INVESTMENT DECISIONS AND FINANCIAL STANDING OF PORTUGUESE FIRMS – RECENT EVIDENCE*

*Luisa Farinha** | Pedro Prego***

ABSTRACT

The analysis of firms' investment decisions and the firm's financial standing is particularly relevant under a scenario of (i) the high indebtedness levels of Portuguese firms, (ii) the reduction in profitability of these firms, which reduces the amount of internally available funds thus increasing the demand for external financing, and (iii) the ongoing Financial and Economic Crisis that considerably changed the conditions and access to the credit markets. In this article, yearly balance sheet and financial statements data from the Central Balance Sheet since 2006 until 2011 is used. The results obtained indicate that firms' financial standing is indeed relevant in explaining corporate investment decisions, where the burden of servicing debt, the cost of capital, and the firm's indebtedness all have a negative relationship with firm's investment rate. As for profitability the results suggest a strongly and positive relationship with firms' investment rate. Nonetheless, these results are predominantly seen for smaller firms where large firms investment rate only seem to be affected by the profitability levels. Moreover, there is evidence suggesting that the impact of firms' financial standing became more relevant during the period of the sovereign debt crisis in the euro area.

1. Introduction

The analysis of firms´ investment decisions is particularly relevant when assessing and projecting economic activity. In the context of financial frictions that can significantly affect firms´ demand of productive factors and hence future economic output capacity, the financial accelerator literature states that corporate investment is highly volatile and strongly concentrated in certain periods followed by sharp declines (Bernanke *et al*., 1999). In this context, it is argued that the presence of financial frictions exacerbates business cycles. Therefore, examining the relationship between firms' financial health and their investment decisions is an important matter.

Despite the relevance of this topic, only a few papers in the empirical literature use data for the Portuguese economy. Farinha (1995) used a firm level dataset ranging from 1986 to 1992 and concluded that the availability of internally generated funds affects investment decisions of firms, except in the case of the largest firms. Barbosa *et al*. (2007) focused on the period from 1995-2005 and found a negative relation between several measures of firms financial pressure and their investment flows. Oliveira and Fortunato (2006) used balance sheet data from 1990 to 2001 and found that smaller and younger firms have higher growth-cash flow sensitivities than larger and more mature firms.

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** Banco de Portugal, Economics and Research Department.

The present economic and financial crisis is leading to an unprecedented drop in investment of Portuguese corporations. The collapse of investment has been determined by the drop in demand and the high uncertainty concerning its recovery. Moreover, the narrowing of firms' internal financing capacity has been going together with tight credit supply. In such a context is likely that firms' financial position is playing a more relevant role in explaining investment rates at the firm level. The aim of this article is to give further insight into the relationship between private sector investment decisions and its financial standing. More specifically, in the line of Barbosa *et al*. (2007) this paper analyses how firm's financial position (proxied by Indebtedness level, Interest Burden, Financing Cost, and Profitability) relates to and potentially limits corporate investment decisions.

Using a very comprehensive dataset composed of all non-financial private sector firms' balance sheet and income statements covering the period from 2006 to 2011, we are able to present a more detailed analysis of this relationship than previous studies. Furthermore, the study also focuses on two additional aspects concerning this relationship. On the one hand, we test if the effect of financial conditions changes according to the size of the firm. On the other hand, we test if the relationship between financial conditions and corporate investment changed during this period.

The rest of the article is structured as follows. Section 2 reviews some of the existing literature on firm's investment decisions and financial factors. Section 3 describes the data used in the article and provides a descriptive analysis on the relationship between investment rates and firm's financial position. Section 4 presents the baseline specification and estimation method as well as the main results, closing with some robustness checks. Section 5 concludes by summarizing the main results and presenting some lines for future research.

2. Literature Review

The neoclassical theory of capital accumulation established that under perfect capital markets the firm's capital structure is irrelevant (Modigliani and Miller, 1958). With that regard, several theories have been proposed, a common stepping stone being the existence of asymmetric information and non-frictionless capital markets as the main factors explaining how firms may be rationed out of credit markets and how different origins of capital have different costs for firms and thus different attractiveness.

The work of Stiglitz and Weiss (1981) and Myers and Majluf (1984) are references when studying the problem of asymmetric information. Stiglitz and Weiss (1981) developed a model of credit rationing where asymmetry of information creates a problem of adverse selection. This happens because when interest rates rise, and given that lenders cannot differentiate borrowers' quality (or the probability of a borrower to repay its loan), the borrowers to initially leave the market for credit are the ones with the highest quality (or more likely to re-pay). This process is then reinforced where a larger proportion of "bad" borrowers remain in the market for credit thus reducing the expected payoff for the lenders, making these raise interest rates in order to limit the supply of credit.

In the same line, Myers and Majluf (1984) show that relying on internally generated capital to fund investment opportunities is preferred to all other options of external finance given that managers have complete information not only on the firm's current state but also on future investments under consideration. Moreover, Myers and Majluf (1984) show that if firms do have to raise capital externally, when running out of internally generated funds, doing it through debt rather than through equity is optimal because debt is information insensitive. These arguments have come to be known as the "pecking order" theory stating that internally generated funds are the most preferred (cheaper) way of raising capital, followed by debt and only as a last resort do firms issue new equity.

Different branches have been developed in the domain of imperfections in credit markets. The balance sheet channel hypothesis developed by Kiyotaki and Moore (1997; 2002) states that firms might become financially constrained, even in cases where they were not directly exposed to a negative shock, given reductions in assets prices in other sectors that were being used as collateral, which leads to a higher

cost of financing thus increasing the likelihood of default. Yet, Kiyotaki and Moore (1997; 2002) also mention that the aforementioned process is only valid when occurring among credit constrained firms. In that sense, the chain effect (or the balance sheet channel) stops as soon as one of the firms in the credit chain is not credit constrained, limiting the contagion effect among credit constrained firms.[1]

Holmstrom and Tirole (1997) developed a model of "credit crunch" where the market for credit clears at the quantity level rather than from prices [in the line of Stiglitz and Weiss (1981)]. The model in Holmstrom and Tirole (1997) works through a reduction in the supply of available resources to the credit market (be it a credit crunch, a collateral squeeze or a savings squeeze), showing that poorly capitalized firms suffer disproportionally. A particular feature of this model is that credit rationing might happen at the same time as the price of credit decreases.[2]

From the seminal work of Fazzari *et al*. (1988) a vast empirical literature followed the work of Stiglitz and Weiss (1981) and Myers and Majluf (1984). In this respect, Fazzari *et al*. (1988) used an approach based on the Tobin's Q model of Investment that has the advantage of capturing the market's valuation of the firm's investment opportunities.[3]

In addition, the authors followed an approach where they used firm's cash flow information to proxy the existence of internally generated funds, showing that firm's investment decisions are significantly affected by internally generated funds. Nonetheless, some authors pointed that including a measure for cash flow in an investment equation cannot, by itself, be a proof of financing constraints. In particular, Kaplan and Zingales (1997) argued that the results previously found are highly dependent on the definition of financially constrained firms and the higher sensitivity found may be a result of precautionary savings or risk-aversion. In that regard, Kaplan and Zingales (1997) classify firms as unconstrained, possibly constrained and constrained and found that the latter are less sensitive to cash-flow. More recently, Alti (2003) showed that even in the case of frictionless credit markets investment decisions are sensitive to cash-flow because, due to uncertainties around investments' outcomes, firms make future investment dependent on cash-flows realizations making investment highly sensitive to cash-flow realizations. Nonetheless, Alti (2003) showed that, even after performing a correction for firm's investment opportunities (proxied by the Q value), firms do seem to be sensitive to cash-flows. In the same spirit, Oliveira and Fortunato (2006), using a data set of Portuguese manufacturing firms from 1990 to 2001, argued that the higher sensitivity to cash-flows found for smaller and younger firms might in part be due to the fact that cash-flows realization is particularly important for these firms, and not necessarily indicating the existence of financing constraints.

Recent studies, such as Martínez-Carrascal and Ferrando (2008), have followed an approach of using several "financial pressure" indicators where they showed that investment decisions are significantly constrained by firm's financial position (proxied by Indebtedness level, Interest Burden and Profitability). Additionally, Nickell and Nicolitsas (1999) studied how firm's financial pressure (proxied by the firm's Interest Burden) related to firm level employment finding a negative relationship between the two. Likewise, Benito and Hernando (2007) found not only a negative relationship between financial pressure and employment but also to inventories and dividend policies. In addition, Benito and Hernando (2007) presented evidence of the existence of non-linearities in the relationship between financial position

1 In an empirical analysis, Martínez-Carrascal and Ferrando (2008) argued that monetary policy will have important consequences not only through the common interest rate channel but also through this balance sheet channel, given that higher interest rates reduce discounted cash flows and collateral values. Thus, the balance sheet channel might be especially relevant given the deleveraging process that Portugal (and other highly credit constrained countries in the euro area) is currently undertaking.

2 Ivashina and Scharfstein (2010) gave recent empirical support to the case of a "credit crunch" for the US economy after the failure of Lehman Brothers in 2008 where banks more exposed to credit-line drawbacks cut lending to a greater extent.

3 In this article, the Tobin's Q model approach was not used because it is rather difficult to apply this methodology for an economy as Portugal given the very small number of listed companies, thus reducing the possibility of having a good measure of Tobin's Q.

and investment decisions, a result that is also referred in the work of Martínez-Carrascal and Ferrando (2008) and Hernando and Martínez-Carrascal (2008). In this respect, Marchica and Mura (2010) found that financial flexibility, defined as firms with debt levels 'permanently' below what would be expected ex-ante, allowed firms to take advantage of unexpected investment opportunities. In addition, they also found that these "financially flexible" firms invested more heavily and with higher levels of profitability than firms that lacked such flexibility, which might had to pass on profitable investment opportunities.

3. Data and Descriptive Analysis

The analysis in this article uses Banco de Portugal annual Central Balance Sheet database, which is based on *Informação Empresarial Simplificada* (IES). IES collects balance sheet and financial statements from virtually all Portuguese corporate firms in the Portuguese Economy, both private and state owned firms (the latter having been removed from the sample) since 2006 until 2011 (which is the most recent data available).

One of the main benefits of using IES is the ability to focus the analysis at the micro level. In this article only private non-financial indebted firms (from now on it will only be referred to as firms for simplicity) were considered. Morevoer, observations that did not have strictly positive values of financial debt and interest paid were removed from the database, as well as self-employed individuals. It was also necessary to eliminate from the database firms that reported incomplete or incoherent data, such as observations with negative total assets or negative business turnover. Furthermore, firms that did not appear in the dataset for a minimum of three consecutive years were also excluded from the analysis. For the purpose of the econometric analysis only firms with positive gross operating income were considered.[4]

Especial attention had also to be paid to extreme firm assets variations. In that sense, firms that had an increase in fixed assets of more than 500% or a decrease bigger than 75% were removed from the sample (which corresponded to around 5% of initial sample observations). Finally, in order to deal with spurious outlier observations, observations below (and above) the 1st (and 99th) percentile of the relevant variables were winsorised. After applying all the above criteria, the data used in this study is an unbalanced panel of 189.266 observations, corresponding to 97.761 firms observed in the period between 2006 and 2011.

The objective of the study is to analyze firms' investment decisions focusing particularly on the effect of several factors that are related with firms' financial pressure. The investment rate is defined as the amount of Total Investment made by the firm in a given year divided by the Stock of Capital in the year immediately before. Both Total Investment and Total Stock of Capital include tangible and intangible assets. A yearly fixed depreciation rate of 10% was assumed. In line with previous empirical studies, the firm-level proxies for "financial pressure" were the following: a measure for the Interest Burden defined as the ratio between Paid Interest and Gross Operating Income; firm's Indebtedness level defined as Financial Debt to Total Assets; the Financing Cost defined as the ratio between Paid Interest and Financial Debt; firm's Profitability defined as Gross Operating Income to Total Assets.

The charts below present the simple percentiles of order 10, 25, 50, 75 and 90 of the distribution of the variables of interest for the different years under analysis. This approach makes it possible to evaluate the evolution of the typical firm (*i.e.* the median firm every year), as well as the evolution of firms in several points of the distributions.

Chart 1 shows how Portuguese firms in general reduced their investment ratio during the period under analysis, except in 2010. Additionally, the data shows that firms that were located in the top percentiles

4 This condition is necessary in order to preserve the monotonicity of the relation between the interest burden ratio and firms' financial standing. In fact, the interest burden resulting from a negative operative income with a large absolute value is lower than the interest burden resulting from a negative operating income with a small absolute value.

decreased their investment rate more strongly, squeezing the right hand side of the distribution. With respect to the median firm in each size category there are not considerable differences (see Chart 2). These results are in line with the ones obtained in the previous study made by Barbosa *et al*. (2007) where a reduction in the investment rate had been already occurring since 1999.

Indebtedness of Portuguese firms (Chart 3) increased slightly (but steadily) from 2006 until 2009, increased significantly in 2010 and decreased again in 2011 (yet, still staying above the level observed in 2009). Indebtedness levels for Medium and Large sized firms were considerably higher than those for Micro and Small sized firms from 2006 until 2009 (Chart 4). In 2010, indebtedness levels of Micro and Small firms increased considerably, reaching the same indebtedness level of Medium sized firms, decreasing slightly in 2011 for the former. On the other hand, indebtedness levels for Large firms decreased in 2010 and remained constant in 2011.

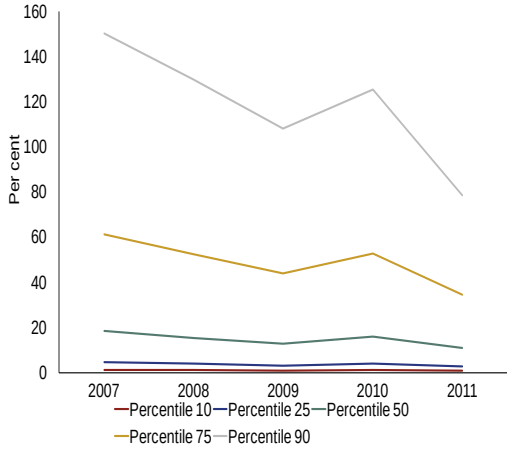
With respect to the evolution of firms' Financing Cost during the period under analysis two different patterns emerged, with a downward trend from 2006 until 2010, being especially significant since 2008, followed by a slight increase in 2011. There was a significant compression of the distribution in 2010, which occurred mostly from the right-hand side of the distribution (see Chart 5). From Chart 6 it is interesting to note that the pattern described seems to be the same across firm sizes.

Following the same pattern of the Financing Cost indicator, there is a significant reduction in the dispersion of the Interest Burden distribution that occurred mostly in 2010 (see Chart 7). It is also worth pointing to the fact that Small and Medium sized firms present a similar level for the median interest burden across the time span of this study, which stood above the level recorded for Micro and Large Firms (see Chart 8).

Chart 9 shows that the overall profitability of firms has been slightly declining over the entire period under analysis. This result is particularly relevant given that, as documented by Barbosa *et al*. (2007), the profitability of the representative firm in Portugal has already been in decline since 1995. Our results also show how the dispersion of the distribution increased slightly for the left-hand size, suggesting that less profitable firms were particularly affected. When looking at the different size categories (Chart 10), the profitability level of the representative firm for each firm-size category increases slightly, with the exception of the Micro sized firm category.[5]

Chart 1

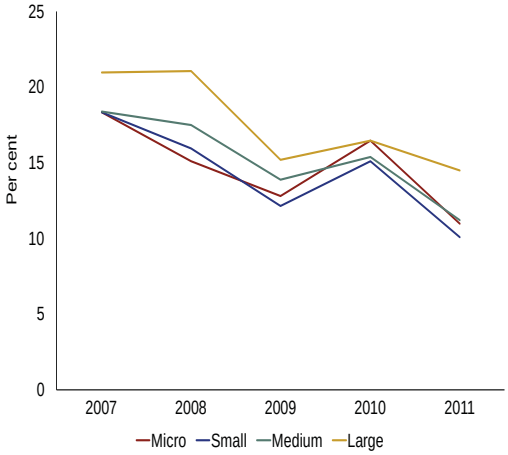
EVOLUTION OF INVESTMENT RATE



Source: Banco de Portugal (Central Balance Sheet).

Chart 2

EVOLUTION OF MEDIAN INVESTMENT RATE BY FIRM SIZE

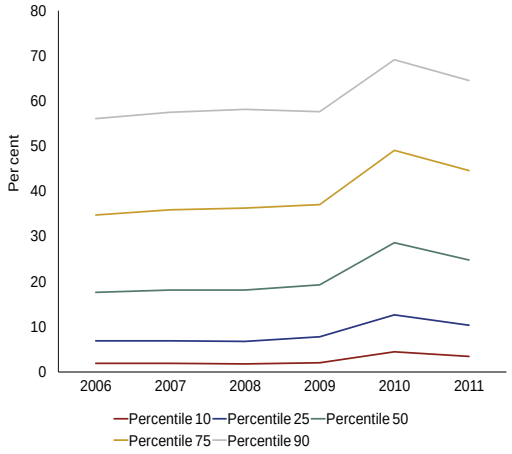


Source: Banco de Portugal (Central Balance Sheet).

5 The results from Figure 9 and Figure 10 might seem contradictory given that the median Profitability for the overall distribution is slightly declining and when splitting according to size the results show an upward Profitability level with the exception of Micro sized firms. The reason for this difference relies upon the fact that the distribution in Figure 9 is dominated by Micro sized firms (which represent 83% of the sample).

Chart 3

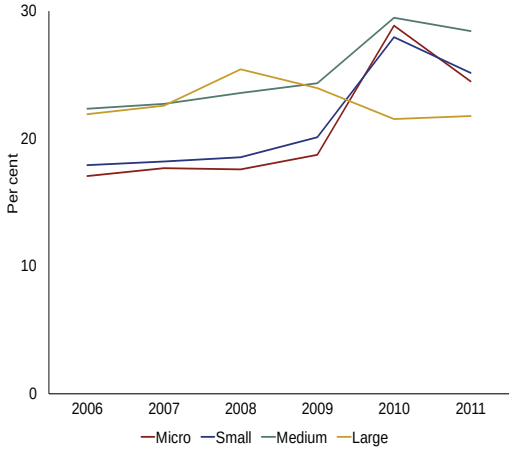
EVOLUTION OF INDEBTEDNESS LEVEL



Source: Banco de Portugal (Central Balance Sheet).

Chart 4

EVOLUTION OF MEDIAN INDEBTEDNESS LEVEL BY FIRM SIZE

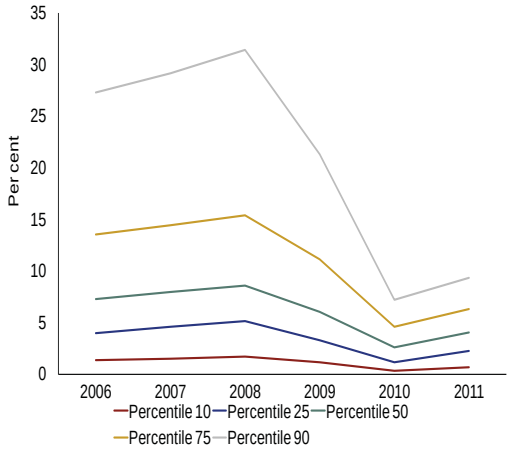


Source: Banco de Portugal (Central Balance Sheet).

In order to assess the relationship between the investment rate and several indicators of the firms' financial situation, it is useful to perform a bivariate analysis, which provides an initial understanding of the relationship between the investment rate and the main variables of interest. The chosen variables are those presented before, that is, indebtedness, the financing cost, the interest burden and profitability. Charts 11, 12, 13 and 14 compare the median investment rate in different corporate groupings defined on the basis of the variables that are expected to influence the investment rate. Each chart presents the median cash holding ratio for firms with high, medium and low levels, respectively, of that indicator. The median decile (which includes firms between percentiles 45 and 55) can be regarded as representative of the behaviour of the typical firm of that size in terms of the respective variable, while the top (bottom) decile includes the 10% of firms with the highest (lowest) value of the variable. Moreover, Charts 15, 16,

Chart 5

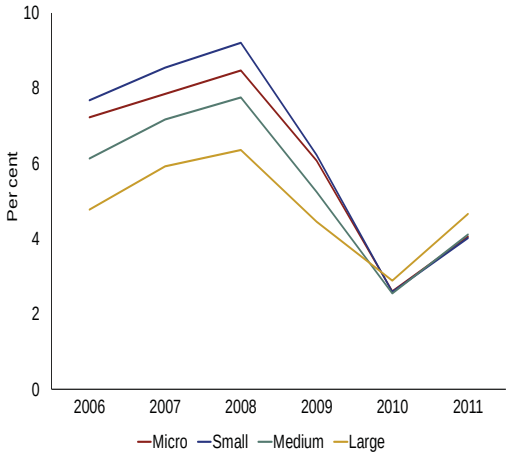
EVOLUTION OF FINANCING COST



Source: Banco de Portugal (Central Balance Sheet).

Chart 6

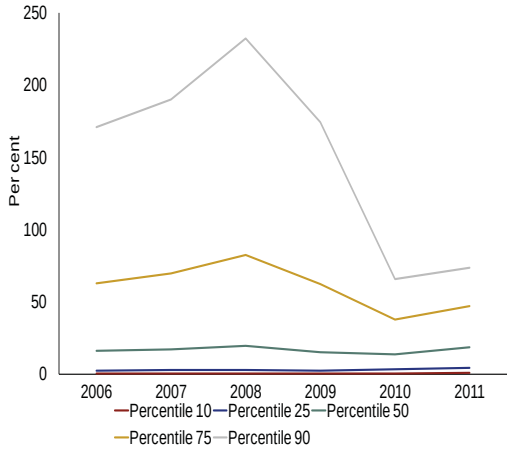
EVOLUTION OF MEDIAN FINANCING COST BY FIRM SIZE



Source: Banco de Portugal (Central Balance Sheet).

Chart 7

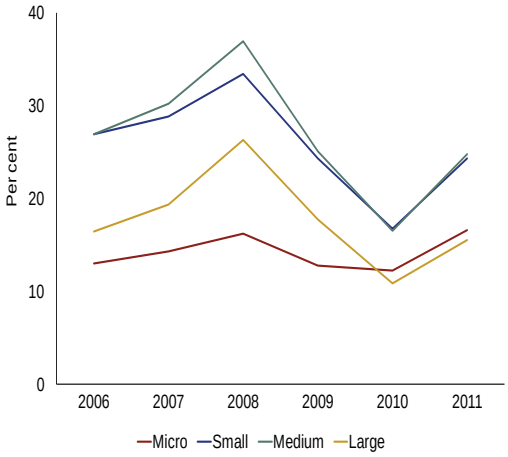
EVOLUTION OF INTEREST BURDEN



Source: Banco de Portugal (Central Balance Sheet).

Chart 8

EVOLUTION OF MEDIAN INTEREST BURDEN BY FIRM SIZE



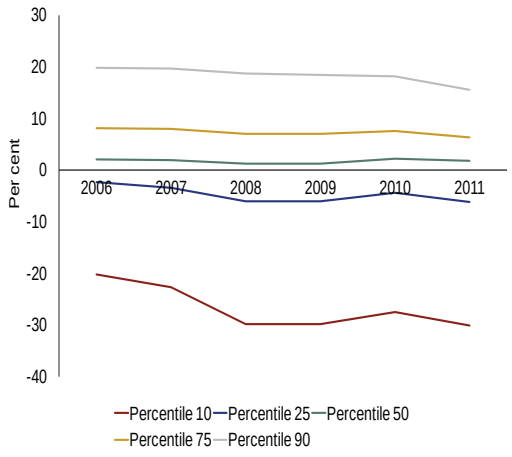
Source: Banco de Portugal (Central Balance Sheet).

17and 18 (in Appendix – Chart-Analysis part]) depict the median investment rate for firms belonging to the top, median and bottom deciles of the indicators for micro, small, medium and large firms, respectively.

Chart 11 shows that firms with high levels of indebtedness show substantially lower investment rates than firms with intermediate or low levels of this variable. This pattern is broadly seen in all size groups (Chart 15). One interesting feature is the fact that, for the group of Large Firms with a lower indebtedness level (and less for the group of firms in the mid decile), the investment rate in 2011 increased moderately, which might indicate a decision for these less-constrained firms to take advantage of potential investments opportunities.

Chart 9

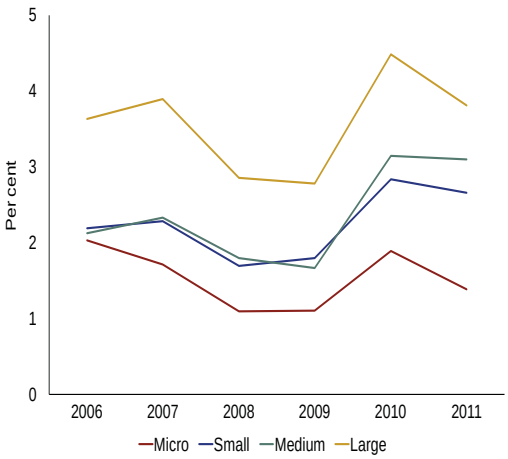
EVOLUTION OF PROFITABILITY



Source: Banco de Portugal (Central Balance Sheet).

Chart 10

EVOLUTION OF MEDIAN PROFITABILITY BY FIRM SIZE



Source: Banco de Portugal (Central Balance Sheet).

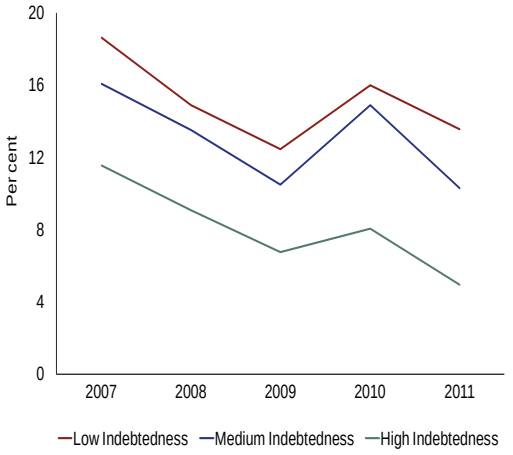
When looking at the relation between investment and the Financing Cost variable (Chart 12), firms in the last decile of the Financing Cost distribution present an investment rate that is higher but close to the ones with a median Financing Cost. This apparently unexpected result could be related to the fact that under a bivariate analysis there are factors affecting investment that are not controlled. For instance, small and young firms are usually assumed to be riskier thus facing a higher financing cost but still having a greater growth potential. This may explain the higher investment demand. This pattern is also generally observed for firms in the different size categories (Chart 16).

As for the Interest Burden indicator (Chart 13) a clearer cut relationship is obtained. In fact a higher Interest Burden ratio might indicate a more financially pressured firm. In that sense, the results show that firms with a higher Interest Burden present the smaller rates of investment. The same pattern is generally seen for the different size categories (Chart 17).

With respect to the relationship between investment and the Profitability indicator (Chart 14) the results show two different patterns. On the one hand, firms in the upper decile of Profitability present higher

Chart 11

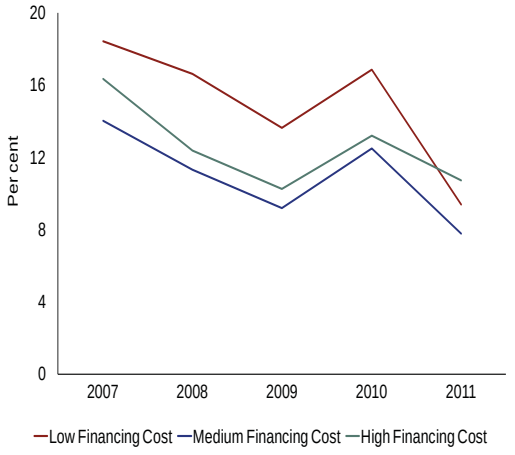
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT INDEBTEDNESS LEVELS



Source: Banco de Portugal (Central Balance Sheet).

Chart 12

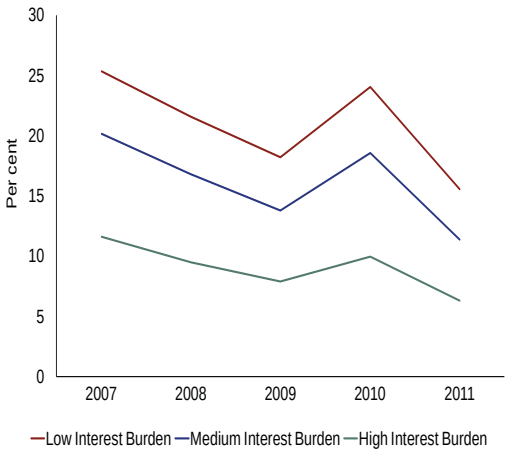
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT FINANCING COST LEVELS



Source: Banco de Portugal (Central Balance Sheet).

Chart 13

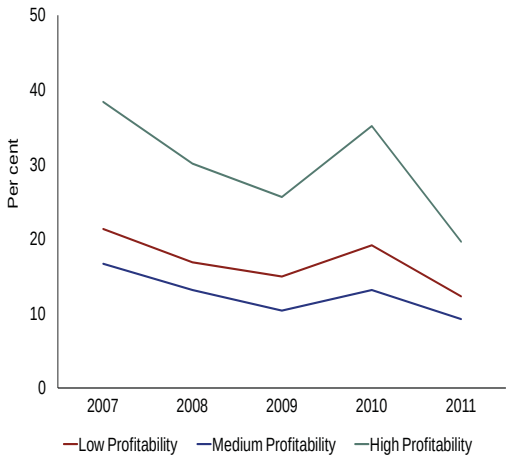
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT INTEREST BURDEN LEVELS



Source: Banco de Portugal (Central Balance Sheet).

Chart 14

EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT PROFITABILITY LEVELS



Source: Banco de Portugal (Central Balance Sheet).

investment rates. On the other hand, and somehow unexpected as firms with low profitability levels (in the first decile) have a higher investment rate than firms with median profitability. However, this pattern seems to break down when the analysis is performed according to firm sizes (Chart 18) with the exception being the Large Firms group in 2010, where firms located in mid-decile of the Profitability distribution present a lower investment rate than firms located in the lower profitability decile.

4. Econometric Analysis and Main Results

4.1 Methodology and model specification

Previous section presents a simple bivariate analysis of firms' investment rate according to the various measures of their financial standing. These measures are expected to be correlated with each other, as well as with other firms' characteristics what makes the interpretation of the results based on that analysis particularly difficult. In order to overcome this limitation, this section presents the results of multivariate regressions for firms' investment rate. The objective of the econometric analysis is not to obtain a causal relationship between firms' financial standing and investment but merely to test the sign and significance of the correlation between them. The analysis is based on the estimation of the following equation:

$$Inv_{i,t} = \alpha_i + \gamma Inv_{i,t-1} + \beta X_{i,t-1} + \delta Sales_{i,t-1} + \varphi_j Size_{j,t-1} + \theta_t + S_i + \varepsilon_{i,t} \quad (1)$$

where i indexes firms $\mathrm{i} = 1,2,\ldots,\mathrm{N}$ and t indexes year $\mathrm{t} = 1,2,\ldots,\mathrm{T}$ and j indexes each firm size category where $\mathrm{j} = 1,2,3,4$ corresponding to Micro, Small, Medium and Large Firms (with the latter being the omitted category) respectively. As for the variables used, $Inv_{i,t}$ refers to the firm's i investment rate at time t, $X_{i,t-1}$ represents the vector of financial variables of interest (interest burden, indebtedness, financing cost, and profitability), Sales are the log of real sales or business turnover, θ_t are time effects controlling for macroeconomic influences, S_i are fixed industry effects, and finally $\epsilon_{i,t}$ is the error term. With the exception of the investment rate variable, all continuous variables are presented as logarithms and as deviations from the sample mean in order to facilitate the reading of the results.[6]

Besides the above specification and with the aim of evaluating how the impact of the financial variables of interest change according to firm size, equation 1 was re-estimated using instead the financial variable under review interacted with the four firm-size categories. In addition, a test was made to a differentiated effect for the period before and after crisis (defined as a dummy variable equal to 1 for 2010 and 2011).

The estimation method consists of using the GMM-System estimator proposed by Arellano and Bover (1995) and further developed by Blundell and Bond (1998). These models are particularly indicated when the number of years is small and the number of firms is large; there are fixed individual effects, autoregressive variables that show high persistence; and independent variables that are not strictly exogenous. By using this methodology, equations are estimated in levels and in differences and the instruments for these are the lagged values of the non-strictly exogenous variables. For all estimations, the Hansen test (at the conventional 5% level) for the validity of instruments and the Arellano and Bond (1991) test of non-existence of first and second order serial correlation in the first-differenced residuals (labeled AR 1 and AR 2) are presented.

6 The specification in question corresponds to considering for the interest burden (B), for instance, the variable $b_{i,t} = \ln\left(B_{i,t}\right) - \overline{ln(B)}$ where $\overline{ln(B)}$ is the sample mean.

4.2 Main results

The baseline scenario

The main results are presented in Table 1 and are structured as follows: Column 1 presents the results of estimating the base model that does not include any of the financial variables; Columns 2 to 5 report the estimates of the basic specification augmented with one financial variable at a time. As referred in section 3, these results were obtained with a large sample of private, indebted non-financial corporations. Moreover, in order to preserve the monotonicity of the relation between the interest burden ratio and firms' financial standing only observations with a positive gross operating income were considered.[7]

The results for the base model suggest that there is persistency in company level investment as the estimated coefficient for the 1-period lagged investment rate assumes a positive and statistically significant value (in line with the work of Barbosa *et al*., 2007). As expected, the effect of Sales, which proxies firms' growth potential, is positive and significant. In line with the prior that larger firms are more mature in their respective life cycle, which reduces the need to make significant investments in capital accumulation, the magnitude and significance of the size dummies in column 1 show that the investment rate of small and micro firms is significantly higher than the investment rate of large firms (the omitted category). The coefficients associated to the year dummies show that the investment rates in 2009 and particularly in 2011 were lower than in 2008 (the omitted year) but were higher in 2010. The above results are globally confirmed by the models that include firms' financial variables with a few exceptions such as the negative and statistically coefficient (yet only at the 10% level) for the Sales variable in column 3 and the negative but not statistically significant coefficient for the 1-period lag investment in column 4.

Regarding the effect of firms' financial variables, which is the main focus of the analysis in this article, the results show that these effects have the expected sign and are statistically significant at the usual levels of significance as found in related work (Martínez-Carrascal and Ferrando, 2008; Bond *et al*., 2003; Benito and Hernando, 2007; Hernando and Martínez-Carrascal, 2008; Barbosa *et al*., 2007). More specifically, the model in column 2 includes the variable measuring firm's indebtedness level, which shows a negative and significant relationship with the investment rate suggesting that higher levels of debt might restrain firms from future investments. In column 3, Profitability also has the expected positive and significant coefficient indicating that firms with high levels of profitability tend to invest more in the subsequent year. With respect to the Interest Burden variable (column 4) the results showed a negative and highly significant coefficient suggesting that this measure appears to be relevant in the analysis of the Portuguese corporate investment. A similar result was found for the impact of firms' Financing Cost (column 5) that showed a negative and highly significant coefficient indicating that an increase in the cost of capital makes it less likely for future investments to become worthwhile pursuing. In general, these results support the hypothesis that financial pressure faced by firms is relevant to explain corporate investment decisions, as the interest burden, indebtedness, financing cost and profitability are found to be significant when included in investment equations.[8]

7 The models in columns 1, 2, 3 and 5 were also estimated without imposing this last restriction. The results of these estimations do not change the conclusions.

8 As in Barbosa *et al*. (2007) and Benito and Hernando (2007) a specification that included three of the financial variables under analysis (Indebtedness, Financing Cost and Profitability) simultaneously was also tested. Under this specification, only Financing Cost and Profitability are statistically significant and have the expected negative and positive coefficient respectively. On the other hand, the Indebtedness variable had a positive coefficient yet not statistically significant. This result is similar to the ones found in Barbosa *et al*. (2007) where the signs of the coefficients were the same but only Profitability and Indebtedness were statistically significant.

Table 1

ECONOMETRIC RESULTS FOR THE INVESTMENT RATE ($INV_{i,T}$)

	Base Model	Indebtedness	Profitability	Interest Burden	Financing Cost
$Inv_{i,t-1}$	0.0145***	0.0135***	0.0138***	-0.00971	0.00735*
	(4.717)	(3.904)	(4.016)	(-1.263)	(1.789)
$Sales_{i,t-1}$	0.00244*	0.00264*	-0.00243*	-0.00119	0.00384***
	(1.779)	(1.919)	(-1.771)	(-0.683)	(2.655)
Micro firms $_{i,t-1}$	0.0918***	0.0936***	0.0843***	0.116***	0.104***
	(7.966)	(8.073)	(7.336)	(7.982)	(8.550)
Small firms $_{i,t-1}$	0.0403***	0.0445***	0.0450***	0.0844***	0.0518***
	(3.709)	(4.022)	(4.154)	(4.728)	(4.520)
Medium firms$_{i,t-1}$	0.000262	0.00766	0.0102	0.0449**	0.00310
	(0.0228)	(0.642)	(0.891)	(2.478)	(0.268)
Year 2009	-0.0451***	-0.0407***	-0.0456***	-0.0366***	-0.0373***
	(-14.14)	(-12.45)	(-13.59)	(-7.216)	(-11.01)
Year 2010	0.0533***	0.0572***	0.0515***	0.0357***	0.0385***
	(15.31)	(15.27)	(14.16)	(7.432)	(6.446)
Year 2011	-0.0760***	-0.0540***	-0.100***	-0.163***	-0.132***
	(-24.89)	(-6.954)	(-31.76)	(-6.821)	(-7.006)
$X_{i,t-1}$		-0.0295**	0.0460***	-0.0688***	-0.0410***
		(-2.464)	(42.29)	(-3.186)	(-3.238)
Observations	188,852	188,852	188,852	188,852	188,852
No of firms	97,499	97,499	97,499	97,499	97,499
Hansen (p-value)	0.152	0.220	0.453	0.380	0.117
AR 1 (p-value)	0	0	0	0	0
AR 2 (p-value)	0.881	0.800	0.771	0.983	0.970

Source: Banco de Portugal (Central Balance Sheet).

Notes: Estimation by GMM system estimator, using the routine xtabond2, developed by Roodman (2005). The variable $X_{i,t-1}$ corresponds to the financial variables under analysis presented on top of each column. Lags 1 to 4 in levels of investment rate were used for columns 1, 2, 3 and 5 while in column 4 it was only used lags 2 to 4. Lag 2 of investment rate was also used as first-differencing instrument in column 1 and 4. Were used as instrument in column 2 the indebtedness lag 2 and 3 in levels; in column 4 the interest burden lag 3 and 4 in level; in column 5 the financing cost lag 4 in first-differencing; and Profitability was taken as strictly exogenous in column 3.The variables Sales, the Size indicator dummies, as well as the year and sectoral dummies were used as regular instrument, even though Sales was used only in levels. T-statistics in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

The effect of firm size

Financial frictions in the access to credit motivated mainly by asymmetries of information are expected to affect smaller firms more significantly. Larger firms will be more capable of reducing information asymmetries vis-à-vis potential lenders as they are able to better report their financial conditions. Furthermore, larger firms also have easier access to alternative financing sources than smaller firms, such as equity markets. Hence, it is expected that larger firms will be less affected by their own financial conditions and thus less financially constrained then smaller firms. Accordingly, the base model presented in Equation 1, was re-estimated considering that the coefficient of the financial variable under review is different

for each of the four categories of firm size[9], which corresponds to estimate the following specification:

$$\mathrm{Inv}_{i,t} = \alpha_i + \gamma Inv_{i,t-1} + \beta_k X_{i,t-1} Size^k_{j,t-1} + \delta Sales_{i,t-1} + \varphi_j Size_{j,t-1} + \theta_t + S_i + \varepsilon_{i,t} \quad (2)$$

where $k = 1,,\ldots,4$ indexes the four firm-sizes categories and where the financial variable under review is interacted with each of the firm size dummies (ranging from Micro to Large Firms) and the results are reported in Table 2.

In this specification, the results show that the 1-period lagged investment rate variable is positive and highly significant when using the Indebtedness and Profitability financial variables, which reinforces the previous result for the existence of persistence in this variable. Nevertheless, it is no longer statistically significant in column 4 (Financing Cost) and is negative and statistically significant in column 3 (Interest Burden).[10]

Overall, the signs and statistical significance of the coefficients associated with the financial variables are in line with the ones previously obtained. As expected in the case of Large Firms, the effect of some of the financial variables are non-significant, which might indicate that these firms are less severely affected by their financial conditions. More specifically, this is the case for the Interest Burden, which is negative and significant for all firm size categories with the exception of large firms. In addition, the magnitude of the coefficient increases for smaller firms, which supports the suggestion that smaller firms are particularly affected by a high ratio of the cost of debt to income. In the same line, the interaction between Financing Cost and the Large Firm size indicator is also not statistically significant. On the other hand, and given the proximity of the size of the coefficients and the fact that all are highly statistically significant, the measure that seems to affect all firm sizes in the same manner is Profitability.[11]

The effect of the Financial Crisis

The relationship between firm's financial conditions and its investment decisions may have changed during the period of financial and economic crisis where access to bank finance and the credit markets in general deteriorated considerably.[12] To test this hypothesis equation 1 was re-estimated but now adding interaction terms, combining the financial crisis dummy with the financial variables of interest, *i.e.,*:

$$Inv_{i,t} = \alpha_i + \gamma Inv_{i,t-1} + \beta_1 X_{i,t-1} + \beta_2 X_{i,t-1} Crisis_{i,t-1} + \delta Sales_{i,t-1} + \varphi_j Size_{j,t-1} + \theta_t + S_i + \varepsilon_{i,t} \quad (3)$$

where Crisis is a dummy variable that is equal to 1 for the years of 2010 and 2011 and zero otherwise. The estimation results from this analysis (reported in Table 3) show that the several financial variables used had different impacts on corporate investment during the financial crisis period. The results concerning Profitability (column 2) and Interest Burden (column 3) suggest that the effect of these variables was amplified during the most recent period. More specifically, the results show that the interaction term between the Crisis dummy and Profitability, the crisis interaction term is positive and highly significant

9 A specification with a continuous measure for firm size (based on the logarithm of total assets at constant prices) with a quadratic term was tested, but it was not statistically significant, even though the linear term was negative and significant, representative of the same negative relationship between firm size and investment rate.

10 It is worth noting the lack of consensus in the literature regarding the expected sign of the 1-period lag investment variable given that both positive (Martínez-Carrascal and Ferrando, 2008; Barbosa *et al.*, 2007), insignificant (Benito and Hernando, 2007; Bond *et al.*, 2003; Hernando and Martínez-Carrascal, 2008), as well as statistically significant negative results (Martínez-Carrascal and Ferrando, 2008) have been found.

11 The above analysis was re-estimated by running regressions solely on the specific firm-size categories instead of using a dummy variable approach. The results from these estimations were in line with the ones found when using firm-size dummy interactions with the financial variable of interest. More specifically, the financial variables stop being statistically significant as firms get larger with the exception being the firm's profitability, which is statistically significant regardless of firm size.

12 The tightening of credit standards being determined by banks difficulties in financing in the international wholesale debt markets, reflecting the increase in sovereign risk premium and a general rise of risk aversion.

Table 2

ECONOMETRIC RESULTS FOR THE INVESTMENT RATE ($INV_{i,T}$) BY SIZE

	Indebtedness	Profitability	Interest Burden	Financing Cost
$Inv_{i,t-1}$	0.0128***	0.0137***	-0.0108**	0.00382
	(3.714)	(4.003)	(-2.433)	(0.973)
$Sales_{i,t-1}$	0.00254*	-0.00244*	-0.00326**	0.00427***
	(1.846)	(-1.775)	(-2.104)	(2.818)
$Micro\ firms_{i,t-1}$	0.101***	0.0852***	0.152***	0.0996***
	(7.878)	(7.374)	(8.009)	(6.924)
$Small\ firms_{i,t-1}$	0.0508***	0.0451***	0.120***	0.0460***
	(4.163)	(4.127)	(6.409)	(3.338)
$Medium\ firms_{i,t-1}$	0.0262*	0.0102	0.0651***	-0.00961
	(1.924)	(0.881)	(3.037)	(-0.651)
Year 2009	-0.0398***	-0.0456***	-0.0290***	-0.0355***
	(-12.21)	(-13.60)	(-7.737)	(-10.55)
Year 2010	0.0568***	0.0515***	0.0311***	0.0295***
	(15.71)	(14.16)	(8.098)	(5.645)
Year 2011	-0.0554***	-0.100***	-0.206***	-0.167***
	(-11.41)	(-31.75)	(-20.03)	(-11.03)
$X_{i,t-1}$ * $Micro\ firms_{i,t-1}$	-0.0288***	0.0470***	-0.117***	-0.0635***
	(-3.031)	(32.53)	(-10.26)	(-5.828)
$X_{i,t-1}$ *$Small\ firms_{i,t-1}$	-0.0135*	0.0446***	-0.103***	-0.0542***
	(-1.769)	(25.69)	(-11.17)	(-5.826)
$X_{i,t-1}$* $Medium\ firms_{i,t-1}$	-0.101***	0.0443***	-0.0856***	-0.153**
	(-4.091)	(13.34)	(-6.310)	(-2.542)
$X_{i,t-1}$ * $Big\ firms_{i,t-1}$	-0.134**	0.0384***	-0.0545	0.0689
	(-2.092)	(3.006)	(-1.289)	(0.823)
Observations	188,852	188,852	188,852	188,852
No of firms	97,499	97,499	97,499	97,499
Hansen (p-value)	0.0754	0.457	0.302	0.0729
AR 1 (p-value)	0	0	0	0
AR 2 (p-value)	0.833	0.773	0.676	0.990

Source: Banco de Portugal (Central Balance Sheet).

Notes: The variable $X_{i,t-1}$ corresponds to the financial variables under analysis interacted with the respective firm size indicator variable. Lags 1 to 4 in levels of investment rate were used for all regressions. In column 1, it was used as first-differencing instruments lag 2 of Indebtedness*Micro and Indebtedness*Medium, and lag 2 and 3 in first-differencing of Indebtedness*Small and Indebtedness*Big. It was also used lag 1 to 3 in levels of Indebtedness*Small. In column 3, it was used lags 3 both in levels and first-differencing for all interest burden interactions. In column 4, it was used as first-differencing instruments lag 3 to 4 of Financing Cost*Micro, Financing Cost*Small and Financing Cost*Big, and in levels lag 3 of Financing Cost*Small, Financing Cost*Medium and Financing Cost*Big. In column 2, Profitability interactions were once again used as strictly exogenous. The variables Sales, the Size indicator dummies, as well as the year and sectoral dummies were used as regular instrument, even though Sales was used only in levels. T-statistics in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

Table 3

ECONOMETRIC RESULTS FOR THE INVESTMENT RATE ($INVI_{i,T}$) INTERACTED WITH CRISIS YEAR DUMMY

	Indebtedness	Profitability	Interest Burden	Financing Cost
$Inv_{i,t-1}$	0.0138***	0.0137***	0.288*	0.00540
	(3.992)	(3.985)	(1.754)	(1.487)
$Sales_{i,t-1}$	0.00172	-0.00243*	-0.00936***	0.00450***
	(1.230)	(-1.772)	(-2.621)	(3.212)
Micro firms $_{i,t-1}$	0.0934***	0.0841***	0.0912***	0.113***
	(8.085)	(7.321)	(3.659)	(9.543)
Small firms $_{i,t-1}$	0.0426***	0.0448***	0.0791***	0.0598***
	(3.892)	(4.134)	(3.721)	(5.373)
Medium firms$_{i,t-1}$	0.00179	0.00998	0.0559***	0.00677
	(0.155)	(0.871)	(3.482)	(0.582)
Year 2009	-0.0406***	-0.0459***	-0.0119	-0.0351***
	(-12.40)	(-13.68)	(-1.242)	(-10.56)
Year 2010	0.0512***	0.0537***	0.0845***	0.0258***
	(13.20)	(13.99)	(3.025)	(5.873)
Year 2011	-0.0674***	-0.0992***	-0.186***	-0.151***
	(-14.08)	(-30.92)	(-12.91)	(-17.06)
$X_{i,t-1}$	0.0192*	0.0431***	-0.103***	-0.0683***
	(1.684)	(30.29)	(-13.10)	(-11.26)
$X_{i,t-1}$* $Crisis_{i,t-1}$	-0.0353***	0.00619***	-0.00863*	0.0214***
	(-2.689)	(2.972)	(-1.710)	(3.772)
Observations	188,852	188,852	188,852	188,852
No of firms	97,499	97,499	97,499	97,499
Hansen (p-value)	0.211	0.454	0.134	0.239
AR 1 (p-value)	0	0	6.07e-05	0
AR 2 (p-value)	0.848	0.772	0.0472	0.998

Source: Banco de Portugal (Central Balance Sheet).

Notes: The variable $X_{i,t-1}$ corresponds to the financial variables under analysis interacted with a dummy indicator equal to 1 in years 2010 and 2011. Lag 1 to 3 in levels of investment rate were used for all regressions with the exception of column 3 where it was only used lag 3. In column 1, it was used lag 1 to 3 of indebtedness in levels and lag 2 in levels and first-differencing for the interaction variable. In column 3, it was used as instrument lag 2 to 4 of interest burden in first-differencing, and lag 3 to 4 of the interaction in levels. In column 4, it was used lag 2 to 4 of Financing Cost in first-differencing and lag 2 and 3 of the interaction in levels. In column 2, Profitability interactions were once again used as strictly exogenous. The variables Sales, the Size indicator dummies, as well as the year and sectoral dummies were used as regular instrument, even though Sales was used only in levels. T-statistics in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

suggesting that internally generated funds became increasingly important during the period of harsher access to financial markets. As for Profitability, the crisis interaction term and Interest Burden is negative and statistically significant (yet, only at the 10% level) indicating that firms with higher debt burdens suffered the most during this period.

The results also show that, in 2010 and 2011, the effect of Indebtedness on corporate investment was negative, more than offsetting the positive effect that is estimated for the period prior to 2010 (though

this positive effect is significant only at the 10 per cent level of significance). This result suggests that a high level of indebtedness can become particularly harmful to firms in a period of economic and financial stress. Moreover, and despite the fact that no explicit test for the existence of non-linear effects between financial conditions and corporate investment rates was made (as in Hernando and Martínez-Carrascal, 2008), these results may also suggest that the impact of financial conditions on firm's investment demand is non-linear and also depends on external financial conditions.

With respect to the Financing Cost variable, the results show that firms' investment has been less sensitive to their cost of financing in the more recent period, a result that is consistent with the prevalence of credit rationing in the amount of credit available rather than through its price (as suggested by Holmstrom and Tirole (1997)). Even though Financing Cost remained significant in explaining corporate investment decisions its impact on investment decisions seemed to decrease during the financial crisis period.

5. Concluding remarks

The aim of this analysis was to study how corporate investment decisions relate to the financial standing of Portuguese indebted firms, proxied by Indebtedness levels, Profitability, Interest Burden and Financing Cost. The analysis of the link between corporate financial standing and investment decisions is particularly relevant given (i) the high indebtedness levels of Portuguese firms, (ii) the reduction in profitability of the Portuguese firms, which reduces the amount of internally available funds thus increasing the demand for external financing, and (iii) the ongoing Financial and Economic Crisis that considerably changed the conditions and access to the credit markets.

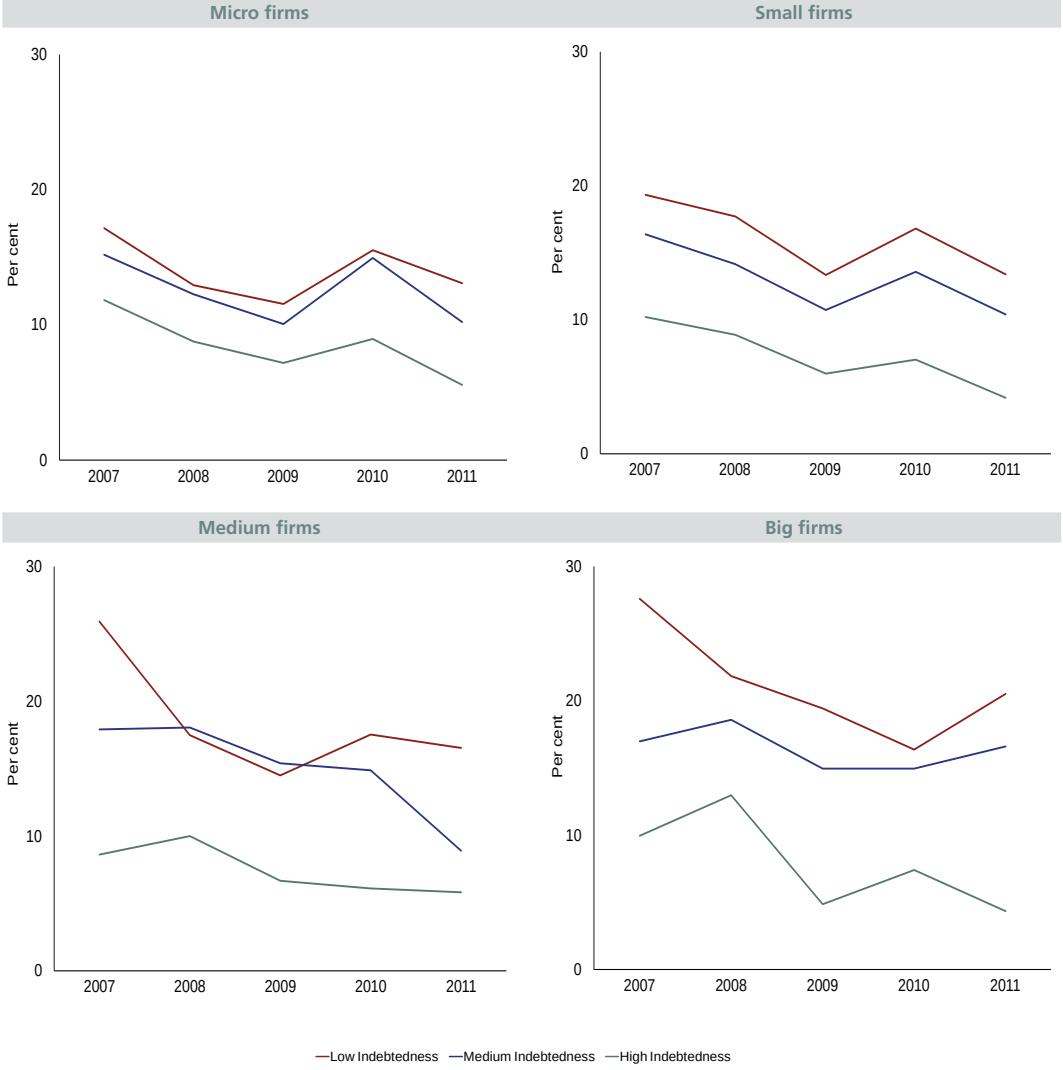
The results obtained indicate that firms' financial standing is indeed relevant in explaining corporate investment decisions, as the financial variables of interest are all statistically significant in the estimated investment equations and have the expected signs. More specifically, the results show that the burden of servicing debt, the cost of capital, and the firm's indebtedness all have a negative relationship with firm's investment rate. Furthermore, the results strongly suggest a positive (and statistically significant) relationship between the firm's profitability and its investment decisions. Nonetheless, this sensitivity is not uniform across firms and depends on some of their specific characteristics. In particular, we studied potential differences between smaller and larger firms in the relationship between financial standing and investment rates. From this analysis, we found some evidence that larger firms seem to be less sensitive to financial pressure, as the significance of some of the financial conditions indicators (Interest Burden and Financing Cost) were either not-significant in explaining investment decisions for larger firms or had coefficients with smaller magnitude. In addition, there is evidence suggesting that the impact of firms' financial standing became more relevant during the period of the sovereign debt crisis in the euro area. In particular, we found that the magnitude of Profitability and Interest Burden was amplified during this period. The impact of firm's indebtedness level moved from positive to negative and the impact of the Financing Cost seemed to have become less pronounced in the most recent period.

Several avenues for future research may be explored such as the existence of potential non-linear relationships between the financial variables considered and corporate investment decisions. More specifically, and following the work of Benito and Hernando (2007) and Hernando and Martínez-Carrascal (2008) we intend to perform quantile regressions to test the hypothesis that by being in a different point of the distribution of the financial variable relates differently to the level of corporate investment.

Appendix – Investment and Financial Standing according to Firm Size

Chart 15

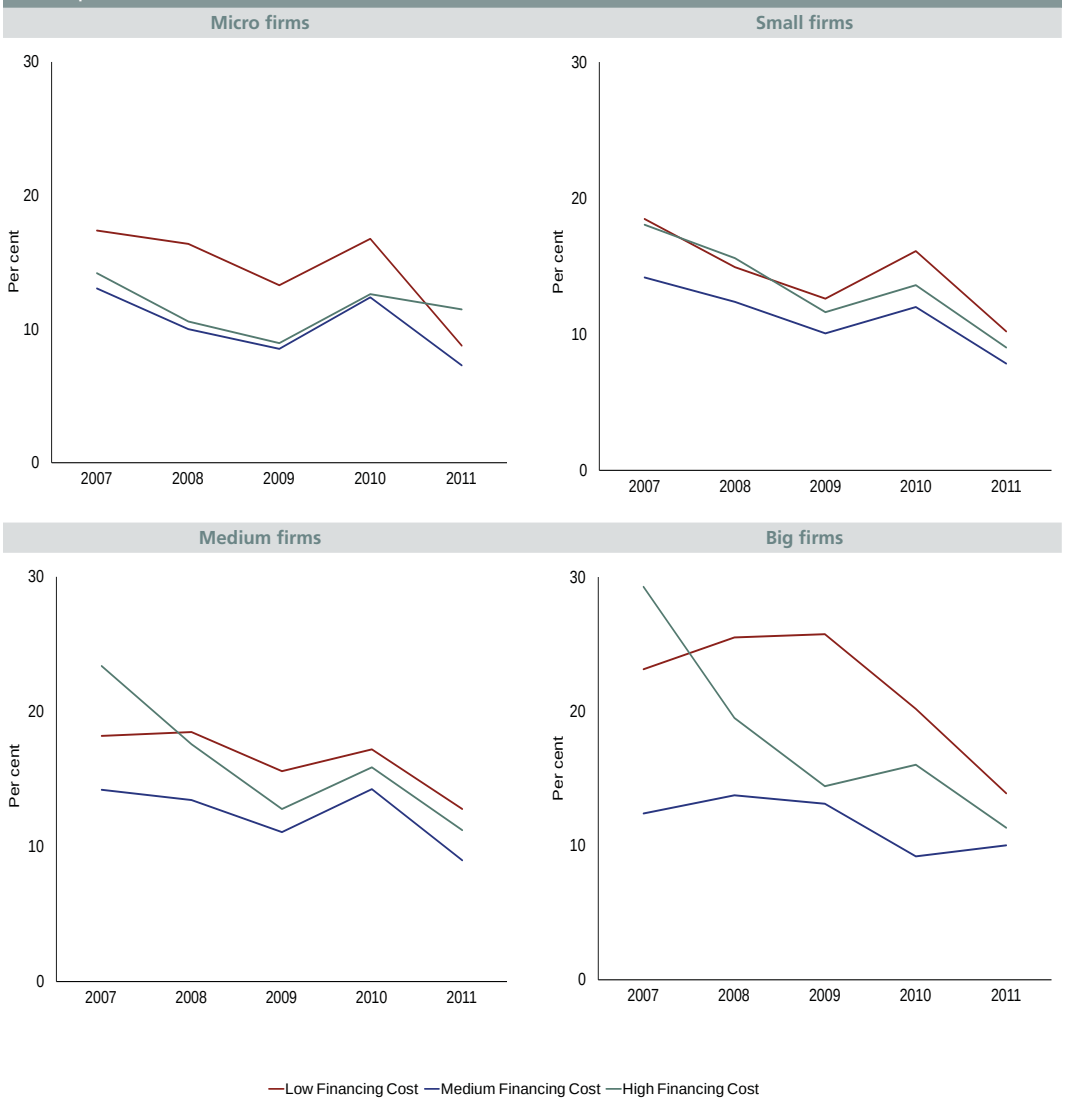
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT INDEBTEDNESS LEVELS BY FIRM SIZE | SEGUNDO A DIMENSÃO DA EMPRESA



Source: Banco de Portugal (Central Balance Sheet).

Chart 16

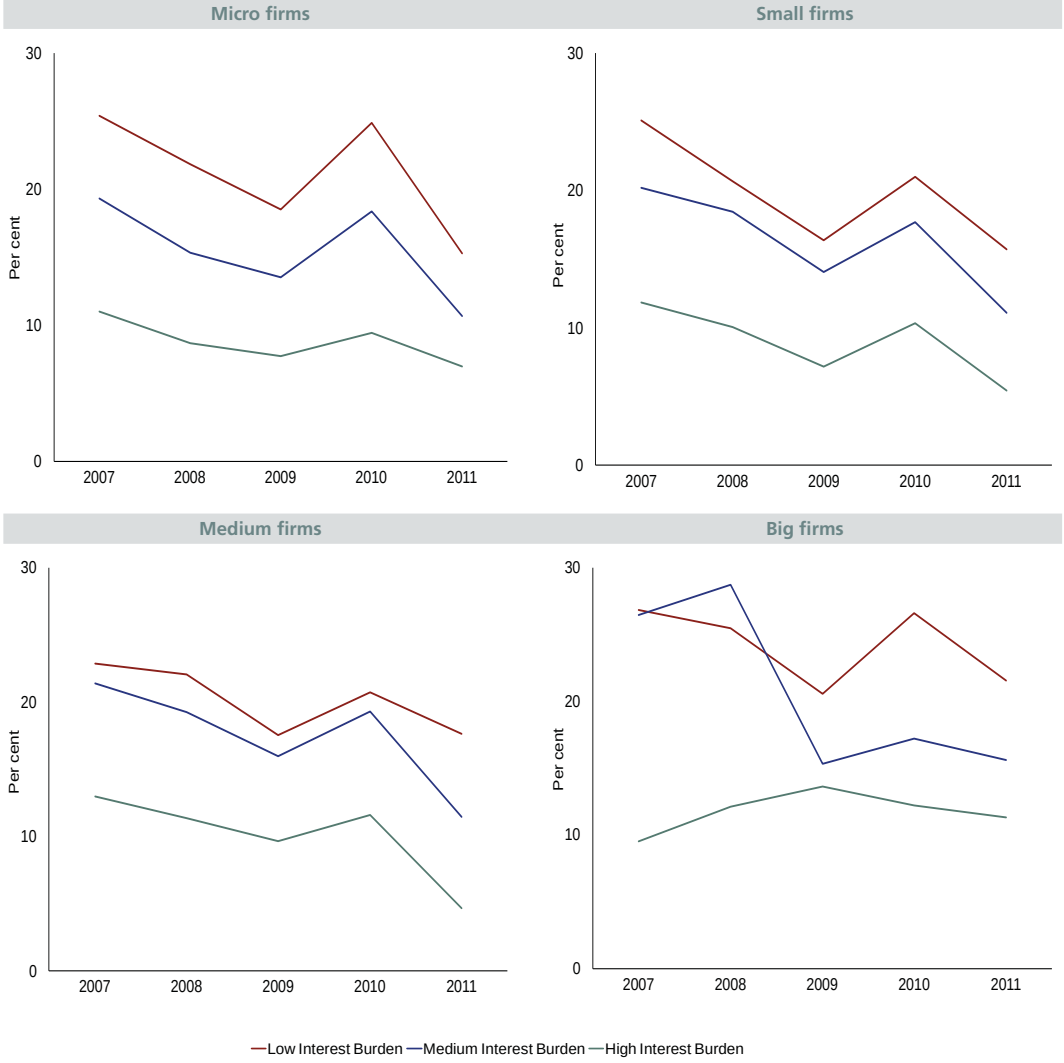
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT FINANCING COST LEVELS AND FIRM SIZES | SEGUNDO A DIMENSÃO DA EMPRESA



Source: Banco de Portugal (Central Balance Sheet).

Chart 17

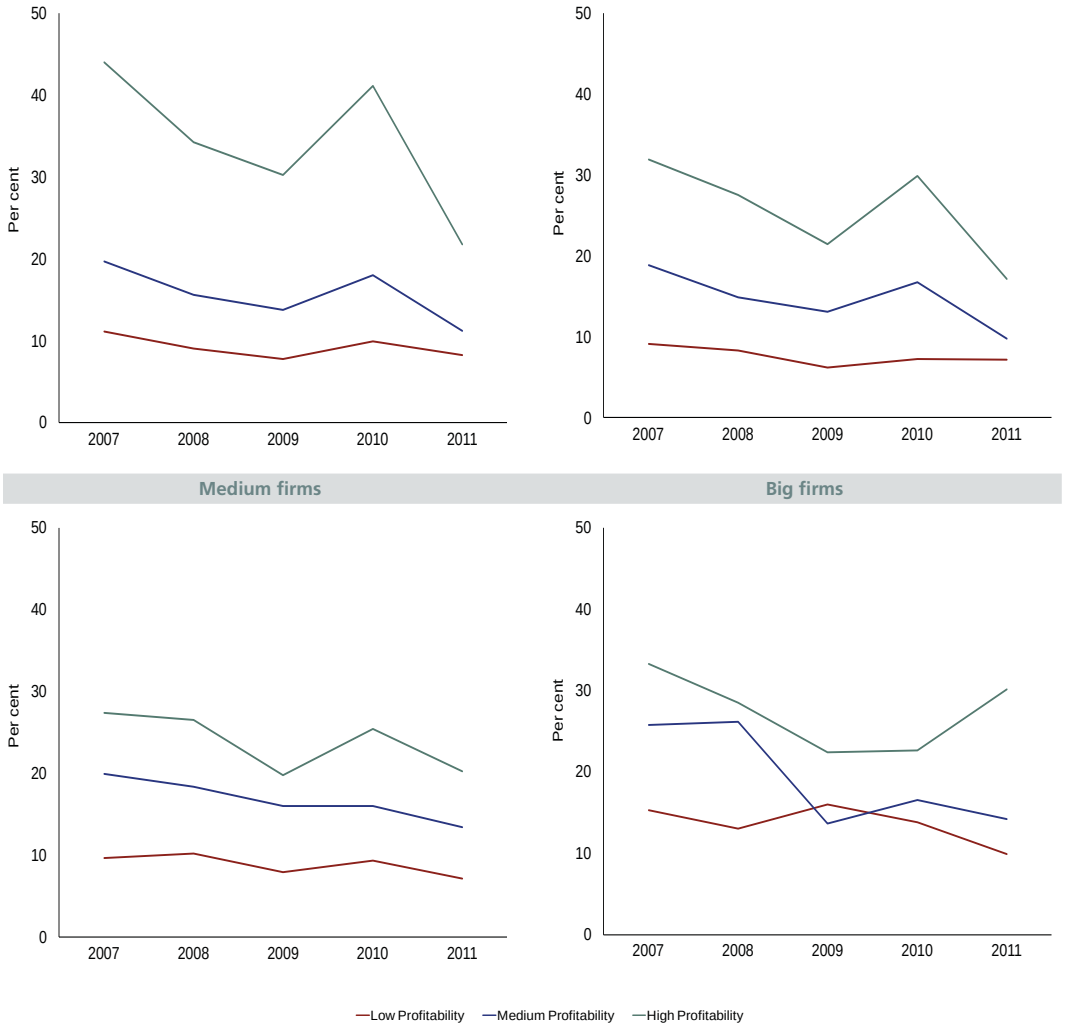
EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT INTEREST BURDEN LEVELS AND FIRM SIZES | SEGUNDO A DIMENSÃO DA EMPRESA



Source: Banco de Portugal (Central Balance Sheet).

Chart 18

EVOLUTION OF INVESTMENT RATE ACCORDING TO DIFFERENT PROFITABILITY LEVELS AND FIRM SIZES
| SEGUNDO A DIMENSÃO DA EMPRESA



Source: Banco de Portugal (Central de Balanços anual).

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