Evidence on the Investment-Cash Flow Sensitivity for a Panel of Portuguese Manufacturing Firms

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ABSTRACT

In the last two decades, a renewed interest about the influence of financial factors on a firm's capital investment decision emerged. In fact, theoretical developments that occurred in the field of information economics, which emphasised the existence of information problems in financial markets, allowed to rationalise a close relationship between financial factors and investment expenses of firms.
This paper aims at contributing to the empirical literature on this subject, presenting the results of an empirical study undertaken for a panel of Portuguese manufacturing firms. The results obtained suggest that the impact of financial factors on investment decisions of firms is greater for those facing higher information problems in financial markets, such as: small, young and low retention firms.

INTRODUCTION

According to the investment models that assume perfect capital markets (e.g. the neoclassical model of Jorgenson, 1963, and the Q-model of Tobin, 1969), the availability of internal funds does not affect investment decisions. Investment outlays in each period are determined in perfectly functioning capital markets. Financial factors are only considered in the cost of capital, which, in turn, is independent of the way in which the firm finances itself. This independence derives from the assumption that capital markets are perfect. Thus, firms can obtain all financing that they need to implement investment projects, providing that the expected marginal return exceeds the cost of capital.
In other words, it would not be expected that a company, with a profitable investment opportunity but an investment outlay greater than its available funds, would invest less than a company with the same investment opportunities but with greater cash flow. Any insufficiency will attract finance in capital markets as investors attempt to explore the profit opportunity. This also means that the marginal costs of financing through debt, external equity capital and internal funds are the same.
In this context, it could be argued that the availability of adequate cash flows is not a restriction on investment and that the financial structure of firms does not affect the cost of capital.
By contrast, the financing constraints model is based, primarily, on the assumption that capital markets are not perfect. In this case, the decision about the sources of finance become extremely important, since the cost of internal funds may diverge significantly from that of external funds. According to Myers (1984), a hierarchy of finance is created, in which the firm starts by using the cheaper funds, i.e. firstly it will use internal funds, secondly debt and, finally, new equity capital.
Therefore, when a company has to decide about its investment expenses, it should consider not only the real aspects of the investment decision (e.g. the output, the relative price of inputs, or technology), but also the financial aspects, namely, the generated cash flows and the level of internal funds, so that the company does not forego valuable investment opportunities.
The designation of this model as the financing onstraints model comes from the basic assumption that, at least, some firms can face financial restrictions. One can say that there are financial restrictions when a company cannot obtain all the amount of finance it needs, irrespective of the opportunity cost of funds. In other words, financial restrictions refer to the situation in which profitable investment projects, that would be undertaken if there were sufficient internal funds in the firm, would be abandoned since the availability of external funds for the company is limited, due to (i) information imperfections in capital markets, and (ii) to the fact that the cost of external funds is greater than that of internal funds (Kim, 1999).
It should be emphasised that the idea of including financial variables in an econometric investment equation is not new. The models that integrated these variables assumed great importance in the 1950's. However, three fundamental reasons justify their abandonment. Firstly, the ad hoc manner in which these variables were included in the econometric investment equations. Secondly, the famous proposition 1 of Modigliani and Miller (1958), which provided the

theoretical foundations required to consider only the real aspects of the investment decision. Thirdly, the empirical results obtained by using these models in comparison with more consistent theoretical ones were poor.

The recent resurgence of investment models that include financial factors is due to two main reasons. The first one is related to the emergence of a new theoretical body that flourished since the 1970's, that emphasises the role played by information problems in financial markets. These are related, on the one hand, to the existence of asymmetric information in financial markets, which leads to adverse selection problems and moral hazard, as the works of Akerlof (1970), Stiglitz and Weiss (1981), Greenwald, Stiglitz and Weiss (1984) and Myers and Majluf (1984) demonstrated, and, on the other hand, to agency problems as stressed by Jensen and Meckling (1976) and Jensen (1986).

The second reason derives from the pioneer empirical study of Fazzari, Hubbard and Petersen (1988). Their empirical research was of great importance for two main reasons. Firstly, these authors emphasise the use of firm-level panel data, which allows obtaining pure microeconomic results, therefore increasing the knowledge on how firms make decisions. Secondly, they abandon the assumption of a representative firm, which was common in the previous studies on the determinants of investment behaviour of firms. A drawback of this procedure is that it does not allow to test whether the sensitivity of investment to cash flows differ according to different types of firms. Consequently, Fazzari, Hubbard and Petersen (1988) argue that when the objective is to test the validity of the financial restrictions model it is necessary to identify, a priori, the type of firms that are included in the sample, i.e. to identify the firms that are more and less subject to information problems in financial markets and, as such, the firms that face a higher differential in the costs of internal and external funds.

In brief, Fazzari, Hubbard and Petersen (1988) proposed a new methodology for evaluating the impact of financial factors on investment decisions of firms. In fact, the basic contribution of the financing constraints model can be stated as follows. Although some kinds of firms can easily obtain external funds to smoothen their investment expenses when internal funds fluctuate, the time and the amount of capital outlays of other firms, with limited or with no access to external funds, will likely be conditioned by fluctuations in internal funds. This fact may give rise to a situation of under investment of firms.

To test this prediction Fazzari, Hubbard and Petersen (1988) proposed a new methodology, which can be described as follows. Firstly, a sample of firms is divided into two sub-samples, according to how much firms are affected by information problems in capital markets, and thus more subject to financial restrictions. Secondly, to verify if there are systematic differences in the values obtained for the coefficients on financial variables, an econometric investment equation is estimated for each sub-sample, and the results obtained for the coefficients compared.

The predictions of the financing constraints model has been empirically confirmed by several studies for different countries. A significant number of these studies relate to the case of the US economy. Some examples are: Fazzari, Hubbard and Petersen (1988); Whited (1992); Oliner and Rudebusch (1992); Fazzari and Petersen (1993); Vogt (1994); Ramirez (1995); Gilchrist and Himmelberg (1995); Chirinko and Schaller (1995); Calomiris and Hubbard (1995); Hubbard, Kashyap and Whited (1995); Lamont (1997); Stanca and Gallegati (1999); Carpenter and Petersen (2002).

There is, also, wide empirical evidence on the excess sensitivity of investment to cash flows in several European countries , e.g. Bond and Meghir (1994); Fohlin (1998); Deloof (1998); Palenzuela and Iturriaga (1998); Vermeulen (2002); Goergen and Renneboog (2001); Bo, Lensink and Sterken (2003); Bond, Elston, Mairesse and Mulkay (2003); Guariglia (2004); Mizen and Vermeulen (2004).

Finally, more empirical evidence in other countries such as Japan [Hoshi, Kashyap and Scharfstein (1991)]; Canada [Schaller (1993)]; Mexico [Gelos and Werner (2002)]; South Korea [Shin and Park (1999), and Kim (1999)]; and Autralia [Mills, Morling and Tease (1995)] can be found.

The aim of this paper is to contribute to the empirical literature on the determinants of capital investment decisions of firms by presenting the results obtained from a sample of Portuguese manufacturing firms.

The remainder of the paper is organised as follows. In Section 2 the hypothesis to be tested are set. Section 3 describes the sample and the variables used. Section 4 identify the criteria used for classifying firms. Section 5 presents the specification adopted for the econometric investment equation. In Section 6 the estimation results are shown. Finally, Section 7 draws the main conclusions, emphasizing the policy implications of the results obtained.

HYPOTHESIS UNDER TEST

To evaluate the impact of cash flows on investment decisions of firms, the methodology proposed initially by Fazzari, Hubbard and Petersen (1988) was adopted.

In this study two key hypothesis are tested. Firstly, the aim is to verify whether investment decisions of firms are affected by cash flows. This fact may derive as a result of a non-perfect substitutability among the different sources of funds that a firm can access, that is, internal funds, debt, and new equity capital. If this is the case, the financial structure of a firm is relevant, which implies that investment and financial decisions are not independent. So, one can conclude that internal funds

are, apart from real variables, an important determinant of business fixed investment.
Secondly, the aim is to test whether the impact of cash flows differs from firm to firm. That is, to determine the extent to which the effect of cash flows on investment decisions of firms is more important for those identified, a priori, as suffering more from information problems in capital markets and, consequently, where the differential between the costs of internal and external funds are higher, thus contributing for the existence of financial restrictions. Hence, the more a firm is exposed to finance constraints the more its investment decisions should be determined by the availability of internal funds.

DATA AND VARIABLES

In the empirical study undertaken, a panel data was used to obtain empirical evidence on whether firms belonging to the Portuguese manufacturing sector face financial restrictions.
The sample used in this study, comprised, initially, about 8090 firms, for a period between 1990 and 2000. This data came from the Central de Balanços do Banco de Portugal.
Since a balanced panel data was used, firms had to respect several criteria to be included in the sample. Firstly, only private firms, belonging to the manufacturing sector, with at least 25 employees, were considered. Secondly, only companies that presented values for all variables and for every year of the period considered were selected. As a result, the final sample comprised a total of 714 firms.
As far as the variables used were concerned, they were computed from the accounting data of the firms selected, and can be described as follows:
• 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 (LTD): correspond to the medium- and long-term debt of the firm.

Table 1 shows some descriptive statistics of the firms in the sample. The most relevant features are the following. Firstly, the mean value of the fixed assets held by firms was € 3,311,994. Secondly, the mean value of the investment in fixed assets was € 699,019, whilst the mean value of the investment in working capital was € 131,562. Thirdly, the mean rate of investment in fixed assets was 33%, whilst the mean rate of investment in working capital was 7%. Finally, sales represented, on average, six times the value of fixed assets of the firms considered.

Table 1 – Descriptive statistics for firms of the full sample. Number of observations 7140.

Variables	Full Sample	
	Mean	S. D.
K (€)	3,311,994	6,308,335
I (€)	699,019	1,659,003
ΔWC (€)	131,562	2,748,804
I_t/K_{t-1}	0.331	0.563
$\Delta WC_t/K_{t-1}$	0.068	1.195
S_t/K_{t-1}	6.276	8.187
CF_t/K_{t-1}	0.365	0.623
WC_{t-1}/K_{t-1}	1.143	2.674
$\Delta LTD_{t-1}/K_{t-1}$	0.033	0.516

CRITERIA FOR SPLITTING THE SAMPLE

In this subsection the criteria used to identify firms that face greater financial restrictions, due to information problems in capital markets are described.

Size

The first criterion used to split firms into two groups was the firms' size (a group of large firms and a group of small firms), where size was measured by firms' sales.
According to this criterion, it is assumed that large firms are, a priori, less subject to financial restrictions.
The decision to split the sample according to size can be 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 use more different sources of funds than small companies, which allow 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 from the idiosyncratic type of risk.
Table 2 shows descriptive statistics for both types of firms, large and small. By comparing the figures for both types of firms, the following conclusions can be drawn. Firstly, the mean values of fixed assets, of investment in fixed assets and of investment in working capital are nine, eight, and eleven times greater for large firms than for small firms, respectively. Clearly, this fact shows how different the firms included in each group are.

Table 2 – Descriptive statistics for firms classified according with size. Number of observations 3570.

Variables	Large Firms		Small Firms	
	Mean	S. D.	Mean	S. D.
K (€)	5,957,508	8,067,413	666,479	718,849
I (€)	1,238,918	2,203,110	159,119	261,752
ΔWC (€)	240,486	3,873,230	22,637	297,184
I_t/K_{t-1}	0.292	0.361	0.370	0.709
$\Delta WC_t/K_{t-1}$	0.042	0.599	0.093	1.580
S_t/K_{t-1}	5.454	5.601	7.098	10.067
CF_t/K_{t-1}	0.338	0.445	0.393	0.760
WC_{t-1}/K_{t-1}	0.851	1.499	1.435	3.448
$\Delta LTD_{t-1}/K_{t-1}$	0.036	0.514	0.030	0.518

Secondly, the mean rate of investment in fixed assets and the mean rate of investment in working capital are greater for small firms than for large firms (37% vs. 29% e 9% vs. 4%, respectively).
Finally, the proportion of the mean value of sales on the mean value of fixed assets is greater for small firms than for large firms.

Age

The second criterion used to divide firms into two groups was the firms' age (a group of mature firms and a group of young firms).
It is assumed that mature firms are less likely to face information problems in capital markets for: (a) creditors have, in general, more information about mature firms, since they have been visible for a longer period of time, and (b) mature firms can establish continued relationships with creditors and suppliers based on mutual confidence, which helps to overcome information problems.
In Table 3 some descriptive statistics are presented for both types of firms, mature and young.

Table 3 – Descriptive statistics for firms classified according with age. Number of observations 3570.

Variables	Mature Firms		Young Firms	
	Mean	S. D.	Mean	S. D.
K (€)	4,583,178	7,917,781	2,040,809	3,698,288
I (€)	936,291	2,137,560	461,746	907,503
ΔWC (€)	138,967	3,533,964	124,157	1,620,172
I_t/K_{t-1}	0.309	0.579	0.353	0547
$\Delta WC_t/K_{t-1}$	0.062	1.309	0.073	8.742
S_t/K_{t-1}	5.835	7.337	6.716	8.936
CF_t/K_{t-1}	0.345	0.588	0.386	0.655
WC_{t-1}/K_{t-1}	1.375	3.107	0.911	2.132
$\Delta LTD_{t-1}/K_{t-1}$	0.026	0.621	0.040	0.384

Table 3 shows that mature firms have mean values for fixed assets and for investment in fixed assets that are twice as great as those of young firms. This is an indication that mature firms tend to be greater than young firms. However, this effect tends to be counterbalanced, since young firms show a mean rate of investment in fixed assets higher than mature firms (35,3% vs. 30,9%).
It is also important to point out that the mean values for investment in working capital, rate of investment in working capital and the proportion of sales on the stock of fixed assets, are similar in the two groups of firms.

Retention ratio

The last criterion used to classify firms was the profits retention ratio. Hence, there is a group that includes firms with the lowest retention ratio and another composed by firms that have the highest retention ratios.
The basic assumption for having used this criterion was that the availability of internal funds can restrict the investment expenses of firms with higher retention ratio. Two reasons justify this rationale, according to Fazzari, Hubbard and Petersen (1988). On one hand, firms may need funds to finance an amount of investment that exceeds their cash flow. So, they opt to retain all internal funds at low cost, which they generated from their normal activity. On the other hand, since dividend payments and investment outlays correspond to alternative uses of funds, companies that face severe restrictions in obtaining finance should choose low dividend payouts.
Table 4 shows descriptive statistics for both types of firms, lower and higher profit retention ratios companies.

Table 4 – Descriptive statistics for firms classified according with retention practices. Number of observations 3570.

Variables	Low Retention Firms		High Retention Firms	
	Mean	S. D.	Mean	S. D.
K (€)	4,046,521	7,194,304	2,577,466	5,173,388
I (€)	794,617	1,840,733	603,421	1,448,714
ΔWC (€)	139,043	3,095,253	124,081	2,352,289
I_t/K_{t-1}	0.304	0.569	0.359	0557
$\Delta WC_t/K_{t-1}$	0.043	1.297	0.093	1.084
S_t/K_{t-1}	5.526	7.039	7.025	9.132
CF_t/K_{t-1}	0.337	0.643	0.393	0.601
WC_{t-1}/K_{t-1}	1.077	2.503	1.208	2.834
$\Delta LTD_{t-1}/K_{t-1}$	0.029	0.492	0.037	0.540

The main features are the following. Firstly, companies with a low retention ratio tend to be larger, since they have a mean value for the stock of fixed assets higher than their counterparts (€ 4,046,521 vs. € 2,577,466).
However, the mean values of investment in fixed assets and working capital, although higher for low retention firms, do not differ much in both types of firms. On the other hand, the mean rates of investment in fixed assets and in working capital are higher for high retention firms.

SPECIFICATION OF THE ECONOMETRIC INVESTMENT EQUATION

To test the two hypothesis set forth at the beginning of this section, an econometric investment equation was estimated, based on the specification proposed by Fazzari and Petersen (1993).

The basic idea of this model focuses on the role that working capital may perform 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 argument, developed by Fazzari and Petersen (1993), is as follows: (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, then the two kinds of investment (in fixed and working capital) compete for obtaining finance, due to information problems in capital markets. Hence, it would be expected a negative relationship between fixed investment and working capital investment, since firms use working capital to smooth there fixed investment.

Thus, the specification adopted for the econometric investment equation was the following:

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

where I represents firm investment in fixed assets; S corresponds to sales; CF is cash flow; ΔWC represents change in working capital; and ΔLTD is the change in medium- and long-term debt of the firm. All variables are divided by the stock of capital (K) to address the problem of heteroscedasticity. (α_i) corresponds to the firm effect, (α_t) to the year effect and (ε_{it}) is the error term. The subscripts i and t correspond to firm and time, respectively.

The inclusion of the variable sales serves as a way to control investment opportunities faced by firms.

The cash flow variable is a proxy for a firm's internal funds. If these are not important for investment decisions of a firm, the coefficient on the cash flow variable has no statistical significance.

If the estimated coefficient for the variable change in working capital (ΔWC) is negative, this is an indication that firms may face financial restrictions, as suggested by Fazzari and Petersen (1993).

Given that the second main source of funds that a firm can access is debt, the variable change in medium- and long-term debt (ΔLTD) was included to be taken into account the effect that debt might have on investment decisions. The existence of a positive relationship between variation in debt and investment expenses means that firms adjust their financial structure in such a way that allows them to accomplish their investment plans.

ESTIMATION RESULTS

In this subsection we present the estimation results for the specifications of the investment equation adopted and for the various criteria used to split the sample.

All equations were estimated using a fixed effects model, as proposed by Hsiao (2003).

Full sample

Table 5 shows the regression results for the econometric investment equation, considering the full sample. The following conclusions can be drawn from table 5: (a) all explanatory variables are significant at one per cent level, and the estimated coefficients have the sign indicated by theory; (b) there is a positive relationship between investment expenses and cash flow and between the change in the medium- and long-term debt, which suggests the importance of the financial structure of a firm on its investment decisions; and (c) there is a negative relationship between the two types of investment (fixed and working capital), which indicates that firms may face financing restrictions.

Table 5 – Regression results for full sample. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis.
Number of observations 7140.

Independent Variable	Full sample
S_{it}/K_{it-1}	0.026*
	(0.0013)
CF_{it}/K_{it-1}	0.328*
	(0.0122)
$\Delta WC_{it}/K_{it-1}$	-0.296*
	(0.0124)
$\Delta LTD_{it}/K_{it-1}$	0.339*
	(0.0127)
Adjusted R^2	0.53
DW	1.95

* Significant at 1% level.

Size

Table 6 shows the regression results for the econometric investment equation, when the sample was divided according to firms' size.

Table 6 – Regression results for firms classified according to their size. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis. Number of observations 3570.

Independent Variable	Large Firms	Small Firms
S_{it}/K_{it-1}	0.023*	0.026*
	(0.0013)	(0.0019)
CF_{it}/ K_{it-1}	0.234*	0.468*
	(0.0123)	(0.0183)
$\Delta WC_{it}/ K_{it-1}$	-0.219*	-0.418*
	(0.0113)	(0.0211)
$\Delta LTD_{it}/ K_{it-1}$	0.243*	0.495*
	(0.0197)	(0.0183)
Adjusted R^2	0.47	0.59
DW	1.87	2.04

* Significant at 1% level.

The main features of the regression results shown in table 6 are the following. Firstly, although the estimated coefficients of the cash flow variable are statistically significant for both types of firms, the parameter for cash flow for small firms is twice the one for large firms. The results obtained indicate that an increase of one euro on cash flow of small firms leads to an increase of 47 cents on their investment, whilst an identical increase in cash flow of large firms only increases investment on 23 cents.

Secondly, the results shown in table 6 confirm that investments in fixed assets and in working capital compete for the financing available, and that this effect is more important for small firms.

Thirdly, there is a positive relationship between investment and variation in their medium- and long-term debt (ΔLTD). This means that, in order to undertake investment projects, firms adjust their financial structure.

Finally, it is important to point out that although sales were included in the investment equation, cash flow becomes always statistically significant. This fact can be interpreted as an indication that cash flows themselves play a role in explaining investment expenses of firms, and they are not proxying for shifts in investment demand.

Age

Table 7 shows the regression results for the econometric investment equation when the sample was divided by age.

Table 7 – Regression results for firms classified according to their age. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis. Number of observations 3570.

Independent Variable	Mature Firms	Young Firms
S_{it}/K_{it-1}	0.028*	0.023*
	(0.0012)	(0.0018)
CF_{it}/ K_{it-1}	0.193*	0.485*
	(0.0132)	(0.0177)
$\Delta WC_{it}/ K_{it-1}$	-0.165*	-0.456*
	(0.0118)	(0.0181)
$\Delta LTD_{it}/ K_{it-1}$	0.200*	0.514*
	(0.0129)	(0.0179)
Adjusted R^2	0.42	0.65
DW	1.89	2.03

* Significant at 1% level.

The following features are noteworthy. Firstly, given that the cash flow coefficient is higher for young firms than for mature firms, it can be argued that young firms tend to suffer more from finance constraints than mature firms.

Secondly, this conclusion is enhanced by the behaviour of the variables investment in working capital (ΔWC) and change in medium- and long-term debt (ΔLTD). On one hand, the fact that both types of investment (in fixed and working capital) compete for the limited availability of funds for investment financing is confirmed and on other hand, there is a positive relationship between investment and change in medium- and long-term debt.

Finally, since sales are statistically significant at one per cent level, this result confirms, on one hand, the importance of the accelerator principle as a determinant for investment expenses of firms and, on the other hand, the need to control the investment opportunities that firms face to evaluate the true impact of financial factors on the investment of companies.

Retention ratio

Table 8 shows the regression results for the econometric investment equation when the sample was divided by profits retention ratio.

Table 8 – Regression results for firms classified according to their retention practices. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis. Number of observations 3570.

Independent Variable	Low Retention Firms	High Retention Firms
S_{it}/K_{it-1}	0.028*	0.022*
	(0.0012)	(0.0013)
CF_{it}/ K_{it-1}	0.180*	0.588*
	(0.0113)	(0.0186)
$\Delta WC_{it}/ K_{it-1}$	-0.171*	-0.532*
	(0.0110)	(0.0189)
$\Delta LTD_{it}/ K_{it-1}$	0.197*	0.586*
	(0.0095)	(0.0202)
Adjusted R^2	0.42	0.71
DW	1.89	2.07

* Significant at 1% level.

This table shows that although the cash flow variable is statistically significant at a level of one per cent for both types of firms, the estimated coefficient is much higher for firms with high retention ratios (the difference between them reaches 0.408). This result is a clear indication that there are firms that face a finance hierarchy that can be explained by the existence of asymmetric information in financial markets.

From table 8 it is also possible to conclude that: (a) the impact of investment in working capital (ΔWC) and of the change in medium- and long-term debt (ΔLTD) on investment is higher for high retention firms, and (b) sales are an important determinant of fixed capital investment of firms.

Multicriteria

In the previous subsections only one criterion was used each time to classify firms according to the information problems they face in financial markets. The same procedure has been adopted in the majority of the other studies on the investment cash flow relationship. However, as pointed out by Schiantarelli (1996), there is no reason not to use more than one criterion simultaneously to classify firms.

Following this line of reasoning, the three criteria used previously were considered together to obtain empirical evidence about the link between the financial structure of a firm and its investment decisions. As such, the econometric investment equation was regressed for two groups of firms: one with the large, mature and low retention firms, and the other with the small, young and high retention firms.

Table 9 shows the results of the regressions. As it can be seen in the table, the predictions of the financial restrictions model are clearly supported by the results obtained. In fact, the estimated coefficient for the cash flow variable is about ten times greater for small, young and high retention firms than for large, mature and low retention firms.

Table 9 – Regression results for firms classified according to the three criteria simultaneously. Dependent variable, I_t/k_{t-1}. Standard errors are in parenthesis.

Independent Variable	Large, Mature and Low Retention Firms	Small, Young and High Retention Firms
S_{it}/K_{it-1}	0.024*	0.021*
	(0.0016)	(0.0022)
CF_{it}/ K_{it-1}	0.064*	0.652*
	(0.0074)	(0.0318)
$\Delta WC_{it}/ K_{it-1}$	-0.064*	-0.589*
	(0.0055)	(0.0292)
$\Delta LTD_{it}/ K_{it-1}$	0.103*	0.749*
	(0.0098)	(0.0223)
Adjusted R^2	0.34	0.72
DW	1.77	2.13
Nº Obs.	1240	1160

* Significant at 1% level.

Moreover, the results indicate, also, that the small, young and high retention firms use in greater magnitude the working capital to smooth their fixed investment. This can be interpreted as an indication that these type of firms have more problems in obtaining external funds to finance their investment opportunities.

Finally, small, young and high retention firms tend to adjust in higher magnitude its financial structure to accomplish their investment plans than large, mature and low retention firms.

CONCLUSIONS AND FURTHER RESEARCH

There has been in recent times a growing interest, from 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 can have a great influence over business cycles. Secondly, a new research topic about investment determinants (i.e., the role of financing 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. In fact, two key hypotheses were tested. On one hand, financial factors are, apart from the real variables, important determinants of business fixed investment. On the other hand, the effect of financial factors 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 findings of the empirical study confirm both hypotheses set in this study. In fact, the results obtained

showed that financial factors have an impact on investment decisions of all firms, and that this influence is greater for those facing higher information problems in financial markets, such as: small, young and low retention firms.

In terms of policy implications, the strong connection between firms' financial status and investment, suggests that in the case, for example, of a restrictive monetary policy the real economy will be affected not only through the traditional channel of the cost of capital, but also through the availability of funds channel, which means that an increase in interest expenses of firms will reduce the availability of relatively cheap internal funds and increase the cost of external funds.

Another important policy implication resulting from this study is the impact of tax policy changes. The main argument is that, when firms face limitations in obtaining finance due to imperfections in the financial markets, any increase in the tax revenue coming from tax charged to firms has a negative impact on investment, since it limits the availability of funds to which the company can access to achieve its investment plans. Therefore, it could be argued that tax policy measures such as the reduction in corporate tax rate, measures that disincentive high dividend payouts, accelerated depreciation allowances, and the introduction of an investment tax credit, could induce more investment in fixed capital by firms.

REFERENCES

Akerlof, G., (1970) The Market for lemons: Quality and the Market Mechanism. *Quarterly Journal of Economics*, 84, 488-500.

Bo, H; Lensink, R., and Sterken, E., (2003) Uncertainty and Financing Constraints. *European Finance Review*, 7, 297-321.

Bond, S., Elston, J., Mairesse, J., and Mulkay, B., (2003) Financial Factors and Investment in Belgium, France, Germany, and the United Kingdom: A Comparison Using Company Panel Data. *Review of Economics and Statistics*, 85 (1), 153-165.

Bond, S., and Meghir, C., (1994) Dynamic Investment Models and the Firm's Financial Policy. *Review of Economic Studies*, 61, 2, 197-222.

Calomiris, C., and Hubbard, R., (1995) Internal Finance and Firm-Level Investment: Evidence from the Undistributed Profits Tax of 1936-37. *Journal of Business*, 68, 4, 443-482.

Carpenter, R.; and Petersen, B., (2002) Is the Growth of Small Firms Constrained by Internal Finance?, *Review of Economics and Statistics*, 84, 298-309.

Chirinko, R., and Schaller, H., (1995) Why Does Liquidity Matter in Investment Equations?. *Journal of Money, Credit, Banking*, 27, 525-548.

Deloof, M., (1998) Internal Capital Markets, Bank Borrowing, and Financing Constraints: Evidence from Belgian Firms. *Journal of Business Finance & Accounting*, 25, 7 e 8, 945-968.

Fazzari, S., and Petersen, B., (1993) Working Capital and Fixed Investment: New Evidence on Financing Constraints. *RAND Journal of Economics*, 24, 328-342.

Fazzari, S., Hubbard, R., and Petersen, B., (1988) Financing Constraints and Corporate Investment. *Brooking Papers on Economic Activity*, 1, 141-195.

Fohlin, C., (1998) Relationship Banking, Liquidity, and Investment in the German Industrialization., *Journal of Finance*, 53, 5, 1737-1758.

Gelos, R., and Werner, A., (2002) Financial Liberalization, Credit Constraints, and Collateral: Investment in the Mexican Manufacturing Sector. *Journal of Development Economics*, 67, 1-27.

Gilchrist, S., and Himmelberg, C., (1995) Evidence on the Role of Cash Flow for Investment. *Journal of Monetary Economics*, 36, 541-572.

Goergen, M., and Renneboog, L., (2001) Investment Policy, Internal Financing and Ownership Concentration in the UK. *Journal of Corporate Finance*, 7, 257-284.

Greenwald, B., Stiglitz, J., and Weiss, A., (1984) Informational Imperfections in the Capital Market and Macroeconomic Fluctuations. *American Economic Review*, 74, 2, 194-199.

Guariglia, A., (2004) *Internal Funds, Asymmetric Information, and Investment Choice: Evidence from a Panel of UK Firms*. Mimeograph University of Nottingham.

Hoshi, T., Kashyap, A., and Scharfstein, D., (1991) Corporate Structure, Liquidity, and Investment: Evidence from Japanese Panel Data. *Quarterly Journal of Economics*, 106, 33-60.

Hsiao, C., (2003) *Analysis of Panel Data*, 2nd Edition, Cambridge University Press, Cambridge, UK.

Hubbard, R., Kashyap, A., and Whited, T., (1995) Internal Finance and Firm Investment. *Journal of Money, Credit, Banking*, 27, 3, 683-701.

Jensen, M., (1986) Agency Cost of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review*, 76, 2, 323-329.

Jensen, M., and Meckling, W., (1976) The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3305-360.

Jorgenson, D., (1963) Capital Theory and Investment Behavior. *American Economic Review*, 53, 2, 247-259.

Kim, J., (1999) The Relaxation of Financing Constraints by the Initial Public Offering of Small Manufacturing Firms. *Small Business Economics*, 12, 191-202.

Lamont, O., (1997) Cash Flow and Investment: Evidence from Internal Capital Markets. *Journal of Finance*, 52, 1, 83-109.

Mills, K., Morling, S., and Tease, W., (1995) The Influence of Financial Factors on Corporate Investment. *The Australian Economic Review*, 50-64.

Mizen, P., and Vermeulen, P., (2004) *Corporate Investment and Financial Constraints: What Drives the Relationship?*. ECB Working Paper.

Modigliani, F., and Miller, M., (1958) The Cost of Capital, Corporation Finance, and the Theory of Investment. *American Economic Review*, 48, 3, 261-297.

Myers, S., (1984) The Capital Structure Puzzle. *Journal of Finance*, 39, 575-592.

Myers, S., and Majluf, N., (1984) Corporate Financing and Investment Decisions When Firms Have Information that

Investors Do Not Have. *Journal of Financial Economics*, 13, 2, 187-221.

Oliner, S., and Rudebusch, G., (1992) Sources of the Financing Hierarchy for Business Investment and Agency Costs. *Review of Economics and Statistics*, 74, 643-653.

Palenzuela, V., and Iturriaga, F., (1998) Déterminants Financiers de l'Investissement en Capiatl Fixe: Le Cas Espagnol. *Revue D'Economie Industrielle*, 25-48.

Ramirez, C., (1995) Did J.P. Morgan's Men Add Liquidity? Corporate Investment, Cash Flow and Financial Structure at the Turn of the Twentieth Century. *Journal of Finance*, 50, 2, 661-678.

Schaller, H., (1993) Asymmetric Information, Liquidity Constraints and Canadian Investment. *Canadian Journal of Economics*, 26, 552-574.

Schiantarelli, F., (1996) Financial Constraints and Investment: Methodological Issues and International Evidence. *Oxford Review of Economic Policy*, 12, 70-89.

Shin, H., and Park, Y., (1999) Financing Constraints and Internal Capital Markets: Evidence from Korean "Chaebols". *Journal of Corporate Finance*, 5, 169-191.

Stanca, L., and Gallegati, M., (1999) The Dynamic Relation between Financial Positions and Investment: Evidence from Company Account Data. *Industrial and Corporate Change*, 8, 3, 551-572.

Stiglitz, J., and Weiss, A., (1981) Credit Rationing in Markets with Imperfect Information. *American Economic Review*, 71, 3, 393-410.

Tobin, J., (1969) A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit, Banking*, 1, 1, 15-29.

Vermeulen, P., (2002) Business Fixed Investment: Evidence of a Financial Accelerator in Europe, *Oxford Bulletin of Economic and Statistics*, Vol. 64, pp. 213-31.

Vogt, S., (1994) The Cash Flow/Investment Relationship: Evidence from U.S. Manufacturing Firms. *Financial Management*, 23, 3-20.

Whited, T., (1992) Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data. *Journal of Finance*, 47, 1425-1460.