aside in that of *proportions* (*cf.* part III).

B - A COMPARISON

In this section we introduce a brief comparison of the classical analysis with the Walrasian (subsection 1) and Keynesian (subsection 2) perspectives. As a way of conclusion to this part, subsection 3 discusses the interest and the limits of the classical approach.

1. Equilibrium and Disequilibrium in the Walrasian Perspective

The classical and neoclassical conceptions of equilibrium and disequilibrium must be contrasted in several respects.

In a Walrasian equilibrium, prices are such that all markets clear. Thus, these prices are functions of the initial endowments in reproducible goods. This is obvious in a pure exchange model, but is also true in a model with production. In the simple atemporal form of these models, one fraction or the total of the inputs is produced during the period itself (an evident weakness). In the general intertemporal model, time is treated properly, but prices are still determined in the same manner (*cf.* DUMÉNIL G., LÉVY D. 1985(a)). In a classical equilibrium, commodity markets clear, but prices are not fixed in order to obtain this clearing. Prices are such that a uniform profit rate exists. The equality between supply and demand results from the allocation of capital in adequate proportions (*i.e.*, the long-term adjustment of supply to demand).

Disequilibrium is not analyzed in a realistic manner by the neoclassicals. The *tâtonnement* is an unrealistic necessity in the Walrasian model. In the *tâtonnement* a fictitious centralized agent, the auctioneer, announces disequilibrium prices. Economic agents respond, indicating the quantities that they would sell or buy, if the prices announced prevailed with the guarantee that all markets will be in equilibrium. But no transactions actually occur. The auctioneer repeats this procedure, until equilibrium prices are determined. Only then are transactions performed.[1]

Some ambiguity exists concerning the von Neumann model (*cf.* von NEUMANN J. 1938 and MORISHIMA M. 1964). In our opinion, this model belongs to the classical perspective. A long-term equilibrium is defined, in which endowments do not play any role and prices are equal to prices of production.

In a number of applied works of neoclassical inspiration (in the Industrial Organization literature, for example, see STIGLER G. 1963), the point of view of a long-

[1] *The Marshallian (*MARSHALL A. 1890*) conception of equilibrium (although partial) can be located somewhere inbetween the classical and traditional Walrasian analysis. With the assumption of a given demand function for each industry, firms are assumed to enter in each industry expanding supply until marginal profit is zero. This analysis does not imply a notion of "mobility of capital", as in the classics. This notion can only be used in a general model (instead of partial) in which the decisions of capitalists are constrained by the availability of capital.*

term equilibrium with mobility of capital, is adopted. The problem with neoclassical economists is not that they ignore the simple and realistic behaviors described by the classics, but that their models describe a system which does not correspond to real capitalism.

Neoclassical economists object to modeling behavior in terms of adjustment on the ground that these behaviors are *ad hoc*. In fact, in a world fraught with uncertainty, the adjustment to shocks is precisely the optimal behavior of price- and quantity-maker enterprises (*cf.* HOLT C.C., MODIGLIANI F., MUTH J.F., SIMON H.A. 1960 and BLINDER A.S. 1982 and 1986, and DUMÉNIL G., LÉVY D. 1989(c)).

2. Equilibrium and Disequilibrium in the Keynesian Perspective

In the Keynesian conception of macroeconomic "equilibrium", activity is determined at a level which insures the equality of supply and demand. An equation is written which expresses this equality between, Y, the national product of the period and the elements of final demand, consumption C and investment I. These two components are themselves functions of Y. Thus, Y is determined as the solution of this equation. However, this particular value of Y has no reason to insure the full or "normal" utilization of resources, capital and labor. (In the present discussion we will abstract from the utilization of labor).

In his desire to produce a simple explanation of why the economy does not necessarily converge toward an equilibrium *with full or "normal" utilization of resources*, Keynes denies the existence of any decentralized mechanism which could push the economy toward an equilibrium such as that described by the classics.

Although the classics are not explicit concerning these mechanisms at the micro or macro levels, it is clear that they are sympathetic to the idea of an equilibrium with full or "normal" utilization of resources. Like the classics we keep at the center of our explanatory device this type of equilibrium. As we will show in the rest of this study, the fact that capitalism does not necessarily converge toward this situation must be analyzed as a deficiency of the convergence mechanism. To produce such an analysis, it is necessary to put the consideration of equilibrium *and* disequilibrium at the center of the investigation, and not rule out disequilibrium, as in the neoclassical tradition, or rule out equilibrium with a full utilization of capacity, as in the Keynesian tradition.

This latter remark introduces what must be said of the Keynesian conception of disequilibrium. In the original form of the model (solving $Y = C+I$), no consideration is given of the actual disequilibrium process which is supposed to push the economy toward a Keynesian equilibrium. No microeconomic foundations are provided. The "Theory of Disequilibrium" (*cf.* BENASSY J.P. 1982 and MALINVAUD E. 1977) claimed to provide such foundations, using a framework of temporary equilibrium with fixed prices. In spite of the reference to disequilibrium in the name of the theory, no realistic treatment of disequilibrium was given: A "non-Walrasian equilibrium" can only

result from a *tâtonnement* on quantities. Moreover, the absence of buffer inventories complicates the analysis of the commodity market. With buffer inventories, buyers are not rationed in a vicinity of equilibrium.

During and after World War II, a tradition of Keynesian inspiration developed which attempted to formalize economic mechanisms using adjustment procedures (for example, SAMUELSON P.A. 1939, METZLER L.A. 1941, LOVELL M. 1961 and 1962). These procedures were criticized by the profession as *ad hoc*, and this promising approach was abandoned.

3. The Classics and Beyond

From a restoration of the classical analysis, one can expect a new conception of equilibrium and a new interest in disequilibrium. A definition of equilibrium which corresponds to the actual nature and workings of capitalism is an advantage of this perspective, as well as the ability to realistically describe the mechanisms which can guarantee the stability of this equilibrium.

In our opinion, however, the important chapter in this restoration of classical economics is that of the conditions for the stability of equilibrium, and the investigation of what happens when such conditions are not met. We believe that the realistic description of behaviors in disequilibrium opens new avenues in the study of crisis and the business cycle, and their historical determinants.

This view can be summarized as follows:

1. The notion of an equilibrium with full or "normal" utilization of capacities must not be abandoned (as it is in the Keynesian analysis).
2. The study of the mechanisms which can insure the stability of this equilibrium is crucial. This implies the modeling of disequilibrium.
3. The theory of crisis and the business cycle is a development of this investigation.
4. The theory of the historical determinants of stability can only be derived from a disequilibrium analysis of the business cycle.

It is obvious that, in this program, the classical analysis is not only restored, but developed. One might be surprised, however, to discover that the elaboration of one aspect of the work of the classics, their conception of competition, leads to other important elements of their analysis, their conception of crisis and history.

II - THE MODEL

In this part, we present the model in which our analysis is conducted (a more

detailed presentation and treatment of this model can be found in DUMÉNIL G., LÉVY D. 1989(b)). Section A introduces the general framework of analysis, including the treatment of money and finance. The behavioral equations are presented in section B. Thus, this section specifically deals with *disequilibrium microeconomics.*

A - THE GENERAL FRAMEWORK OF ANALYSIS

In the following construction of the model, we introduced a sufficient degree of complexity to allow for the demonstration of a number of basic properties. We also made drastic simplifying assumptions in many important respects, to render the model manageable.

The various agents are introduced in subsection 1. Subsection 2 presents monetary and financial mechanisms. Two types of constraints (liquidity and capital constraints) are distinguished in subsection 3. Subsection 4 is devoted to the modeling of technology.

1. Agents

Five agents are considered in this study: wage earners, capitalists, enterprises, banks, and the state.

1. *Wage earners.* Wage earners sell their labor force to enterprises. They produce and receive a wage in cash. They purchase consumption goods in various proportions, possibly on credit.
2. *Capitalists.* Capitalists control all capital set free (cash flow of enterprises, *i.e.*, profits and depreciation allowances). They distribute their purchasing power between consumption and gross accumulation (net accumulation plus replacement). Concerning consumption, like the wage earners, they choose among various commodities, and can buy on credit. Concerning accumulation, they allocate capital among different enterprises (mobility of capital).
3. *Enterprises.* Enterprises organize production (one good is produced in each enterprise). They decide on the price and quantity of their product. They pay wages and make the cash flow available to capitalists. They receive funds from the capitalists and invest. They can borrow for production, financial transfer of the cash flow, and investment.
4. *Banks.* The role of the banks in the model is limited to their relationship with enterprises. The latter deposit and withdraw funds, and obtain loans. No central bank or Federal Reserve is modeled separately. The behavior of the banking system in the model describes, in a simple form, both commercial banks and the central monetary authority. It is obvious that the forms of monetary and credit relationships in a capitalist economy are extremely diverse, and that the model only inadequately accounts for this complexity.

5. *State.* The state is not emphasized in this study. However, it plays a double role through its *monetary* and *demand* policies (*cf.* IV.C).

2. Money, Credit, and Finance

Although this distinction is not crucial in the presentation of the model, it is convenient to distinguish between two forms of money, cash and bank deposits, and to consider each type of liquidity as characteristic of only one group of agents. Enterprises maintain their accounts in the banks. They withdraw cash to pay wages and inputs, or to transfer the cash flow to capitalists, but never hoard this cash. They also deposit all cash received in payment. Final consumers only hold cash.

The exact form of the financial operations between capitalists and enterprises (payment of dividends, issuance of new shares, borrowings) have no consequence in the model. It is obvious, for example, that an important share of the cash flow can remain in the enterprise (self-financing).

Three types of credit are modeled:

1. *Customer credit.* This first type of credit is granted by enterprises to final consumers (wage earners and capitalists). Enterprises grant this credit for commercial purposes. They attempt to diminish their inventories or increase their capacity utilization rate. We assume that credit decisions are made by enterprises and that buyers are always ready to accept these offers.

2. *Loans for investment.* Banks extend this second type of credit to enterprises who want to expand their investment beyond the limitations of the funds allocated by capitalists. Enterprises are constrained by the restrictions imposed by the banks. The quantity of borrowing results from negotiations between enterprises and banks. The value of the capacity utilization rate is the variable considered in the determination of these amounts.

3. *Loans for the transactions of enterprises.* A third type of credit is considered in the model. Enterprises can always withdraw funds from the bank for the purchase of inputs, the payment of wages, and the transfer of the cash flow. No constraint is ever felt in this respect. A consequence of this treatment of short-term borrowings is that we abstract from reciprocal credit between enterprises.

3. The Liquidity and Capital Constraints

From the above presentation, it is clear that enterprises could be subject to two types of constraints, a liquidity constraint and a capital constraint, but that only one holds in the model presented in this study.

1. *The liquidity constraint.* A first constraint concerns the availabiliy of liquidity for production and transfer of cash flow to capitalists. Because of the assumption which we made concerning the constant availability of short-term credit from the

bank, for all transactions of enterprises with the exception of investment, this constraint is not felt. A consequence of this absence of constraint for short-term transactions is that enterprises' decisions concerning production, prices, and customer credit lines are only made on the basis of physical variables (capacity utilization rate and inventories to sales ratio), abstracting from monetary variables (such as a liquidity ratio). It is possible to abstract from this constraint since, in a vicinity of equilibrium, enterprises do not go into cumulative debt for this type of credit.

2. *The capital constraint.* A second constraint concerns the availability of funds for investment (*Re-allocated cash flow* + *Loans for investment*). This constraint holds in the model. It plays a crucial role in the classical conception of long-term equilibrium, since the notion of *mobility* of capital has no meaning, if a capital constraint is not felt. Firms are not limited in their expansion by diminishing returns (they can open new units of production without restriction or exhaustion of natural resources), but by the availability of funds. It is for this reason that we use a technology with constant return to scale.

These different treatments of liquidity and capital constraints are possible since no permeability is allowed between the financings of the two types of transactions: production and financial transfer, on the one hand, and investment, on the other. In the balance sheet of enterprises, the sum *Equity* + *Bank loans for investment*, must always be equal to the value of the net stock of fixed capital.

The term *finance* should be reserved for the allocation of capital and borrowings from the bank for investment. Only these funds can finance fixed capital.

4. Technology

Three types of inputs are required for production: a stock of fixed capital goods and a certain amount of the two categories of circulating inputs (physical inputs and labor). Returns are constant for the three groups of inputs. This is equivalent to stating that the number of units of production can be increased in the long run.

In the short run, *i.e.*, for a given stock of fixed capital goods, a maximum output can be realized, but the full productive capacity is not necessarily used. Therefore, the capacity utilization rate is an important variable of the model. It varies from 0 to 1, with constant returns with respect to circulating inputs.

B - BEHAVIORAL EQUATIONS

In this section we apply to the various decisions involved in the model, the general guidelines defined in I.A.2 (disequilibrium microeconomics). The reaction of agents to the observation of disequilibrium is modeled by reaction functions. For simplicity, we present linear expressions for these functions. In these linear equations, the intensity of the reaction of an agent is measured by one or several reaction coefficients.

(Nonlinear reaction functions are only considered in part IV).

We use the following notation:

i, l	*Index of a firm (superscript), Index of a capitalist (superscript)*
n, m	*Number of enterprises, of capitalists*
t	*Index of the period (subscript)*
p	*Price*
r	*Rate of profit*
$s, \overline{s}$	*Ratio of inventories, Target ratio of inventories*
$u, \overline{u}$	*Capacity utilization rate, Target capacity utilization rate*
K	*Accumulated capital*
ΔC	*Net customer credit*
ΔK	*Net loans for investment*

Six reaction coefficients are considered:

σ	*Decision to produce (stickiness of u)*
ϵ	*Decision to produce (sensitivity to s)*
β	*Price decision (sensitivity to s)*
γ	*Allocation of capital (sensitivity to profit rate differentials)*
ω	*Borrowings for investment (sensitivity to u)*
φ	*Lending to consumers (sensitivity to s)*

We will successively consider the behavior of: 1) Enterprises in the short run, 2) Capitalists, 3) Enterprises *vis-à-vis* borrowings for investment, and 4) Final consumers. Short-term borrowing is automatic and no equation will be defined for this decision. For simplicity, the *rate of interest* is never considered in the decisions concerning credit and loans.

1. Enterprises in the Short Run

Two signs of disequilibrium play a role:

1. *Disequilibrium between supply and demand.* At the level of a firm, for accounting reasons, the difference between supply and demand is equal to inventories (the variation of inventories is equal to the difference between output and demand). Because of the constant gravitation of demand, firms do not attempt to reduce their inventories to zero, but tend to maintain a target ratio of inventories (in the U.S. Manufacturing, $\overline{s}$ corresponds to about .6 month of sales for the inventories of finished goods). The variable which accounts for this disequilibrium is $s_t^i - \overline{s}^i$.
2. *Disequilibrium in the utilization of productive capacities.* Because of the constant fluctuations in activity, firms do not attempt to use their capacity at 100 percent. As in the case of inventories, they tend to maintain a target capacity utilization rate (in the U.S. economy, $\overline{u}$ corresponds to about 82 percent). The variable which accounts for this disequilibrium is $u_t^i - \overline{u}^i$.

Three decisions are modeled (*cf.* HOLT C.C., MODIGLIANI F., MUTH J.F., SIMON

H.A. 1960 and BLINDER A.S. 1982 and 1986, and DUMÉNIL G., LÉVY D. 1989(c)):

1. *Price decision.* Deficient or excessive outlets are assessed by the level of inventories, and lead to the modification of prices:

$$p^i_{t+1} = p^i_t \left(1 - \beta^i \left(s^i_t - \overline{s}^i\right)\right) \tag{1}$$

The deviation of the capacity utilization rate could also be considered.

2. *Decision to produce.* The two disequilibria in inventories and the capacity utilization rates determine the decision to produce, *i.e.*, the choice of a given capacity utilization rate (since the stock of fixed capital is given in the short run):

$$u^i_{t+1} - \overline{u}^i = \sigma^i \left(u^i_t - \overline{u}^i\right) - \varepsilon^i \left(s^i_t - \overline{s}^i\right) \tag{2}$$

When inventories are high enterprises diminish their production (a lower u). This sensitivity to stockpiling is controled in the model by the coefficient ε. The first term $\sigma^i \left(u^i_t - \overline{u}^i\right)$ expresses two different types of phenomena: 1) We make an implicit assumption on the demand function which the enterprise confronts: It is subject to random shock and only returns progressively to normal levels (autorgressive shocks), 2) In addition to traditional production costs, the enterprise incurs disequilibrium costs, such as cost of stockpiling or changing production (the existence of this latter cost also induce a degree of stickiness in the decision to produce). This decision also determines the amount of wages payed to wage earners. (The wage rate is given.)

3. *Decision to grant customer credit.* The purpose of this decision is to reabsorb involuntary inventories. Net credit ΔC is determined by:

$$\Delta C^i_{t+1} = \varphi^i \left(s^i_t - \overline{s}^i_t\right) \tag{3}$$

As in the case of equation 1, the disequilibrium on capacity utilization rates could also be added as a variable in this equation.

2. The Allocation of Capital by Capitalists

At each period a capitalist receives a portion of the total cash flow of the enterprises in which he owns shares or to which he/she has lent funds. He/she divides this amount into two parts, one for consumption, and the other for accumulation. The fraction accumulated by capitalist l is denoted K^l_{t+1}. He/she allocates this capital among various enterprises. Enterprise i receives $K^{i,l}_{t+1}$, with:

$$\sum_{i=1}^{n} K^{i,l}_{t+1} = K^l_{t+1}$$

In this behavior the capitalist is sensitive to disequilibrium on the profit rate. We assume that, $K^{i,l}_t / K^l_t$, the shares of total capital K^l_t of capitalist l allocated to enterprise i are modified as a function of the difference between r^i_t and, $\overline{r}^l_t$, the average

profit rate of this capitalist in all enterprises in which he/she invested capital:

$$\frac{K_{t+1}^{i,l}}{K_{t+1}^{l}} = \frac{K_{t}^{i,l}}{K_{t}^{l}} \left(1 + \gamma^{l} \left(r_{t}^{i} - \overline{r}_{t}^{l}\right)\right)$$

3. Bank loans for Investment

In addition to the funds allocated by capitalists, banks also make loans to enterprises for investments. This decision concerning net loans, ΔK_{t+1}^{i}, is expressed in relation to the value of the capacity utilization rate, which accounts for the desire of enterprises to borrow:

$$\Delta K_{t+1}^{i} = \omega \left(u_{t}^{i} - \overline{u}^{i}\right) \tag{4}$$

However, enterprises are always constrained. The reaction coefficient ω has no superscript since we consider the banking system globally.

Through this behavior, banks allow enterprises to attempt to restore their capacity utilization rates at normal levels. Net borrowing is added to Equity, and allows a certain investment in each enterprise.

Equation 4 accounts, in a very simple form, for a complex chain of mechanisms in which commercial banks and the monetary authorities (central bank, or Federal Reserve) are involved. The value of ω is a first important characteristic of monetary policy. A second characteristic is that no constant term is considered in this equation ($\Delta K_{t+1}^{i} = 0$, if $u_{t}^{i} - \overline{u}^{i} = 0$).

4. Final Consumption

Wage earners and capitalists finance their consumption from their income. They can transfer balances of cash from one period to the other. They receive customer credit from enterprises. On this basis, it is possible to define a demand function.

III - STABILITY IN PROPORTIONS AND DIMENSION

An analytical treatment of the model is not made in this study. Section A presents and discusses the results obtained in other works (in particular DUMÉNIL G., LÉVY D. 1989(b)). The two aspects of the stability problem, proportions and dimension, are distinguished in section B. The thesis of the stability of capitalism *vis-à-vis* proportions and instability *vis-à-vis* dimension is then stated. A last section introduces simple forms of the model which can be useful in the *separate* analysis of proportions or dimension.

A - EQUILIBRIUM AND ITS STABILITY

Subsection 1 briefly recalls the structure of a dynamic model such as that considered in this study. It defines equilibrium and its stability. Subsection 2 presents the results concerning stability, in particular the conditions to which this stability is subject.

1. A Dynamic Model

The model described above (of which many forms can be defined) is a sequential model. The values of the N variables $x \in R^N$ in period $t+1$ are defined as functions of the values of these variables in the previous period(s). The model can be expressed as a relation of recursion:

$$x_{t+1} = X(x_t) \tag{5}$$

where function X depends on technology and wages, and on the reaction functions of the agents.

From a mathematical point of view, an *equilibrium*, a fixed point, is a value of x (the vector of the N variables) which is not altered by a new step in the recursion, *i.e.*, which satisfies $x = X(x)$. In a growth model, this definition of equilibrium can be relaxed. We denote an equilibrium as a *situation of balanced growth with possibly a uniform, and constant over time, rate of increase of prices.*

Our model obviously has an equilibrium which we call *normal equilibrium.* It possesses the following properties: 1) The capacity utilization rates are normal ($u^i = \overline{u}^i$), 2) The ratios of inventories are normal ($s^i = \overline{s}^i$), 3) The general level of prices is constant. *This normal equilibrium corresponds to the classical conception of long-term equilibrium.*

The study of the existence of an equilibrium must be distinguished from that of its *stability.* Stability deals with the behavior of variables when they differ from their equilibrium value: Will these variables converge toward these equilibrium values or diverge in another direction ? An unstable equilibrium has little economic significance.

2. The stability of Classical Equilibrium

The analysis of the stability of the model reveals that *stability can be insured, but is conditional.* Two types of conditions are involved:

1. The initial values of the variables must not be too different from their equilibrium values. This is equivalent to stating that convergence is local. Disequilibria can be corrected, within certain limits.
2. The value of reaction coefficients γ^i, β^i, ε^i, σ^i, φ^i, and ω must be adequate. These reaction coefficients must be sufficient, but not excessive. If agents are insensitive to disequilibrium, convergence can certainly not be obtained. If their

reaction is excessive, uncontrolled fluctuations are generated. The comparison with the driver of a car is illuminating. Disequilibria correspond to deviations from the desired trajectory. A driver responds to disequilibrium by turning the wheel with a certain intensity. Deficient as well as excessive sensitivity can be fatal!

From a mathematical stand point, stability is obtained if all the eigenvalues of the Jacobian matrix are smaller than 1 in modulus. (The Jacobian is a $N \times N$ matrix whose element i, j is $\partial X^i / \partial x^j$.)

B - PROPORTIONS AND DIMENSION

Subsection 1 distinguishes two types of instability (in dimension and proportions) and gives the stability conditions with special emphasis on stability in dimension. Subsection 2 formulates the thesis of the stability in proportions in capitalism and its instability in dimension.

1. Two Types of Instability

Two aspects can be distinguished in the study of stability: stability in proportions and stability in dimension. Recall that we mean by *proportions* the relative values of the variables and by *dimension* the general size of the activity.

From a mathematical point of view, general stability (in proportions *and* dimension) is insured if all the eigenvalues of the Jacobian matrix are smaller than 1 in modulus. The two types of instability correspond to the manner in which the stability conditions are violated. If two complex conjugate eigenvalues have a modulus equal to 1, the model becomes unstable in proportions. If one eigenvalue is equal to 1, then the model becomes unstable in dimension. (The divergence corresponding to one eigenvalue equal to -1 has no economic meaning.)

The condition for the stability in proportions is difficult to make explicit. However, it is possible to demonstrate specific properties. For example, if the reaction coefficients ε^i are too small, the model is unstable in proportions. In a similar manner, a sufficient value of ω is favorable to the attainment of convergence in proportions.

The condition for the stability in dimension can be expressed explicitly, assuming that all enterprises are identical. With θ denoting a synthetic parameter and, A, B, and C constant parameters which depend on technology and other reaction coefficients, one obtains:

$$\theta = \sigma + \varepsilon \frac{\omega + A}{\varphi + B} C < 1 \tag{6}$$

This condition shows that large values of ε and ω jeopardize stability in dimension, and that a large φ stabilizes the economy. The two first reactions (decisions to produce in relation to stockpiling and to lend for investment) are "procyclical" mech-

anisms. The latter reaction (customer credit in response to stockpiling) is "countercyclical".

Concerning the procyclical character of ε, this property can be easily understood if one realizes, that a recession is nothing other than a cumulative movement downward of production. A large reduction in production responding to deficient outlets cuts demand in the rest of the economy, because of diminished purchases of inputs and payments of wages. This movement downward pervades the whole economy.

It is easy to understand the opposite properties of the two credit mechanisms. If enterprises grant credit when inventories are bloated, they contribute to the restoration of purchasing power in the economy. When they borrow to invest in order to re-establish, *in the future*, their capacity utilization rates which remain high in spite of the influx of capital, they stimulate, *in the present*, an already active situation. Symmetrically, a low capacity utilization rate results in diminished orders of investment goods. In the long run, this behavior contributes to the restoration of the capacity utilization rate but, in the short run, the observation of a deficient demand leads to a further curtailment of demand, as in the case of ε.

For a given value of other reaction coefficients, the stability in dimension can be endangered by:

1. *The excessive reaction of enterprises to excess or deficient stockpiling (a large ε).* This first factor is related to the *management of firms.*
2. A lack of balance between pro and countercyclical forces in the control of purchasing power through credit and monetary mechanisms (a large ratio $(\omega + A)/(\varphi + B)$). A large ω reflects the constant tendency in capitalism to reach beyond the limits of the availability of financing, in an attempt to avoid the limits of the *capital constraint.*

2. Stability in Proportions and Instability in Dimension

It is our contention that capitalism is very stable from the point of view of proportions and unstable from the point of view of dimension.

These properties of capitalism can be established theoretically, but this demonstration is beyond the limits of this study. This view of the concrete workings of capitalism can also be derived from the mere observation of its history. In a capitalist economy, it is generally possible to purchase any commodity on the market. Excessive stockpiling is scarce (or general in a recession). Capitalists quickly locate profitable spheres of investment.[2]

Ricardo was conscious of this property of capitalism:

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[2] *This view concerning the stability in proportions of capitalism has been confirmed by empirical observation. Prices are close to prices of production (cf.* EHRBAR H., GLICK M. 1988(a) *and* 1988(b)*).*

"When we look to the markets of a large town, and observe how regularly they are supplied both with home and foreign commodities, in the quantities in which they are required, under all the circumstances of varying demand, arising from the caprice of taste, or a change in the amount of population, without often producing either the effects of a glut from a too abundant supply, or an enormously high price from the supply being unequal to the demand, we must confess that the principles which apportions capital to each trade in the precise amount that it is required is more active that is generally supposed." (RICARDO D. 1817, p. 49)

This is the strong point of capitalism, and a constant argument for its justification in opposition to socialist economies.

On the other hand, the mere observation of capitalism confirms the idea of its fragility with respect to dimension. Paraphrasing Herbert Hoover's famous assertion, one can contend that "recession is always around the corner" ! The examination of figures **2** and **3** in part IV illustrates this phenomenon.

From a mathematical point of view this property of capitalism means that the dominant eigenvalue of the Jacobian matrix is always maintained in a vicinity of 1 — an important property which needs to be explained (*cf.* V.C below).

C - SIMPLE FORMS OF THE MODEL

Depending on the motivation of the research, it is possible to build particular forms of the models specifically adapted to analyze stability in proportions or in dimension. It is also possible to build short-term models of classical inspiration. In this section we present three such frameworks of analysis : 1) Models in which only the stability in proportions is considered, 2) Models in which only dimension is considered, and 3) Models for the analysis of short-term equilibrium.

1. The Convergence toward Prices of Production

The debate which developed a few years ago concerning the convergence of market prices toward prices of production was conducted in a framework which generally abstracted from the issue of dimension. The general level of activity was determined by assumption (usually in an implicit manner).

Before 1983, a widely spread view concerning the classical analysis of competition was that the process described by the classics did not work. An unpublished paper by Hobuo Nikaido (NIKAIDO H. 1977, now published in NIKAIDO H. 1983) had addressed this issue and concluded rather negatively. In France a debate developed and led also to similar negative conclusions (a special issue of *Les cahiers d'Économie Politique* was devoted to this topic in 1981, with contributions such as BENETTI C. 1981 and CARTELIER J. 1981). In 1983, we presented our first model (DUMÉNIL G., LÉVY D. 1987(d)) in which the possibility of the classical convergence process was

demonstrated.[3]

An important step forward was accomplished in 1984 at a conference organized on this topic, in Nanterre (France). A number of models were presented, and published in the proceedings of the conference (*cf.* BIDARD C. 1984), which stirred new interest in the subject.[4]

Although there is still no common view on the exact framework, it is now widely admitted that the classical analysis of competition can be modeled and convergence can be obtained. More recently we devoted several studies to this demonstration in various frameworks.[5]

2. Models with a Single Commodity

In order to investigate separately the problem of dimension, it is possible to build a model with only one commodity. In such a model the analysis focuses on the role of coefficents σ, ε, φ, and ω, which refer to the decision to produce and to grant new credit and loans.

Although our first treatment of dimension was obtained using a model with three commodities and computer simulation (DUMÉNIL G., LÉVY D. 1985(c) and 1986), we developed an analytical treatment of a model with one commodity in DUMÉNIL G., LÉVY D. 1985(b)[6] and 1987(b).

3. Short-Term Equilibrium

In order to analyze the achievements of the competitive process in the short run, it is just necessary to consider that the stocks of capital are given and constant. Equilibrium is obtained by the determination of capacity utilization rates different

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[3] *At a conference held in Paris at the* Observatoire Français des Conjonctures Économiques. *The proceedings are available in French in* FITOUSSI J.P., MUET P.A. 1987.

[4] *For example,* ARENA R., FROESCHLE C., TORRE D. 1984 *(now published in* ARENA R., FROESCHLE C., TORRE D. 1988*)*, BOGGIO L. 1984 *(see also* BOGGIO L. 1985 *and* 1986*)*, FLASCHEL P., SEMMLER W. 1984 *(see also* FLASCHEL P., SEMMLER W. 1987*)*, FRANKE R. 1984 *(see also* FRANKE R. 1985*), and our own contribution now published in* DUMÉNIL G., LÉVY D. 1987(a).

[5] *1)* DUMÉNIL G., LÉVY D. 1985(c), *The treatment by simulation of a model with three commodities and one capitalist, with fixed capital, 2)* DUMÉNIL G., LÉVY D. 1989(a), *The analytic treatment of a model with three commodities and one capitalist, with fixed capital, 3)* DUMÉNIL G., LÉVY D. 1987(c), *The analytic treatment of a model with any number of commodities and capitalists, without fixed capital, 4)* DUMÉNIL G., LÉVY D. 1989(b), *the model described in the present study.*

[6] *Paper prepared for a conference held in Venice in 1986: "Advances in the Analysis of Economic Dynamic Systems".*

from normal (such a model is described in DUMÉNIL G., LÉVY D. 1989(a)).

Parenthetically, this approach to short-term equilibrium must be contrasted with that adopted in a Walrasian model. A crucial difference is that the adaptation of supply to demand is realized by *quantities* instead of prices : Capacity utilization rates differ from their target value. Although prices are determined, this determination does not correspond to the requirement of market clearing.

IV - THE BUSINESS CYCLE

In a model in which the reactions to disequilibrium are modeled by nonlinear functions, two other equilibria can exist in addition to normal equilibrium. The configuration of equilibria, with respect to their existence and stability, depends on θ the synthetic parameter introduced in condition 6. Section A describes this configuration of equilibria in relation to the value of θ. Section B gives an interpretation of the business cycle on the basis of this analytical device. Section C shows that the general conditions which governs the opening of new credit lines and, thus, the formation of aggregate demand, also impact on the position of the equilibria.

A - THE CONFIGURATION OF EQUILIBRIA : THE PITCHFORK

Nonlinearities in the behavior of economic agents are introduced in subsection 1. The two other equilibria, different from normal equilibrium, are presented in subsection 2. The configuration of the equilibria is described as that of a pitchfork in subsection 3.

1. Nonlinearities

In section II.B, linear reaction functions have been defined which account for the behavior of economic agents in a vicinity of normal equilibrium. This simple form of the model cannot claim realism at a distance from this equilibrium.

At least three sources of nonlinear behaviors are already implicitly embodied in the model:

1. The capacity utilization rate is confined between the two boundaries 0 and 1. For example, a deficient rate of inventories, $s < \bar{s}$, will impact to a lesser extent on u, when it is already close to 1. In a more sophisticated model, this effect would reflect increasing costs, as capacities are used more intensively.
2. The issuance and destruction of money and credit are not two symmetrical mechanisms. It is easier to increase the stock of money than to reduce it.

3. It is a textbook type property of the modeling of demand that the propensity to consume becomes larger as income is reduced.

The existence of these nonlinearities have different consequences, depending on the stability or instability of normal equilibrium:

1. In III.B.1, we have shown that the economy gravitates around normal equilibrium, if θ is smaller than 1. The convergence region of this equilibrium is quite large. Under such circumstances, the economy can be destabilized by a shock, but a process is initiated which progressively corrects this departure from equilibrium. The consideration of nonlinear behaviors does not modify the results presented so far.

2. However, capitalism can be characterized by its recurrent instability in dimension (III.B.2). This is equivalent to stating that parameter θ is constantly oscillating around 1, and consequently often larger than 1. When normal equilibrium is unstable, the economy does not converge toward this situation. If $\theta > 1$, no realistic description of what will occur can be given on the basis of the linear form of the equations. An unstable *linear* model can only "explode" (as does the simple linear recursion $x_{t+1} = \lambda x_t$ for $\lambda > 1$). This explosion does not lay the foundations for a theory of business cycle. A more realistic description must be given of behaviors at a distance of normal equilibrium, in which nonlinearities are implied.

Below we analyze the properties of the model, for $\theta > 1$, when such nonlinearities are introduced (for example, a nonlinear reaction function for the decision to produce, instead of equation 2).

2. Three Regimes

If condition 6 is satisfied ($\theta < 1$), normal equilibrium exists and is stable. If $\theta > 1$, two equilibria in the mathematical sense of the term exist and are stable. (Normal equilibrium still exists, but is unstable.):

1. An equilibrium in which the capacity utilization rate is larger than its target value, and the ratio of inventory smaller than its target value. We call this equilibrium *Overheating*.

2. An equilibrium in which the capacity utilization rate is smaller than its target value and the ratio of inventory larger than its target value. We call this equilibrium *Stagnation*.

Since two stable equilibria exist, the economy can converge toward either one of them, depending on initial conditions.

From an economic point of view, these two fixed point of the recursion should rather be characterized as disequilibria ("stationary disequilibria").

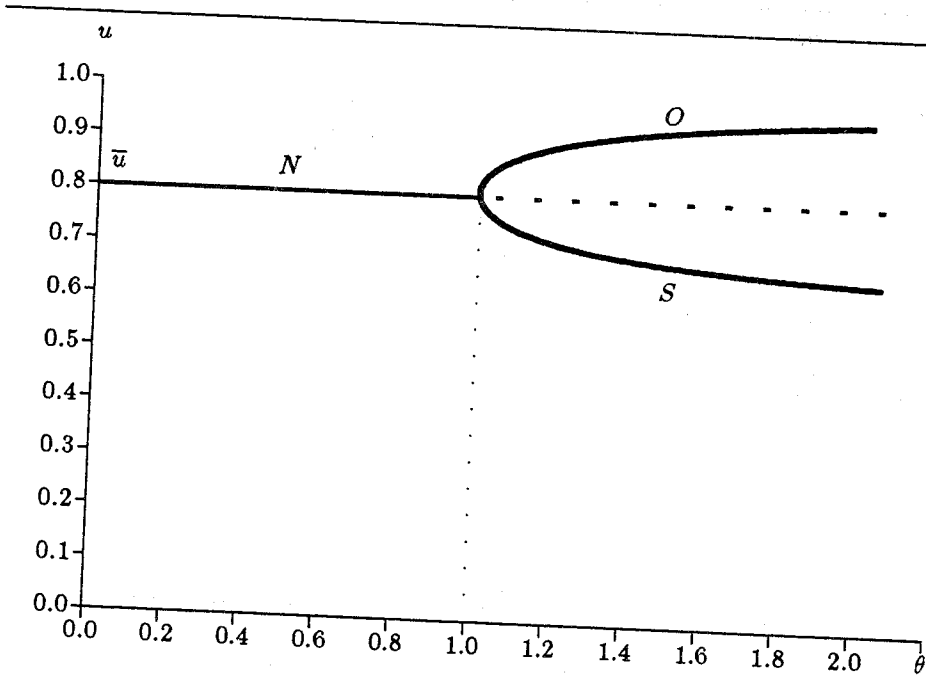

Figure 1 - The Pitchfork
The Configuration of Equilibria

This figure represents the configuration of the equilibria with respect to the value of the capacity utilization rates obtained, as functions of θ. Stable equilibria are represented by a dark line and the unstable normal equilibrium for $\theta > 1$, by a doted line. N, O, and S respectively denote "Normal equilibrium", "Overheating", and "Stagnation". The gap between overheating and stagnation increases with θ.

3. The Pitchfork

The number of stable equilibria is determined by the value of θ. For $\theta < 1$, only one equilibrium exists and is stable. For $\theta > 1$, three equilibria exist of which two are stable: overheating and stagnation. However, the dependence of overheating and stagnation on θ is stronger. The value of θ also impacts on the capacity utilization rate and ratio of inventories which characterize these equilibria.

In figure **1**, these values of the capacity utilization rate have been plotted as functions of θ. The image is that of a pitchfork with two prongs corresponding to overheating and stagnation. For $\theta = 1$, there is a bifurcation. As θ increases, the gap between the two stationary disequilibria becomes wider.

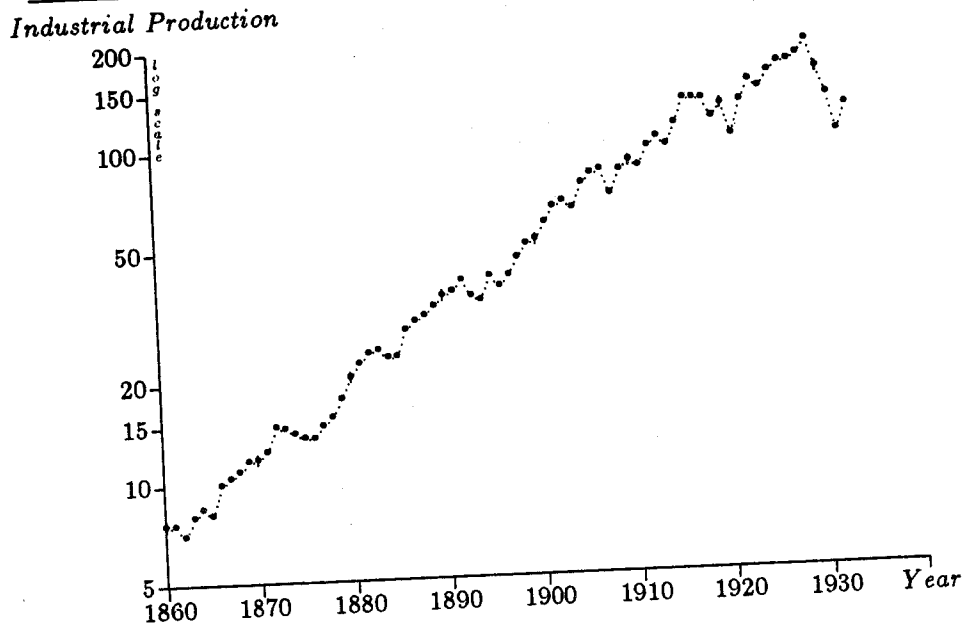

Figure 2 - Index of Industrial Production (1860-1933)

B - THE CYCLE

On the basis of the above presentation of these three distinct equilibria, it is possible to analyze the business cycle as a succession of switches from one regime to the other.[7]

The traditional form of the business cycle is that which Marx described for the 19th century in England:

> *"If we consider the turnover cycle [Umschlagszyklen] in which modern industry moves—inactivity, growing animation, prosperity, overproduction, crash, stagnation, inactivity, etc., ..."* (MARX K. 1894, p. 482)

This cycle can be analyzed as a succession of switches from stagnation to normal equilibrium, to overheating, and then back to stagnation. The term recession refers to the sudden destabilization of overheating and decline into stagnation. The two other switches unfold in a progressive manner. A characteristic feature of these cycles is that normal equilibrium prevails over a segment of the cycle (a few years in the 19th

[7] *The early forms of economic fluctuations such as Ricardo's "states of distress", do not correspond to such switches, but should rather be interpreted as important departures from normal equilibrium resulting from shocks such as poor crops or wars.*

century).

This form of the cycle can be illustrated by the example of the U.S. economy in the 19th and early 20th century. Figure **2** displays the profile of industrial production in this country for the years 1860 to 1933. After two years of low activity, 1862 and 1865, a period of balanced growth can be observed until 1871. After an overheating in 1872, a recession occurs and stagnation prevails until 1876. A new phase of balanced growth can be observed until 1882 or 1883. The same scenario is repeated up to the 1890s. In the years that follow the profile is modified, but a new period of about ten years of rather balanced growth is initiated. A slightly different image of the business cycle is obtained from the consideration of the Net National Product (*cf.* figure **5** below).

The 1920s represent a final example of this decennial cycle. However, what followed the crash of 1929 was not a switch from overheating to stagnation through a recession, as is usually the case, but a complete dislocation of the structure which allows such regimes to exist. The crisis of the stock market degenerated into a crisis of the entire banking system.

A variation of θ is involved in this typical form of the cycle. In the Marxist tradition, it can correspond, for example, to the cyclical exhaustion of the reserve army which degenerates into an increased wage rate (Marx's analysis of the overaccumulation of capital, *cf.* MARX K. 1894, Vol. III, Ch. 15) and induces stricter management of firms (a larger ε and, thus, a larger θ, *cf.* equation 6). The same chain of events could follow from a progressive rise of the rate of interest resulting in a higher cost of stockpiling or the desire to escape from the capital constraint (a large ω).

On the basis of the same description of the configuration of the equilibria, one can account for another type of cycle, in which the value of θ is maintained above 1. A succession of switches between overheating and stagnation occur as a response to various shocks, while the phase of normal equilibrium in the business cycle disappears.

In the early 20th century, from 1905 to World War I, one can observe a first phase in which this form of the business cycle prevailed (*cf.* figure **2**). It was also typical of the 1950s and, in an other context, of the new instability following 1970. Figure **3** presents the profile of the capacity utilization rate in Manufacturing industries. The period of fluctuation of this ratio in the 1950s is of short duration. The economy never stabilizes.

The contention set forward in III.B.2, that θ is always maintained in a vicinity of 1, accounts for an important prediction of our model: This constant oscillation of the capacity utilization rate is paralleled by a movement of the ratio of inventories. When u is large, s is low, and *vice versa*. This property can be verified empirically, as shown in figure **4**, using monthly data for the years 1950 to 1985.[8] We call this relation

[8] *The two variables are detrended. This is important with respect to s, since $\bar{s}$ followed a downward trend after 1974. Without subtracting the trend, the relationship is stable*

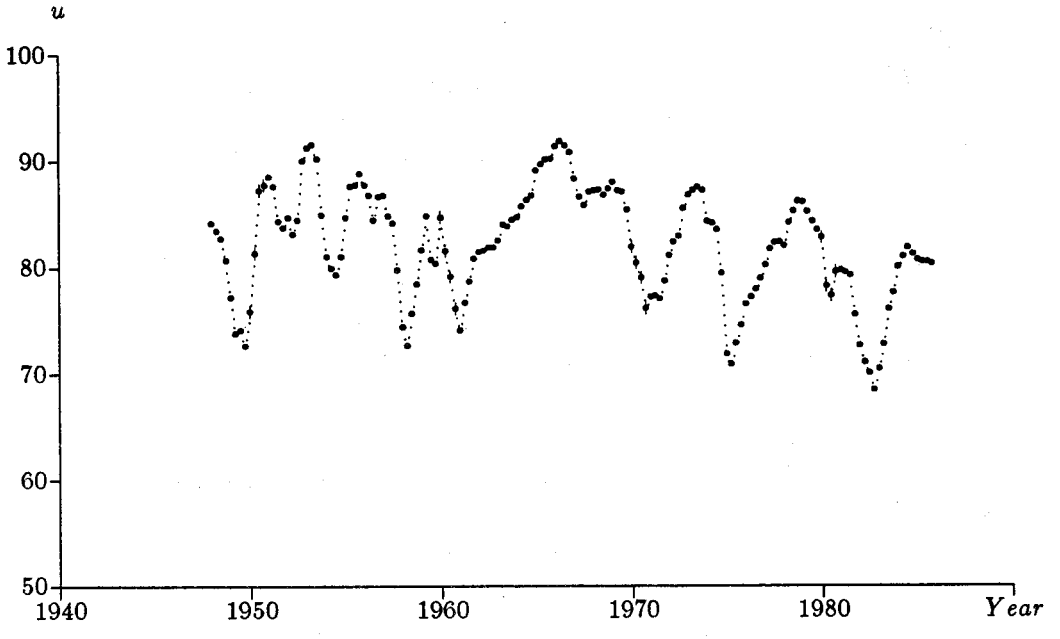

Figure 3 - Capacity Utilization Rate
Manufacturing Industries, Quarterly Data (1948-1985)

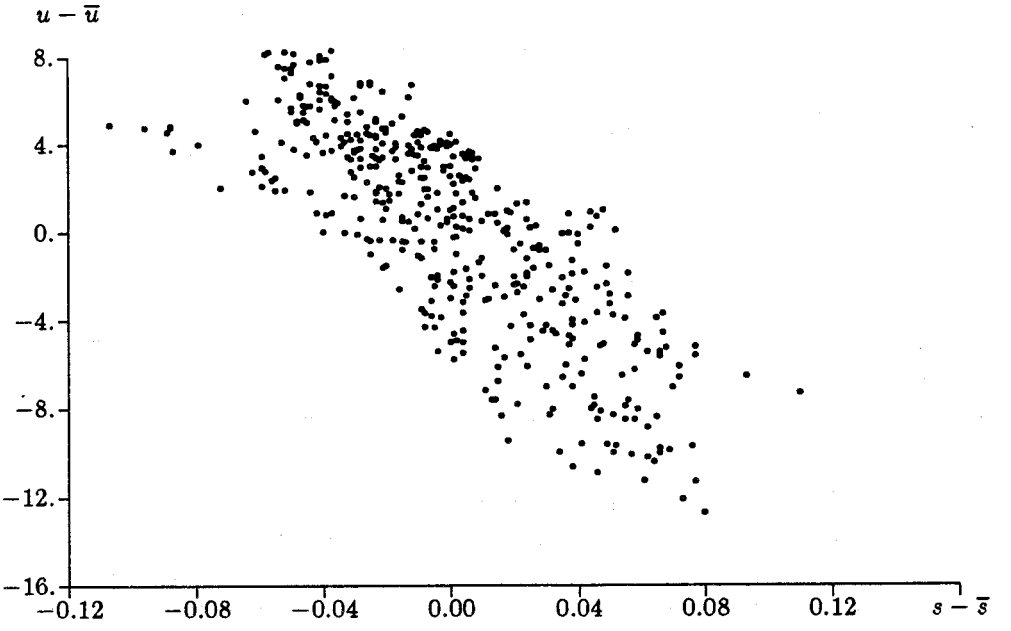

Figure 4 - Plot of u Against s (Residual Around the Trends)
Manufacturing Industries, 1950.01-1985.12

for the two subperiods 1952-1972 or 1974-1981, as shown in DUMÉNIL G., LÉVY D.

the "u/s-trade-off". The fact that only inventories of finished goods are considered is crucial, since the two other components of total inventories, goods in process and inventories of inputs, do not follow the same dynamics. The existence of this trade-off proves: 1) That λ is close to 1, and 2) That equation 2 is relevant.

C - THE SHIFT OF THE PITCHFORK

Normal equilibrium with $u = \overline{u}$ and $s = \overline{s}$ only holds if credit and monetary mechanisms are not biased, and if all demand is financed out of income. This is equivalent to stating that no constant term must exist in the two credit equations and in the demand function:

1. Customer credit responds to the disequilibrium in inventories (*cf.* equation 3). The equation must be such that $\Delta C^i = 0$, if $s_t^i = \overline{s}_t^i$. Borrowing for investment responds to the disequilibrium in the capacity utilization rate (*cf.* equation 4). The equation must be such that $\Delta K^i = 0$, if $u_t^i = \overline{u}_t^i$. It is the function of monetary policy to control these two mechanisms.
2. Demand policy can be interpreted in the model as a constant term in the demand function.

If such biases prevail, two results follow:

1. The pitchfork still exists. This first property is important because it shows that this analytical device is not subject to any condition related to the management of social demand.
2. It is shifted upward or downward depending on the direction of the bias (its exact form is also altered). Expansionary demand and monetary policies boost the economy for all values of θ. For example, stagnation is less "stagnating" (u is larger).

In section IV.B above, the notion of a trade-off between u and s has been introduced (*cf.* figure **4**). The shift of the pitchfork is reflected by a displacement of the cluster upward or downward along the same line. Thus, the image obtained in figure **4** also mirrors the effects of shifts.

The post-World-War-II U.S. economy provides a series of illustrations of the explanatory power of the notion of a shift. The early saw a 1950s shift upward, whereas the years following the 1958 recession correspond to a downward shift. The Kennedy advisers were well aware of this latter phenomenon and initiated an unprecedented effort to pull the economy upward in the 1960s. The progressive and steady shift downward following 1970 must be related to the new course of events and stagflation, which will not be considered in this study (*cf.* DUMÉNIL G., LÉVY D. 1988(b)).

It is more difficult to discuss the existence of shifts before World War II, since

1988(c).

reliable capacity utilization rates are not available before this date. A shift can only be detected through the examination of the fluctuations of the growth rate of aggregate output, and the associated variations of distribution. (When the capacity utilization rate soars, profits are bloated, and conversely for a low rate.) It is evident from various series presented in part V, that two dramatic shifts of this type occured at the end of the 19th century, one upward, and the other downward (*cf.* V.A.1).

V - STABILITY: AN HISTORICAL PERSPECTIVE

The business cycle has been a continuous feature of capitalism. However, the illustrations which we gave of the forms of the business cycle in the 19th century and after World War II suggest that this cycle underwent important transformations along the history of capitalism. These two features of capitalism must be explained: 1) Why is capitalism constantly maintained in a vicinity of the limits of its stability in dimension? 2) How can we account for the metamorphoses of the cycle? In this last part, we propose an interpretation of these historical patterns.

In conformity with the original classical analysis, the stability problem under capitalism must be examined in an historical perspective. Our general interpretation can be summarized as follows:

1. Capitalism is subject to historical tendencies, among which the tendency for the rate of profit to fall is the most famous.

2. Private agents, basically enterprises, react to these tendencies and restore profitability to a certain extent.

3. This reaction implies a stricter control of every fraction of capital advanced and jeopardizes the stability in dimension of the economy. Therefore, the restoration of profitability does not result in any improvement in the stability of the system —quite the contrary.

4. Stability can only be maintained, or even improved, by the constant transformation of the institional framework (new agencies, laws, and regulations) and more efficient policies.

Section A presents the historical profile of a number of basic variables. Section B discusses the long-term movements of the profit rate in relation to Marx's thesis of a falling profit rate. Section C draws a relationship between these movements and the stability in dimension of the economy—in particular, the forms of the business cycle.

A - HISTORICAL TRENDS

We first examine the evolution of a few series: NNP, net stock of fixed capital, productivity of labor, real wage (subsection 1) and profit rate (subsection 2). Then the rather steady movement of the first four series is constrasted with the historical fluctuations of the profit rate (subsection 3).

1. Steady Upward Trends

It is obviously not possible to account for the historical trends in the U.S. economy on the basis of a few series. In this subsection, we limit our investigation to the four basic indicators mentioned above (figures **5**, **6**, **7**, and **8**).

Figure **5** shows that it is very difficult to identify long waves in the historical evolution of NNP. The great depression of the 1930s marks a prominent rupture and is followed by a bulge corresponding to World War II, but the general trend is steady from the beginning to the end of the period, *i.e.*, over more than one century. Recessions of different amplitudes are evident all along the curve.[9]

One can notice in this figure, for the late 19th century, the impress of the two "shifts" mentioned in section IV.C above. In the late 1870s the rate of growth of NNP peaks. The annual rate of growth for 1875-1880 is 9.2 percent. The economy then culminates in an overheating (the rate of growth of NNP in 1880 is 15.0 percent), and enters into a stagnation from 1881 to 1896. The annual rate of growth for this period is 2.2 percent. The period of sluggishness from 1880 to 1888, with an annual rate of growth of 1.3 percent, ends, after a short acceleration, in two consecutive recessions in 1893-1894 and 1896.

The combination of the business cycle and shift downward at the end of the 19th century, which is the expression of the shift of the whole pitchfork, accounts for the difficulty in characterizing this period globally. The existence of a period of balanced growth and an overheating seems to contradict the thesis of a lingering period of stagnation. The general sluggishness of the activity suggests an opposite interpretation.

The evolution of the net stock of fixed capital in constant dollars is plotted in figure **6**. The trend is steadily upward, with the exception of a major rupture in the 1930s. During the great depression, the stock of capital was considerably reduced. In addition, a second, less prominent, rupture can be observed around 1910.

Figure **7** displays the evolution of labor productivity. Again fluctuations translate the effects of the business cycle. In particular, the effect of the two successive shifts of the economy in the late 19th century is striking. A prominent is oscillation reflects

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[9] *The amplitude of the recessions in the 19th century might be a mere artifact due to the small number of goods considered in production indexes (cf.* ROMER C.D. 1986*).*

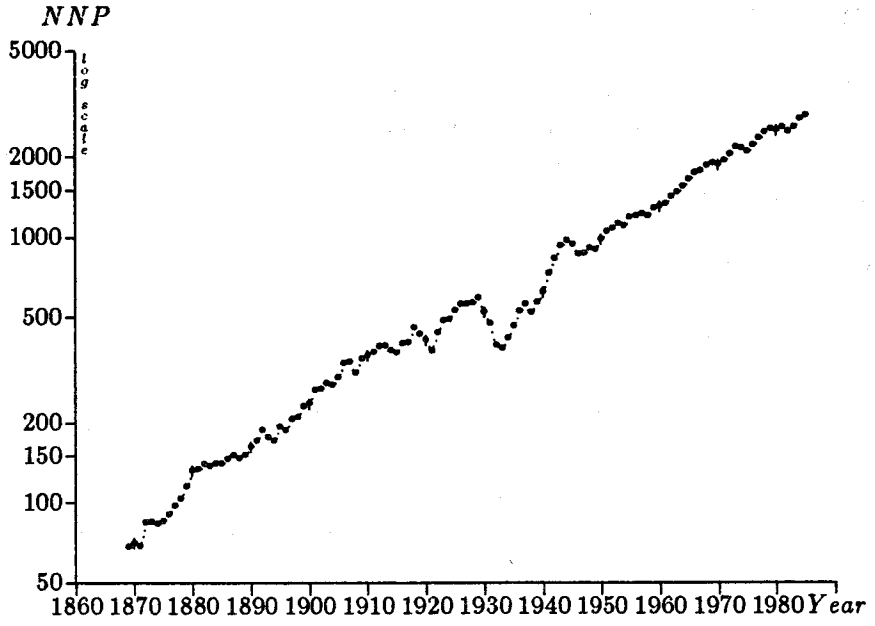

Figure 5 - Private Net National Product in Constant $
Total Economy (1869-1985)

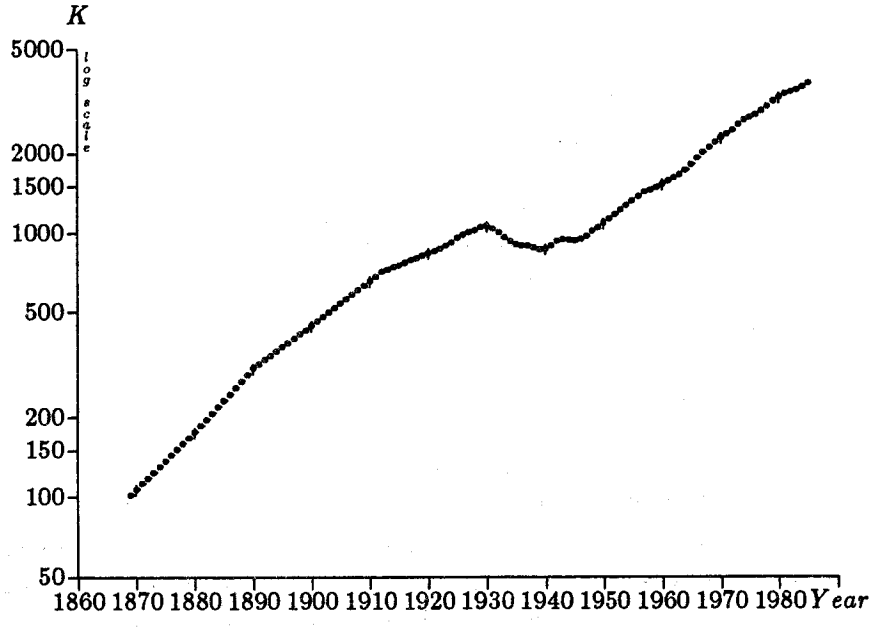

Figure 6 - Net Stock of Fixed Capital in Constant $
Total Economy (1869-1985)

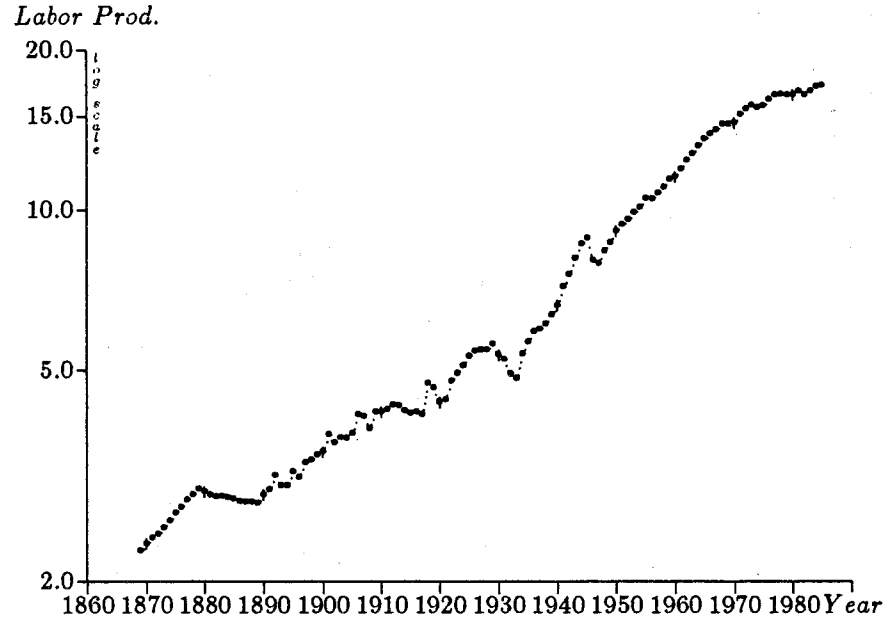

Figure 7 - Labor Productivity (Private NNP/Hours)
Total Economy (1869-1985)

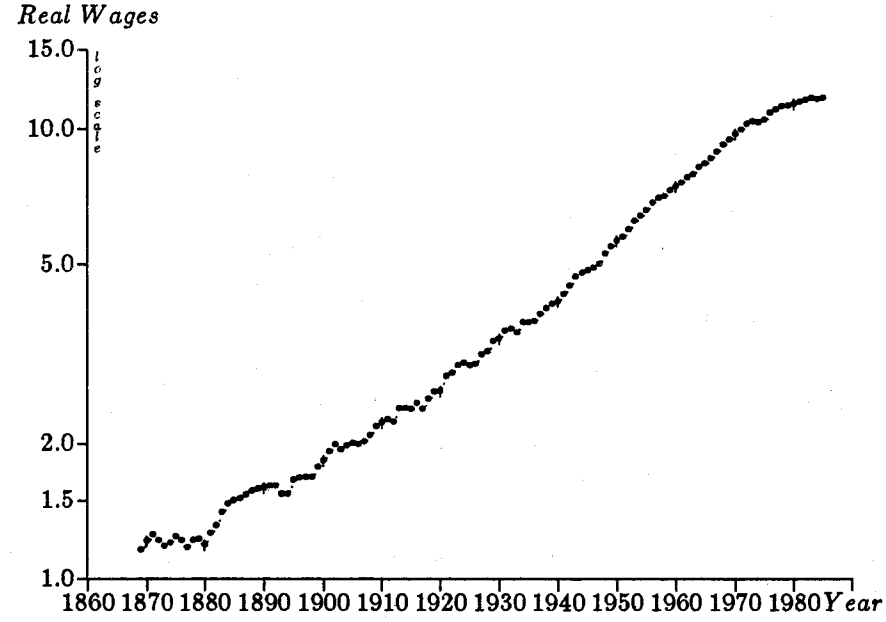

Figure 8 - Real Wages per Hour
Total Economy (1869-1985)

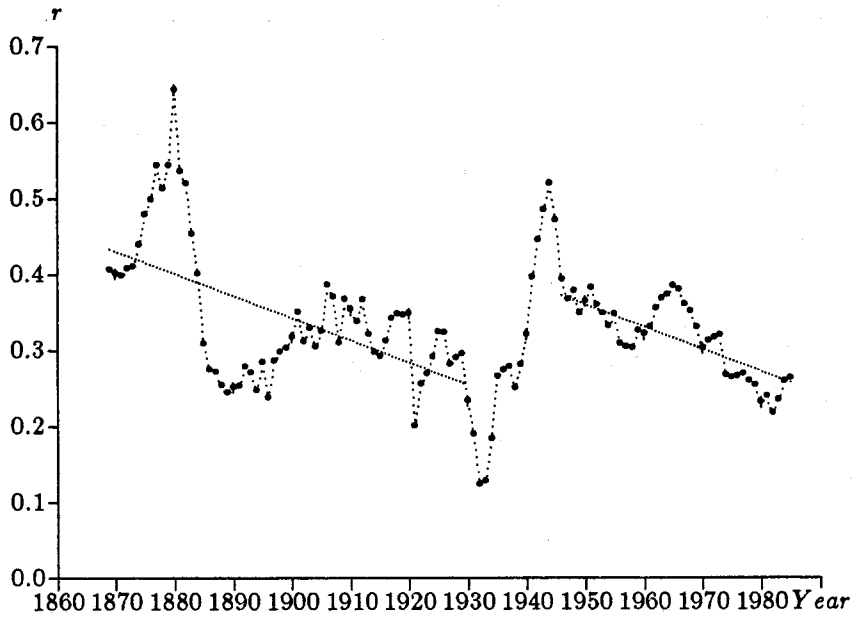

Figure 9 - The Profit Rate
(1869-1985)

The two doted lines in the figure represent the trends of the profit rate for the two periods preceding and following World War II, considered separately. In V.A.2 we abstract from these lines, which are discussed in V.B.2.b.

the effects of the great depression and World War II. A rupture can be noticed at the end of the great depression. Labor productivity soars during World War II, and the trend remains steep for 20 years (until the late sixties). A slowdown is then evident. This observation suggests—in contrast to figure **5**—that something changed in the history of capitalism in the late 1930s or early 1940s.

The rate of real wages is presented in figure **8**. An acceleration can be noticed after World War I, and a slowdown is evident in the recent years (since 1973).

2. Trend and Fluctuations in Profitability

The historical profile of the rate of profit is very different from those observed above (*cf.* figure **9**):

1. Considering the whole period of more than one century, the rate of profit displays a downward trend. A regression for the years 1869 to 1985 reveals a significant downward trend with a loss of 0.09 percent every year.

2. In the late 19th century, the profit rate displays an ample oscillation. The peak is reached in 1880 and the trough in 1896. The rate of profit fluctuates around 18 percent for more than 10 years. Abstracting from this dramatic variation, from the first five years in the series (1869-1873) to the pre-World-War-I levels (1900-1914), the profit rate declined from 40.2 to 33.3 percent, a ratio of 33.3/40.2=0.83.

3. Another step downward of smaller amplitude is evident after World War I (*cf.* DUMÉNIL G., GLICK M., RANGEL J. 1987 and 1988): The average rate for 1922-1929 is 28.8 percent, a ratio of 0.86 in comparison to 1900-1914.

4. The dramatic event, however, is the restoration of the profit rate following the great depression and World War II. The profit rate averaged 35.9 percent during the years 1946 to 1955, a ratio of 1.25 in comparison to the 1920s. This major phenomenon has been unduly neglected in the analysis of capitalism (*cf.* DUMÉNIL G., GLICK M., LÉVY D. 1988).

5. After World War II, the profit rate is first stable, and then a progressive slide downward (to 24.3 percent for 1976-1985, a ratio of 0.68 in comparison to 1946-1955) is evident since the late 1960s, which can be associated with the recent "crisis" of capitalism.

3. The Profit Rate and its Determinants

Abstracting from the effect of the variations of the relative prices of output, capital, and consumption goods, the profit rate can be expressed as a function of the series considered in subsection 1:

$$Rate\ of\ profit = \left(1 - \frac{Rate\ of\ wages}{Labor\ Productivity}\right) \frac{NNP}{Capital\ stock} \qquad (7)$$

It is a striking result of the examination of these series that small fluctuations translate into ample oscillations of the profit rate. The rate of profit plunges into the great depression and soars during World War II. A more surprising example may be that of the oscillation during the late 19th century which dramatically reflects the succession of the two "shifts" upward and downward described above.

The trends of these variables have no *a priori* reason to result in the specific profile of the profit rate which was observed. Consider, for example, wages. The average growth rate of annual real wages over the entire period has been 1.73 percent. Had this rate been 2.06 percent, the profit rate would have been reduced to zero. Conversely, the profit rate would have been doubled, if the rate of growth of wages had been 1.21 percent. (Obviously this simple computation assumes an unaltered technological progress — an unrealistic assumption.)

Thus, the profile of the profit rate resulted from a very specific and *not coincidental* combination of the historical trends of its determinants. *This observation*

suggests that a type of social control is at work. We interpret this very specific pattern of events on the basis of Marx's dialectical analysis of the tendency for the profit rate to fall, and the associated countertendencies created by the tendency itself.

B - THE TENDENCY FOR THE RATE OF PROFIT TO FALL

In this section we provide an interpretation of the profile observed for the profit rate. Subsection 1 restates Marx's analysis of the tendency for the profit rate to fall. Subsection 2 discusses the factual relevance of this analysis. Subsection 3 introduces the notion of countertendency and its historical concrete application. In this section we will abstract from a number of difficulties concerning the relationship between price and value aggregates, or distinctions such as that between productive and improductive labor.

1. Marx's Analysis in *Capital*

In its formulation in Volume III of *Capital* (*cf.* MARX K. 1894, Vol. III, Ch. 13), the tendency for the profit rate to fall is related to a thesis concerning technological change. As is well-known, Marx linked the falling rate of profit to the increasing organic composition of capital (*Constant Capital/Wages*), counteracted by the increasing rate of surplus value. He derived this view from his observation of mechanization during the industrial revolution, and its consequences for both the amounts of machinery in comparaison to labor and the progress of labor productivity.

The consideration of the organic composition of capital is not quite appropriate, and Marx's view of technological change must be restated on the basis of equation 7 which can be expressed as:

$$r = \textit{Share of profits} \times \textit{Productivity of Capital}$$

A more appropriate formulation is the following: Progress in labor productivity requires an increased amount of capital per unit of output (an increased *Capital/Output* ratio or a diminished productivity of capital: *Output/Capital*). The tendency for the profit rate to fall results from this augmented advance in fixed capital in comparison to output. It is paralleled by a tendency for the share of profits to increase which alleviates the pressure on the rate of profit, but which does not fully offset the falling productivity of capital.

The difficulty in the acceptance of this analysis is related to the question of why enterprises should engage such transformations of the technology if, in doing so, they diminish their profit rate. Marx's analysis is not convincing in this respect, under the assumption of a constant real wage, as was shown by Nobuo Okishio (OKISHIO N. 1961). Our interpretation is that the falling profit rate is, thus, accompanied by a rising real wage.

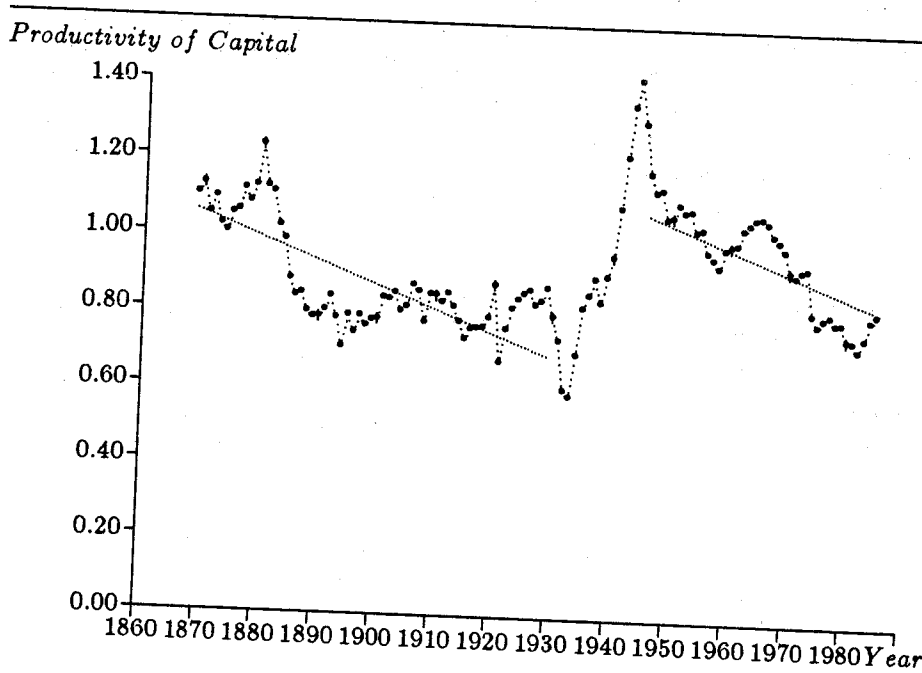

Figure 10 - Productivity of Capital (1869-1985)

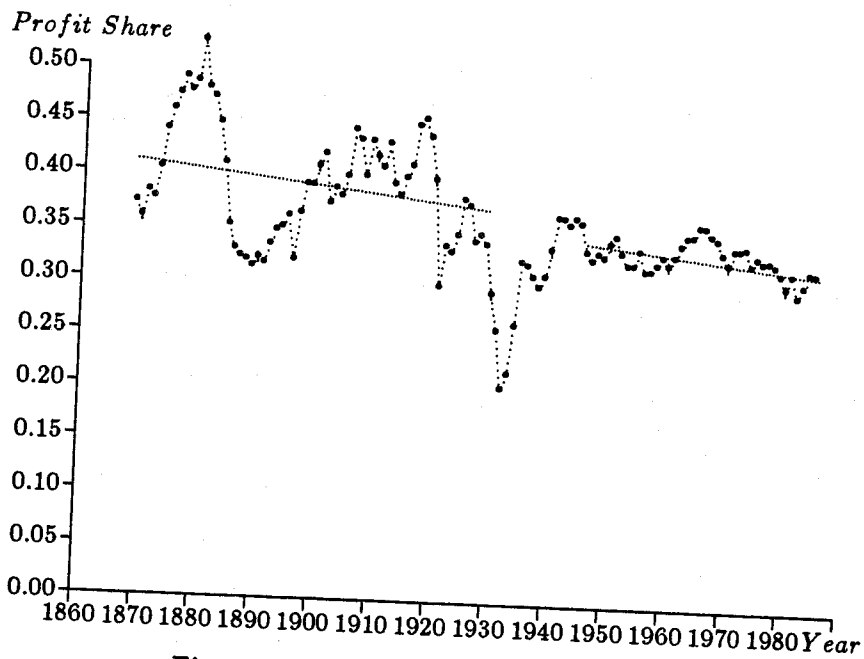

Figure 11 - Share of Profits in NNP (1869-1985)

This analysis does not imply that workers generally push the profit rate downward, by excessive demands with respect to their wages. Other aspects of Marx's analysis (*cf.* MARX K. 1867, Ch. 25, and 1894, Ch. 15) suggest that accumulation periodically increases employment to the limits of the availability of labor (the reabsorption of the reserve army and overaccumulation), and results in larger real wages. In periods of overheating or during a war enterprises are constrained by competition to grant rises of wages. The action of workers is often limited to the consolidation of these gains.

It is important to notice here that the classical analysis of the labor market is very different from the neoclassical view. Disequilibrium (the rate of employment) in the classical perspective, impacts on wages, but the rate of wages is not a price whose value is determined in order to clear the market. No short-term control of the labor supply exists (in contrast to what occurs for the supply of commodities). Therefore, the employment of labor, as that of fixed capital, follows the pattern of the business cycle.

Marx's complete thesis can, thus, be stated as follows: *As accumulation progresses, from one business cycle to another, real wages increase, capital is substituted for labor, and the productivity of capital tends to diminish so much that the rate of profit falls, although the share of profits tends to increase.* No technology exists which can produce the simultaneous rise of the rates of wages and profit.

2. Factual Relevance of the Law

We will now comment on figure **9** for the profit rate, and figures **10** and **11** which display the profiles of the productivity of capital and share of profits. It is possible to conduct this investigation from different points of view, depending on the time span considered.

a. *The Secular Trend*

Considering the period of more than a century, the record concerning the straightforward manifestation of historical tendencies confirms Marx's view as moderately accurate. As was noted in subsection 2, the trend of the profit rate is downward. However, no significant trend can be observed for the productivity of capital and the share of profits does not display a trend upward, but downward. This last result, however, should be discussed in relation to the substitution of unproductive labor for productive labor, which lies beyond the limit of this study (*cf.* MOSELEY F. 1988).

b. *Two Periods of Declining profitability and the World-War-II leap forward*

A closer examination of figure **9** suggests a more fruitful interpretation. World War II should be interpreted as a major recovery interrupting a quite significant tendency downward. World War II is not the only period in which the rate of profit is increased, but other movements upward express more the upswing of a fluctuation

than a rupture. In figure **9** two trend lines have been drawn for each subperiod 1869-1929 and 1947-1985, obtained from a single regression with the same slope for the two subperiods and a dummy variable for the second period. A very significant downward trend can be observed. The trend decline is equal to 0.29 percent every year. Extrapolating the prewar trend and retrapolating the postwar trend, the two fictitious rates for 1940 are 22.4 and 38.9 percent, *i.e.*, a ratio of 1.73. In DUMÉNIL G., GLICK M., LÉVY D. 1988, we called this sudden recovery the *World-War-II leap forward.*

A comparison of figures **10** and **11** shows that this restoration originated from a jump in the productivity of capital and not a modification of distribution. Concerning the productivity of capital, the two periods, in accordance with Marx' view, reveal a downward trend. During the first period, up until the depression, the productivity of capital is progressively stabilizing. Conversely, after World War II the slope becomes steeper as time passes.

c. *Absolute Declines and Restorations of the Profit Rate*

An even closer examination of the series suggests a more sophisticated hypothesis: *Absolute declines of the profit rate which occured periodically along the history of capitalism resulted in intense perturbations and transformations (technological change, new institutions, new social classes, new policies, etc.), leading to a restoration of the profit rate.* World War II only represents a vivid illustration of this law of motion of capitalism, related to the succession of the great depression and the war. Following this interpretation, three major chains of events of this type can be observed over the 120 years covered by our investigation:

1. The profit rate declined in the mid-1880s and was *partially* restored at the turn of the century, after more than ten years of low profitability.
2. A second step downward can be observed in the aftermath of World War I. Again after about ten years of low rates, plus a depression, the profit rate was restored in exceptional proportions after World War II.
3. A third step downward occured in the 1970s and the profit rate was seriously diminished for about ten years. This latter example is still in progress and the data considered in our study end in 1985, as new important developments are under way. We assume here that the future will confirm that the late 1980s coincide with a certain recovery of the profit rate.

It is not possible to account here for the complete set of transformations which accompained the successive restorations of the profit rate. The first episode related above, which occured at the turn of the century, was linked to the progress in workplace organization (Taylorism). This transformation implied the development of new groups of employees. World War II also coincided with an acceleration in the development of managers and organizers in general. It is well known that the war ushered in a new period of state intervention in economic affairs. It is probably too early to actually assess the significance of the evolution which is presently under way.

3. Countertendencies

As is clear from the analysis above, the constant pressure downward on the profit rate would have taken capitalism to the mat, if capitalists and managers had not been partially successful in offsetting this tendency, and if specific economical and political circumstances had not periodically created new contexts favorable to a restoration. Independently of the timing of their effects, permanent or periodical, two aspects of these countertendencies must be stressed:

1. *A More Intensive Use of Fixed Capital.* An important reaction to falling profitability has been the more intensive use of fixed capital. By this we mean well-known transformations in the organization of the labor process and the extension of the number of shifts. The complete mix of technology and organization should be considered here. The development of Taylorism from the beginning of the century is a famous illustration, which probably accounts for the stabilizing productivity of capital. What occured during the depression and World War II is certainly an even more dramatic manifestation of the same process, in an incredibly short span of time. The restoration of the profit rate during these years of intense transformation was the effect of the sudden increase of the productivity of capital (the share of profits was about constant). In this relative decrease of the stock of fixed capital, in comparison to output, the two components of capital, structures and equipment, were affected differently. The secular decline in the ratio of *structures* to *equipment* in the stock of capital was strongly accelerated (*cf.* DUMÉNIL G., GLICK M., LÉVY D. 1988).
2. *A stricter management of firms.* The same evolution was paralleled by a huge progress in the management of inventories and liquidities. A firm managed as in the 19th century would not survive long in today's capitalism. This evolution manifested itself in the tremendous increase of the fraction of the working force involved in activities related to management.

The World-War-II leap forward in the profit rate did not coincide with a relaxation of the pressure put on firm management, since the increased profits were appropriated by the state through taxation. Enterprises were, thus, left with a diminished profit rate.

C - THE HISTORICAL DETERMINANTS OF STABILITY

The improved management of firms, which responded to the pressure of diminishing profitability, had positive effects at the level of individual firms, since it contributed to the restoration of the profit rate. This was obtained as a result of a strict control of the use of each fraction of capital invested. *It is our contention that this progress, although efficient in the restoration of the profit rate, did not re-create the conditions of stability.* The determinants of stability are related to the historical movements of the profit rate, but the conditions for stability do not mirror in a straightforward

manner the value of the profit rate.

In DUMÉNIL G., LÉVY D. 1988(c), we gave an empirical illustration of this thesis, using the example of inventories in Manufacturing industries after World War II. We tried to estimate the evolution of reaction coefficient ε since World War II. This investigation revealed that the new fall in the profit rate (after all taxes, as it is felt by enterprises), since the late 1960s, has been accompained by a diminished target ratio of inventories, $\overline{s}$, and a rising reaction coefficient ε.

These two transformations are related to a stricter management. This is evident for the diminishing $\overline{s}$ which cuts into the share of financing required by the existence of inventories. A stronger ε means a careful watch on inventories, naturally associated with the reduced $\overline{s}$. The transformations also result in an increased instability of the system (*cf.* condition 6), and can therefore be considered as factors in the intense fluctutations which characterize the U.S. economy since 1970.

It is possible, on this basis, to push the above statement concerning the effects on stability of the successive restorations of the profit rate, one step further. Not only do these movements not recreate the stability conditions, but *the mechanisms by which the diminishing profitability in capitalism is compensated for, imply a tendency toward an increasing instability.*

This historical "law", in Marx's sense of the term, of an increasing instability in capitalism, is in turn counteracted by other transformations of the capitalist mode of production. As the falling profit rate induces countertendential forces, the accompaining instability stimulates important institutional innovations which tend to restore stability. The progressive involvement of the state in economic affairs is certainly the most prominent.

This analysis provides answers to the two questions which were raised at the beginning of this part:

1. *Capitalism is constantly maintained in a vicinity of the limits of its stability in dimension, as a result of the permanent race between the tendency toward an increased instability, created mostly at the firm level, and the institutional framework of social control and economic policy.*

2. *The metamorphoses of the forms of the cycle are the expression of the evolution of the reaction of economic agents in the direction indicated above, in particular, a larger value of ε. As was shown in subsection III.B.1, a larger ε results in a larger θ. These circumstances are favorable to a constant fluctuation of the economy between overheating and stagnation (cf. figure 1), and scarce returns to normal equilibrium. This is precisely what can be observed in the U.S. economy since World War II.*

LIST OF FIGURES AND SOURCES

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11 *Share of Profits in NNP (1869-1985).*

The series plotted in figure **2** is from B.E.A. 1973: *Industrial Production Index, NBER, Nutter, 1869-1969, Series A15.* The series and computations in figures **3** and **4** are from DUMÉNIL G., LÉVY D. 1988(c). The series in figures **5**, **6**, **7**, **9**, **10**, **11** are from DUMÉNIL G., LÉVY D. 1988(a). The money wage used in figure **8** is also described in DUMÉNIL G., LÉVY D. 1988(a). It has been divided by *Consumer prices, all items, BLS, 1860-1970, Series B69* from B.E.A. 1973 for 1869-1928, updated to 1985 by the consumer price index from NIPA.

REFERENCES

ARENA R., FROESCHLE C., TORRE D. 1984, Gravitation et Reproductibilité : Un Point de Vue Classique, in BIDARD C. 1984.

ARENA R., FROESCHLE C., TORRE D. 1988, "Formation des prix et équilibre classique, Un examen préliminaire," *Revue Économique*, # 6, pp. 1097-1117.

B.E.A. 1973, *Long Term Economic Growth, 1860-1970*, Department of Commerce, Bureau of Economic Analysis.

BENASSY J.P. 1982, *The Economics of Market Disequilibrium*, Academic Press, New York, London.

BENETTI C. 1981, "La Question de la Gravitation des Prix de Marché dans *La Richesse des Nations*," *Cahiers d'Économie Politique*, # 6, pp. 9-31.

BIDARD C. 1984 (ed.), *La Gravitation*, Cahiers de la R.C.P. "Systèmes de prix de production" (C.N.R.S.) # 2-3, Université de Paris X-Nanterre.

BLINDER A.S. 1982, "Inventories and Sticky Prices : More on the Microfoundations of Macroeconomics," *The American Economic Review*, Vol. 72, # 3, pp. 334-348.

BLINDER A.S. 1986, "Can the Production Smoothing Model of Inventory Behavior Be Saved," *The Quarterly Journal of Economics*, Vol. CI, # 3, pp. 431-453.

BOGGIO L. 1984, Convergence to Production Prices Under Alternative Disequilibrium Assumptions, in BIDARD C. 1984.

BOGGIO L. 1985, "On the Stability of Production Prices," *Metroeconomica*, Vol. XXXVII, # 3, pp. 241-267.

BOGGIO L. 1986, Stability of Production Prices in a Model of General Interdependence, in SEMMLER W. 1986.

CARTELIER J. 1981, "Marchandise Homothétique, Capital Financier et Loi de Say : de la Convergence des Prix de Marché vers les Prix Naturels," *Cahiers d'Économie Politique*, # 6.

DUMÉNIL G., GLICK M., RANGEL J. 1987, "The Rate of Profit in the United States," *Cambridge Journal of Economics*, Vol. 11, # 4, pp. 331-360.

DUMÉNIL G., GLICK M., RANGEL J. 1988, "Theories of the Great Depression : Why did Profitability Matter ?," *The Review of Radical Political Economics*, Vol. 19, # 2.

DUMÉNIL G., GLICK M., LÉVY D. 1988, réaffecté dugy 1989 a, ***, ***.

DUMÉNIL G., LÉVY D. 1985(a), "The Classicals and the Neoclassicals, A Rejoinder to Frank Hahn," *Cambridge Journal of Economics*, # 9, pp. 327-345.

DUMÉNIL G., LÉVY D. 1985(b), The Macroeconomics of Disequilibrium: A Classical View, CEPREMAP, Paris.

DUMÉNIL G., LÉVY D. 1985(c), Stability and Instability in a Dynamic Model of Capitalist Production (abridged version), pp. 132-169, in SEMMLER W. 1986.

DUMÉNIL G., LÉVY D. 1986, "Real and Financial Stability in Capitalism: The Law of the Tendency toward Increasing Instability," *Economic Forum, University of Utah*, Vol. XVI, # 1, pp. 1-27.

DUMÉNIL G., LÉVY D. 1987(a), "The Dynamics of Competition: A Restoration of the Classical Analysis," *Cambridge Journal of Economics*, Vol. 11, # 2, pp. 133-164.

DUMÉNIL G., LÉVY D. 1987(b), "The Macroeconomics of Disequilibrium," *Journal of Economic Behavior and Organization*, Vol. 8, pp. 377-395.

DUMÉNIL G., LÉVY D. 1987(c), The Stability of Long-Term Equilibrium in a General Disequilibrium Model, CEPREMAP # 8717, Paris.

DUMÉNIL G., LÉVY D. 1987(d), La concurrence capitaliste: un processus dynamique, pp. 127-154, in FITOUSSI J.P., MUET P.A. 1987.

DUMÉNIL G., LÉVY D. 1988(a), "Ajustements par les prix et par les quantités dans le cadre d'une micro-économie d'inspiration classique," *Revue d'économie politique*, # 1, pp. 127-149.

DUMÉNIL G., LÉVY D. 1988(b), Theory and Facts, What can we Learn from a Century of History of the U.S. Economy?, Colloque international sur la théorie de la Régulation, Barcelone, Juin 1988.

DUMÉNIL G., LÉVY D. 1988(c), Why Does Profitability Matter?, CEPREMAP, LAREA-CEDRA, Paris.

DUMÉNIL G., LÉVY D. 1989(a), "The Analytics of the Competitive Process in a Fixed Capital Environment," *The Manchester School*, Vol. LVII, # 1, pp. 34-57.

DUMÉNIL G., LÉVY D. 1989(b), Micro Adjustment Behavior and Macro Stability, forthcoming in *Seoul Journal of Economics*, Seoul, CEPREMAP # 8915, Paris.

DUMÉNIL G., LÉVY D. 1989(c), The Rationality of Adjustment Behavior in a Model of Monopolistic Competition, Paper presented at the Conference *Micro Models 1989*, Liblice Castle 20-24 March 1989, Institute of Economics, Czechoslovak Academy of Sciences, to be published in *Proceedings of the Conference*, by R. Quandt and D. Tříska, CEPREMAP # 8916, Paris.

EHRBAR H., GLICK M. 1988(a), "Profit Rate Equalization in the U.S. and Europe: An Econometric Investigation," *European Journal of Political Economy, Europäische Zeitschrift für Politishe Ökonomie*, Special Issue, Vol. 4, # 1, pp. 179-201.

EHRBAR H., GLICK M. 1988(b), "Structural Change in Profit Rate Differentials:

The Post World War II U.S. Economy," *British Review of Economic Issues*, Vol. 10, # 22, Spring, pp. 81-102.

FITOUSSI J.P., MUET P.A. 1987 (ed.), *Macrodynamique et déséquilibres*, Économica, Paris.

FLASCHEL P., SEMMLER W. 1984, The Dynamic equalization of Profit Rates, New School for Social Research, New York.

FLASCHEL P., SEMMLER W. 1987, "Classical and Neoclassical Competitive Adjustment Processes," *The Manchester School*, # 1, pp. 13-37.

FRANKE R. 1984, Modelling Gravitation Processes as Sequences of Temporary Equilibria, Universität Bremen, Bremen.

FRANKE R. 1985, Production Prices and Dynamical Processes of the Gravitation of Market Prices, Dissertation, Universität Bremen, Bremen.

HOLT C.C., MODIGLIANI F., MUTH J.F., SIMON H.A. 1960, Planning Production, Inventories, and Work Force, Prentice-Hall, Inc., Englewood Cliffs, N.J..

LOVELL M. 1961, "Manufacturers' Inventories, Sales Expectations, and the Acceleration Principle," *Econometrica*, Vol. 29, # 3, pp. 293-314.

LOVELL M. 1962, "Buffer stocks, Sales Expectations, and Stability : A Multi-Sector Analysis of the Inventory Cycle," *Econometrica*, Vol.30, # 2, pp. 267-296.

MALINVAUD E. 1977, *The Theory of Unemployment Reconsidered*, Basill Blackwell, Oxford.

MARSHALL A. 1890, *Principles of Economics, Eight Edition*, The Macmillan Press Ltd, London and Basingstoke, 1972.

MARX K. 1867, *Capital, Volume I*, First Vintage Book Edition, New York, 1981.

MARX K. 1894, *Capital, Volume III*, First Vintage Book Edition, New York, 1981.

METZLER L.A. 1941, "The Nature and Stability of Inventory Cycles," *Review of Economic Statistics*, Vol. III, August, pp. 113-129.

MORISHIMA M. 1964, *Equilibrium, Stability, and Growth*, Clarendon Press, Oxford.

MOSELEY F. 1988, The Decline of the Rate of Profit in the Postwar U.S. Economy : Regulation and Marxian Explanations, Colby College, Waterville.

NIKAIDO H. 1977, Refutation of the Dynamic Equalization of Profit Rates in Marx's Scheme of Reproduction, Department of Economics, University of Southern California.

NIKAIDO H. 1983, "Marx on Competition," *Zeitschrift für Nationalökonomie*, Vol.43 # 4, pp. 337-362.

OKISHIO N. 1961, "Technical Change and the Rate of Profit," *Kobe University Economic Review*, Vol. 7, pp. 86-99.

RICARDO D. 1817, *The Principles of Political Economy and Taxation*, Dent and Son Ltd, London, 1960.

ROMER C.D. 1986, "Is the Stabilization of the Postwar Economy a Figment of the data," *The American Economic Review*, Vol. 76, # 3, pp. 314-334.

SAMUELSON P.A. 1939, "Interactions between the Multiplier Analysis and the Principle of Acceleration," *Review of Economic Statistics*, May.

SEMMLER W. 1986 (ed.), *Competition, Instability, and Nonlinear Cycles*, Lecture Notes in Economics and Mathematical Systems, # 275, Springer-Verlag, Berlin.

SMITH A. 1776, *The Wealth of Nations*, Dent and Son Ltd, London, 1964.

STIGLER G. 1963, *Capital and Rates of Return in Manufacturing Industries*, Princeton University Press, N.J..

von NEUMANN J. 1938, "A Model of General Economic Equilibrium," *The Review of Economic Studies*, Vol. 13, 1945-1946, pp. 1-9.

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