Title of Paper: Business Fixed Investment: The Case of the Portuguese Manufacturing Industry

ABSTRACT

The objective of this paper is to present the results of a study undertaken on the identification of the main determinants of business fixed investment decisions in the Portuguese manufacturing industry. Special attention was given to the validity of the financial constraint hypothesis. This can be seen in the light of the strong connection between the investment decisions of the firm and their cash flows. The independence between the firm's investment and financing decisions is thus not possible.

A sample of 808 firms belonging to the manufacturing sector was used. This sample was divided into two groups according to a number of criteria (size of firm, maturity, and equity to total assets ratio) in order to identify differences in the investment behaviour of these two groups.

The main results of this study were: (1) the financial restrictions hypothesis is valid; (2) the estimated coefficients of the cash flows are higher for firms that are *a priori* less exposed to information problems.

Key words: Investment; Cash Flow; Financial Constraints.

1 INTRODUCTION

The study of investment decisions is important for several reasons. Firstly, investment allows an increase in the production capacity of an economy. Secondly, investment expenditures are an important source of demand of durable goods industries and the construction industry. Thirdly, investment is the component of the aggregate demand that shows higher volatility, and is responsible for a great part of the variation in GDP of a country over the business cycle. Finally, it is through investment expenditures that interest rates (monetary policy) affect the economy. Moreover, tax policies that affect investment are important tools of fiscal policy.

In this paper we seek to identify the major determinants of business fixed investment decisions, such as structures and equipment. Particular attention is given to the role that the financial structure of a firm might play in investment decisions. In other words, we want to test the hypothesis of perfect capital markets.

The methodology adopted in the empirical study follows the approach used in the work by Fazzari, Hubbard and Petersen (1988). This approach has been used in several studies for various countries, where the objective was to evaluate the extent to which firms subject to financial constraints had their investment opportunities limited.

The main results obtained in this study were the following. Firstly, of the several econometric specifications tested, the one that seems to have the higher explanation power among the determinants of investment includes an accelerator element, a cash flow component, and changes in liability and working capital. Secondly and contrary to what one would expect[1], cash flow has a higher estimated coefficient for firms that have, *a priori*, less information problems and are therefore less subject to financial constraints.

The remainder of the paper is organized as follows. In section 2 there is a brief review of the main theoretical contributions on business fixed investment. Section 3 contains a description of the methodology adopted, the definition of sample and the variables used, the criteria for grouping the firms of the sample, the specifications of the investment equation, and the results of the regressions that were undertaken. In section 4 the main conclusions of this study are presented.

[1] See, for example, the studies of Fazzari, Hubbard and Petersen (1988), Hoshi, Kashyap and Scharstein (1991), Whited (1992), Schaller (1993), Mills, Morling and Tease (1995), Palenzuela and Iturriaga (1998), Kim (1999).

2 THE THEORY

In this section we present a brief review of the theories that explain fixed investment decisions.

The first theoretical contribution that is known is the accelerator model. It was developed by Clark (1917) and later by Chenery (1952), Koyck (1954) and Eisner (1960, 1967).

The rationale behind this model is that demand for capital goods depends on changes in outputs (or sales, if we admit that they represent a constant fraction of production).

Investment expenses by firms are thus seen to be induced by changes in the demand for goods and services by consumers, which in turn would imply changes in the quantities produced/sold.

The accelerator model is based on a very simple idea, but has no theoretical basis, and does not consider price variables.

A new theory to explain investment behaviour at the level of the firm was developed and became known as the neoclassical model, Jorgenson (1963, 1967).

In this model, the firm's objective is to maximise the present value of future cash flows, subject to a technological restriction represented by the production function and to a restriction imposed by the capital accumulation equation. Investment expenses are thus a function of the value of output, the user cost of capital, and the output capital elasticity. The user cost of capital can be divided into two main elements: the real interest rate and the economic depreciation rate.

The neoclassical investment theory presents, however, some weaknesses. Firstly, the use of an endogenous variable to explain the desired capital stock means that the output variable is simultaneously a determinant of inputs and a function of the inputs themselves. Secondly, Jorgenson (1963) admitted that technology could be appropriately represented by a Cobb-Douglas production function. Thirdly, the hypothesis of constant returns to scale and unitary elasticity of capital is questionable.

In the late 1960's a new theory was developed based on the same assumptions of the neoclassical theory, but it was far more accurate and allowed some of the former theories' problems to be overcome. It has theoretical consistency and its forward-looking nature made it one of the most popular explanation models for business fixed investment.

This theory, known as Q theory was developed by Tobin (1969), and established a relationship between the real and the financial sectors of the economy. This relationship is

given by the ratio between the market value of the firm and the replacement cost of existing capital (ratio Q).

The use of the market value of the firm, obtained from the price established in the stock market, made it possible for the expectations formulated by the economic agents about the future that could influence the performance of the firm, and hence its value, to be included in the model.

According to this model, whenever the Q ratio is greater than one, a stimulus for investment exists. The rationale behind this statement is as follows. If the ratio is greater than one, this means that as a result of the investment made the market is evaluating the firm in a higher amount than the effective cost of the investment goods bought. Hence, the firm can benefit from this profit.

In spite of its theoretical consistency, empirical evidence[2] has demonstrated that although Q ratio is an important determinant of investment, a significant part of the variation in investment remains unexplained.

This fact can be justified by two major reasons. Firstly, it is necessary to guarantee that the true (or intrinsic) value of the firm is given by its market value (price of shares times number of shares), and is not driven by speculative decisions. If this is not the case, a gap between what is predicted by the theory and the actual Q exists.

Secondly, the Q model (and also the neoclassical model) is based on a set of very restrictive assumptions namely, the assumption of perfect capital markets. If this assumption does not occur in reality, e.g. these are information problems in capital markets, it is not surprising that Q model shows a poor empirical performance.

This fact, together with the theoretical developments of the 1970's and 1980's, known as information economics, led to the appearance of an alternative explanation for business fixed investment decisions.

This new approach became known as the financial constraints model. Its main assumption is that if information is not perfect, capital markets are not perfect and completely efficient, which leads to a difference in the cost of funds available to the firm.

Myers (1984) calls this the pecking order hypothesis. When firms need finance, they first use internal funds (e.g. retained earnings), followed by debt, and finally they issue new equity.

[2] See the papers by Bischof (1971), Clark (1979), Abel and Blanchard (1986), Blundell *et al* (1992), Fazzari, Hubbard and Petersen (1988), Hoshi, Kashyap and Scharstein (1991) and Schaller (1993).

Theoretical contributions that support this model were attributed to Akerlof (1970), Stiglitz and Weiss (1981), Greenwald *et al.* (1984), Myers and Majluf (1984), and Jensen e Meckling (1976). The increasing interest about the financial constraints model led to a major empirical study undertaken by Fazzari, Hubbard and Petersen (1988).

The objective of their study was to investigate the extent to which the financial status of a firm could explain its investment behaviour, in addition to the real aspects.

In the neoclassical and Q models, financial variables[3] do not have any role in explaining the firm's investment behaviour. In fact, only real variables were considered (such as, input and output prices, and technology)[4]. This fact was supported by the famous proposition I of Modigliani and Miller (1958), which states, as a corollary, that the investment and finance decisions are independent.

3 THE CASE OF THE MANUFACTURING INDUSTRY

3.1 Definition of the Methodology and of the Sample

The methodology used in this paper to identify the major determinants of investment, in general, and to test the validity of the hypothesis that firms face financial constraints in particular, follows the one proposed by Fazzari, Hubbard and Petersen (1988).

This methodology can be described as follows. Firms selected in the sample were divided into two groups, according to how much they were affected, *a priori*, by information problems, and thus more subject to financial constraints. Then, for each group an econometric equation of investment was estimated and the results obtained for the coefficients compared.

In the empirical study, information about 8090 firms was obtained, for a period between 1990 and 2000. This data came from the *Central de Balanços do Banco de Portugal*.

Since we want to use a balanced panel data, firms had to respect several criteria to be included in the sample. Firstly, only private firms, belonging to the manufacturing sector, with at least 20 employees, were considered. Secondly, only companies that presented values

[3] The only exception being the interest rate.

[4] It may be pointed out that in the accelerator model, sometimes financial variables were included as a factor explaining the investment behaviour of firms – this kind of model was known as accelerator cum liquidity model. See Jorgenson (1971). Therefore, the idea that capital markets may not be perfect and, as such, financial variables can be important, is not new. What is new is related to: (1) the existence of a new solid theoretical body which allows the explaining of the inclusion of this kind of variables in the investment models; (2) the new empirical methodology proposed by Fazzari, Hubbard e Petersen (1988).

for all variables and for every year of the period considered were selected. As a result, the sample comprised a total of 808 firms.

3.2 Variables

The variables used in the empirical study were:

- Investment (I): acquisitions of new structures and equipments.
- Stock of capital (K): represented by fixed assets.
- Sales (S): total sales of the firm.
- Cash flow (CF): given by the sum of profits and depreciation.
- Working capital (WC): current assets minus current liabilities.
- Debt (P): correspond to the total liabilities of the firm.
- Stock of liquid assets (AL): sum of cash, deposits and marketable securities.

3.3 Criteria for Dividing the Sample

In this subsection we describe the criteria used to group the firms, according to the information problems they face, and the resulting severity of the restrictions that impend over them.

The first criterion adopted refers to size. We split the sample into two groups – large and small firms, and assumed that large firms are less, *a priori*, subject to financial constraints.

The decision to split the sample according to size is justified as follows. Firstly, larger companies have an easier access to capital markets, due to the possibility of using the firm's assets as collateral. Secondly, it is likely that transaction and floatation costs for new share or bond issues decrease with dimension. Thirdly, larger companies can make use of more different sources of funds than small companies can, which allows large companies to reduce the risk of financing. Fourthly, larger companies have, in general, to meet more obligations in terms of financial statements produced and information released about their activities and future prospects. Finally, it is likely that small firms suffer more of the idiosyncratic risk.

Tables 1 and 2 show the descriptive statistics for both types of firms. The most relevant features are the following. Firstly, smaller firms have a higher investment rate than larger

ones (37% vs. 29%). Secondly, the proportion of cash flows and stock of liquid assets in terms of fixed assets is significantly higher for smaller firms.

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.2908	6.1549	0.0005	0.3891
S_t/K_{t-1}	4.7861	70.329	0.2065	5.2714
CF_t/K_{t-1}	0.3250	13.365	-2.2441	0.4252
AL_t/K_{t-1}	0.2554	9.2469	0.000004	0.5988
$\Delta WC_t/K_{t-1}$	0.0363	6.4799	-6.4843	0.5865
$\Delta P_t/K_{t-1}$	0.1952	16.567	-14.349	0.9955

Table 1 – Descriptive statistics for firms classified as large. Number of observations 4040.

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.3773	17.073	0.00009	0.7059
S_t/K_{t-1}	7.6072	325.44	0.1494	11.243
CF_t/K_{t-1}	0.4050	46.050	-8.5120	0.9886
AL_t/K_{t-1}	0.5226	53.087	0.000009	1.7025
$\Delta WC_t/K_{t-1}$	0.0967	43.627	-37.195	1.8696
$\Delta P_t/K_{t-1}$	0.2716	30.063	-55.673	1.6827

Table 2 – Descriptive statistics for firms classified as small. Number of observations 4040.

A second criterion used to group firms was their maturity, that is, we compared old (mature) and new (young) firms.

With this criterion we want to evaluate if age influences the severity of financial restrictions that a firm faces as a result of information problems.

The idea is to establish if mature firms face fewer information problems in capital markets.

Two main reasons justify this rationale. Firstly, creditors have, in general, more information about mature firms, since they have been visible for a longer period of time. Secondly, mature firms can establish continued relationships with creditors and suppliers based on mutual confidence, which helps alleviate information problems.

Tables 3 and 4 show the descriptive statistics for mature and young firms, respectively. The most relevant feature is the fact that mature firms have a weaker investment rate than young firms (31% vs. 36%).

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.3143	17.073	0.00009	0.6214
S_t/K_{t-1}	5.8901	93.365	0.1494	7.1682
CF_t/K_{t-1}	0.3461	9.9412	-6.5358	0.5741
AL_t/K_{t-1}	0.4273	45.008	0.00003	1.3663
$\Delta WC_t/K_{t-1}$	0.0587	33.571	-37.195	1.2520
$\Delta P_t/K_{t-1}$	0.1896	30.063	-17.441	1.2618

Table 3 – Descriptive statistics for firms classified as mature. Number of observations 4040.

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.3649	12.859	0.0002	0.5573
S_t/K_{t-1}	6.8663	325.44	0.2065	10.906
CF_t/K_{t-1}	0.3941	46.050	-8.5120	0.9660
AL_t/K_{t-1}	0.3851	53.087	0.000004	1.3235
$\Delta WC_t/K_{t-1}$	0.0821	43.627	-32.063	1.6368
$\Delta P_t/K_{t-1}$	0.2870	21.311	-55.673	1.5701

Table 4 – Descriptive statistics for firms classified as young. Number of observations 4040.

The last criterion used to split the sample was the equity (net-worth) to total asset ratio.

According to this criterion, we assumed that a firm with a high equity to total asset ratio is less subject to financial constraints.

The rationale behind this statement is the following. A firm with a high equity to total asset ratio has to commit a smaller fraction of its cash flow to the debt service. In this sense, the firm is less exposed to cash flow volatility and thus would not have to cut its level of investment.

Tables 5 and 6 show descriptive statistics for firms with high and low equity to total assets ratio, respectively. The relevant features are the following. Firstly, the rate of investment for both groups of firms is similar (32% vs. 34%). Secondly, cash flow represents 45% of the capital stock for firms with high equity to total asset ratio, and 30% for firms with low equity to total asset ratio.

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.3296	15.081	0.0002	0.5724
S_t/K_{t-1}	5.4637	243.52	0.2504	7.0877
CF_t/K_{t-1}	0.4414	13.670	-1.0377	0.5642
AL_t/K_{t-1}	0.5122	53.087	0.00002	1.7399
$\Delta WC_t/K_{t-1}$	0.0852	17.134	-11.228	0.6386
$\Delta P_t/K_{t-1}$	0.1541	30.063	-15.381	1.0827

Table 5 – Descriptive statistics for firms classified as young. Number of observations 4040.

Variable	Mean	Max	Min	S. D.
I_t/K_{t-1}	0.3496	17.0727	0.00009	0.6084
S_t/K_{t-1}	7.2928	325.44	0.1494	10.903
CF_t/K_{t-1}	0.2988	46.050	-8.5120	0.9671
AL_t/K_{t-1}	0.3002	16.670	0.000004	0.7546
$\Delta WC_t/K_{t-1}$	0.0557	43.627	-37.195	1.9593
$\Delta P_t/K_{t-1}$	0.3225	21.311	-55.673	1.6958

Table 6 – Descriptive statistics for firms classified as young. Number of observations 4040.

3.4 Specifications of the Investment Equation

In this paper we want to test two key hypotheses. Firstly, cash flows are, apart from the real variables, an important determinant of business fixed investment. The rationale for this is that there is no perfect substitutability between the different sources of funds that a firm can access, namely, internal funds, debt, and external equity. Therefore, the assumption that the investment and financial decisions of a firm are independent does not ring true, so that the financial structure of a firm is relevant for investment decisions.

The other hypothesis is that the effect of cash flow is more important for firms that are, *a priori*, more exposed to information problems and, hence, where the severity of financial constraints is more acute.

The way that the cash flow variable is considered in an investment equation is a delicate question. Although the estimated coefficient for cash flow may have statistical significance, this does not necessarily imply that problems of financial constraints exist. An alternative explanation is that cash flows are a proxy for changes in investment demand[5], and not because there is a wedge cost in funds that a firm can access.

Therefore, in order to evaluate the true impact of cash flows it is necessary to control the investment opportunities that a firm faces[6]. In this paper we use the accelerator principle as the best alternative to model the demand side of investment. Hence, the inclusion of a cash flow variable in a model that includes sales, means that if the cash flow coefficient has statistical significance, this may be interpreted as an indication that firms face financial constraints.

On the basis of the accelerator model, we considered three alternative econometric specifications for the investment equation.

The first and the simplest one, is given by the following expression:

$$I_{it}/K_{it-1} = \alpha_i + \alpha_t + \beta_1(S_{it}/K_{it-1}) + \beta_2(CF_{it}/K_{it-1}) + \varepsilon_{it} \qquad (3.4.1)$$

where investment of the firm in fixed assets (I) is a function of sales (S) and cash flow (CF). All variables are divided by the stock of capital (K) to address the problem of

[5] This possibility come from the fact that cash flow volatility is highly correlated with sales variation and prospects of future profitability.

[6] In graphical terms this maintains unchanged the investment demand curve. In contrast, the offer curve of funds for investment becomes not completely horizontal, like is assumed in the neoclassical models. Now it has an increasing component, which depends on the level of internal funds that the firm possesses. A change in the level of internal funds of the firm induces a change in the configuration of the offer curve and, therefore, a change in the level of investment of the firm.

heteroscedasticity. (α_i) corresponds to the firm effect, (α_t) to the year effect and (ε_{it}) is the error term.

The second alternative specification is given by:

$$I_{it}/K_{it-1} = \alpha_i + \alpha_t + \beta_1(S_{it}/K_{it-1}) + \beta_2(CF_{it}/K_{it-1}) + \beta_3(AL_{it}/K_{it-1}) + \varepsilon_{it} \quad (3.4.2)$$

In relation to the previous specification, we now included a variable related to the stock of liquid assets (AL) of the firm. The rationale is that for firms that accumulate financial slack over time (in the form of cash or marketable securities) this represents a source of finance at low cost in case they face information problems in capital markets. It also allows firms to reduce the sensitivity of investment to variations in cash flows.

The third econometric specification adopted for the investment equation is:

$$I_{it}/K_{it-1}=\alpha_i+\alpha_t+\beta_1(S_{it}/K_{it-1})+\beta_2(CF_{it}/K_{it-1})+\beta_3(\Delta WC_{it}/K_{it-1})+\beta_4(\Delta P_{it}/K_{it-1})+\varepsilon_{it} \quad (3.4.3)$$

With this specification we want to take into account two additional aspects. The first is the role that working capital may play in an investment equation, given the possibility that in some cases it corresponds to the use of funds and, in other cases, to a source of funds.

The idea, developed by Fazzari and Petersen (1993), is that (a) if firms face restrictions in accessing funds for finance, (b) if fixed investment is relatively irreversible, and (c) if firms want to maintain unchanged their fixed investment, the two kinds of investment (in fixed and working capital) become competitors for obtaining finance, due to information problems in capital markets. Hence, we can see that by including the variable ΔWC (investment in working capital), if its estimated coefficient is negative that will constitute evidence that financial constraints may exists[7].

The second aspect considered in this specification is related to the variation in debt (ΔP) and is due to the fact that it is the second main source of funds[8]. The existence of a positive relationship between variation in debt (or total liabilities) and investment expenses of a firm, means that firms adjust their financial structure in such a way that allows them to accomplish their investment decisions. This allows the role of cash flow in investment decisions of firms in fixed assets, when firms face financing constraints, to be isolated.

[7] If financial constraints does not exists the relationship between the two kinds of investment is positive.
[8] The main source of funds to firms is internal funds, namely, retained earnings.

3.5 Results

All equations were estimated using a fixed effects model. Standard errors were corrected for heteroscedasticity by the White method.

Table 7 shows the regression results for the three specifications of the investment equation, when the sample was divided by firm size.

Independent variable	Large Firms			Small Firms		
	(1)	(2)	(3)	(1)	(2)	(3)
S_t/K_{t-1}	0.0361*	0.0357*	0.0213*	0.0181*	0.0175*	0.014**
	(0.0045)	(0.0046)	(0.0043)	(0.0057)	(0.0061)	(0.0067)
CF_t/K_{t-1}	0.1447*	0.1429*	0.2728*	0.1305	0.1307	0.238**
	(0.038)	(0.0379)	(0.0449)	(0.1011)	(0.0996)	(0.0975)
AL_t/K_{t-1}		0.0086			0.0089	
		(0.0323)			(0.0356)	
$\Delta WC_t/K_{t-1}$			-0.126*			-0.074*
			(0.0222)			(0.025)
$\Delta P_t/K_{t-1}$			0.1357*			0.1223*
			(0.0255)			(0.0301)
Adjusted R^2	0.204	0.204	0.363	0.136	0.136	0.259
DW	1.66	1.66	1.77	2.25	2.25	2.24
	NT = 4040			NT = 4040		

Table 7 – Regression results for firms classified according to their size, considering the alternative specifications of the investment equation. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis.
* Significant at 1% level.
** Significant at 5% level.

The main features of the regression results are the following. Firstly, the cash flow variable has statistical significance for all specifications for the group of large firms. For small firms, it is only statistically significant in the case of specification 3. This result contrasts with what would be initially expected on theoretical grounds.

Secondly, the stock of liquid assets variable has no explanation power when included in all the three econometric specifications, for both types of firms[9]. This result seems somewhat surprising for small firms, given that the stock of liquid assets of these firms represent almost fifty per cent of their stock of capital.

Thirdly, the sales variable has statistical significance for the several alternative econometric specifications of the investment equation. This confirms the results of other studies[10], where an accelerator component is an explanation for investment.

Finally, the specification that shows the best empirical performance, for both large and small firms, is specification 3. This result can be explained by the following facts. Firstly, all

[9] This same result was obtained for the regressions done for the other criteria of splitting the sample.
[10] We may cite the papers by Fazzari, Hubbard and Petersen (1988), Hoshi, Kashyap and Scharstein (1991), Schaller (1993), Mills, Morling and Tease (1995), Kim (1999).

variables included in the regression (sales, cash flow, change in debt, and change in working capital), are statistically significant for a level of significance of one or five per cent. Secondly, estimated coefficients show the sign indicated by theory. Thirdly, the adjusted R-squared almost doubles relatively to the other specifications. Fourthly, it is clear that the inclusion of the variation in debt and variation in working capital variables emphasize the role of cash flow. Observe that the estimated coefficient for sales decreases and the estimated coefficient for cash flow increases by eighty per cent.

Table 8 shows regression results for the three specifications of the investment equation, when the sample was divided by maturity.

Independent	Mature Firms			Young Firms		
Variable	(1)	(2)	(3)	(1)	(2)	(3)
S_t/K_{t-1}	0.0293*	0.0312*	0.0156*	0.0234*	0.0215*	0.0206*
	(0.0063)	(0.0063)	(0.006)	(0.0058)	(0.0063)	(0.0068)
CF_t/K_{t-1}	0.356**	0.366**	0.4556*	0.0317	0.0346	0.13***
	(0.1469)	(0.1494)	(0.1418)	(0.0698)	(0.0641)	(0.0715)
AL_t/K_{t-1}		-0.0345			0.0201	
		(0.0302)			(0.052)	
$\Delta WC_t/K_{t-1}$			-0.099*			-0.069*
			(0.0416)			(0.0268)
$\Delta P_t/K_{t-1}$			0.1578*			0.0967*
			(0.0379)			(0.0218)
Adjusted R^2	0.196	0.198	0.328	0.166	0.167	0.283
DW	1.93	1.92	2.05	2.17	2.18	2.16
	NT = 4040			NT = 4040		

Table 8 – Regression results for firms classified according to their maturity, considering the alternative specifications of the investment equation. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

The results obtained show that: (a) the cash flow variable has statistical significance for all specifications for the mature firms. For younger firms, cash flow becomes statistically significant, for a level of significance of ten per cent, for specification (3) only. This fact contrasts again with what would be expected; (b) the stock of liquid assets variable does not show any explanation power for investment, whilst the sales variable has statistical significance for all specifications considered; and (c) specification (3) is again the one that shows the best empirical performance.

Table 8 shows regression results for the three specifications of the investment equation considered, when the sample was split according the equity to total asset ratio.

Independent Variable	High equity to total assets ratio firms			Low equity to total assets ratio firms		
	(1)	(2)	(3)	(1)	(2)	(3)
S_t/K_{t-1}	0.0007	0.0091	-0.0009	0.0221*	0.0204*	0.0199*
	(0.0152)	(0.0141)	(0.0109)	(0.0041)	(0.0042)	(0.0047)
CF_t/K_{t-1}	0.5669*	0.5764*	0.7059*	0.0506	0.0459	0.13***
	(0.1806)	(0.1837)	(0.159)	(0.0738)	(0.0724)	(0.0738)
AL_t/K_{t-1}		-0.0545			0.074	
		(0.036)			(0.053)	
$\Delta WC_t/K_{t-1}$			-0.376*			-0.04**
			(0.0602)			(0.0171)
$\Delta P_t/K_{t-1}$			0.1297*			0.122*
			(0.0315)			(0.0331)
Adjusted R^2	0.265	0.273	0.475	0.123	0.128	0.256
DW	2.02	1.99	1.94	2.15	2.15	2.14
	NT = 4040			NT = 4040		

Table 9 – Regression results for firms classified according to their equity to total asset ratio, considering the alternative specifications of the investment equation. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

As can be seen, results do not differ much from the ones obtained by the previous regressions. However, two main differences can be observed. Firstly, the sales variable, although showing a coefficient with the right sign, does not have statistical significance for the group of firms with a high equity to total assets ratio. For the other group, the sales variable is statistically significant for a level of significance of one per cent. Secondly, the difference between the estimated coefficients for working capital variable for both groups of firms is greater than for the other criteria.

4 CONCLUSION

There has been in recent times a growing interest, by empirical researchers, in the study of the determinants of business fixed investment decisions. This interest can be justified by two main reasons. Firstly, investment is a very volatile component of GDP, which means that it has a big influence over business cycles. Secondly, a new research topic about investment determinants (i.e., the role of financial constraints) was induced by recent developments in information economics.

The aim of this paper was to apply these new theoretical developments to the case of the Portuguese manufacturing industry, using an empirical methodology that has been used in several studies for a variety of countries. These studies have revealed the validity of the

financial constraint hypothesis and, hence, the sensitivity of investment expenses to cash flow and to the strength of the balance sheet. Therefore, the independence between investment and financial decisions by firms is not verified in practice.

From the empirical results obtained in this study there are two major conclusions. Firstly, cash flows are an important determinant of business fixed investment decisions, hence rejecting the assumption of independence between firms' investment and financial decisions. This conclusion is, clearly, supported by the results obtained with the econometric specification (3) of the investment equation.

Secondly, the cash flow variable was more important for firms that, *a priori*, one would expect to be less exposed to information problems and, hence, to be less financially constrained. This result contrasts with previous empirical studies[11]. Potential explanations for this result are: (1) the criteria used to split the sample may not reflect the true differences concerning information problems that affect firms; (2) the way in which financial variables were introduced and estimated may not be the correct one, since econometric investment equations were not derived from a structural model; (3) the hypothesis of free cash flow, Jensen (1986), may play an important role.

In fact, this hypothesis provides another explanation for the excess sensitivity of investment in relation to cash flows. Jensen (1986) considers that managers of firms that generate high cash flows may divert them to expenditures for self interest, with reduced or negative profitability. In this case, shareholders would prefer managers pay out this cash flows as dividends or shares repurchases.

The criteria used in this paper to classify firms (size, maturity, and equity to total asset ratio) and the results obtained, may be seen to support the free cash flow hypothesis.

However, the results also indicate that there is a need for further research to obtain a deeper insight about the main determinants of business fixed investment decisions.

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[11] Kaplan and Zingales (1997) and Cleary (1999) get results that point in the some direction as ours.

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