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WHY DOES PROFITABILITY MATTER?

Profitability and Stability in the U.S. Economy since the 1950s*

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RÉSUMÉ

POURQUOI LA RENTABILITÉ EST-ELLE IMPORTANTE ?

Cette étude démontre empiriquement l'existence d'une relation entre le taux de profit et la stabilité. On présente et estime un modèle dynamique de court-terme et avec monnaie, des économies capitalistes, dans lequel le déséquilibre est pris en considération et les agents réagissent à l'observation des déséquilibres. La condition qui garantit la stabilité du niveau général d'activité est exprimée en fonction des intensités des réactions des agents. Une réaction accrue par les quantités, de la part des entreprises, face aux déséquilibres de l'offre et de la demande, met en danger la stabilité du system. On montre empiriquement que le taux de profit a un impact sur ce degré de réaction, et, donc, sur la stabilité.

ABSTRACT

WHY DOES PROFITABILITY MATTER ?

This study empirically reveals a direct link between profitability and stability. To make the demonstration, we develop and then estimate a short-run dynamic disequilibrium model of a capitalist economy, with money, in which agents react to the observation of disequilibria. The condition for the stability of the general level of activity is expressed as a function of the reactions of economic agents. An increased reaction by quantities to disequilibria between supply and demand, on the part of firms, jeopardizes stability. It is demonstrated empirically that the variations of the profit rate influence this degree of reaction and, therefore, impact on stability.

MOTS CLEFS : Taux de Profit, Stabilité, Cycle Conjoncturel, Crise

KEYWORDS : Profit rate, Stability, Business Cycle, Crisis

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INTRODUCTION

Within the Marxist tradition, considerable research has been devoted to the historical movement of the *profit rate*, both theoretically and empirically. Despite agreement that the profit rate plays a central role in the functioning of capitalism, there is no consensus among economists concerning the exact nature of the mechanisms through which this impact is manifested. At least three explanations of the importance of profitability to capitalist crisis appear in the literature: (1) Excessive profitability leads to too little demand for consumption goods, (2) insufficient profit slows the pace of accumulation or, alternatively (3) diminishes the inducement to invest. We contend that the first view is erroneous and that the second and third perspectives, while not incorrect, must be severely qualified.

In our opinion, however, these traditional explanations fail to recognize the importance of *stability* analysis. The stability of the general level of economic activity is subject to conditions which are dependent on the value of the profit rate. Specifically, the impact of profitability is channelled to the macroeconomy through its effects on *firms management*. For example, the degree to which firms respond to demand signals by the direct adjustment of their output (adjustment by quantities) is a function of the profit rate — an increased adjustment by quantities is detrimental to the stability of the general level of activity. The process is summarized by the following chain of events:

Diminished Profitability $\longrightarrow$ *Stronger Adjustment by Quantities* $\longrightarrow$ *Increased Instability of the General Level of Activity*

Thus, the importance of profitability is primarily expressed on the supply side of the economy, rather than in the demand function.

It is the purpose of this paper to articulate the effect of profitability on stability, and to test for its empirical relevance. (The issue of the tendency for the rate of profit to fall will not be addressed, see DUMÉNIL G., LÉVY D. 1991(a).)

We develop a macroeconomic model for the analysis of the stability of capitalist economies, identify its stability condition, and estimate it for the U.S. Manufacturing industries between 1953 and 1989. We find two important results:

1. The profit rate is a significant explanatory variable in the stability condition (far more significant that the rate of interest, for example).
2. This effect can be more precisely located, on the supply side, in the degree to which firms react to disequilibria between supply and demand, by directly adjusting their levels of activity.

Monetary and credit mechanisms, as well as other institutional transformations of firm management, markets, etc., are also important components of capitalist stability (see, for example, DUMÉNIL G., LÉVY D. 1988(b) or 1991(a)). The specificity of profitability in this process lies in the analysis of historical patterns concerning stability. Declines in the profit rate induce modifications of firm behavior which have a destabilizing effect on the macroeconomy. These transformations, in combination with financial innovations, initiate phases of instability which require new changes in the institutional framework responsible for the macroeconomic stability of the economic system — a correction which may come after important delays.

Three specific features of the stability problem in capitalist economies follow from this analysis:

1. Since the progress of the social control of stability usually occurs *ex post*, as a response to instability, the economic system constantly remains in the vicinity of its stability condition which is sometimes satisfied and sometimes violated.
2. If the profit rate exhibits a downward historical trend, or if the transformations of firm management tend to become permanent, a tendential instability is built into the system, which requires a cumulative progress of stabilizing mechanisms. Thus, new territories must constantly be explored. For this reason, we denote the stability condition as a "stability frontier".
3. The relevant observation in the historical analysis of stability is not the *absolute level* of the profit rate, but its recurrent declines.

In our work, we distinguish between stability in *proportions* and stability in *dimension*. Stability in "proportions" refers to the relative values of the variables (relative prices, outputs, and capital stocks among industries and enterprises). By "dimension" we refer to the general levels of activity and prices. In our opinion, capitalism is generally stable with respect to proportions, but often unstable with respect to dimension. Therefore, dimension represents the crucial stability problem in these economies. Thus, the investigation in this paper is limited to stability in dimension, totally abstracting from proportions.

Section 1 is devoted to a brief discussion of the competing theses concerning the importance of profitability, including our own view. Section 2 presents our model and its first estimation. In section 3, we test the impact of profitability in this model.

1 - FOUR COMPETING EXPLANATIONS

The idea that a decreasing or a deficient level of profitability can cause a crisis is common in the works of most Marxist economists. In this respect, the idea of a relationship between profitability and crisis (instability of the general level of activity) is not original, and was already at the basis of Marx's analysis of the capitalist system:

> "*[A fall in the rate of profit] promotes overproduction, speculation and crises, and leads to the existence of excess capital alongside a surplus population.*"

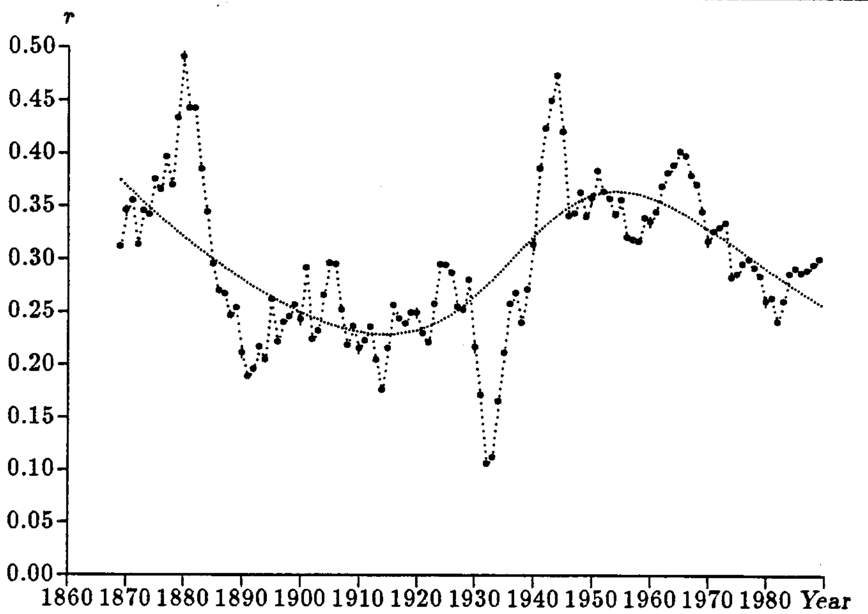

Figure 1 - The Rate of Profit in the Total Private Sector (•) and its Trend (·) (1869-1989)

Profits are defined as Net National Product minus Compensation for Labor (including a correction for self-employed). Profits and Capital are net of depreciation. The construction of the series and the interpretation of its profile are presented in DUMÉNIL G., GLICK M., LÉVY D. 1991, *and* DUMÉNIL G., LÉVY D. 1991(a) *and* 1991(b).

(MARX K. 1894, Ch. 15, p. 350)

However, a review of the most prominent literature on this issue reveals that the precise mechanisms through which the movements of the rate of profit can provoke a crisis are not well defined. In this first section, we briefly criticize three such explanations, and introduce our own view. The first interpretation relates the occurrence of crises to *excessive*, or rising, levels of profitability, whereas the last three focus on the effects of *low*, or diminishing, profit rates.

1.1 A DEFICIENT DEMAND FOR CONSUMPTION GOODS

The notion that low wages — and correspondingly high profits — can result in realization problems has traditionally been part of the analysis of capitalism by many Marxist economists. Crises resulting from the falling rate of profit and realization crises linked to excess profitability are usually distinguished (*cf.* for example, SWEEZY

P. 1942, Ch. VIII and IX or, more recently, MANDEL E. 1985, Ch. XXV).

Excess profitability and its underconsumption offspring have often been cited as explanations for the Great Depression, while scarcely mentioned as factors in the modern crisis of capitalism today (since the 1970s).

In the 1930s, the lack of purchasing power on the part of final consumers (mainly wage earners) was a popular explanation of the depression. This view was given a theoretical body at the Brookings Institution. For example, Harold Moulton, of this school, wrote:

> *"Our study of the productive process led us to a negative conclusion — no limiting factor or serious impediment to a full utilization of our productive capacity could there be discovered. Our investigation of the distribution of income, on the other hand, revealed a maladjustment of basic significance* [to the advantage of profits]. *Our capacity to produce consumer goods has been chronically in excess of the amount which consumers are able, or willing, to take off the market, and this situation is attributable to the increasing proportion of the total income which is diverted to savings channels. The result is a chronic inability* [...] *to find market outlets adequate to absorb our full productive capacity."* (MOULTON H.G. 1935, p. 45-46)

This analysis of the Great Depression has been revived in France by the Regulation School (AGLIETTA M. 1979, BOYER R., MISTRAL J. 1978, and LIPIETZ A. 1979), which describes the 1920s as a period of *intensive accumulation* without *mass consumption.* Intensive accumulation is characterized by a rapid growth of the productivity of labor. The lack of mass consumption accompanies the high levels of profitability. Deficient demand for consumption goods, combined with increased supply, was responsible, according to the Regulation School, for the depression.

In several studies (DUMÉNIL G., GLICK M., RANGEL J. 1984, DUMÉNIL G., LÉVY D. 1988(a), and DUMÉNIL G., GLICK M., LÉVY D. 1989), we have repeatedly contended that this view of the origin of the Great Depression is indefensible. In the 1920s, the profitability of capital was clearly not exceptional. As shown in figure **1**, profits were comparatively high in the 19th century and after World War II. In addition, consumption was also exceptionally high during the decade as shown in DUMÉNIL G., LÉVY D. 1988(a).

1.2 A DEFICIENT RATE OF ACCUMULATION

We now turn to the examination of a second type of relationship between the rate of profit and crisis which focuses on the consequences of low levels of profitability. The basis of the relationship is the fact that capital accumulation must be financed out of *past profits.* Thus, a low rate of profit should result into a low rate of accumulation. The growth of the economy is, in the long run, determined by its ability to save and invest. This view reflects the classical conception of accumulation.

If one assumes that accumulation is financed out of profits and that the share of

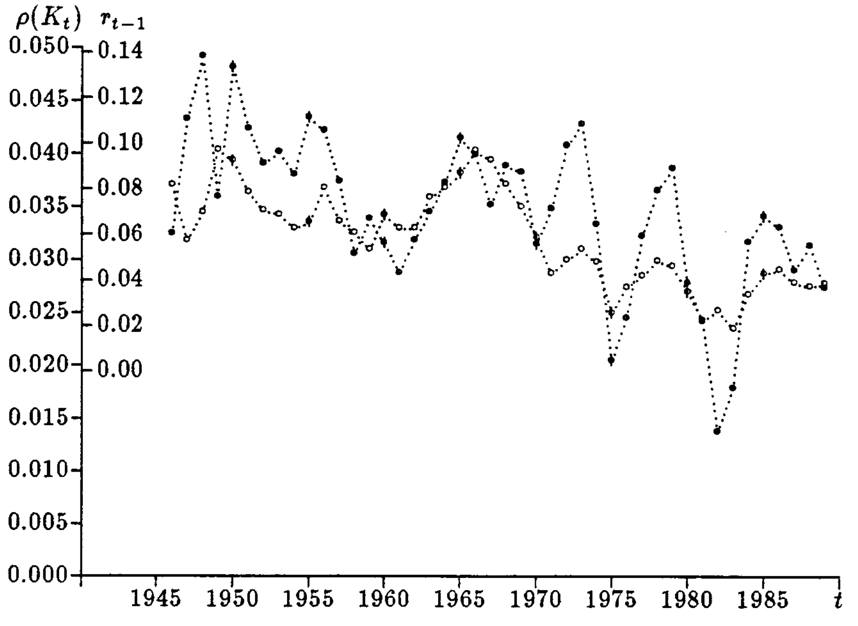

Figure 2 - The Rate of Growth of Capital (•) and the Rate of Profit (○) Corporate Sector, After all Taxes, 1946-1989

The profit rate is leading by one year. In order to show more clearly the relationship between the two variables, we plot ρ_t and r_{t-1}

these profits devoted to accumulation is constant, then, the value of the profit rate *determines* the rate of accumulation. The rate of growth of the output is also determined, provided that the *Output/Capital* ratio is given. Although such assumptions may be meaningful in the medium run, it is not clear that they make sense in the very-long run. This is probably the reason why Marx did not associate the tendency for the rate of profit to fall with a decreasing rate of accumulation, but rather with an increasing rate:

> *"A fall in the profit rate, and accelerated accumulation, are simply different expressions of the same process, in so far as both express the development of productivity."* (MARX K. 1894, p. 349)

However, if one limits the investigation to the period following World War II, a positive relationship is evident between profitability and accumulation. Figure 2 illustrates this, in which the rate of growth of the stock of fixed capital (net of depreciation) has been plotted together with the rate of profit after all taxes (indirect business taxes and corporate profits taxes), with a lag of one year. (A similar figure is presented in BOWLES S., GORDON D., WEISSKOPF T. 1991.) The unit of analysis is the corporate sector of the economy (all industries) and the period covered is 1946-1989. A positive relation exists.[1] It is also clear that a transformation occurs after 1970 when the rate of accumulation displays more fluctuation than the profit rate.

The problem with an analysis of the consequences of the falling profitability of capital which focuses on a diminished rate of accumulation is not that such a relation does not exist. A slower accumulation can account for the increase of unemployment, but it does not explain why a *crisis* should occur.[2]

1.3 A DIMINISHED INDUCEMENT TO INVEST

A third view of the importance of profitability focuses on its importance to investment. A "sufficient" *expected rate of profit*, it is agued, must exist to induce capitalists to invest their capital in a given activity or, in another formulation, that a higher expected rate of profit will provoke a higher level of investment.[3]

The notion of profit as an inducement to investment is old and common to various traditions in economics. For example, it is present in both the works of Ricardo and Keynes:

• In his *Principles* (RICARDO D. 1817), Ricardo analyzes the consequences on the profit rate of a high price of labor power due to the increasing difficulty to produce workers' basic consumption goods. In this analysis, the fact that a low rate of profit would be detrimental to accumulation is taken as given by Ricardo. Only on a few occasions does he raises this relationship. For example, he states that, for accumulation to proceed, capital must yield *some profit*:

> *"It follows, then, from these admissions that there is no limit to demand — no limit to the employment of capital while it yields any profit, and that, however abundant capital may become, there is no other adequate reason for a fall of profit but a rise of wages, [...]."* (RICARDO D. 1817, p. 197)

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[1] *With obvious notation, we obtain:*

$$\rho(K_t) = \underset{(t=8.1)}{0.0195} + \underset{(t=6.4)}{0.215}\, r_{t-1} \qquad R^2 = 0.51$$

The results for r_t or r_{t-2} are less satisfactory, as is also the case if profits are gross of interest as in BOWLES S., GORDON D., WEISSKOPF T. 1991 *for the period 1951-1989.*

[2] *A similar view is expressed by Duncan Foley: "If the rate of profit were indeed falling consistently, why would the capitalist system not adapt to this fall through a gradual reduction of the rate of accumulation? [...] this explanation of crisis has to produce some systematic reason why a fall in the rate of profit leads at certain moments to sharp and discontinuous adjustments in economic activity."* (FOLEY D. 1986, *p. 153).*

[3] *Capital is guided, in his migration from one industry to another, by profitability differentials. In this sense, investment is clearly dependent on expected profitability. However, our analysis below focuses on the consequences of the general level of the rate of profit in the economy on the level of total investment.*

• It is well-known that investment in Keynes' analysis is determined by the confrontation between the marginal efficiency of capital and the rate of interest. The marginal efficiency of capital is an *expected rate of profit*, specifically the expected internal rate of return on investment. Thus, in Keynes' words:

> *"Now it is obvious that the actual rate of current investment will be pushed to the point where there is no longer any class of capital-asset of which the marginal efficiency exceeds the current rate of interest."* (KEYNES J.M. 1936, p. 136)

The fact that the marginal efficiency of capital is an *expected* rate of profit has important consequences for the volatility of investment (*cf.* Chapter 22 of the *General theory*, "Notes on the Trade Cycle"). It is not clear in Keynes' analysis, whether the expected rate of profit is actually related to the actual rate. In Chapter 22, Keynes asserts that investors on financial markets are often "ignorant" of the actual yield of capital assets! Keynes liked to refer to "psychological" mechanisms ("animal spirits") to explain business fluctuations. However, Keynesian models traditionally use future profits as a measure of expected profits in a given period.

It is difficult to empirically distinguish between inducement and accumulation. Inducement suggests that profit rates in the future are the crucial variables, while accumulation should focus on *past* profits. With this criterion, empirics favor the thesis of accumulation. The correlation coefficients between the profit rate and the rate of accumulation for the various lags of the profit rate are displayed in table 1. The best result is obtained with a lag of 1 period for the profit rate (*i.e.*, r is leading by one period over $\rho(K)$).

Table 1 - corr$(r_{t-T}, \rho(K_t))$					
T	-2	-1	0	1	2
	0.291	0.457	0.684	0.686	0.589

1.4 AN INCREASED INSTABILITY

In this section, we present our own view of the importance of profitability in capitalism. We stress the relationship between profitability and stability which we introduced in our studies DUMÉNIL G., LÉVY D. 1985 and 1989. This approach to the impact of profitability is now gaining acceptance in Marxist and Keynesian literature where the use of dynamic models is becoming popular (for example, FOLEY D. 1986, SHAIKH A. 1986, and BOWLES S., BOYER R. 1990).

Our view of the importance of profitability in capitalism is set apart from the theses described above by two major distinguishing features:

1. Profitability's importance is to the *supply* side of the economic process, and not

demand as in the first (deficient demand for consumer goods) and third (deficient inducement to invest) theses above.

2. The main relationship concerns the *short run* (business fluctuations), and not the *long run* as in the second thesis above (accumulation).

Our view can be summarized as follows: *The profit rate is a crucial determinant of the manner in which firms react to disequilibria between supply and demand on commodity markets. Low levels of profitability induce firms to react more intensely to such disequilibria through adjustments in output (level of utilization of capacities), rather than prices, and conversely for higher profit rates. These changes affect the stability of the economy. A strong adjustment by quantities has a destabilizing effect on the general level of activity, and the opposite effect is produced by a weak reaction.*

This analysis raises two critical issues: (1) the relationship between the profit rate and the degree of the adjustment of output to quantity signals on the market, and (2) an explanation for the link between strong reactions by quantities and instability in the general level of activity:

1. *Profitability and Reaction by Quantities.* A diminished profitability induces firms to tighter management of their financial resources, trade credit, and inventories. Such pressure implies stronger reactions to quantity signals.
2. *Reaction by Quantities and Stability.* The intuition behind the destabilizing effêct is that firms reactions determine the speed of an overheating or a recession, because such phenomena are nothing other than cumulative movements upward or downward of output. For example, in a recession, a diminished level of activity will progressively pervade the entire economic system, at a rate which depends on the sensitivity of firms to stockpiling.

The purpose of this paper is to empirically test this relationship between profitability and stability. This requires that we first make explicit the dynamic model which is at the basis of our analysis (section 2), and then demonstrate the factual relevance of the relationship between the profit rate and the parameters of the model which condition stability (section 3). Conversely, the theoretical investigation of the mechanisms responsible for this relationship will remain beyond the limits of the present investigation.

2 - A MODEL FOR THE ANALYSIS OF STABILITY

The purpose of this section is to present a simple form of our model (2.1) and its estimation (2.2) for total U.S. Manufacturing since 1953. We temporarily abstract from the impact of profitability which is considered in the next section (3).

In order to study the stability of an equilibrium, it is necessary to construct a dynamic model, in which disequilibrium is permitted. The model used here is a *general disequilibrium* model with money, in which the utilization of productive capacity can differ from normal, and supply is not necessarily equal to demand (consequently stocks of involuntary inventories may prevail or rationing may occur). There is a reciprocal dependence between demand and supply, and between real and financial phenomena.

We model the microeconomic behaviors of agents reacting to the observation of disequilibrium (such as inventories for enterprises or inflation for monetary authorities). The general principle of these disequilibrium microeconomics can be symbolically represented as follows:

$$\cdots \longrightarrow \begin{array}{c}\textit{Evidence}\\ \textit{of disequilibrium}\end{array} \longrightarrow \begin{array}{c}\textit{Modification}\\ \textit{of behavior}\end{array} \longrightarrow \cdots$$

In comparison to several of our previous studies (for example, DUMÉNIL G., LÉVY D. 1990 and 1991(c)), this model is specific in a number of respects. In particular: (1) A single commodity is considered and, consequently, "proportions", or intersectoral issues, cannot be studied, and (2) it is a short-term model, since the capital stock is given.

The model is simple in many respects, in particular its treatment of prices and money (and credit). The specific form utilized here allows for the elimination of these monetary variables, and focuses on the two crucial variables in the description of the dynamics of the general level of activity, the degree of utilization of capacities and the level of inventories — but, of course, the structure of the model remains determined by its monetary character. (For example, the condition for stability relies on the functioning of the banking system.)

As is traditional in the literature, we make the simplifying assumption that the periods of production and decision are equal. In a model in which the period of decision is shorter than the production period, it is possible to discuss the effects of an increasing frequency of decisions on stability (*cf.* DUMÉNIL G., LÉVY D. 1991(d)).

2.1 THE MODEL

Section 2.1.1 introduces the structural form of the model (decision to produce and to fix prices, formation of demand, and issuance of money), and section 2.1.2 manipulates the original equations (to obtain two "reduced forms") in order to allow for the treatment of stability and the estimation of the model in section 2.2. Section 2.1.3 makes explicit the relationship between the thesis on the "stability frontier", sketched in the introduction, and the formalism of the model. The stability condition is presented in section 2.1.4.

In this first investigation, we use linear forms of behavioral equations. A nonlinear form will be introduced in section 3.4.

2.1.1 Structural Form

The notation is as follows:

Y	*Output*
S	*Inventories of finished goods*
$\overline{Y}$	*Target output*
$\overline{S}$	*Target inventories*
P	*Price*
j	*Rate of variation of the general price level*
M	*Stock of money*
D	*Demand*
Δ	*Difference operator:* $\Delta x_t = x_t - x_{t-1}$

The decision to produce by enterprises is a first example of the modeling of reactions by agents to the observation of disequilibrium. Because of constant fluctuations in demand, enterprises modify their output in relation to a target level of output (*i.e.*, of utilization of their capacity) and target inventories (in relation to the usual level of sales). They attempt to restore their target level of utilization, but this movement is conditioned by the signals emanating from the level of inventories. Large inventories induce a reduction of output and conversely for depleted inventories. The disequilibrium in output is measured by $Y_{t-1} - \overline{Y}$, and the disequilibrium in inventories by $S_t - \overline{S}$. The equation used is the following:

$$\begin{aligned} Y_t &= \overline{Y} + \sigma(Y_{t-1} - \overline{Y}) - \varepsilon(S_t - \overline{S}) \qquad (1) \\ \text{or} \quad \Delta Y_t &= -(1-\sigma)(Y_{t-1} - \overline{Y}) - \varepsilon(S_t - \overline{S}) \end{aligned}$$

The degree of reaction is measured by reaction coefficients σ and ε. A value of σ close to 1 means that enterprises only slowly change their output, and a large ε indicates that they are very sensitive to large or small inventories.

In a similar manner, prices are progressively changed after observation of the disequilibria in the level of activity as well as between supply and demand, revealed through the level of inventories:

$$P_t = P_{t-1}(1 + \alpha(Y_t - \overline{Y}) - \beta(S_{t-1} - \overline{S}))$$

With this model, the rate of variation of prices is $j_t = \alpha(Y_t - \overline{Y}) - \beta(S_{t-1} - \overline{S})$.

Demand is a function of both output and of the stock of available purchasing power, M_t, in the economy denoted here as "money", but which also includes credits:

$$D_t = a + bY_t + c\frac{M_t}{P_t} \qquad (2)$$

The issuance of money responds to the level of production and to the rate of inflation:

$$\frac{M_t - M_{t-1}}{M_{t-1}} = d(Y_t - \overline{Y}) - ej_t \qquad (3)$$

The first term represents the sensitivity of the banking system to the strong demand for funds emanating from firms or households during periods of high activity, and the reverse for periods of contraction. It also mirrors the propensity of enterprises to use commercial credit. This behavior is *destabilizing* as expressed by the chain: *Large output* $\rightarrow$*Stimulation of the issuance of money* $\rightarrow$*Stimulation of demand* $\rightarrow$*Larger output.* The second term expresses the sensitivity of monetary authorities to the rate of variation of prices (with $e > 0$). This behavior is *stabilizing* as in the chain: *Inflation* $\rightarrow$*Reduction of the issuance of money* $\rightarrow$*Reduction of output* $\rightarrow$*Diminished inflation.* Stabilizing policies could also be incorporated in the model, as a positive influence of low levels of activity on credit and money, *i.e.*, a diminished coefficient d. For this reason, it is not structural in the model that parameter d is positive.

Added to these behavioral equations, is an accounting relationship between the variation of inventories, output, and demand:

$$\Delta S_t = Y_t - D_t$$

D_t denotes total demand expressed during period t. S_{t-1} and S_t denote inventories at the beginning and the end of the period, respectively.

It is easy to check that there is an equilibrium in this model for $Y^* = \overline{Y}$, $S^* = \overline{S}$, $D^* = \overline{Y}$, $j^* = 0$, and $\left(\frac{M}{P}\right)^* = \frac{(1-b)\overline{Y} - a}{c}$.

2.1.2 Reduced Forms

One can eliminate P, j, and D and, thereby, reduce the number of variables to three: Y, S, and M/P. The equation for M/P is not linear and is linearized around equilibrium.

For brevity, we introduce the auxiliary notation:

$Y - \overline{Y} = u$	*Disequilibrium of Output*
$S - \overline{S} = s$	*Disequilibrium of Inventories*
$\frac{M}{P} - \left(\frac{M}{P}\right)^* = m$	*Disequilibrium of the Money Stock*

With this notation a first "reduced form" of the model can be written as:

$$\begin{aligned} \Delta u_t &= -(1-\sigma)u_{t-1} - \varepsilon s_t \\ \Delta s_t &= (1-b)u_t - cm_t \\ \Delta m_t &= (d - \alpha(e+1))\left(\frac{M}{P}\right)^* u_t + \beta(e+1)\left(\frac{M}{P}\right)^* s_{t-1} \end{aligned} \tag{4}$$

In order to avoid the difficulties associated with the choice of the appropriate monetary aggregate, equations 5 and 6 eliminate money from the above system:

$$\Delta u_t = -(1-\sigma)u_{t-1} - \varepsilon s_t \tag{5}$$

$$\Delta^2 s_t = A\Delta u_t + Bu_t + Cs_{t-1} \tag{6}$$

$$\textit{with} \quad A = 1-b, \quad B = -c(d-\alpha(e+1))\left(\frac{M}{p}\right)^{*}, \qquad \textit{and} \quad C = -c\beta(e+1)\left(\frac{M}{p}\right)^{*}$$

Note that the signs of $1-b$ and $d-\alpha(e+1)$ are not obvious and, consequently, the same is also true for parameters A and B.

2.1.3 The Stability Frontier

The instability of the general level of activity is a striking feature of capitalist economies. Recession is always around the corner, in spite of the progress of economic policy. This is obvious in the observation of the profile of the capacity utilization rate which is sometimes smooth and sometimes subject to swift variations (in particular, downward).

In the introduction, we alluded to the reasons that may explain this property. There is a destabilizing component in the evolution of the behavior of enterprises (concerning prices, output, and demand for loans), and the transformation of the mechanisms of social control responsible for stability follows in response to this growing instability. However, the implementation of required institutional transformations may take some time. During such transitions, instability continues to persist in the economy. We denote this analysis as the "tendential instability thesis".

This analysis has an important implication from the point of view of the model. It means that *the stability condition is violated on and off, i.e., that the economy remains in the vicinity of its stability condition.* For example, if the relation of recursion defined by the model were as simple as $x_t = \lambda x_{t-1}$, the equilibrium would be $x^* = 0$, and the stability condition $|\lambda| < 1$. The observation that the economy is constantly switching from stability to instability corresponds to the fact that λ is oscillating around 1.

2.1.4 Stability

A first manner of discussing the stability of the model is to eliminate s from equations 5 and 6, and express u as a function of its own lagged values:

$$u_t = Du_{t-1} + Eu_{t-2} + Fu_{t-3} \tag{7}$$

in which D, E, and F are functions of σ, ε, A, B, and C. Stability is obtained if the three roots of polynomial $P(\lambda) = \lambda^3 - D\lambda^2 - E\lambda - F$ have a modulus smaller than 1 (the equivalent of $|\lambda| < 1$ in the example in the previous section).

The thesis concerning the instability in dimension of capitalist economies and the "stability frontier" is recovered in the model by the fact that the dominant root is real and close to 1. Under such circumstances (*i.e.*, if $1 - D - E - F$ is close to zero), it is possible to provide an approximation of this root:

$$\lambda = 1 - \frac{1 - D - E - F}{3 - 2D - E} \tag{8}$$

A second approach to the stability condition determines the Jacobian matrix of the recursion and studies its eigenvalues. If the eigenvalues have a modulus smaller than 1, the recursion is stable. These eigenvalues are the roots of the polynomial characteristic (for equations 4):

$$P'(\lambda) = \begin{vmatrix} \lambda - \sigma & \varepsilon\lambda & 0 \\ -A\lambda & \lambda - 1 & c\lambda \\ B\lambda/c & C/c & \lambda - 1 \end{vmatrix}$$

Polynomials P and P' are identical and the stability condition is the same as above.

What is interesting about this second method is that the eigenvector, V, associated with the eigenvalue with the largest modulus (dominant eigenvalue) has an economic interpretation. It describes the dominant components of the dynamics around equilibrium. Thus, disequilibrium is no longer synonymous with total *disorder*, and some of its main features can be analyzed.

The two components of V corresponding to u and s are $-\varepsilon\lambda$ and $\lambda-\sigma$. Therefore, outside of equilibrium, the two variables are linked through the following relationship:

$$(\lambda - \sigma)u + \lambda\varepsilon s = 0 \tag{9}$$

This equation defines a covariation between the two disequilibria, on capacity utilization and inventories.

Under the same assumption as above, that λ is real and close to 1, λ can be expressed as:

$$\lambda = 1 - \frac{1 - \sigma - \varepsilon\dfrac{B}{C}}{1 - (1-\sigma)\left(2 + \dfrac{A}{C}\right)} \tag{10}$$

We will show empirically below that the denominator in this expression is positive. Therefore, the condition $\lambda < 1$ holds when the numerator is positive, *i.e.*, whenever:

$$\theta < 1 \quad \textit{with} \quad \theta = \sigma + \varepsilon\frac{d - \alpha e - \alpha}{\beta e + \beta}$$

It is possible to provide an economic interpretation for this condition for the stability in dimension:

1. The stability condition is a function of the behavior of enterprises (ε, σ, α, and β) and of the financial system (d and e), but not of the parameters (a, b, and c) in the demand function. This property illustrates the importance of supply mechanisms in this analysis.

2. Stickiness in the capacity utilization rate (σ close to 1) and a strong sensitivity to stockpiling (ajustment by quantities) in the decision to produce (a large ε) are destabilizing.

3. A strong response of money and credit to disequilibria in capacity utilization rates (a large d) is destabilizing, but it can be countered by a strong reaction from monetary authorities (large αe and βe). (Coefficients α and β alone account

for a real balance effects which we consider as secondary in comparison to the other terms.)

The notion of a "stability frontier" refers to the fact that the rise of ε or d poses an increasing challenge to the institutions in charge of the central control of stability, which must progressively improve their capability to adjust to disequilibrium, raising coefficient e, or counteracting the rise of d. Finally, θ constantly oscillates around 1.

2.2 ESTIMATION OF THE MODEL

In this section, we introduce the data used (2.2.1) and estimate the model presented above (2.2.2). We then provide two estimates of the dominant eigenvalue which conditions stability (2.2.3), and the associated eigenvector (2.2.4).

2.2.1 The Data

The two variables of the model, u and s, the disequilibria in the utilization of productive capacities and in the holding of inventories of finished goods, must be constructed. The unit of analysis is Manufacturing industries, and we consider monthly data. We begin the series in 1953 because of the abnormal fluctuations of inventories in the aftermath of World War II.

Starting with the index of industrial production, Y_t, and the amount of inventories of finished goods in constant dollars, S_t, it is evident that the target values of these variables, $\overline{Y}$ and $\overline{S}$, cannot be treated as constant over a period of forty years, because of the effects of growth and structural transformations of management. They drift over time, but at a slow rate in comparison to the short-term dynamics of the variables considered here. In order to separate these two effects (drifting targets and short-term fluctuations), we use the Hodrick-Prescott filter (HODRICK R.J., PRESCOTT E.C. 1980) with a ponderation of 15000.[4] We define u and s as $u_t = ln\,Y_t - ln\,\overline{Y}_t$ and $s_t = ln\,S_t - ln\,\overline{S}_t$.

This procedure is illustrated in figures 3 and 4. These two figures plot $ln\,Y$ and $ln\,S$ for the 1970s, with the two trend lines representing $ln\,\overline{Y}$ and $ln\,\overline{S}$. u and s correspond to the fluctuations, *i.e.*, the differences between the two lines. Parenthetically, notice on these figures the profiles of the three recessions in 1970, 1974, and 1980, and their opposite effects on the two fluctuations, u and s, to which we will return later (2.2.4).

This procedure has two advantages. First, u and s are approached in the exact same manner. Second, no third variable is necessary, such as sales in the assessment of the level of inventories. Therefore, we can be sure that the movement in one variable

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[4] *A standard value of this parameter is 1600 for quarterly data. This is equivalent to* $(3)^2 \times 1600$ *for monthly data, i.e., approximately 15000.*

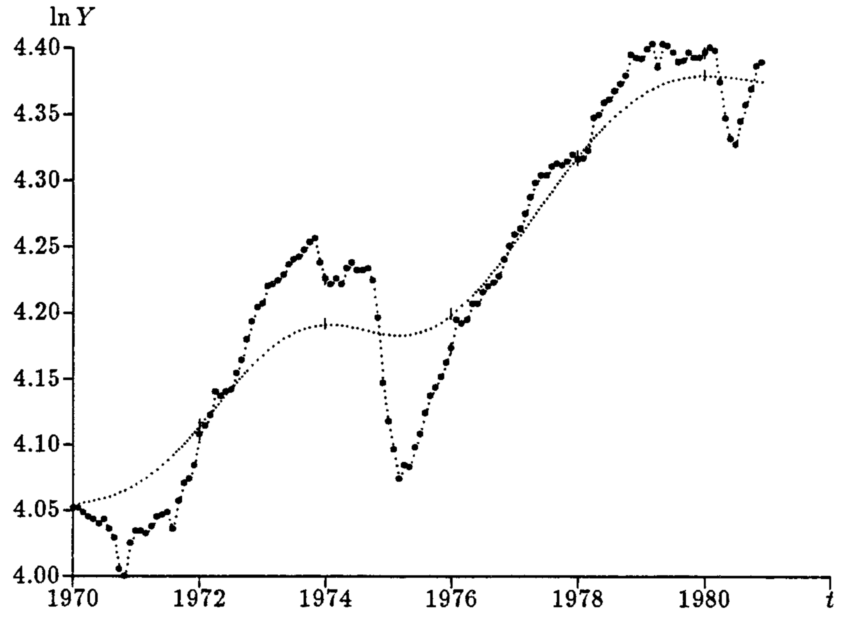


Figure 3 - Output (•) and its Trend (·)
The Example of the 1970s

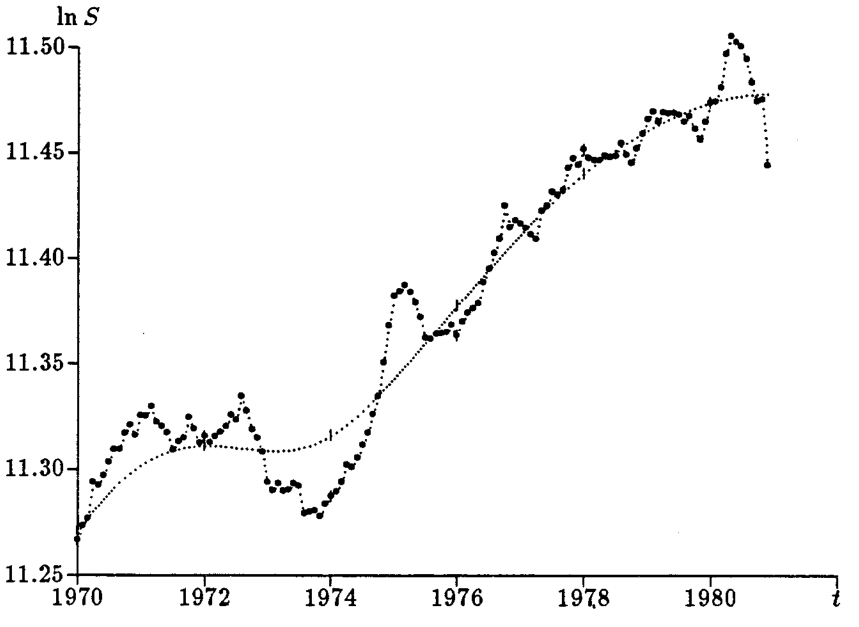


Figure 4 - Inventories of Finished Goods (•) and their Trend (·)
The Example of the 1970s

is not the image of the evolution of another used in the construction of the series. (In the appendix we test for the use of other definitions of these variables: the capacity utilization rate and the ratio of inventories to productive capacity.)

The decision to produce as in equation 1 implies that the model refers to industries in which stockpiling is possible, *i.e.*, where goods are produced, and in which a true *supply behavior* in the short run is possible (and not the mere response to demand). This is the case in sectors such as Industry and Trade. A problem with limiting the study to Manufacturing is that demand originates from the total economy (and foreign markets). Therefore, in equation 2, Y_t should refer to the output for the total economy. There is, however, little difference in the business fluctuations in Manufacturing industries and the total economy. If the filter applied above to Manufacturing industries is also used for total GNP, the correlation coefficient between the two fluctuations is 0.96.[5]

2.2.2 Estimation

We estimate the model as defined by equations 5 and 6, with the method SUR (Seemingly Unrelated Regressions or Generalized Least Square) of the SYSLIN procedure in SAS, and obtain:

$$\begin{aligned}
\Delta u_t &= -\underset{(t=6.0)}{0.0913}\, u_{t-1} - \underset{(t=8.4)}{0.244}\, s_t \\
\Delta^2 s_t &= -\underset{(t=2.7)}{0.0934}\, \Delta u_t - \underset{(t=2.2)}{0.0281}\, u_t - \underset{(t=7.2)}{0.171}\, s_{t-1}
\end{aligned} \qquad \overline{R}^2 = 0.13$$

($\overline{R}^2$ is the system weighted R^2. This $\overline{R}^2$ is small since the endogenous variables in the regression are differences.)

The two signs in the decision to produce (first equation above) correspond to the assumptions made in the construction of the model. Concerning the second equation, the sign before s_{t-1} is also consistent with that introduced in the theoretical presentation of the model for the issuance of money (equation 3). The sign of the coefficient of u_t is negative (*i.e.*, $d > \alpha(e+1)$), and this shows that the destabilizing component for the issuance of money is dominant and strong. The sign of the coefficient of Δu_t is negative, and this is equivalent to the fact that b must be larger than 1 in the demand function (equation 2), *i.e.*, the propensity to spend (consumption and investment) in relation to the product of the period is larger than one (probably as a result of the strongly procyclical character of investment and demand for intermediary goods).

2.2.3 Stability

We now provide an estimate of the dominant eigenvalue (with the two methods

---

[5] *The two series are the logarithms of GNP for Manufacturing industries and for total economy in 1982 dollars. For these two annual series, we use a parameter equal to 100, i.e., the equivalent of 1600 utilized for quarterly data.*

introduced in section 2.1.4 to show that they provide coherent estimates of λ).

We first compute λ from equation 10, using the estimates of the parameters presented in section 2.2.2, and obtain: $\lambda = 0.93$. It is also possible to estimate equation 7:

$$u_t = \underset{(t=26.0)}{1.23}\ u_{t-1} - \underset{(t=2.1)}{0.154}\ u_{t-2} - \underset{(t=3.5)}{0.164}\ u_{t-3} \qquad R^2 = 0.91$$

and determine λ with equation 8: $\lambda = 0.87$.

Considering the imprecision of the measures (the confidence intervals), the approximations made for the computation of λ, and the simple features of the model, these two estimates are quite consistent. In both cases, the result justifies the approximations above.

Concerning the thesis that the dominant eigenvalue is close to 1, and the economy switching above and below this value, a more precise measure will be given in section 3.4, including an evaluation by subperiods.

2.2.4 The Dominant Eigenvector

As stated in section 2.1.4, an important prediction of our model is that there is a covariation between the degree of the utilization of capacity and the level of inventories (equation 9). Since $\lambda = 0.93$ and $\sigma = 0.91$, λ is larger than σ, and this covariation appears as a *trade-off* between u and s. This trade-off corresponds to the eigenvector associated with the dominant eigenvalue and describes the behavior of the two variables u and s out of equilibrium. It is easy to verify this thesis empirically, by measuring the correlation between u and s. In this relation, s is a leading variable, and the correlation is improved if this variable is lagged.[6] Over the entire period the correlation coefficient is equal to -0.55, with a lag of 5 months on s, *i.e.*, is strong and negative as predicted.

It was already clear in figures **3** and **4** that the fluctuations of the two variables around their trend counter each other. The scatter diagram corresponding to this period is presented in figure **5**. The correlation coefficient is equal to -0.74 with a lag of 1 month on s. One of the reasons why the correlation is larger than for the entire period is that the values of the parameters of the model, and therefore the slope of the trade-off, varied over time (*cf.* section 3).

One should notice that the reference to the existence of a negative correlation between output and inventories of finished goods in the modern economic literature is rare. It is not mentioned, for example, in Victor Zarnowitz's authoritative study of the business cycle (ZARNOWITZ V. 1985). The work of Moses Abramovitz, however, is an exception to this observation (*cf.* ABRAMOVITZ M. 1948 and 1950). More attention has been devoted to total inventories, which move procyclically, than to inventories

[6] *This lag is related to the effect of the other eigenvalues which are complex conjugate.*

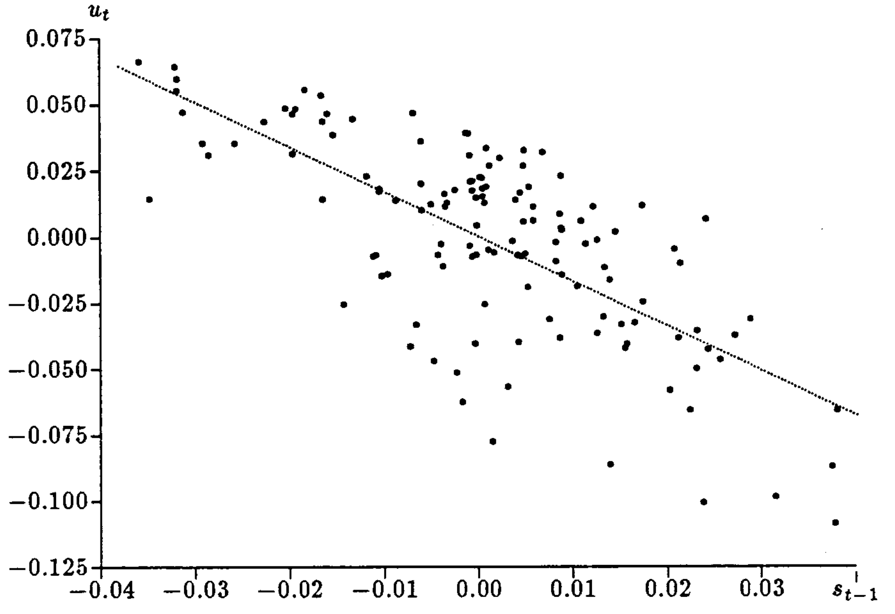


**Figure 5 - The Trade-off between the Fluctuations of Output and Inventories
The Example of the 1970s**

Inventories are leading by one month. The variables used in the scatter are u_t and s_{t-1}.

of finished goods, which move countercyclically. Economists in the 19th century had already observed that inventories of finished goods increase when output begins to decline in a recession, and it is for this reason that crises used to be called crises of "overproduction".

3 - THE IMPACT OF PROFITABILITY

The purpose of this section is to provide an empirical test of the thesis that profitability affects stability *via* the adjustment of output to the disequilibria between supply and demand. In this investigation, we will test the profit rate against the rate of interest, as an explanatory variable.

We first present the rate of profit and interest rate used in this analysis (3.1). We then test for the hypothesis that the profit rate is a determinant of stability (3.2) using equation 7 in which we introduce the profit rate. The purpose of the following section

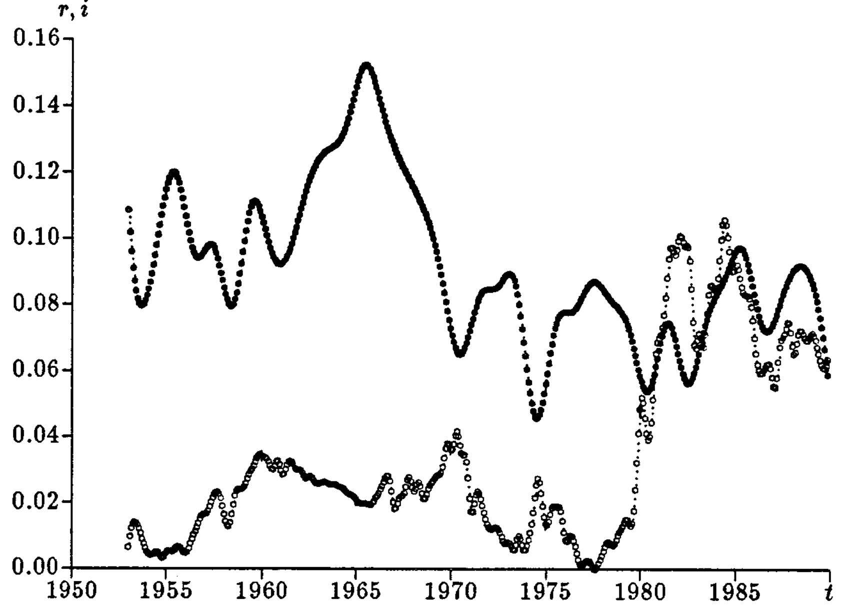


Figure 6 - Profit Rate (•) and Real Interest Rate (∘) (1953-1989)

(3.3) is to determine the parameters in the model on which the profit rate specifically impacts and, in particular, to test for the thesis that profitability conditions the degree to which firms adjust output. The issue in section 3.4 is to provide a precise estimate of the distance from the stability frontier and its variation with time.

3.1 THE DATA

In order to compute a profit rate after all taxes (Indirect Business Taxes and Profits Taxes), it is necessary to restrict the unit of analysis to *Corporate Manufacturing.* (Nearly all of the Manufacturing firms are corporations.)

We define *profits* as corporate profits after all taxes, with inventory valuation adjustment and capital consumption allowance adjustment. Capital is the sum of the stock of fixed capital net of depreciation and inventories. Other definitions can also be used (profits before taxes, gross of interests paid or depreciation, net of dividends, etc.). Results are presented in the appendix for such definitions.

Several definitions of the rate of interest are available, for example: Discount Rates on New Issues of Three Month Treasury Bills, Yield on New Issues of High-Grade Corporate Bonds, Average Prime Rate Charged by Banks. The most significant results in the regressions are obtained when Yield on New Issues of High-Grade Corporate Bonds is used. It is this rate which is employed in the basic estimations below. We determine real interest rates using the GNP deflator.

The data are annual for the profit rate and quarterly for interest rates. We use the SAS procedure EXPAND to generate monthly series.

The two rates are displayed in figure **6**. It is easy to recognize in this figure the characteristic profile of the after-tax profit rate, with the 1960s bulge and the fall at the end of the decade, as well as the surge in the real interest rate after 1979.

Note that, in order to allow the comparison between the results of the regressions, we subtract from these variables their average value over the period.

3.2 DOES THE PROFIT RATE IMPACT ON STABILITY?

A straightforward manner of testing for the impact of the profit rate, r, on stability is to estimate equation 7 with a dependence on r for parameters D, E and F: $D = D_0 + D_1 r_t$, and the like for E and F. If D, E, and F are functions of r, the same is also true of the dominant eigenvalue (*cf.* equation 8) which conditions the stability of the economy. From the point of view of econometrics, this is equivalent to the introduction of interaction terms such as $r_t u_{t-1}$, $r_t u_{t-2}$, etc., in addition to the original variables u_{t-1}, u_{t-2}, etc. The same methodology can be used for the rate of interest i, with $i_t u_{t-1}$, $i_t u_{t-2}$, etc. It is also possible to include the two types of terms in order to test for the combined effects of r and i. Below, we present the most significant combinations (*i.e.*, those which yield the most significant Student t on the interaction terms).

- Assuming that the parameters only depend on r:

$$u_t = \underset{(t=25.5)}{1.21}\ u_{t-1} - \underset{(t=2.6)}{5.35}\ r_t u_{t-1} - \underset{(t=2.1)}{0.154}\ u_{t-2} + \underset{(t=2.0)}{4.24}\ r_t u_{t-2} - \underset{(t=3.3)}{0.154}\ u_{t-3} \qquad R^2 = 0.91 \tag{11}$$

- Assuming that the parameters only depend on i:

$$u_t = \underset{(t=25.1)}{1.21}\ u_{t-1} - \underset{(t=1.3)}{2.61}\ i_t u_{t-1} - \underset{(t=1.9)}{0.146}\ u_{t-2} + \underset{(t=1.1)}{2.18}\ i_t u_{t-2} - \underset{(t=3.4)}{0.161}\ u_{t-3} \qquad R^2 = 0.91 \tag{12}$$

- Assuming that the parameters depend on r and i:

$$u_t = \underset{(t=24.3)}{1.18}\ u_{t-1} - \underset{(t=3.0)}{6.17}\ r_t u_{t-1} - \underset{(t=1.9)}{3.81}\ i_t u_{t-1} - \underset{(t=1.9)}{0.144}\ u_{t-2} + \underset{(t=2.3)}{4.90}\ r_t u_{t-2} + \underset{(t=1.6)}{3.17}\ i_t u_{t-2} - \underset{(t=3.1)}{0.147}\ u_{t-3} \qquad R^2 = 0.91 \tag{13}$$

It is clear from these results that r *is truly a significant determinant of stability*, in contrast to i, which is never significant when considered alone. The combination of the two variables improves the significance levels for both variables, and the rate of interest becomes nearly significant.

Stability is basically determined in equation 8 by the value of $1 - D - E - F$. If this expression is larger, then the dominant eigenvalue diminishes and stability is improved. Parameters D and E are functions of r, and the same is true for $1-D-E-F$. In this expression, utilizing equation 13, the coefficient of r is $6.17 - 4.90 = 1.27$, *i.e.*, larger than 0. Consequently, a large r improves stability and conversely for low levels of profitability. In a similar manner, the coefficient of i in $1 - D - E - F$ is $3.81 - 3.17 = 0.64$, *i.e.*, also larger than 0. This shows that a large rate of interest must be associated with improved stability.

The main conclusions can be summarized as follows:

1. *The results for r fully confirm our basic hypothesis that profitability impacts on stability, larger profit rates being associated with an improved stability and the converse.*

2. The results for i are not significant. The sign obtained could, however, be interpreted in relation to the dramatic rise of the real interest rate. This rise is the major phenomenon during the period, and must be seen as a proxy for the transformation of monetary policy. A tighter control of money and credit, which had stabilizing effects, was associated with larger interest rates. (See the discussion below in section 3.4.5.)

3. The simultaneous incorporation of r and i improves the significance levels for the two variables in the regressions, but i is still not significant.

3.3 HOW DOES THE PROFIT RATE IMPACT ON STABILITY?

The previous section showed that the profit rate is a significant determinant of stability, but nothing has been said concerning the mechanisms involved: supply (equation 5) or demand (equation 6) mechanism?

It is important to locate among the five parameters of equations 5 and 6 the source of the dependence on r (and i). The methodology will be the same as in the previous section. For example, in order to test for the dependence on r of parameter A, we introduce in equation 6 a new variable $r_t \Delta u_t$, leave equation 5 unchanged, and estimate equations 5 and 6. The Student t for this interaction term is equal to 1.0, as can be seen at the beginning of the first line of table 2.

Table 2 - Student t of the Interaction Terms					
	A	B	C	$-(1-\sigma)$	ε
r	1.0	0.7	0.6	1.5	2.9
i	0.2	0.4	0.1	0.3	0.7

For a test of the five parameters, with a separate treatment of r and i, 10 separate estimations of the system formed by equations 5 and 6 must be made. The results of this investigation are presented in table 2. The only significant term corresponds to the dependence of coefficient ε on r in the decision to produce. Coefficient σ, also in the decision to produce, is second, but not really significant. No interaction term with i is significant. Therefore, the best estimation is the following:

$$
\begin{aligned}
\Delta u_t &= -\underset{(t=6.3)}{0.0950}\; u_{t-1} - \underset{(t=8.1)}{0.234}\; s_t + \underset{(t=2.9)}{3.68}\; r_t s_t \\
\Delta^2 s_t &= -\underset{(t=2.6)}{0.0875}\; \Delta u_t - \underset{(t=2.2)}{0.0274}\; u_t - \underset{(t=7.1)}{0.170}\; s_{t-1}
\end{aligned}
\qquad \overline{R}^2 = 0.14 \qquad (14)
$$

The main results are as follows:

1. *The primary impact of the profit rate on stability is clearly located in the decision to produce (the supply side), mostly in its effects on parameter ε which measures the sensitivity of firms to the level of their inventories—and not in the demand equation.* Larger profit rates diminish ε ($\varepsilon = 0.234 - 3.68r$) and improve stability.
2. The exact mechanism accounting for the effect of the interest rate is difficult to pinpoint.

3.4 HOW FAR FROM THE STABILITY FRONTIER?

The purpose of this section is to discuss to what extent the effects of profitability (and interest rate) on behaviors really affect the stability condition. Thus, we will attempt to provide a more precise quantitative answer to the question of the effects of the profit rate on the dominant eigenvalue.

As a preface to this investigation, it will be necessary to slightly develop the model in section 3.4.1, by considering the nonlinear character of reactions to disequilibrium. Section 3.4.2 will test for the relevant nonlinearities and present the estimation of the model. The economic interpretation of these nonlinearities is discussed in section 3.4.3. Then, section 3.4.4 is devoted to the impact of the profit rate (and interest rate). Last, in section 3.4.5, we give a measure of instability, as it results from the variations of the rate of profit (and rate of interest).

3.4.1 The Role of Nonlinearities

In a *linear* model, if the stability condition is violated, the variables may be drawn away from equilibrium or begin to oscillate with increasing amplitude, *i.e.*, "explode". This is, for example, the case for the recursion $x_t = \lambda x_{t-1}$, whenever $|\lambda|$ is larger than 1. This outcome cannot be considered to be a realistic description of economic fluctuations. For the period following World War II, for example, the capacity utilization rate in Manufacturing industries fluctuated between 70 and 92 percent.

This limitation in the amplitude of variation of the variables must be related to the nonlinear character of behaviors. For example, in the decision to produce, as in equation 1, we assumed a correction proportional to the deviation of inventories independently of the value of the capacity utilization rate. It is clear, however, that when the firm is moving toward the full utilization of its productive capacity the same signal given by depleted inventories will provoke a smaller reaction.

The existence of nonlinear reactions can be inferred from the casual inspection of figure 5. The slope, $-\varepsilon/(1-\sigma)$, of the trade-off would be different if estimated separately for positive and negative values of u (smaller for $u > 0$), and this observation shows that either ε or σ, or both parameters, may differ depending on the value of u.

3.4.2 Identification

In order to determine the relevant nonlinearities, we introduce successively in the regressions a quadratic term, such as $(u_{t-1})^2$, $u_{t-1}s_t$, or $(s_t)^2$ in equation 5, and conserve the term that has the best Student t. Since nonlinearities may often be related to limitations, such as the full utilization of capacities, we also test for asymmetrical reactions (linear in one direction, *i.e.*, with a constant reaction coefficient, and quadratic, *i.e.*, with a linear reaction coefficient, in the other).

Beginning with symmetrical reactions, the results are the following. For equation 5, the most significant results, in comparison to the two other possible nonlinear terms, are obtained for $u_{t-1}s_t$. For equation 6, the best results (among six) are for $u_t s_{t-1}$.

These results can be improved with asymmetrical reactions, *i.e.*, using X_t and Z_t in equations 5 and 6, with:

$$\begin{array}{llllll} X_t = u_{t-1}s_t & \textit{if} \;\; u_{t-1} \geq 0 & \textit{and} & X_t = 0 & \text{if} & u_{t-1} < 0 \\ Z_t = u_t s_{t-1} & \textit{if} \;\; s_{t-1} \geq 0 & \textit{and} & Z_t = 0 & \text{if} & s_{t-1} < 0 \end{array}$$

With this representation of behavior, the estimation yields:

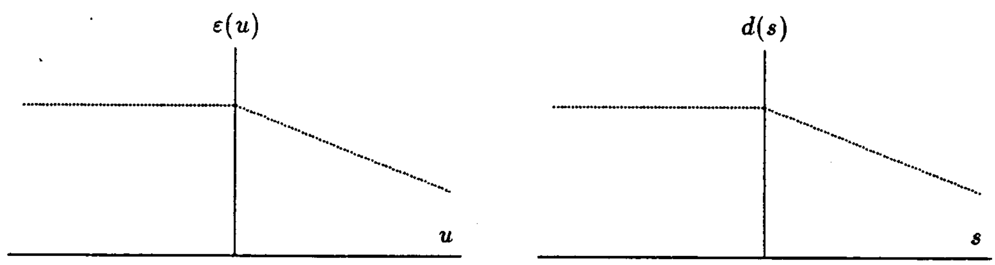
$$\begin{array}{l} \Delta u_t = -\underset{(t=5.7)}{0.0865}\, u_{t-1} - \underset{(t=9.0)}{0.338}\, s_t + \underset{(t=3.8)}{5.48}\, X_t \\ \Delta^2 s_t = -\underset{(t=3.2)}{0.1104}\, \Delta u_t - \underset{(t=3.3)}{0.0512}\, u_t - \underset{(t=7.3)}{0.174}\, s_{t-1} + \underset{(t=2.3)}{2.03}\, Z_t \end{array} \qquad \overline{R}^2 = 0.15 \qquad (15)$$

3.4.3 Interpretation

The nonlinearities identified in the previous section can be interpreted economically: X_t models the dependence of ε on u and Z_t, the dependence of d on s (*cf.* equation 3).

As shown in figure (a) below, the reaction of firms to the level of inventories, measured by coefficient ε, is constant for low levels of utilization, but for a large utilization of capacities, ε diminishes progressively as the firm moves toward full utilization. One can hypothesize that under such circumstances, the adjustment of prices will be stronger.

Z_t can be interpreted in relation to the dependence of coefficient d in the issuance of money on the capacity utilization rate, measured by coefficient d. This coefficient is a function of s, as shown in figure (b) below. Following the mechanism in equation 3, if the capacity utilization rate is low, money is destroyed, *i.e.*, the outstanding stock of loans diminishes, since firms are less eager to borrow. The dependence of d on s expresses the fact that this destruction will be less severe if inventories are large. If the capacity utilization rate is large, money is issued as new loans are granted. The dependence of d on s corresponds to the fact that less money will be issued if inventories are large.



(a) (b)

These two nonlinearities have symmetrical effects when the economy is in an overheating or a recession. For high levels of activity, the first mechanism above puts a limitation to the movement upward. For low levels of activity, the second mechanism prevents further reduction of the activity.

3.4.4 The Impact of Profitability

With this model, it is possible to test for the impact of r and i. With r alone, one obtains:

$$
\begin{array}{rl}
\Delta u_t = & -\underset{(t=6.0)}{0.0902}\, u_{t-1} - \underset{(t=8.5)}{0.521}\, s_t + \underset{(t=2.5)}{3.15}\, r_t s_t + \underset{(t=3.4)}{5.00}\, X_t \\
\Delta^2 s_t = & -\underset{(t=3.1)}{0.107}\, \Delta u_t - \underset{(t=3.2)}{0.0511}\, u_t - \underset{(t=7.3)}{0.173}\, s_{t-1} + \underset{(t=2.3)}{2.06}\, Z_t
\end{array}
\qquad \overline{R}^2 = 0.16 \qquad (16)
$$

With the interest rate in the demand equation (equation 6), the best result is the following:

$$\begin{aligned}
\Delta u_t &= -\underset{(t=6.0)}{0.0902}\ u_{t-1} - \underset{(t=8.5)}{0.522}\ s_t + \underset{(t=2.5)}{3.15}\ r_t s_t + \underset{(t=3.4)}{5.01}\ X_t \\
\Delta^2 s_t &= -\underset{(t=3.1)}{0.108}\ \Delta u_t - \underset{(t=3.0)}{0.0487}\ u_t - \underset{(t=7.3)}{0.174}\ s_{t-1} + \underset{(t=0.7)}{0.344}\ i_t u_t + \underset{(t=2.4)}{2.12}\ Z_t
\end{aligned} \qquad \overline{R}^2 = 0.16 \qquad (17)$$

Thus, the significance of r is confirmed. As for i, its Student t is slightly increased in comparison to 0.4 in table 2 (second line, second column), but it is still not significant. We believe, however, that i acts here as a proxy for other monetary variables and, for this reason, we will retain it in the economic interpretation in the next section.

3.4.5 Around the Stability Frontier

Using equation 10, one can compute, λ, the dominant eigenvalue, for the entire period. Equations 15, 16, and 17, provide estimates of λ, as it varies over time with r and i. The average values of λ for the entire period and four subperiods are displayed in table 3.

Table 3 - A measure of instability: λ

	1953-1959	1960-1969	1970-1979	1980-1989	**1953-1989**
Without r and i					1.02
With r, without i	1.00	0.97	1.03	1.02	1.01
With r and i	1.01	0.97	1.04	0.98	1.00

The first result is that *the dominant eigenvalue for the entire period is very close to 1, in conformity with the view expressed earlier that the economy is moving around the stability frontier*. As a result of the consideration of nonlinearities, we now measure the dynamics in a vicinity of equilibrium, that actually matters in the stability condition, and not the average dynamics including the fluctuations at a distance from equilibrium. This explains the difference with the estimates given in section 2.2.3, where lower values of λ were found.

Concerning the subperiods, there is no surprise that the profile obtained is basically the inverted image of that of r as in figure 6, with the impress of i in the 1980s, when i is included. The 1950s appear as a period of average stability. A very significant restoration is manifested in the 1960s when the profit rate peaks at unusually high levels. Then the 1970s stand out as a period of exceptional instability (a high plateau in the value of λ) and, finally, a restoration is manifested in the 1980s, in particular if the interest rate is considered in the regression.

The replication of the (inverted) effects of the profit rate illustrates the central element in this study: *Profitability is an important determinant of stability*, and we have shown that this relationship expresses the dependence on r of the adjustment to disequilibria between supply and demand in the decision to produce.

The interpretation of the role conferred to the interest rate is more difficult and less central to the argument put forth in this study. This effect can be fundamentally attributed to the sudden rise of real interest rates in 1979. The Student t for i is reduced from 0.7 to 0.1 if the investigation is limited to the period 1953-1978 (whereas the significance of r is increased, with Student t rising from 2.5 to 2.9). In the regressions, i must be seen *as a proxy for the transformation of monetary policy.*

In our opinion, the relationship between high interest rates and stability is twofold: (1) a negative impact on stability *via* the profit rate, which we consider since the profit rate in the regressions is net of interest, (2) a positive correlation corresponding to the improvement in monetary policy which had a stabilizing effect —and this is what we try to identify in the regressions with the variable i.

Events following the 1950s can be seen as an illustration of our general thesis that we denote as the "tendential instability thesis": A fall in the profit rate provokes a modification of the behavior of enterprises, which build more instability into the economic system, and the transformation of the institutions in charge of the social management of stability occurs as a response to this new instability, but with a lag of several years. Thus, stability is periodically destroyed and restored, with sometimes phases of enduring instability.

This chain of events was observed after World War II, probably a first time in the late 1950s, but dramatically at the end of the 1960s, when the profit rate fell from its peak in 1965. A new instability (in comparison to the 1960s) was observed with two dramatic recessions in 1970 and 1974, and two periods of overheating in 1972 and 1979. In spite of the recent recession (1990-1991), the sharp transformation of policy in 1979, in relation to the acceleration of inflation, ushered in a new phase of improved stability, but the price for this recovery was considerable: the most severe downturn since the war in 1982.

This restoration of stability is the strong point of the 1980s. The weak points are well-known: a still stagnating profitability, stagnating or diminishing purchasing power of salaried workers, the chronic deficit of the budget, and the ensuing host of hardships and tensions.

APPENDIX

This appendix divides into four sections. Section A.1 is devoted to a number of variants of the basic estimation of the model. Section A.2 computes the exact values of the three eigenvalues. Section A.3 describes the sources of the series used. Last, section A.4 presents a list of the figures.

A.1 VARIANTS OF THE BASIC ESTIMATION

Two types of variants are considered, concerning the definition of r (A.1.1), and of u and s (A.1.2), respectively. Beginning with the basic estimation as in equation 14, we change only one assumption at a time, and *check Student t for the interaction term.*

A.1.1 The Definition of the Profit Rate

We first test for the importance of the definition of the profit rate:

	Definition of r:	Student t
r_1:	*After-tax corporate profits with inventory valuation adjustment and capital consumption allowance adjustment, Net capital plus inventories*	2.9
r_2:	*Profits gross of all taxes*	2.1
r_3:	*Profits without adjustments*	1.8
r_4:	*Profits net of dividends*	3.6
r_5:	*Profits gross of depreciation allowances*	3.0
r_6:	*Profits gross of interests*	3.3
r_7:	*Capital excluding inventories*	2.6
r_8:	*Capital gross of depreciation allowances*	2.6

Indeed, the results are sensitive to the definition of r. Concerning the measure of capital, the inclusion of inventories improves the significance level (r_7). As for profits, the most significant measure corresponds to the narrowest definition, in which retained earnings are considered (r_4). On the contrary, profits gross of taxes are less significant (r_2). One can also notice the role of adjustments, which improve the results (r_3). Profits gross of interests are more significant (r_6). This result is difficult to interpret, and should be related, in our opinion, to the difficulty to locate the role of the interest rate in the system.

A.1.2 The definition of u and s

We now test for the importance of the value of the parameter used in the Hodrick-Prescott filter. As shown in the following table, this choice makes a difference, but does not question the significance of the results:

Parameter:	Student t
10000	3.0
15000	2.9
20000	2.8

Since the deflator of the inventories of finished goods is not available for the entire period, we tried two proxies. The most significant result is obtained when the deflator of total inventories of Manufacturing and Trade is used:

Deflator:	Student t
Total inventories (Manufacturing and Trade)	2.9
Industrial price index (Manufacturing)	1.9

It is, of course, possible to define the capacity utilization rate by its traditional definition as the ratio *Output/Productive Capacity*. This suggests that one measures the level of inventories by the ratio *Inventories of Finished Goods/Productive Capacity*. Since productive capacity is only slowly modified, the short-term fluctuations of these two ratios are only the image of the fluctuation of their numerator. With this definition, s has a downard trend over the period considered in this study, reflecting the progress of firm management. In order to correct for this trend, we use the Hodrick-Prescott filter with the same parameter, 15000, for the two variables, and define u and s as the fluctuations of the series.

These new definitions of u and s are not very different from those used in the basic estimate. The correlation coefficient between the two series is equal to 0.999, for u, and to 0.996 for s. The results with this definition are slightly more significant than in the basic estimation:

Definition of u and s:	Student t
As in section 2.2.1	2.9
As ratios	3.0

In spite of this finding, we choose the first definition in which no third variable (such as productive capacity) is involved in addition to the two basic series, output and inventories.

A.2 THE COMPUTATION OF THE EIGENVALUES

Once the polynomial characteristic of the recursion has been determined, it is possible to numerically compute the value of the three eigenvalues, without resorting to the approximation only valid in the vicinity of the stability frontier (*cf.* equations 8 and 10 in section 2.1.4). For the model with nonlinearities, but no interaction terms in r or i (equation 15). One obtains:

$$\lambda_1 = 1.021 \quad and \quad \lambda_{2,3} = 0.918 \pm 0.321 \text{ i}$$

Two conclusions follow:

1. The approximation given in equation 10 ($\lambda = 1.016$) is satisfactory. (The error is inferior to 0.4 percent.) We thus verify that λ_1 is close to 1.

2. The two other eigenvalues, λ_2 and λ_3, are complex conjugate and have a modulus equal to 0.97, thus smaller than λ_1.

A.3 SOURCES

We will consider in turn the definitions of u and s (A.3.1), of the profit rates (A.3.2), and of the interest rates (A.3.3).

A.3.1 u and s

• U.S. Department of Commerce, Bureau of the Census:
Manufacturers' Inventories by Stages of Fabrication,
Stage III: Finished Goods: **IVM3**

• U.S. Department of Commerce, Bureau of Economic Analysis:
Inventories, Manufacturing and Trade:
Current \$ **IVMT**
\$82 **IVMT82**

• Board of Governors of the Federal Reserve System:
Industrial Production Index, Manufacturing: **IPMFG**
Capacity Utilization, Manufacturing: **IPMCA**
Capacity, Manufacturing: **IPXCAP**

• Department of Labor, Bureau of Labor Statistics:
Producer Price Index, Manufacturing: **PWM**

All of the above are monthly series, with the exception of IPXCAP, for which we use the procedure EXPAND of SAS to determine:
Capacity, Manufacturing (Monthly): **IPXMCAP**

In the basic estimation, we use:

$$Y = \text{IPMFG} \quad \textit{and} \quad S = \text{IVM3(IVMT82/IVMT)}$$

and for the variant using ratios, in section A.1.2:

$$u = \text{IPXMCA} \quad \textit{and} \quad s = \frac{\text{IVM3(IVMT82/IVMT)}}{\text{IPXMCAP}}$$

A.3.2 Profit Rates

• National Income and Product Accounts, Bureau of Economic Analysis:

5.10	*Inventories and Final Sales of Business by Industry Seasonally Adjusted, Quarterly, Total, Manufacturing*	**INV**
6.16	*Inventory Valuation Adjustment to Nonfarm Incomes by Legal Form of Organization and Industry, Corporate Manufacturing*	**IVA**
6.17	*Net Interest by Industry, Manufacturing*	**INT**
6.19	*Corporate Profits before Tax by Industry, Corporate Manufacturing*	**PBT**
6.21	*Corporate Profits after Tax by Industry, Corporate Manufacturing*	**PAT**
6.23	*Undistributed Corporate Profits by Industry, Corporate Manufacturing*	**UNP**
6.24	*Corporate Capital Consumption Allowances by Industry,*	

Corporate Manufacturing			**CCA**
• BEA Wealth Data Tape:			
Gross Capital	Corporate Manuf.	246	**KGC**
Net Capital	Corporate Manuf.	246	**KNC**
Depreciation	Corporate Manuf.	246	**DEC**
Gross Capital	GOPO,[7] Manuf.	621	**KGG**
Net Capital	GOPO, Manuf.	621	**KNG**
Depreciation	GOPO, Manuf.	621	**DEG**

All these series correspond to total capital, *i.e.*, Equipment plus Structures, in current dollars, from section 1 of the tape.

We construct:

$$\mathrm{KG} = \mathrm{KGC} + \mathrm{KGG}$$
$$\mathrm{KN} = \mathrm{KNC} + \mathrm{KNG}$$
$$\mathrm{DE} = \mathrm{DEC} + \mathrm{DEG}$$

and define:

$$\Pi_1 = \mathrm{PAT} + \underbrace{\mathrm{IVA}}_{\substack{\textit{Adjustment}\\ \textit{for inventories}}} + \underbrace{\mathrm{CCA} - \mathrm{DE}}_{\substack{\textit{Adjustment}\\ \textit{for Depreciation}}}$$

$$\Pi_2 = \mathrm{PBT} + \mathrm{IVA} + \mathrm{CCA} - \mathrm{DE} \qquad \Pi_5 = \Pi_1 + \mathrm{DE}$$
$$\Pi_3 = \mathrm{PAT} \qquad \Pi_6 = \Pi_1 + \mathrm{INT}$$
$$\Pi_4 = \mathrm{UNP} + \mathrm{IVA} + \mathrm{CCA} - \mathrm{DE}$$

$$K_1 = \mathrm{KN} + \mathrm{INV} \qquad r_i = \Pi_i/K_1 \quad \textit{for} \quad i = 1, \ldots, 6$$
$$K_2 = \mathrm{KN} \qquad r_7 = \Pi_1/K_2$$
$$K_3 = \mathrm{KG} \qquad r_8 = \Pi_1/K_3$$

All of the above series concern the Corporate Manufacturing, with the exception of inventories, INV, and interest, INT, which are only available for total Manufacturing. However, the noncorporate sector of Manufacturing is small.

The profit rate for the total corporate sector as in figure **2** is obtained from NIPA for profits, and the BEA Wealth data tape for the stock of capital, as above. Profits come from table 1.16, line 16, *Corporate profits with inventory valuation and capital consumption adjustments, Profits after taxes.* Capital is the sum of Equipment (250), Structures (251), and Residential (380), *Net capital, Corporate total, Current costs.* The rate of accumulation is the rate of growth of the same series in constant dollars.

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[7] *Government Owned Privately Operated*

A.3.3 Interest Rates

• U.S. Department of Commerce, Bureau of Economic Analysis, Business Conditions Digest.

Discount Rate on New Issues of Three-Month Treasury Bills	114	**FYGN3**
Yield on New Issues of High-Grade Corporate Bonds	116	**FYAAC**
Yield on Long-Term Treasury Bonds (Treasury)	115	**FYGL2**
Average Prime Rate Charged by Banks (FRB)	109	**FYPR**

The rates are deflated using:

• National Income and Product Accounts, U.S. Department of Commerce, Bureau of Economic Analysis.

Implicit Price Deflator of GNP **GD**

This series is available quarterly, and we use the procedure EXPAND of SAS, to obtain monthly estimates.

A.4 LIST OF FIGURES

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