Title of Paper: The existence of a financial accelerator mechanism: The case of the Portuguese manufacturing sector.

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ABSTRACT

The recent financial and economic crises that affected a large number of countries, on one hand, and the recent theoretical developments in the field of information economics, on the other, drew attention to the existence of a potential link between financial factors and fluctuations in economic activity in what concerns investment in fixed assets. An issue that has been highlighted is the possibility that fluctuations in economic activity are related and amplified by financial weaknesses of firms – the so-called financial accelerator mechanism.

Based on this reasoning, this paper aims at enhancing current empirical knowledge by analysing the relationship between a firm's investment decision and its financial position. To that purpose three hypotheses were tested: (a) the financial position of a firm is a major determinant of its capital investment decisions; (b) the financial position of a firm is more important for firms that face higher information problems in financial markets; and (c) the financial position of a firm is even more important for firms that face bigger information problems in financial markets at times of economic recession.

The study herein presented, used a panel of aggregate data of sixteen Portuguese industrial sectors, covering a period of time from 1990 to 2005.

The findings obtained seem to lend support to the financial accelerator hypothesis. In fact, it was found that, in general, the financial position is an important determinant of a firms' investment decision, and that this impact is higher for smaller firms. However, the result on the influence of the business cycle was not as clear as it was expected.

Key-words: Investment; Financial accelerator; Information problems; Balance sheet position; Business cycle.

JEL codes: E32; G31

1. INTRODUCTION

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 (see, for example, Bernanke et al., 1996, Gertler, 1988), which emphasised the existence of information problems in financial markets, suggested the existence of a close relationship between financial factors, investment expenses of firms and fluctuations in economic activity. According to Gertler (1988: 560), these studies share the common assumption that information asymmetries can introduce inefficiencies in financial markets, which can have important real effects.

It should be emphasised that this issue is presently quite relevant given the Great Recession that most industrialised countries have experienced in 2008-2009. In fact, as highlighted by Gertler and Kiyotaki (2010: 2) «to motivate interest in a paper on financial factors in business fluctuations it used to be necessary to appeal either to the Great Depression or to the experiences of many emerging market economies. This is no longer necessary. Over the past few years the United States and much of the industrialized world have experienced the worst financial crisis of the post-war. The global recession that has followed also appears to have been the most severe of this era».

In this context, an issue that has deserved attention is the possibility that fluctuations in economic activity can be induced, not by shocks on production or on productivity, but by fragilities in firms' financial status. This fact is known as the financial accelerator mechanism. According to Bernanke et al. (1996: 2), the justification for the existence of that mechanism is based on the following arguments. Firstly, external finance is more costly than internal finance, due to asymmetric information problems in capital markets. Secondly, given the total amount of finance required, the premium of external finance is inversely related to the net worth of firms. Thirdly, a decline in net worth, increasing both the premium of external finance and the amount of external finance required, reduces the spending and production of firms.

This last result is the fundamental idea behind the concept of the financial accelerator. To the extent that negative shocks on the economy decrease firms' net worth, the effects on production and spending of firms resulting from the initial shock will be amplified.

In terms of investment, the impact of the financial accelerator mechanism means that financial variables (such as, balance sheet position and cash flows) affect investment decisions of firms. According to Gertler (1988: 573), these decisions become "excessively sensitive" to cash flows, that is, they are more sensitive than they would be if information problems in capital markets did not exist. In the case of perfect capital markets, cash flow and investment could be positively correlated since changes in the former could signal changes in the potential of future earnings of the firm. With imperfect capital markets there is an additional effect: an increase in cash flows strengthens the balance sheet of firms and thus reduces their capital costs.

Therefore, when a company has to decide about its investment outlays, it should consider not only the real aspects (e.g. relative prices of inputs or technology) of the investment decision, but also financial aspects, namely, its liquidity and its balance sheet position.

Based on this reasoning, this paper aims at contributing to the empirical literature on this issue by testing the following three hypotheses, for the case of the Portuguese manufacturing sector: (a) the financial position of a firm is a major determinant of its capital investment decisions; (b) the financial position of a firm is more important for firms that face higher information problems in financial markets; and (c) the financial position of a firm is even more important for firms that face higher information problems in financial markets at times of economic recession.

The choice for using the Portuguese industrial sector is particularly relevant for the decision to join the euro economies meant that Portugal could no longer use the exchange rate mechanism to stabilize its economy and it effectively led to a reduction in interest rates. Furthermore, globalisation precipitated the entry of less developed countries in market segments of low to medium technology base, the same that Portuguese economy had specialised, but at higher costs. Thus, the Portuguese economy faces the dilemma of either maintaining its "apparent" cost competitiveness (which implies the impoverishment of the country) or climbing up the value chain (producing products with higher value added) and increasing its productivity. Nonetheless, this second alternative involves, among other things, the existence of financially sound firms and solid financial institutions, to avoid investments being undermined by a lack of funding or capital availability.

The remainder of this paper is organised as follows. Section 2 presents a brief description of the literature on the financial accelerator mechanism. Section 3 presents a succinct overview of the Portuguese economy in the last two decades. Section 4 describes the data and the variables used in the empirical study. Section 5 comprises the model specification. In Section 6 the regression results are shown. In Section 7 there is a discussion of these results. Finally, Section 8 draws the main conclusions of this study and emphasises the major policy implications.

2. LITERATURE REVIEW

Although, a number of macroeconomic models assume perfect capital markets with the implication that financing decisions have no impact on real economic behaviour (Hall, 2001), other models that reject this hypothesis have been developed (e.g. Bernanke et al., 1996, and Gertler, 1988). In these models, it is assumed that the way a firm finances their investment is likely to affect the cost of funds and, therefore, its investment activity (Hall, 2001). In fact, a shock to the economy that lowers the value of some asset used as collateral then makes external financing more difficult to obtain. This, in turn, lowers economic activity and, hence, asset prices, even further (Elul, 2008).

Some of these models became known as "balance sheet models", and the "external finance premium" assumes a critical role in them. As emphasised by De Graeve (2008), «few economists would argue that firms can obtain external finance at the risk-free rate. While internal finance is available relatively cheaply, obtaining external funds – through loans, bonds or equity – implies possibly substantial costs».

Most likely, the existence of asymmetric information, which gives rise to financial market imperfections, is the explanation for the external finance premium (De Graeve, 2008). This may arise because external suppliers of funds cannot perfectly assess the risks involved in supplying funds to borrowers and require compensation for expected losses (Hall, 2001). Borrowers using internal funds do not face this problem. Another reason to the wedge cost between internal and external funds could be related to the fact that the risks of lending may rise as a firm's share in investment finance falls relative to that of external lenders (Hall, 2001). This means that the premium for external funds becomes an endogenous variable, which depends inversely on the balance sheet strength of the borrower, since the balance sheet is the key signal through which the creditworthiness of the firm is evaluated (Mody et al., 2007).

The resulting interaction between corporate financial positions and borrowing costs can lead to the amplification and propagation of shocks, the so-called 'financial accelerator effect' in the academic literature (Hall, 2001): frictions in financial markets amplify fluctuations in the spending of borrowers and hence exacerbate fluctuations in aggregate economic activity, relative to a world with frictionless financial markets (Mody et al., 2007).

Another type of model emphasises directly the role of the financial system (and/or financial institutions), of which an example is the work by Carlson et al. (2008). According to these authors «the financial sector of the economy, by facilitating the flow of funds from investors to borrowers, is an important contributor to economic growth. Disruptions that interfere with the ability of the financial sector to intermediate financial flows might therefore be expected to restrain economic activity. In particular, it is possible that a deterioration in the health and the solvency of financial institutions might raise the cost of intermediation. In the extreme case, the failure of a financial institution, valuable banking relationships are lost and firms may find their access to credit restricted and their ability to finance investment is reduced».

Following this reasoning, Carlson et al. (2008) developed a model that «investigates the impact of changes in the health of financial intermediaries on capital investment on a macroeconomic level». They «provide a longer run perspective on the relationship of the health of the financial sector to economic activity, in particular on non-residential investment» and «construct a measure of financial sector health that includes periods of considerable stress, periods of notable strength, and moderate as well as severe fluctuations».

Fazzari et al. (2008) present a Keynesian growth model, in which cycles arise from the financing of investment. These authors demonstrate that «an investment function calibrated to recent empirical results and embedded in a Keynesian macroeconomic model generates well-defined cyclical output

fluctuations». In fact «the amplitude and frequency of the cycles depend critically on how nominal interest rates respond to stages of the business cycle». For example, in periods of economic expansion, when nominal interest rates are rising, this leads to an increase in a firm's debt service, reducing internal cash flow, and, other things equal, lowering investment expenses. This financial process is likely to bring the boom to an end. Fazzari et al. (2008) argue that «the greater the response of interest rates to macroeconomic conditions, the faster this process takes place, creating more volatile business cycles». Therefore, they concluded that «this dynamic process identifies a fundamental non-neutrality of money and monetary policy operating through the financing of investment» and that «if investment depends on cash flow, nominal interest rates drive real investment».

Another line of research, followed by Levy and Hennessy (2007), also tries to explain observed patterns of financing and investment over the economic cycle, using a computable general equilibrium model. These authors considered an «economy where firms differ in the quality of structural protections afforded to outside investors. Differences in investor protections gave rise to cross-sectional differences in the stringency of financing constraints». Therefore, «differences in financing constraints lead to predictable differences in financial behaviour over the business cycle». From their model, Levy and Hennessy (2007) conclude that «firms with tighter financing constraints exhibit pronounced counter-cyclicality in leverage. In contrast, the leverage ratio for more constrained firms is flat over the business cycle. The simulated economy exhibits financial accelerator effects, although contractions have a less pronounced effect on firms facing less stringent financing constraints. The ability to substitute between debt and equity allows less constrained firms to better smooth their investment in response to net worth shocks».

Another approach to assess the impact of the financial accelerator mechanism was adopted by Mody and Taylor (2004). In fact, they use the spread between high yield bonds and government debt or the highest rated commercial debt as an indicator of the premium on external finance. This logic stems from the development of the US market for below investment grade debt since the mid-1980s, and the assumption that there are firms that face higher frictions in credit markets that choose to rise funds on those markets. Mody and Taylor argue that «if the theory of the financial accelerator has some empirical content, therefore, one would expect the high yield spread to be a countercyclical predictor of real activity». The results that they obtained from their empirical study «provide further empirical evidence for the presence of a US financial accelerator».

Although the aforementioned models are centred in corporate investment, there are also models that examine the existence of a financial accelerator mechanism in the residential investment. One example is the model developed by Aoki et al. (2004). These authors proposed a general equilibrium model, focusing on the macroeconomic effects of imperfections in credit markets. They argue that these imperfections «generate premia on the external cost of raising funds, which in turn affect borrowing decisions». Therefore, variations in net worth or collateral contribute to amplify and propagate shocks to the macroeconomy. This works as follows: a positive shock to economic activity causes a rise in housing demand, which leads to a rise in house prices and so an increase in homeowners' net worth. This

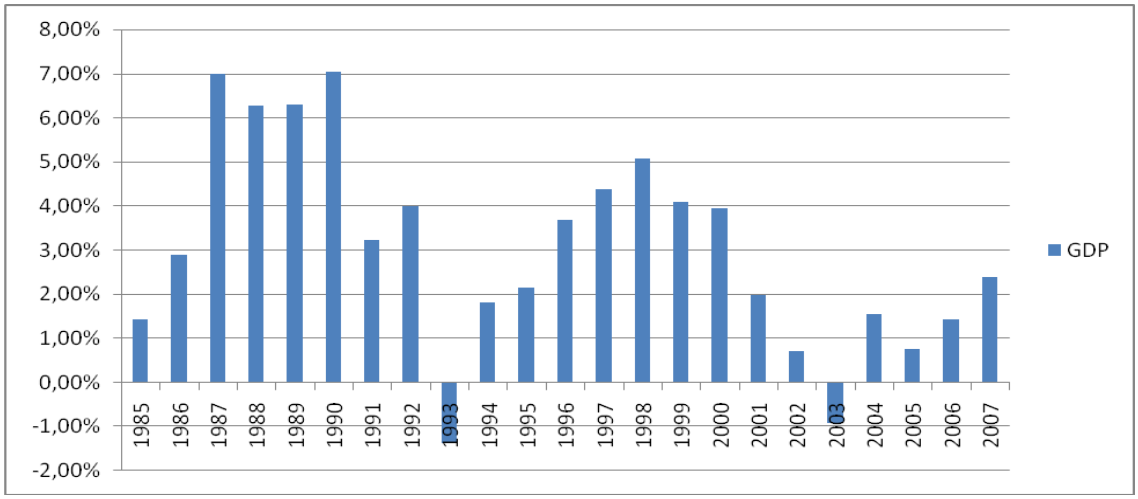
decreases the external finance premium, which leads to a further rise in housing demand and also spills over into consumption demand (Aoki et al. 2004).

In the next section, a brief description of the evolution of the Portuguese economy in the last two decades will be presented in order to set the context in which the three hypothesis mentioned at the beginning of the paper were evaluated.

3. A BRIEF OVERVIEW OF THE PORTUGUESE ECONOMY BETWEEN 1986-2005

According to Reis et al. (2007), during the two decades from 1986 to 2005, two distinct phases in terms of growth of the Portuguese economy can be singled out (see Figure 1): one corresponds to what may be called "the phase of European integration" (the 1985-93 cycle), the other to "the phase of creation of the single currency", in the context of the construction of the Economic and Monetary Union (the 1994-2003 cycle). Although, the two cycles are quite similar in terms of their duration (about 10 years), the economic growth of the first cycle was stronger than of the second one (the average rate of annual growth of GDP were, respectively, 4.2% and 2.4%).

Figure 1 – Portuguese GDP growth rate for 1985-2007 period.



Source: Own elaboration from data available at the *Portuguese Central Bank's* web site.

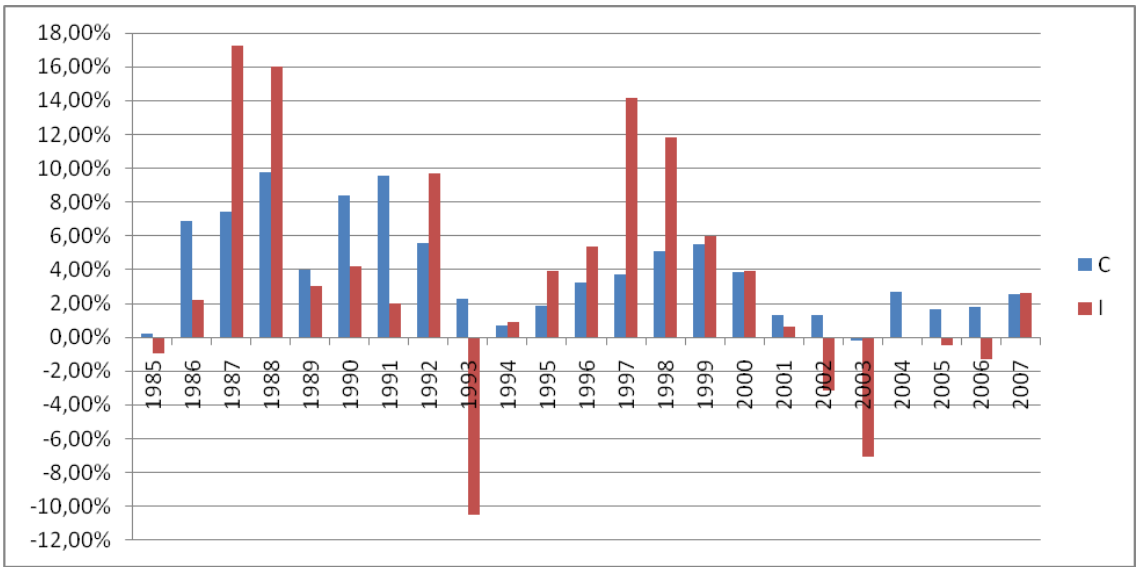
In fact, the first cycle (1985-93) corresponds to the best period of economic growth in the Portuguese Democracy (Amaral, 2010). Particularly, there have been four years (1987 to 1990 inclusive) in which the annual growth rate was close to 7%. According to Amaral (2010), a number of reasons contributed to this strong growth, namely: a) the sharp decline in oil prices between 1984 and 1986; b) the stabilization of the Portuguese economy after 1985, following the intervention of the IMF; c) the increase in Portuguese exports to the European market by virtue of joining the then European Economic Community (EEC) in 1986 (together with the fact that the countries that formed the EEC went through a phase of strong economic growth); d) an extraordinary increase in foreign direct investment; and e) the beginning of the fund transfers from the EU budget for investment in infrastructure and qualification of human resources.

Given this strong growth of the Portuguese economy, inflationary pressures began to emerge. By leaving Portugal within the EEC framework, these pressures became intolerable and restrictive monetary policy measures were adopted, which led to the slowdown of economic activity between 1991 and 1994 (even a recession year occurred in 1993), which, in turn, was enhanced by the crisis that then crossed Europe (Amaral, 2010). In brief, one can say that this crisis was due, particularly, to: a) the abandonment of the *crawling peg* exchange rate policy and the attempt to stabilize the exchange rate of the Portuguese currency (Escudo); b) the differential of inflation still relatively high compared with the main trading partners; c) the growing openness to European imports; and d) the international crisis. It should be noted, for example, that the Portuguese currency has appreciated in real terms by 30% between 1989 and 1992 (Amaral, 2010).

The second cycle (1994-2003) is marked, on the one hand, by the steps taken to end with the *Escudo* and make Portugal a founding member of the Economic and Monetary Union (EMU), and, on the other hand, by a return of optimism after the crisis of 1992-93 (Amaral, 2010). However, as stated above, this cycle resulted in an average annual growth rate not as high as the previous one.

The main reasons underlying the resumption of economic growth were the following. Firstly, the European economic growth recorded since 1994. Secondly, the reduction of interest rates, allowed a stabilization of the exchange rate of the Portuguese currency which contributed to lowering inflation. In fact, nominal and real interest rates fell from 16% and 6% to 4% and 0%, respectively, between 1992 and 2001 (Amaral, 2010). This factor contributed to a sharp increase in consumption and investment, as shown in Figure 2. Concomitantly, there was a modernisation and liberalisation of the financial system and a strong incentive to borrowing. Finally, there was an expansion of certain public expenditures, namely salaries of civil servants and increase of some social spending, like public health or social security, that have further stimulated the economic growth.

Figure 2 – Consumption, C, and Investment, I, growth rates for 1985-2007 period.

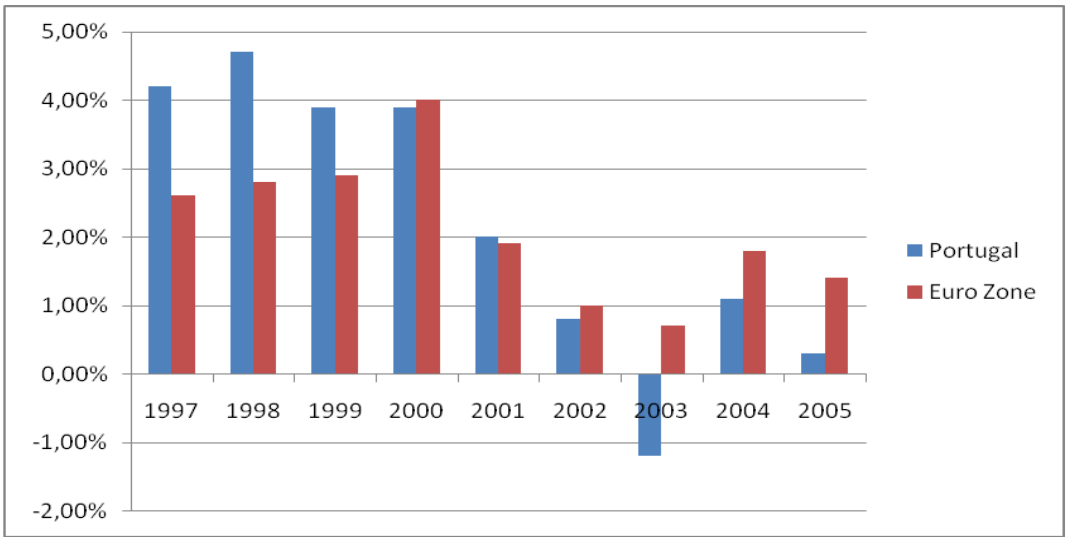


Source: Own elaboration from data available at *Portuguese Central Bank's* web site.

In summary, it can be argued that the economic growth recorded between 1995 and 2001 was based on increased domestic demand, with major impact on the non-tradable goods sector, without a large contribution from exports, as had happened in the previous cycle (Amaral, 2010).

From 2002 to 2005 the Portuguese economic growth was very slow, and included a recession year in 2003. During this period, an interruption in the process of real convergence with the European Union occurred (Reis et al., 2007), as it can be seen in Figure 3. In fact, after a period in which the annual growth rate of Portuguese GDP tended to follow the trend of growth in the euro zone, from 2001 onwards the annual growth rate was always lower than that of the Euro zone.

Figure 3 – Portuguese and Euro Zone GDP growth rates for 1997-2005.



Source: Own elaboration from data of *Portuguese Central Bank's* 2005 Annual Report.

4. DATA AND VARIABLES

In the empirical study undertaken, aggregate data for sixteen industrial sectors[1], covering a period of time from 1991 to 2005, was used. This data was obtained from the Central Balance-Sheet Database of the Portuguese Central Bank. In this database, economic and financial information of Portuguese non-financial firms are included for different industries and size categories.

According to Hsiao (2003), the use of panel data has the following advantages. Firstly, it leads to an increase in the degrees of freedom and to a reduction in the colinearity between explanatory variables, since the researcher has access to numerous data, and thus leading to an increase in the efficiency of the

[1] The sixteen industrial sectors chosen were: food and beverage industries; manufacture of textiles; garment industry preparation, dyeing and manufacture of articles of fur skins; industry of leather and leather products; industry of wood and cork and articles thereof; manufacture of pulp, paper and cardboard and articles thereof; publishing, printing and reproduction of recorded media; manufacture of chemicals and man-made fibers; manufacture of rubber and plastic products; manufacture of other nonmetallic mineral products; manufacture of base metals; manufacture of metal products, except machinery and equipment; manufacture of machinery and equipment; manufacture of electrical and optical equipment; manufacture of transport equipment; other manufacturing, not specified.

estimates. Secondly, panel data allows a researcher to construct and test more complex behavioural models, than would be the case if only cross-sectional or time series data were used. Thirdly, the use of panel data permits the minimisation of problems related to the interpretation of the estimated results that may arise from the effects that the omitted variables can have, especially when one suspects that these variables are correlated with explanatory variables.

As far as the variables used are concerned, they were computed from the accounting data (e.g. balance sheet and income statement), and can be defined as follows: Stock of capital (K) represented by fixed assets; Investment (I) computed from the variation of the stock of capital; Sales (S) total sales of the firm; Interest coverage ratio (ICOV) calculated as operating earnings divided by interest payments; Leverage ratio (LR) which is total debt as a fraction of total assets; Liquidity ratio (CASD) calculated as current assets divided by short-term debt. Table 1 shows some descriptive statistics of the variables used.

Table 1 – Descriptive statistics of the variables used. S.D. indicates standard deviation.

Variables	Mean	S. D.	Max	Min
I/K	0.119	0.2203	1.177	-0.581
ΔS/K	0.111	0.2457	1.944	-0.567
ICOV	3.063	2.8339	23.526	-0.722
LR	0.380	0.0766	0.579	0.145
CASD	2.201	0.5414	4.994	1.151

5. MODEL SPECIFICATION

Given the nature of the data used in this study (industry aggregated data), the best alternative available for specifying the econometric investment equation is the following sales-accelerator specification[2]:

$$(I/K)_{it} = \theta + \beta_1 (I/K)_{it-1} + \beta_2 (\Delta S/K)_{it} + \beta_3 (\Delta S/K)_{it-1} + \beta_4 BSP_{it-1} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

where I is investment in fixed assets by firm *i* in period *t*, ΔS is change in sales, and BSP is a measure of the balance sheet position. The investment and sales variables are divided by stock of capital (K) to address the problem of heteroscedasticity. (α_i) is the firm effect, (α_t) the year effect and (ε_{it}) is the error term.

Following Vermeulen's work (2002), three variables were used in order to identify the balance sheet position of a firm: (1) the interest coverage ratio (ICOV), which measures the extent to which operating earnings are sufficient to pay interest expenses; (2) the leverage ratio (LR), which is a measure of the leverage of the firm; and (3) the liquidity ratio (CASD), which is a measure of the liquidity of the firm[3].

[2] Results obtained by several authors (see, for example, Samuel, 1998; Oliner, Rudebusch and Sichel, 1995; Bernanke, Henning and Reiss, 1988; Clark, 1979; and Bischoff, 1971) demonstrated that the accelerator model has a better empirical performance than other more theoretically consistent models, such as the Tobin-Q model.

[3] In this study, to measure the liquidity of a firm the current ratio (current assets divided by current liabilities) was used. Vermeulen (2002) used the inverse of this ratio.

Since the coefficient β_4 measures the sensitivity of the investment rate with respect to changes in the balance sheet position, one would expect the following results: (1) a positive relationship between the investment rate and the interest coverage ratio and the liquidity ratio, respectively; and (2) a negative relationship between the investment rate and the leverage ratio.

6. REGRESSION RESULTS

Given the dynamic nature of the specified econometric investment equation, it is possible that the explanatory variables might be correlated with the error term of regression (i.e., the regressors are endogenous). For this reason, it is appropriate to use instrumental variables estimation techniques, in order to obtain consistent parameter estimates, which will not happen if the OLS method is used (Hsiao, 2003). Representing the model in matrix notation, one aims at estimating the following equation:

$$\mathbf{Y_{it}} = \mathbf{X_{it}}\boldsymbol{\beta} + \boldsymbol{\varepsilon_{it}}$$

If $E[\mathbf{X}\boldsymbol{\varepsilon}] \neq 0$, the explanatory variables, **X**, will be correlated with the error term, ε. One way to overcome this problem is to use instrumental variables. For example, one can identify a set of instruments, **Z**, that is not correlated with **ε**, even if **ε** is correlated with **X**. Each variable included in the vector **Z** is called an instrument for **X**. In general, it is necessary to have at least as many variables in **Z**, as the variables in **X** correlated with **ε**.

Although the use of instrumental variables constitutes one way of overcoming the problem of endogeneity of regressors, it might happen that the residuals of the model are not homoscedastic. In this case, it is necessary to apply the method of instrumental variables together with the generalized method of moments (GMM) estimation technique. Thus, this ensures that the instrumental variables are correlated with the endogenous regressor and are orthogonal to the error term.

The econometric investment equation was thus estimated by using the Generalized Method of Moments (GMM) estimation procedure. This method requires the need to estimate the investment equation in first-differences to eliminate the firm-specific time-invariant effect, and to use lags of the dependent and explanatory variables as instruments. Therefore, the estimation equation becomes:

$$\Delta(I/K)_{it} = \beta_1 \Delta(I/K)_{it-1} + \beta_2 \Delta(\Delta S/K)_{it} + \beta_3 \Delta(\Delta S/K)_{it-1} + \beta_4 \Delta BSP_{it-1} + (\alpha_t - \alpha_{t-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (2)$$

The estimates were performed by using the STATA software package. The estimation of the above investment equation involved using the following three different estimators: the Anderson and Hsiao (1982), (AH); the Arellano and Bond (1991), (AB); and the Blundell and Bond (1998) System estimator (SE).

6.1 Financial position and investment

In this subsection, the first hypothesis set forth in the introduction of this paper was tested (i.e., the financial position of a firm is a major determinant of its capital investment decisions). Table 2 shows the regression results obtained.

Table 2 – Regression results for full sample.

	All firms								
Variables	AH Estimator			AB Estimator			Syst. Estimator		
$(I/K)_{it-1}$	0.091	0.105	0.086	-0.023	-0.045*	-0.034	0.039	0.018	0.016
	(0.1015)	(0.1136)	(0.1129)	(0.0413)	(0.0166)	(0.0219)	(0.0453)	(0.0184)	(0.0185)
$(\Delta S/K)_{it}$	0.622*	0.691*	0.688*	0.698*	0.741*	0.743*	0.686*	0.712*	0.707*
	(0.0481)	(0.0516)	(0.0527)	(0.0241)	(0.0292)	(0.0306)	(0.0347)	(0.0261)	(0.0396)
$(\Delta S /K)_{it-1}$	-0.223*	-0.146	-0.141	-0.068**	-0.003	-0.002	-0.104*	-0.047	-0.053*
	(0.0849)	(0.0913)	(0.0915)	(0.0286)	(0.0184)	(0.0180)	(0.0311)	(0.0315)	(0.0149)
$ICOV_{it-1}$	0.038*			0.025*			0.020*		
	(0.0063)			(0.0034)			(0.0030)		
LR_{it-1}		-1.491**			-0.464			-0.204	
		(0.5971)			(0.3123)			(0.4897)	
$CASD_{it-1}$			0.029			0.015			0.021*
			(0.0795)			(0.0349)			(0.0061)
m_1	-6.0	-6.98	-6.83	-2.20	-2.19	-2.16	-2.18	-2.12	-2.12
p-value	0.000	0.000	0.000	0.028	0.029	0.030	0.029	0.034	0.034
m_2	-1.51	-0.42	-0.48	-1.13	-1.07	-0.99	-0.92	-0.70	-0.75
p-value	0.132	0.671	0.634	0.258	0.287	0.324	0.359	0.486	0.455
Sargan				83.80	90.42	80.74	100.86	93.27	90.59
p-value				0.279	0.141	0.363	0.184	0.358	0.433

Dependent variable, I_{it}/K_{it-1}. The GMM first-differences estimation procedure was adopted. The instrument set used includes all right-side variables dated *t-2*. Standard errors are in parenthesis. *, **, and *** indicate significance at 1%, 5% and 10% level, respectively.

From the table, it can be seen that all the three variables representing the firm's balance sheet position (ICOV, LR, and CASD), have the right sign, regardless of the estimator used. The variable ICOV is, also, statistically significant at 1% level for the three estimators, whereas the variables LR and CASD only have statistical significance when using the AH and the SE estimators, respectively.

Overall, these results seem to indicate that investment expenses of firms are affected by the strength of their financial positions. Also, one can conclude that the interest coverage ratio (ICOV) appears to be the variable that best represents the financial strength of a firm.

6.2 Financial position and firm size

In this subsection, the second hypothesis set forth in the introduction of this paper was tested (i.e., the financial position of a firm is more important for firms that face higher information problems in financial markets). To group firms according to the severity of asymmetric information that they suffer in financial markets, the size criterion was used in this study. It was assumed that a stronger balance sheet position is more important for smaller firms.

In fact, some authors (e.g. Gelos and Werner, 2002, Chow and Fung, 2000; Kim, 1999; Schiantarelli, 1996; Gilchrist and Himmelberg, 1995) argue that larger firms would be less affected by financing constraints than small ones. Several reasons may justify this argument. Firstly, larger companies have easier access to capital markets, due to the possibility of using the firm's assets as collateral. Secondly, larger companies can use more different sources of funds than smaller companies, which allow large companies to reduce the risk of financing. Finally, it is likely that small firms suffer more from the idiosyncratic risk. Tables 3 and 4 show regression results obtained for small and large firms, respectively.

Table 3 – Regression results for the small firms' sample.

	Small firms								
Variables	AH Estimator			AB Estimator			Syst. Estimator		
$(I/K)_{it-1}$	0.878	-0.036	0.021	-0.147*	-0.138*	-0.135*	-0.029	-0.062	-0.055
	(0.0950)	(0.0993)	(0.1083)	(0.0391)	(0.0369)	(0.0451)	(0.0571)	(0.0462)	(0.0538)
$(\Delta S/K)_{it}$	0.719*	0.756*	0.810*	0.814*	0.822*	0.844*	0.717*	0.824*	0.829*
	(0.0636)	(0.0612)	(0.0635)	(0.0417)	(0.0733)	(0.0501)	(0.0502)	(0.0576)	(0.0363)
$(\Delta S /K)_{it-1}$	-0.033	-0.045	-0.033	0.112**	0.107*	0.125*	-0.013	0.021	0.015
	(0.0967)	(0.0985)	(0.1046)	(0.0442)	(0.0341)	(0.0479)	(0.0589)	(0.0387)	(0.0465)
$ICOV_{it-1}$	0.053*			0.027*			0.017*		
	(0.0163)			(0.0050)			(0.0040)		
LR_{it-1}		1.728*			0.396***			-0.188*	
		(0.5010)			(0.2093)			(0.3395)	
$CASD_{it-1}$			0.157***			0.014			0.016**
			(0.0948)			(0.0334)			(0.0083)
m1	-7.27	-5.97	-6.85	-1.99	-2.09	-2.17	-2.20	-2.24	-2.25
p-value	0.000	0.000	0.000	0.047	0.037	0.030	0.028	0.025	0.025
m2	1.88	0.25	1.63	0.61	0.18	0.40	1.33	0.97	0.98
p-value	0.060	0.803	0.103	0.545	0.858	0.689	0.185	0.332	0.327
Sargan				79.61	80.04	86.68	94.12	91.57	93.74
p-value				0.397	0.384	0.211	0.335	0.405	0.345

Dependent variable, I_{it}/K_{it-1}. The GMM first-differences estimation procedure was adopted. The instrument set used includes all right-side variables dated *t-2*. Standard errors are in parenthesis. *, **, and *** indicate significance at 1%, 5% and 10% level, respectively.

Table 4 – Regression results for the large firms' sample.

	Large firms								
Variables	AH Estimator			AB Estimator			Syst. Estimator		
$(I/K)_{it-1}$	-0.078	-0.101	-0.099	-0.162*	-0.165*	-0.159*	-0120**	-0.115*	-0.127**
	(0.0966)	(0.0948)	(0.0963)	(0.0256)	(0.0236)	(0.0313)	(0.0489)	(0.0400)	(0.0718)
$(\Delta S/K)_{it}$	0.494*	0.473*	0.474*	0.407*	0.403*	0.407*	0.410*	0.403*	0.409*
	(0.0912)	(0.0899)	(0.0900)	(0.0106)	(0.0073)	(0.0082)	(0.0116)	(0.0117)	(0.0199)
$(\Delta S /K)_{it-1}$	0.100	0.077	0.079	0.116*	0.093*	0.089*	-0.061**	0.050***	0.083**
	(0.0936)	(0.0928)	(0.0924)	(0.0196)	(0.0178)	(0.0232)	(0.0297)	(0.0289)	(0.0395)
$ICOV_{it-1}$	0.006			0.002*			0.001		
	(0.0041)			(0.0007)			(0.0006)		
LR_{it-1}		0.136			0.188			0.002	
		(0.4469)			(0.2477)			(0.0278)	
$CASD_{it-1}$			-0.010			0.019*			0.013**
			(0.0578)			(0.0279)			(0.0081)
m1	-8.12	-8.23	-8.18	-2.28	-2.33	-2.40	-2.26	-2.30	-2.23
p-value	0.000	0.000	0.000	0.023	0.020	0.016	0.024	0.021	0.026
m2	-1.80	-1.47	-1.49	-1.28	-1.11	-1.20	-1.09	-0.98	-0.97
p-value	0.072	0.141	0.137	0.201	0.267	0.231	0.276	0.327	0.330
Sargan				74.85	72.85	71.57	87.41	85.99	83.80
p-value				0.548	0.613	0.653	0.528	0.571	0.636

Dependent variable, I_{it}/K_{it-1}. The GMM first-differences estimation procedure was adopted. The instrument set used includes all right-side variables dated *t-2*. Standard errors are in parenthesis. *, **, and *** indicate significance at 1%, 5% and 10% level, respectively.

The results shown in the tables 3 and 4 confirm the hypothesis tested. In fact, although the estimated coefficients on the BSP variables have the correct sign in all cases, regardless of the estimator used (the exception being the LR variable for small firms in two of the estimators), they only have statistical significance for small firms. Also, the value of these coefficients is higher in the case of smaller firms. Furthermore, the point estimates for the BSP variables are higher for small firms than the point estimates obtained for the same variables when considering the full sample.

These results are a clear indication that, for this kind of firms, investment spending depends on the strength of their financial position. Therefore, one can anticipate the existence of a financial accelerator effect. In the next subsection, this issue is further investigated.

6.3 Financial position and business cycle

In this subsection, the third hypothesis set forth in the introduction of this paper was tested (i.e., the financial position of a firm is even more important for firms that face higher information problems in financial markets at times of economic recession).

To test this hypothesis it was necessary to identify recession years. Since the firms used in this study belong to the manufacturing sector, the evolution of the Portuguese Industrial Production Index was used to that purpose (as suggested by Vermeulen, 2002). Table 5 shows the evolution of this index for the period 1990 to 2007. Therefore, five years of recession were identified: 1992, 1993, 2003, 2004, and, 2005.

Table 5 - Industrial Production Index for the Manufacturing Sector 1990-2007

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Value	94.2	94.5	92.1	86.8	87.2	90.3	91.7	95.8	98.2
Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Value	99.6	100.0	103.2	103.8	102.9	100.2	100.3	103.1	105.0

Source: National Institute of Statistics (INE).

Tables 6 and 7 show regression results when the BSP variable is interacted with a business cycle dummy variable (RY) for the sample of small and large firms, respectively. The dummy variable assumes the value of one if it is a recession year and zero otherwise. The estimated coefficient of this interaction variable can be interpreted as the additional impact of the balance sheet strength on investment expenses of firms.

From the tables 6 and 7, one can conclude that BSP variables continue to be more important for small than for large firms. But there is no clear evidence that this result is enhanced at times of economic downturn. In fact, the coefficients of the interaction variables are, in general, not statistically significant both for small and large firms.

Table 6 – Regression results for small firms and the variable BSP interacted with business cycle dummy.

	Small firms (dummy)								
Variables	AH Estimator			AB Estimator			Syst. Estimator		
$(I/K)_{it-1}$	-0.088	-0.056	-0.028	-0.128**	-0.158*	-0.209***	-0.512	0.031	-0.037
	(0.0952)	(0.0951)	(0.1058)	(0.0509)	(0.0309)	(0.1135)	(0.0402)	(0.0649)	(0.0783)
$(\Delta S/K)_{it}$	0.720*	0.768*	0.813*	0.811*	0.871*	0.851*	0.712*	0.705*	0.813*
	(0.0651)	(0.0623)	(0.0645)	(0.0468)	(0.0529)	(0.0464)	(0.0467)	(0.0748)	(0.0489)
$(\Delta S /K)_{it-1}$	-0.033	-0.031	-0.028	-0.072	0.129*	0.166**	-0.019	-0.036	-0.014
	(0.0967)	(0.0969)	(0.1044)	(0.0515)	(0.0307)	(0.0793)	(0.0517)	(0.0554)	(0.0770)
$ICOV_{it-1}$	0.052*			0.029*			0.022*		
	(0.0171)			(0.0083)			(0.0049)		
$RY*ICOV_{it-1}$	0.001			-0.012*			-0.012***		
	(0.0139)			(0.0033)			(0.0027)		
LR_{it-1}		1.728*			0.563**			-0.279	
		(0.4944)			(0.2247)			(0.1954)	
$RY*LR_{it-1}$		0.089			0.034***			0.013	
		(0.0730)			(0.0198)			(0.0197)	
$CASD_{it-1}$			0.153			0.007			0.019**
			(0.0954)			(0.0497)			(0.0087)
$RY*CASD_{it-1}$			0.006			-0.006			-0.004
			(0.0154)			(0.0050)			(0.0039)
m1	-7.30	-6.11	-7.18	-2.07	-2.12	-1.86	-2.09	-2.54	-2.20
p-value	0.000	0.000	0.000	0.039	0.034	0.063	0.037	0.011	0.028
m2	1.88	0.23	1.63	0.75	-0.15	-0.21	1.12	2.01	1.02
p-value	0.060	0.818	0.103	0.454	0.882	0.836	0.262	0.044	0.306
Sargan				78.20	84.91	89.03	93.19	97.09	97.41
p-value				0.440	0.251	0.164	0.360	0.262	0.254

Dependent variable, I_{it}/K_{it-1}. The GMM first-differences estimation procedure was adopted. The instrument set used includes all right-side variables dated *t-2*. Standard errors are in parenthesis. *, **, and *** indicate significance at 1%, 5% and 10% level, respectively.

Table 7 – Regression results for large firms and the variable BSP interacted with business cycle dummy.

	Large firms (dummy)								
Variables	AH Estimator			AB Estimator			Syst. Estimator		
$(I/K)_{it-1}$	-0.776	-0.090	-0.095	-0.151*	-0.141**	-0.168*	-0.071	-0.061	-0.167*
	(0.0965)	(0.0953)	(0.0964)	(0.0240)	(0.0577)	(0.0497)	(0.0789)	(0.0591)	(0.0407)
$(\Delta S/K)_{it}$	0.489*	0.466*	0.471*	0.417*	0.420*	0.416*	0.418*	0.380*	0.387*
	(0.0920)	(0.0909)	(0.0904)	(0.0103)	(0.0145)	(0.0097)	(0.0226)	(0.0149)	(0.0149)
$(\Delta S /K)_{it-1}$	0.097	0.073	0.079	0.099*	0.086***	0.103*	0.051	0.013	0.088*
	(0.0937)	(0.0932)	(0.0924)	(0.0208)	(0.0449)	(0.0381)	(0.0407)	(0.0473)	(0.0207)
$ICOV_{it-1}$	0.007***			0.002*			0.001***		
	(0.0045)			(0.0007)			(0.0006)		
$RY*ICOV_{it-1}$	-0.004			-0.001			-0.001		
	(0.0065)			(0.0011)			(0.0007)		
LR_{it-1}		0.167			0.141			0.041	
		(0.4486)			(0.2337)			(0.0530)	
$RY*LR_{it-1}$		-0.153			-0.017*			-0.106***	
		(0.1350)			(0.0946)			(0.0618)	
$CASD_{it-1}$			0.001			0.040			0.010
			(0.0596)			(0.0257)			(0.0085)
$RY*CASD_{it-1}$			-0.017*			0.001			-0.003
			(0.0194)			(0.0087)			(0.0042)
m1	-8.04	-8.45	-8.41	-2.32	-2.25	-2.34	-2.37	-2.53	-2.28
p-value	0.000	0.000	0.000	0.020	0.025	0.019	0.018	0.011	0.022
m2	-1.79	-1.16	-1.25	-1.25	-0.91	-1.27	-0.69	-0.41	-1.21
p-value	0.074	0.248	0.211	0.210	0.361	0.205	0.489	0.685	0.227
Sargan				74.84	75.83	72.46	87.91	88.97	86.70
p-value				0.549	0.516	0.625	0.513	0.481	0.549

Dependent variable, I_{it}/K_{it-1}. The GMM first-differences estimation procedure was adopted. The instrument set used includes all right-side variables dated *t-2*. Standard errors are in parenthesis. *, **, and *** indicate significance at 1%, 5% and 10% level, respectively.

7. DISCUSSION OF RESULTS

From the regression results obtained in the previous section, it seems clear that investment, particularly of firms facing higher asymmetric information problems in financial markets, is influenced by financial strength of firms.

These findings corroborate evidence obtained from other studies. For example, when analysing the behaviour of investment in the UK in the 1990's, Hall (2001) concluded that the results obtained illustrate «the potential use of balance sheet models as an analytical tool for examining relationships between financial and real factors in the transmission mechanism, interactions absent in many standard macroeconomic models».

Furthermore, Angelopoulou and Gibson (2007) used a panel of UK firms in the manufacturing sector over the period 1970 to 1991 to investigate the relationship between financial constraints of a firm and monetary policy for the UK. They found that: a) «The results provide some support for the view that, using firm size and firm financial policy to classify companies, potentially financially-constrained UK firms show greater investment sensitivity to cash flow»; and b) «Firms as a whole also show greater sensitivity during periods of tight monetary policy and the effect is greater on those that are potentially financially-constrained». Therefore, they concluded that these results «point to the possible existence of a balance sheet channel in addition to other possible transmission mechanisms such as interest rates, the exchange rate or a bank lending channel».

Also, Christensen and Dib (2008) developed and estimated a sticky-price DSGE model to empirically evaluate the importance of the financial accelerator in the amplification and propagation of the effects of transitory shocks to the economy. They found that: a) «The likelihood-ratio test easily rejects the estimated model with no financial accelerator in favour of the one that includes it»; b) «The estimate of a key parameter in the financial accelerator mechanism, the elasticity of the external finance premium with respect to the firm leverage, is statistically significant and close to values used in typical calibrations»; and c) «The model with a financial accelerator generates business cycles moments the closest to those observed in the data».

Mody et al. (2007), on the other hand, analysed the existence of a link between indicators of credit availability and macroeconomic fluctuations at country level, using impulse response functions of GDP growth in response to bank credit shocks in the context of a VAR model, concluded that the findings «appear to be consistent with the propagation mechanism implied by the financial accelerator and with previous empirical studies which have ignored international and regional effects».

Finally, Carlson et al. (2008), investigating the relationship between the health of the financial sector and the rest of the economy, found that: a) «financial stability is connected to corporate investment»; b) «a deterioration in the health of the financial sector can act as a restraint on macroeconomic performance»;

and c) «variations in the health of the financial sector also seem to amplify shocks to other parts of the economy».

8. CONCLUSION

In recent times there has been 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 financial constraints) was induced by recent developments in information economics.

The aim of this paper was to assess the impact of a firm's financial strength on its investment decisions (specifically, three hypotheses were tested). For that purpose, aggregate data for sixteen industrial sectors of the Portuguese economy, covering a period of time from 1990 to 2005, was used.

The empirical evidence obtained in this study seems to lend some support to the financial accelerator hypothesis. In fact, it was found that financial variables were important determinants of firms' investment, and that this impact is higher for small firms than for larger ones. However, more research is necessary to compare the impact of financial variables on investment of small and large firms in each phase of the business cycle, since the results were limited in this respect.

In spite of this fact, and as far as policy implications are concerned, three issues can be highlighted. Firstly, there is no independence between firms' investment and financing decisions, especially for small firms. For this type of firms, its financial structure (or the strength of its balance sheet position) is very important when they have to decide about their investment expenses. This led to what Myers (1984) called the "pecking order hypothesis". Secondly, the strong connection between a firm's financial status and its investment expenses, suggests that there is another mechanism through which monetary policy can be transmitted to the real economy – the balance sheet channel. According to Angelopoulou and Gibson (2007), this mechanism could work as follows. Given that net worth tends to be pro-cyclical, this will cause investment to move pro-cyclically, which in turn would generate accelerator effects and magnifying the amplitude of the business cycle. Furthermore, shocks to net worth which are independent of output can cause fluctuations. They conclude also that even small monetary policy shocks could have large effects. Finally, 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 be used as instruments to stimulate investment in fixed capital by firms.

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