

**INVESTMENT, SALES CONSTRAINTS AND
PROFITABILITY IN FRANCE 1957-1985**

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INVESTMENT, SALES CONSTRAINTS AND PROFITABILITY

IN FRANCE, 1957-1985

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ABSTRACT

This paper is devoted to the analysis of the investment behavior of the firm in the context of a quantity rationing (or disequilibrium) model with monopolistic competition on the goods market. Investment is entirely profit-driven, as in the q theory of investment. The profit variable is however decomposed into three components: the markup rate on variable costs, the capacity utilization rate and the discrepancy between the optimal and the actual capital-labor ratios. The model has the same long run implication as an accelerator model if and only if the optimal capacity utilization rate is constant in the long run.

The suggested quantity rationing model is estimated on French data, over the period 1956-1985. The emphasis is on the investment equation. The parameter estimates are shown to have remained fairly stable over time.

1. INTRODUCTION

Existing empirical macroeconomic rationing (or disequilibrium) models suggest that the employment level since 1981 has been primarily determined by the demand for goods (predominance of Keynesian unemployment)². They also suggest however that demand reflation would be unable to restore full-employment in the short run, because of a shortage of profitable production capacities (see Sneessens-Drèze (1986), Lambert-Lubrano-Sneessens (1984), Artus - Avouyi Dovi - Laroque (1985), e.g.). What would be the effects of such a policy in the longer run crucially depends on the investment behavior of the firms. The aim of this paper is precisely to analyze that behavior and to suggest an empirical investment equation compatible with the logic of a quantity rationing model with monopolistic competition on the goods market. An empirical model is developed and estimated on French aggregate data, for the period 1957-1985.

Our approach is based on Sneessens (1987). That is, we assume a framework of monopolistic competition with endogenous price setting. Goods demand rationing occurs only because there is uncertainty about the exact levels of the demand for goods and of the supply constraints. The technical coefficients associated to labor and capital are fixed in the short run and adjusted in the longer run so as to minimize production costs. Classical unemployment (resp. repressed inflation) obtains when the production capacity (resp. labor supply) constraint is binding. Keynesian unemployment obtains when the firm operates below capacity and does not use its entire labor force. Different firms can of course be in different situations, so that, at the aggregate level, all three regimes do coexist, in proportions that may vary through time.

As is customary in monopolistic competition models, we shall assume that the number of firms adjust in the long run so as to eliminate pure profits. This implies that investment is entirely

² Different sectors can of course be in different situations. This is the point emphasized by Artus - Avouyi Dovi - Laffargue (1987).

profit driven as in the q-theory of investment. The profit variable will be decomposed into three components: a markup on variable costs, a degree of capacity utilization and a measure of the discrepancy between the optimal and the actual capital-labor ratios. These three components can of course be related to the usual three determinants of investment (profitability, sales constraint, relative factor costs), although their interpretation and formulation will be seen to be somewhat different. The model has the same long run implications as the familiar accelerator model if and only if the equilibrium capacity utilization rate is a constant.

The introduction of a variable like the markup rate on variable costs (or equivalently the gross operating surplus) is usually explained by the existence of financial constraints (Coen (1971), Gardner-Sheldon (1975), Sarantis (1979), Muet (1979)) or by the uncertainty about the future demand for goods (Malinvaud (1983), Artus (1984), Lambert-Mulkey (1986)). In both cases, a once and for all change in profits has only a transitory effect on investment. The justification for the markup variable is here different. In a monopolistic competition model with quantity constraints, the markup rate is endogenous and positively related to the pressure of demand. A large markup has exactly the same meaning as a high degree of capacity utilization; it is a signal that the demand for goods is potentially abundant. The investment rate will, ceteris paribus, remain abnormally large as long as the markup rate is abnormally large.

The paper is organized as follows. We start in section 2 with a description of the working of the model when the production technology and the aggregate production capacity are taken as given. The adjustment via investment of the latter two variable to their long run equilibrium values is considered in section 3. Section 4 is devoted to the empirical results obtained when estimating the proposed quantity rationing model on French data, for the period 1957-85; the emphasis is on the empirical investment equation. The other equations are a mere update of Lambert-Lubrano-Sneesens (1984). The main conclusions are summarized in section 5.

2. THE SETTING

The setting developed here is essentially the same as the one given with more details in Sneessens (1987).

Individual Firm Behavior

There is a large number n of (ex ante) identical firms or elementary production units, indexed by i . Each firm uses two inputs, labor and capital. The firm's optimal production technology is determined by cost minimization and adjusted slowly to relative factor cost changes. This production technology is described by the output-labor and output-capital ratios, denoted by (A) and (B) respectively and identical for all the firms. These technical coefficients are considered as given in the short run.

The firm's potential or capacity output level Y_{P_i} is defined as

$$(2.1) \quad Y_{P_i} = B \cdot (KA/n) \cdot v_i$$

where KA is the aggregate capital stock and v_i is a stochastic disturbance term representing the effects of technical breakdowns, e.g. This formulation assumes that all the firms have the same size, given by $KA_i = KA/n$. The firm's potential or capacity employment level is the employment level that would be observed if the firm were working as full capacity, that is:

$$(2.2) \quad LP_i = A^{-1} \cdot Y_{P_i} \rightarrow \text{full}$$

The supply of labor to firm i , LS_i , is equal to the aggregate labour supply LS divided by the number of firms n , plus a stochastic disturbance term w_i representing the effects of strikes, absenteeism... The firm's full-employment output level Y_{S_i} is the output level that would be observed if the firm were using its entire labor force LS_i :

$$(2.3) \quad Y_{S_i} = A \cdot \underbrace{LS/n}_{\text{potential}} \cdot w_i$$

Each firm perceives a demand YD_i for its product equal to a fraction of the total aggregate demand YD ; its market share is determined by (i) the number of competing firms n ; (ii) the price P_i set by the firm relative to the aggregate price level P . (iii) a stochastic disturbance term u_i :

$$(2.4) \quad YD_i = (P_i/P)^{-\epsilon} (YD/n) u_i.$$

The amount of labor that would be needed to produce YD_i will be called the Keynesian employment level and denoted by LK_i :

$$(2.5) \quad LK_i = A^{-1} \cdot YD_i.$$

We assume that the price level has to be announced by the firm before it knows the current realizations of the disturbance terms (u_i, v_i, w_i); employment decisions are taken later. The latter assumption entails, in the absence of labor adjustment costs, that a profit maximizing firm will never hire more labor than required to produce its current output YT_i , i.e.,

$$(2.6) \quad LT_i = A^{-1} \cdot YT_i.$$

At the announced price level, the firm produces whatever is demanded, as long as it has the required production capacity and labor force to do so. In other words, the current output level is determined as the minimum of demand, capacity output and full-employment output:

$$(2.7) \quad YT_i = \min(YD_i, YP_i, YS_i)$$

The firm may end up in one of three different situations, referred to respectively as Keynesian unemployment, when the demand for goods is binding, classical unemployment when production capacities are binding, and repressed inflation when the labor supply is binding.

The price level announced by the firm is the one that maximizes its expected profits:

$$(2.8) \quad \max_{P_i} (P_i - A^{-1}W) E(YT_i) - \text{fixed costs}$$

where W stands the nominal wage rate. Given suitable assumptions on the joint distribution of the disturbance terms (see Gourieroux et al. (1984), e.g.), the expected output level can be written as a CES function of the expected values of YD_i , YP_i and YS_i :

$$(2.9) \quad E(YT_i) = \{E(YD_i)^{-\rho} + E(YP_i)^{-\rho} + E(YS_i)^{-\rho}\}^{-1/\rho} \\ \leq \text{Min} \{E(YD_i), E(YP_i), E(YS_i)\},$$

where parameter ρ is determined by the parameters of the joint distribution of the disturbance terms. The optimal pricing rule is then readily shown to be a markup on unit variable costs:

$$(2.10) \quad P_i = (1+\mu_1)A^{-1}W$$

As usual, the markup rate μ_1 is inversely related to the price elasticity of expected sales η_i :

$$(2.11) \quad \mu_1 = (\eta_i - 1)^{-1}.$$

In our case however, the price elasticity of expected sales is equal to the price elasticity of demand ϵ_{00} times the probability Π_{Ki} that the firm will face a sales constraint:

$$(2.12) \quad \eta_i = \epsilon_{00} \Pi_{Ki}$$

The markup rate will thus vary over the cycle, even though we used constant price elasticity demand functions.

With a CES function like (2.9), the probability Π_{Ki} can be shown to be equal to the ratio of the expected output level to the expected demand for goods, raised to the power ρ :

$$(2.13) \quad \Pi_{Ki} = \text{Pr}(YT_i - YD_i) \\ = \{E(YT_i)/E(YD_i)\}^\rho$$

The other regime probabilities are similarly defined, with of course $\Pi_{Ki} + \Pi_{Ci} + \Pi_{Ii} = 1$. These probabilities depend on the price level set by the firm.

Aggregate Relationships

At the time they fix prices, all the firms are in the same situation and environment. They face identical demand schedules, use the same production technology, have the same capital endowment and labor market share, are confronted with the same uncertainty. Differences appear only later on, when the disturbances have taken their (firm specific) values and the input and output decisions have to be made. At an equilibrium, each firm will thus charge the same price.

This property makes the derivation of the aggregate relationships quite easy. Provided only that the individual disturbances have a mean equal to one and that the number of firms is sufficiently large, the aggregate values of Y_T , Y_D , Y_P , Y_S are equal (up to a scaling factor) to the expected values of the corresponding micro-variables. Aggregate output can thus be written as a CES function of aggregate demand Y_D , of aggregate production capacities Y_P and of the aggregate full-employment output level Y_S :

$$(2.14) \quad Y_T = (Y_D^{-\rho} + Y_P^{-\rho} + Y_S^{-\rho})^{-1/\rho}$$

where

$$(2.15) \quad Y_P = B \cdot K^{\alpha}$$

$$(2.16) \quad Y_S = A \cdot L^{\alpha}$$

To close the model, we simply have to specify the aggregate demand for goods Y_D . For the moment, we assume a simple constant price elasticity function:

$$(2.17) \quad Y_D = YDA \cdot P^{-\epsilon}$$

where YDA stands for the autonomous demand for goods. This equation has to be interpreted as a semi-reduced form equation similar to the aggregate demand schedule of macroeconomic textbooks.

These results imply that, at an equilibrium, the proportion of firms in a given regime is equal to the ex-ante individual

probability of falling in that regime. More specifically, the proportion of firms in the Keynesian regime (Π_K) can be written, using (2.13) and the fact that aggregate quantities are proportional to those expected at the micro level,:

$$(2.18) \quad \Pi_K = \Pi_{K1} = (Y_T/Y_D)^p$$

and similarly for the other two regimes:

$$(2.19) \quad \Pi_C = (Y_T/Y_P)^p \quad ; \quad \Pi_I = 1 - \Pi_K - \Pi_C = (Y_T/Y_S)^p$$

Because each firm sets the same price level, the aggregate price level can be written, using (2.10),:

$$(2.20) \quad P = (1+\mu)A^{-1}W, \text{ with } \mu = (1 - \xi_{00} \cdot \Pi_K)^{-1}$$

Equations (2.15)-(2.20) jointly determine the equilibrium. It is a short-run equilibrium in that the aggregate capital stock KA and the technical coefficients A and B are considered as given.

3. LONG RUN EQUILIBRIUM AND INVESTMENT

In the long run, investment expenditures produce changes in the technical coefficients and in the aggregate production capacity (or equivalently in the degree of capacity utilization), until these variables reach their optimal or equilibrium values.

The optimal production technology

As mentioned before, the technical coefficients A and B appearing in (2.15)-(2.16) are adjusted in the long run so as to minimize average production costs. Assuming that the ex ante technological constraint is Cobb-Douglas, we write the cost minimization problem as:

$$(3.1) \quad \begin{aligned} \text{Min } A^{-1}W + DUC^{-1}B^{-1}V, \\ \text{s.t. } 1 = a(A^{-1})^\alpha (B^{-1})^{1-\alpha} \end{aligned}$$

where V is the capital usage cost and DUC , the capacity utilization rate, is as its long run equilibrium level. The solution to the program yields

$$(3.2) \quad K/L = B^{-1} \cdot A = [(1-\alpha)/\alpha] \cdot [W/(V \cdot DUC^{-1})],$$

that is, the optimal capital-labor ratio is positively related to the relative cost of labor, taking into account the degree of capacity utilization. By substituting this optimal ratio into the Cobb-Douglas function, one obtains separate expressions for the optimal output-labor and output-capital ratios A and B respectively:

$$(3.3) \quad A = a[(1-\alpha)/\alpha]^{1-\alpha} [W/V]^{1-\alpha} DUC^{1-\alpha}$$

$$(3.4) \quad B^{-1} = (1/a) [(1-\alpha)/\alpha]^{\alpha} [W/V]^{\alpha} DUC^{\alpha}$$

The equilibrium production capacity

As it is usual in monopolistic competition models, we assume that in the long run the number of firms is endogenous and adjusts until pure profits are zero. If, for example, the initial price level implied by (2.20) is so large that firms are making pure profits, the number of firms will increase, which reduces each firm's market share, decreases the average degree of capacity utilization, increases the proportion of sales constrained firms, and eventually leads to price cuts. In other words, the production capacity adjust in the long run until the price level becomes equal to the total average production cost:

$$(3.5) \quad P = A^{-1} \cdot W - B^{-1} V \cdot DUC^{-1}$$

Comparative statics

The long-run equilibrium of the economy is determined by the short-run equilibrium conditions (2.15)-(2.20), plus the long-run equilibrium conditions (3.3)-(3.5).

By combining (3.4)-(3.5), one readily verifies that, in the long run, labour's share of output must stay constant and equal to the

coefficient of labour in the Cobb-Douglas function, and similarly for capital; that is

$$(3.6) \quad A^{-1} \cdot (W/P) = \alpha \quad \text{and} \quad B^{-1} \cdot (V/P) \cdot DUC^{-1} = 1 - \alpha$$

It does not mean that these shares remain constant in the short run.

Combining this result with (2.20) also shows that the long-run equilibrium values of the markup rate μ and of the proportion of firms in the Keynesian regime Π_K are constant and given respectively by:

$$(3.7) \quad \mu = (1 - \alpha) / \alpha$$

$$(3.8) \quad \Pi_K = (YT/YD)^\rho = [\epsilon_0 \cdot (1 - \alpha)]^{-1}$$

The optimal long run values of prices and aggregate production capacities are easily obtained in the following manner. Using (3.8) and (2.14), one obtains by total differentiation:

$$(3.9) \quad d\Pi_K / \Pi_K = \rho \cdot \{ -(1 - \Pi_K) \cdot dYD/YD + \Pi_C \cdot dYP/YP + \Pi_I \cdot dYS/YS \} = 0$$

where, by (2.17),:

$$(3.10) \quad dYD/YD = -\epsilon_0 \cdot dP/P + dYDA/YDA$$

Similarly, using the definition of DUC ($DUC = YT/YP = (\Pi_C)^{1/\rho}$) and equating it to the alternative expression obtained by combining (3.4) and (3.6) yields after total differentiation:

$$(3.11) \quad d\Pi_C / \Pi_C = \rho \cdot (\Pi_K \cdot dYD/YD - (1 - \Pi_C) \cdot dYP/YP + \Pi_I \cdot dYS/YS) \\ = [(1 - \alpha) \rho]^{-1} \cdot \{ \alpha \cdot dW/W + (1 - \alpha) \cdot dV/V - dP/P \}$$

Equations (3.9)-(3.11) make together a system of three equations in three unknowns, dP/P , dYD/YD and dYP/YP . The solution reads:

$$(3.12) \quad dP/P = \phi \cdot [\alpha \cdot dW/W + (1 - \alpha) \cdot dV/V \\ + (1 - \phi) \cdot (1/\epsilon_0) \cdot [dYDA/YDA - dYS/YS]]$$

$$(3.13) \quad dYD/YD = dYDA/YDA - \phi \cdot \epsilon_0 [\alpha \cdot dW/W + (1-\alpha) \cdot dV/V] \\ - (1-\phi) \cdot [dYDA/YDA - dYS/YS]$$

$$(3.14) \quad dYP/YP = dYDA/YDA - \psi \cdot \epsilon_0 [\alpha \cdot dW/W + (1-\alpha) \cdot dV/V] \\ - (1-\psi) \cdot [dYDA/YDA - dYS/YS]$$

where $\phi = \Pi_C / [\Pi_C + \epsilon_0 \cdot (1-\alpha) \cdot \rho^2 \cdot \Pi_I]$, with $0 \leq \phi \leq 1$.

$$\psi = \phi [1 + \Pi_I / \Pi_C] \quad , \quad \text{with } \phi \leq \psi \leq 1.$$

Long run price changes are due either to changes in input prices or to a discrepancy between the growth rates of autonomous demand and of the labor supply, the effect of that discrepancy arising via the change in the markup rate induced by the change in the proportion of firms with labor shortages. The aggregate demand for goods and the aggregate production capacity grow at the same rate as the autonomous demand for goods, minus the effects of price changes, be they due to input price changes or to the differential growth of autonomous demand and of labor supply. Note though that, at given YDA, input price increases decrease the aggregate production capacity more than they decrease the aggregate demand for goods ($\psi \leq \phi$), thereby implying an increased degree of capacity utilization. The equilibrium degree of capacity utilization is a constant only if the supply of labor is never binding (so that $\Pi_I = 0$ and $\phi = \psi$) or if the rate of growth of the autonomous demand for goods is equal to the rate of growth of full-employment output plus what is needed to compensate the effects of cost-induced price increases. In such circumstances, the rate of growth of production capacities is equal to the rate of growth of demand and of output.

Dynamic Adjustment

Following the logic of the monopolistic competition model, we assume that the net investment rate is positive when there are positive pure profits, negative when there are negative pure profits, as it is also the case in the q-theory of investment.

Let π stand for the pure profit rate per unit of output. It is equal to the difference between the selling price P and the average total production cost:

$$(3.15) \quad \pi = P - (A^{-1}W + B^{-1}V \cdot DUC^{-1})$$

By definition of the markup rate μ , it is easily seen that π is positive if and only if the product $\mu \cdot DUC [(A^{-1}W)/(B^{-1}V)]$ is bigger than one. This expression can be recast in terms of the discrepancies between the actual and the long-run equilibrium values of the markup rate μ , the degree of capacity utilization DUC , and the capital-labor ratio $B^{-1} \cdot \bar{A} = K/L$:

$$(3.16) \quad \mu \cdot DUC \cdot [(A^{-1}W)/(B^{-1}V)] = [\mu/\mu^*] \cdot [DUC/DUC^*] \cdot [(K/L)^*/(K/L)]$$

where a star denotes a long run equilibrium value. The result follows readily from the definition of μ^* and $(K/L)^*$ in equation (3.7) and (3.2) respectively. The pure profit rate π can thus be regarded as the net outcome of three different influences coming from the markup rate, the capacity utilization rate and the production technology, each measured with respect of its long run value.

This suggests writing the investment rate IT/KA as a function of these three influences taken separately, plus a constant depreciation rate. In dynamic form:

$$(3.17) \quad IT/KA = cst + \kappa_1 \cdot \delta [\ln \mu - \ln \mu^*] + \kappa_2 \cdot \delta [\ln DUC - \ln DUC^*] \\ + \kappa_3 \cdot \delta [\ln (K/L)^* - \ln (K/L)] + (1-\delta) \cdot (IT/KA)_{-1}$$

This specification is compatible with our monopolistic competition model, as it satisfies the restriction that the investment rate be zero in the long run, when μ , DUC and (K/L) are at there equilibrium values and the pure profit rate π is zero. It also remains fairly close to standard investment equations in that it contains the three usual ingredients: a profit variable, a measure of the pressure of demand and a relative factor cost effect. The interpretation and the formulation are however different. Note that the coefficients κ_1 , κ_2 and κ_3 are by no means measures of the long term effects of changes

in the explanatory variables on the capital stock: they merely describe the speed of adjustment to a discrepancy between the actual and the optimal value of the variable. This is especially the case for κ_3 , which is not related to a parameter of the production function. The production function comes in only in the definition of the long run values μ^* , DUC^* , $(K/L)^*$. Equation (3.17) has the same long run implication as the familiar accelerator model if and only if the equilibrium capacity utilization rate is a constant (cf. supra).

4. EMPIRICAL RESULTS

Our main interest is in the investment equation (3.17), which we want to estimate on French aggregate data over the period 1957-85. For estimation purposes, we recast this equation in the more compact form (using (3.16))³:

$$(4.1) \quad IT/K_A = cst + \kappa_1 \delta \ln \mu + \kappa_2 \delta \ln DUC \\ + \kappa_3 \delta \ln [(A^{-1}W)/(B^{-1}V)] + (1-\delta) (IT/K_A)_{-1}$$

The definition of the variable is given in appendix. This equation has to be seen as a part of a complete quantity rationing model, like the one estimated in Lambert-Lubrano-Sneessens (1984). We used the latter model, reestimated over the period 1955-1985, to generate the values of the markup rate, $\mu = [(P-A^{-1}W)/A^{-1}W]$; of the capacity utilization rate DUC , equal to the ratio of actual to potential employment; of our measure of the discrepancy between the optimal and the actual capital-labor ratios, $[(A^{-1}W)/(B^{-1}V)]$.

Estimating the technical coefficients

The underutilization of the production factors during recessions creates a discrepancy between the observed and the technical productivities. Estimates of the technical productivities A and B can be obtained by writing the observed productivities as a dynamic function of the determinants of the technical productivities

³ We implicitly assume that DUC^* is a constant.

(essentially relative factor costs) plus an input utilization rate indicator:

$$(4.2) \quad \ln(YT/LT) = cst + \ln A + v \ln IDUL + \text{error term},$$

$$(4.3) \quad \ln(YT/KA) = cst + \ln B + v' \ln IDUC + \text{error term},$$

where IDUL and IDUC are indicators of the degrees of utilization of labor and capital provided by business surveys. The details of the specification are given in Lambert-Lubrano-Sneessens (1984). We started with a CES production function; the assumption of an unitary elasticity of substitution was not rejected. With a Cobb-Douglas production function, the cost minimizing technical coefficients A and B are essentially a log-linear function of relative factor costs W/V (see (3.3)-(3.4)). The capital usage cost V is approximated by the price of investment goods; this amounts to assuming a fixed expected long-run real interest rate, which is integrated in the constant term of the regression. Alternative definitions based on nominal interest rates and a weighted sum of past inflation rates failed to provide satisfactory results.

Equations (4.2)-(4.3) have been estimated over the period 1955-1985. These results are used to compute the values taken by our measure of the discrepancy between the optimal and the actual capital-labor ratios, $[(A^{-1}W)/(B^{-1}V)]$. The discrepancy is increasing in the first part of the period, decreasing in the second; it reaches a maximum in 1968-69. The markup rate, obtained as $[(P-A^{-1}W)/(A^{-1}W)]$, is relatively large from 1955 to 1974 (around 39%), falls sharply in 1975, and remains at relatively low levels (around (32%) until 1985 (38%).

Actual and potential employment

Equation (2.15) explains aggregate output as a CES function of the demand for goods, the potential output level and the full-employment output level. Given the output-labor ratio A, it can be recast in terms of employment as:

$$(4.4) \quad LT = \{LK^{-\rho} + LP^{-\rho} + LS^{-\rho}\}^{1/\rho}$$

where $LK = A^{-1} YD$ is the Keynesian labor demand and $LP = A^{-1} B.KA$ is the potential (or capacity) employment level. The supply of labor LS is regarded as an exogenous variable. Because some firms are constrained by their inputs, the actual output level YT falls short of the demand for goods YD which is thus unobserved. We assume though that what cannot be produced domestically is imported, so that final demanders are eventually not rationed. Actual imports are the sum of "structural" imports plus a spill-over effect from the domestic goods market. The demand for domestic goods YD appearing in LK is equal to total (observed) final demand minus the "structural" demand for imports. The details of the specification are given in Lambert-Lubrano-Sneessens (1984). These links between the employment and the import equations call for a joint estimation procedure.

The estimated values of LK and LP are reproduced in figure 1, together with LS ; the implied regime proportions are given in figure 2. Note that the proportion of firms in the classical regime Π_C is simply the capacity utilization rate DUC to the power ρ (see 2.19)).

Investment

The results of the estimation of equation (4.1) are given in table 4.1. In order to check the stability of the parameter estimates, we present the results obtain for three different sample period: 1957-74, 1957-80, 1957-85.

Coeff. of	Estimation Period		
	1957-74	1957-80	1957-85
Const.	0.116 (0.027)	0.112 (0.025)	0.112 (0.021)
$\ln \mu$	0.041 (0.017)	0.026 (0.006)	0.027 (0.005)
$\ln DUC$	0.451 (0.154)	0.510 (0.140)	0.528 (0.111)
$\ln[(A^{-1}W)/(B^{-1}V)]$	0.043 (0.018)	0.048 (0.019)	0.047 (0.017)
$(IT/KA)_{-1}$	0.634 (0.088)	0.582 (0.090)	0.585 (0.078)
DW	1.76	1.96	2.11
SER	0.0023	0.0026	0.0023
RMSE	0.0049	0.0015	-

Table 4.1: Estimation of the investment equation (4.1)

All the coefficients have the expected positive sign and are significantly different from zero (standard errors are given between brackets). Adding further dynamics (first and second differences of the first three explanatory variables) does not improve the regression. The coefficient associated to the markup rate is the only one to change noticeably when the estimation period is extended; its value is reduced by one third when post 1974 observations are introduced. However this change remains smaller than the initial estimated standard deviation of the coefficient and the model easily passes a Chow test for a structural break in 1974 (the Chow statistic is equal to 1.07, while the critical value at a 5% significance level is 2.63). Despite the simplicity of our dynamic structure, there is no sign of residual autocorrelation. The last two rows of table 4.1

give respectively the standard error of the regression and the root mean squared post-sample prediction error.

Our investment model can be compared to the one used for instance in von Furstenberg (1977), Chan Lee-Torres (1987). In these papers, investment is explained by a degree of capacity utilization variable and a measure of Tobin's q . The two variables are usually significant. Our model has basically the same explanatory variable, plus an effect of relative factor costs. Omitting that variable significantly deteriorates the quality of the adjustment.

Figure 3 gives an idea of the relative importance of the markup rate, the capacity utilization rate and the relative cost variable in explaining investment fluctuations. The effect of each of these three determinants is measure with respect to its sample average value. For instance, the effect of the markup rate μ is measured as $\kappa_1(\ln\mu - \ln\bar{\mu})$, where $\bar{\mu}$ is the sample average of μ and $\kappa_1 = 0.0643$. To simplify, we have eliminated the lagged endogenous variable. The sum of the three effects so computed is approximately equal to the discrepancy between the actual and the sample average investment rate.

It is interesting to compare the previous results to those obtained (on the same data set) with a traditional flexible accelerator model with profits. This is done in table 4.2. The explanatory variables are now, besides the lagged endogenous variable, the rate of growth of output, the rate of growth of relative factor costs and a profitability variable (gross operating surplus deflated by the price of investment goods per unit of capital). The fit and the predictive performance of this equation are of about the same quality as with equation (4.1). Adding more dynamics (first and second differences of the first three explanatory variables) does not improve the results. However, actual investment is now explained in a totally different way. Relative factor costs have no effect on investment, a result which is incompatible with the production model underlying our technical coefficient and the employment equations. There are other problems. In the logic of the accelerator model, one would expect, *ceteris paribus*, the net investment rate to be equal in the long run to the rate of growth of

output, that is, one would expect a long run coefficient of $\Delta \ln Y_T$ close to unity rather than 0.34. One is also surprised to see the profit variable appearing in levels rather than in first differences. The usual justification for the profit variable in an accelerator model is either in terms of financial constraints or in terms of the uncertainty about future demand. In that perspective, a change in the rate of profits should have a transitory rather than a permanent effect on investment. Note finally that, despite the apparent stability of the coefficients before and after 1974, the model does not pass a Chow test (Chow statistic equal to 3.18; critical value equal to 2.63 at the 5% significance level).

Coeff. of	Estimation Period		
	1957-74	1957-80	1957-85
Const.	-0.005 (0.004)	-0.001 (0.005)	0.0001 (0.005)
$\Delta \ln Y_T$	0.117 (0.032)	0.098 (0.036)	0.114 (0.030)
$\Delta \ln (W/V)$	-0.001 (0.017)	-0.014 (0.022)	-0.004 (0.021)
005/KA	0.333 (0.082)	0.316 (0.096)	0.246 (0.079)
$(IT/KA)_{-1}$	0.614 (0.063)	0.607 (0.075)	0.666 (0.061)
DW	2.43	2.13	2.15
SER	0.0016	0.0023	0.0023
RMSE	0.0037	0.0029	-

Table 4.2: Estimation of a flexible accelerator model with profits

5. CONCLUSIONS

The investment expenditures of French business firms (sociétés + quasi-sociétés) has been shown to be a fairly stable function of three determinants, namely the markup rate on variable production costs, the degree of capacity utilization and a measure of the discrepancy between the optimal and the actual capital labor ratios. This investment equation is compatible with the logic of a quantity rationing model with monopolistic competition. In the late sixties and early seventies, all three determinants act positively on investment, which explains the large investment rates observed over that period. The fall in the investment rate between 1975 and 1982 appears to be due mainly to the fall in the markup rate of the fall in the investment rate. After 1982, the markup rate rises again; at the same time however, the effects of the degree of capacity utilization and of relative factor costs on investment become weaker, so that the investment rate remains below average.

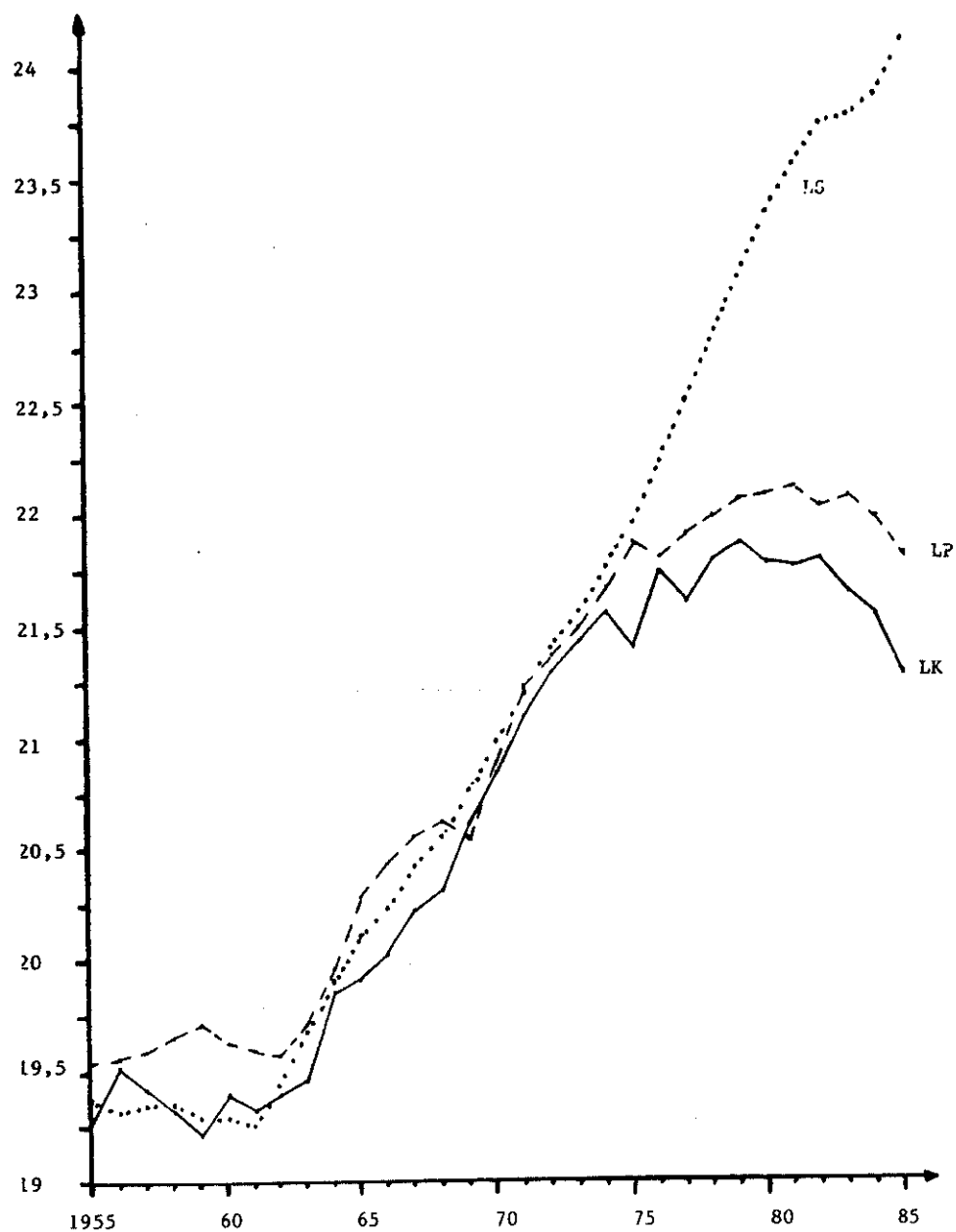


Figure 1. The estimates of LK, LP, LS

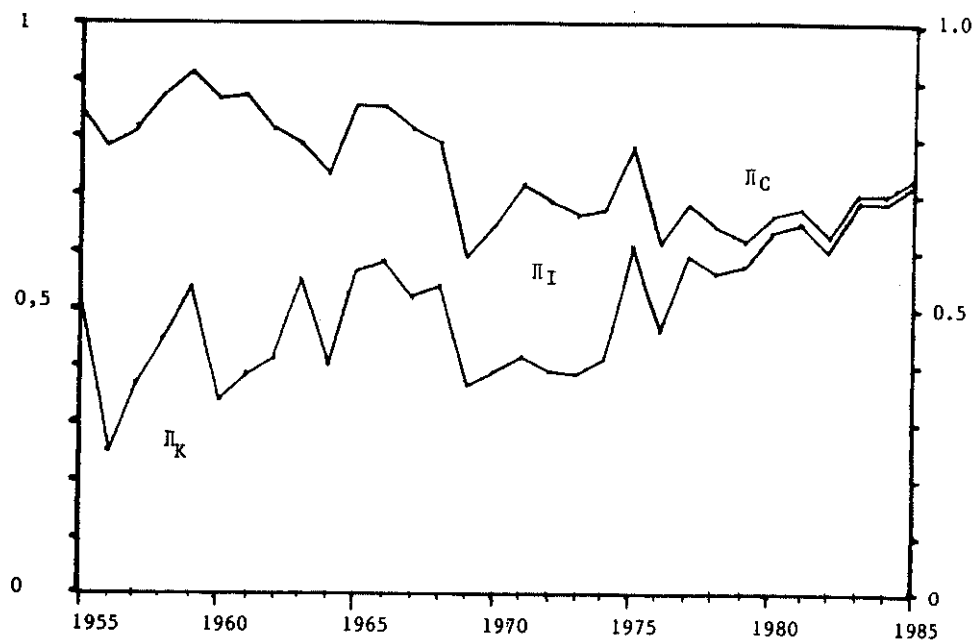


Figure 2. Estimated Regime Proportions

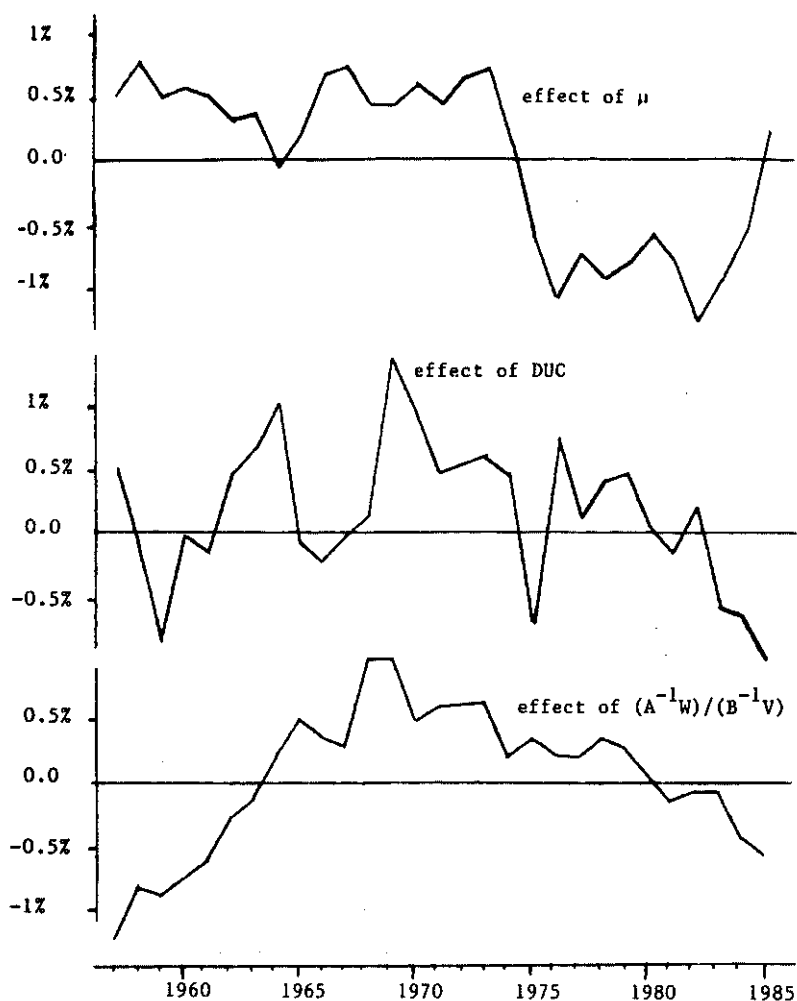


Figure 3. The effects of μ , DUC and $(A^{-1}W)/(B^{-1}V)$, in deviation with respect to teh mean

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