FINANCIAL CONSTRAINTS AND INVESTMENT IN FRANCE AND SPAIN: A COMPARISON USING FIRM LEVEL DATA

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Financial constraints and investment in France and Spain: a comparison using firm level data (*)

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Abstract

This paper analyses corporate investment decisions in France and Spain, focusing on the role of financial constraints in explaining investment behaviour. For this purpose, we take advantage of very carefully harmonised data sets that allow for the use of variables homogeneously defined in both countries. The information used consists of two panel data sets of industry firms selected from those reporting information to the Central Balance Sheet Offices of the Banque de France and of the Banco de España over the period 1991-1999. So as to test for the existence of liquidity constraints, we conduct a test of excess sensitivity of investment to cash flow using a standard Euler equation model. More precisely, both the theoretical model and the testing strategy used in this paper closely follow Bond and Meghir (1994). These authors present an empirical model of investment based on the Euler equation of an extended version of the standard neoclassical model of investment. This model assumes that the firm faces a hierarchy of costs for the alternative sources of finance and leads to different characterisations of investment behaviour for firms pursuing different financial policies. Overall, our results suggest that there are significant differences in investment behaviour which are closely linked to the financial situation of firms. In particular, the evidence found is consistent with the investment expenditure of firms paying zero dividends being constrained by the availability of internally generated funds.

1. Introduction

The analysis of the determinants of investment behaviour has long been a key research field in macroeconomics. On one hand, investment spending by firms determines the future productive power of the economy. On the other, fluctuations in investment spending, which is far more volatile than consumption spending, are a driving force of the business cycle. In this respect, the sizeable volatility of investment as an important contributor to aggregate economic fluctuations has often been used to motivate studies on investment behaviour. In particular, within the empirical literature on company investment, the role of financial factors in explaining business fluctuations is a topic that has merited substantial research[1]. The recent econometric research on the relevance of liquidity constraints for investment spending has relied on a growing body of theoretical work studying informational imperfections in credit markets. At the same time, this literature has helped explain large fluctuations in investment as a response to small shocks. In this sense, some recent models have highlighted the role of financial market conditions in propagating relatively small shocks[2].

The increasing availability of panel data sets has been an essential element for the development of microeconometric research on the links between real and financial decisions. In particular, panel data allow a researcher to adequately test the cross-sectional implications of the models assuming problems of asymmetric information between borrowers and lenders. Moreover, the use of micro data has several additional advantages: more adequate measures of the variables of interest can be obtained; cross-sectional variation improves the precision of the estimates; and the potential biases arising from aggregation across firms, simultaneity or omitted variables may be better addressed[3]. Nevertheless, the use of individual data also entails some problems: the most common of these are the implicit biases in the composition of the samples and the usually short time dimension of the panels.

[1] See Schiantarelli (1996) and Hubbard (1998) for recent surveys of this literature.

[2] See, for instance, Bernanke, Gertler and Gilchrist (1999).

[3] See Hsiao (1986) for the potential advantages of the use of panel data, Blundell, Bond and Meghir (1996) and Bond and van Reenen (2002) for excellent surveys of the microeconometric literature on company investment, and Deutsche Bundesbank (2001) for a collection of papers on investment behaviour based on the use of panel data sets. Finally, within the Monetary Transmission Network of the Eurosystem, several papers have focused on the link between monetary policy and investment using microeconomic data sets: Butzen, Fuss and Vermeulen (2001), Chatelain et al. (2001), Chatelain and Tiomo (2001), Gaiotti and Generale (2001), von Kalckreuth (2001), Lünnemann and Mathä (2001) and Valderrama (2001).

Within this strand of the literature dealing with the microeconometric modelling of investment, several recent papers have addressed the challenge of establishing cross-country comparisons in the analysis of the role of financial factors in company investment decisions[4]. The aim of these papers is to identify cross-country differences in the impact of financial constraints on investment and to link these differences to specific characteristics of the countries (in particular, on the financial systems). But cross-country studies face the difficulty of harmonising information drawn from national sources which, in most cases, follow different accounting rules[5].

In this paper, we analyse corporate investment decisions in France and Spain, focusing on the role of financial constraints in explaining investment behaviour. For this purpose, we take advantage of very carefully harmonised data sets that allow for the use of variables homogeneously defined in both countries. More precisely, the information used consists of two panel data sets of industry firms selected from those reporting information to the Central Balance Sheet Offices of the Banque de France and of the Banco de España over the period 1991-1999. Harmonisation of databases is a key issue in cross-country comparative studies, since the removal of differences in accounting practices is a necessary condition to interpret differences in results as real differences in behaviour.

So as to test for the existence of liquidity constraints, we conduct a test of excess sensitivity of investment to cash flow using a standard Euler equation model. The choice of this methodological approach is justified by the fact that this model, by implicitly controlling for all expectational influences, is less affected by the usual criticism to the excess sensitivity to cash flow tests (cash flow proxies demand shocks rather than indicating the existence of liquidity constraints). More precisely, both the theoretical model and the testing strategy used in this paper closely follow Bond and Meghir (1994). These authors present an empirical model of investment based on the Euler equation of an extended version of the standard neoclassical model of investment. This model assumes that the firm faces a hierarchy of costs for the alternative sources of finance and leads to different characterisations of investment behaviour for firms pursuing different financial policies.

This paper is organised as follows. *Section 2* reviews the literature on investment with financing constraints. *Section 3* describes the main features of the structural model of firm investment, derived in Bond and Meghir (1994), which is based on the Euler equation

[4] See Bond et al. (1997), Hall, Mairesse and Mulkay (1999), Bond, Harhoff and van Reenen (1999), Chatelain et al. (2001), Laeven (2001) and Love (2001) for cross-country microeconometric studies on company investment.

[5] CECB (2000) illustrates the difficulties inherent to the task of harmonising accounting data from different countries.

methodology. *Section 4* presents the definitions and the descriptive statistics of the variables used in the analysis. *Section 5* provides the main results on the testing of the empirical implications of the hierarchy of finance model. Finally, the conclusions are drawn in *Section 6.*

2. Investment, financing and asymmetric information: theoretical considerations

2.1. The relevance of financial conditions for investment decisions

The perfect capital market assumption, on which empirical investment models have traditionally been based, implies that in a world without taxes it is irrelevant for firms to decide between internal and external resources when financing their investment projects. The existence of asymmetric information between fund suppliers and borrowers implies the break-up of the irrelevance of the decision between internal and external financing. There are alternative microfoundations for the link between firms' financial structure and their investment spending. Among the most important are distortionary taxation, transaction costs and the costs of financial distress. Building information asymmetries and/or distortionary taxation into credit-market modelling has yielded two kinds of results, which complement each other, with a direct impact on firms' investment behaviour. First, the most widespread conclusion of these models is that the cost of external funds faced by each firm depends on its financial condition. Second, some of these models conclude that, under certain circumstances, the existence of incomplete information on the quality of firms' investment projects translates into lenders failing to adjust interest rates to the particular situation faced by each firm while imposing, instead, quantitative constraints on the volume of credit granted. These results warrant the relevance of financial structure as a determinant of firm investment.

The first of the above results, namely the dependence of external financing costs on the firm's financial condition, is the most widespread forecast in the vast literature[6] incorporating the existence of asymmetric information in credit market modelling. According to these works, information asymmetries between lenders and borrowers warrant the existence of a spread or premium between the costs of external and internal resources. This premium may be capturing, among other factors, the monitoring costs –associated with the existence of a risk of failure– that investment projects entail for lenders. Moreover, the above-mentioned

[6] Two frequently mentioned examples of such literature include Bernanke and Gertler (1989), and Greenwald and Stiglitz (1993).

literature suggests that this external finance premium depends on the borrower's financial condition. Thus, Bernanke and Gertler (1989) present a model where such a premium depends conversely on the net wealth that can be provided as collateral. The larger the collateral in relation to the volume of credit, the fewer the incentives for the borrower to embark on risky investment projects. Alternatively, in other works, including Bond and Meghir (1994), and Alonso-Borrego (1994), the external financing cost is shown as a function of the level of indebtedness by capital unit. Besides, Estrada and Vallés (1998) test, for Spain, a model that considers the net indebtedness level as a determinant of the external financing cost.

As regards the second result –the existence of credit rationing—its rationale is founded on the incapacity of credit suppliers to observe the returns on investment projects. The likelihood of the credit not being repaid makes lenders' expected returns depend not only on the interest rate set, but also on the risk associated with the projects they finance. As noted by Stiglitz and Weiss (1981), changes in the interest rate set by lenders may have a dual effect on the average risk of their credits as a whole. First, the adverse selection effect (whereby firms taking higher risks and considering the likelihood of repaying their credits rather low are the most willing to accept higher interest rates) leads to a situation where lenders, if they decide to raise the interest rate, end up financing firms that take higher risks. On the other hand, there is an incentive effect, whereby increases in interest rates may induce firms to embark on projects with fewer possibilities of success but more potential returns. For all these reasons, it can be accepted that the interest rate maximising the credit suppliers' expected returns (r*) is such that credit demand exceeds credit supply (i.e. they set up a lower interest rate than the rate that would balance the demand for and the supply of lending funds). In other words, if lenders raise the rates they set above r*, the increase in induced average risk is such that their expected returns decrease. Thus, equilibrium in the market for credit can be characterised by rationing.

This kind of model is observationally equivalent to those suggesting that the spread between the costs of internal and external financing depends on the firm's financial condition, insofar as they forecast that funds availability for each company will depend on observable characteristics reflecting such condition. Therefore, in a group of firms having investment projects with similar expected returns, constraints will apply to those with weaker financial conditions (according to certain observable characteristics). Thus, Gertler (1988), and Calomiris and Hubbard (1990) note that access to external financing will depend on agents' net wealth.

In sum, models incorporating the existence of asymmetric information between fund suppliers and borrowers (or alternatively, the existence of distortionary taxes on the different sources of funds) reveal the influence of agents' financial condition on the terms of access to external financing (cost and availability). Consequently, firms' investment behaviour will be subject to their financial conditions. In particular, when information asymmetries exist, the neoclassical investment model provides a partial view of agents' behaviour, since the investment level will depend not only on the capital path that the firm wants, but also on its financing possibilities[7]. Thus, this theoretical approach allows for the introduction of financial variables into the investment equations. The two variables most frequently used in empirical studies are the level of indebtedness and, above all, internal resource generation capacity. Indebtedness has been used as an indicator of the firm's financial soundness which, as mentioned above, can condition the cost of its external resources or access thereto. Along these lines, the seminal work of Bond and Meghir (1994) considers the cost of external resources as an increasing function of the debt ratio. However, empirical studies have not always confirmed this relationship. Thus, Mato (1989), for instance, finds a negative influence of the indebtedness ratio on the cost of external resources and mentions, among other possible reasons, that this ratio is not exogenous but is, in turn, a decreasing function of their cost.

2.2. Sensitivity of investment to the internal generation of resources

Undoubtedly, the financial variable most used in investment equations based on the existence of asymmetric information has been cash flow, i.e. self-financing capacity. This variable, insofar as it reflects the funds available to the firm, is expected to be positively correlated to the investment level. Besides, it is expected that this positive effect on investment of variables measuring the capacity to generate own resources will reveal itself more clearly in those firms where asymmetric information problems are more pronounced. Moreover, this positive correlation is reinforced, as Fazzari and Athey (1987) show, due to the self-financing capacity acting as an indicator of the financial soundness of the firm. Therefore, lenders use it to discriminate between credit borrowers, since they are not able to see accurately the quality of investment projects owing to the existence of asymmetric information.

This basic hypothesis about the sensitivity of investment to variables which proxy the capacity to generate resources internally being higher for those firms subject to credit

[7] Building information asymmetries into a perfect competition framework means that firms face an intertemporal problem of profit maximisation, subject in each period not only to technology availability, but also to a maximum debt level or to a function of the cost of external resources, increasing in some indicators of their soundness.

constraints has been recently tested in a wide range of works. The strategy followed has been to estimate investment equations for different sub-samples of firms, sorted according to a priori criteria that seek to identify financially constrained firms (or with relevant asymmetric information problems). In this vast literature, the seminal work of Fazzari et al. (1988) should be mentioned. It identifies as potentially constrained firms those not paying dividends in recent years. This type of approach has been used with alternative criteria by other authors: links to industrial grouping (Hoshi et al., 1989), age and size (Devereux and Schiantarelli, 1990, and Estrada and Vallés, 1998), firms' credit rating (Whited, 1992) and dispersion in the firm's share ownership (Schaller, 1993). In general, the division criterion par excellence in this literature is size, since there are several reasons suggesting that the consequences of asymmetric information problems are more noticeable in the case of small firms. Among these reasons, Caminal (1995) highlights that there are economies of scale in supervision and control tasks, and therefore it is more costly for borrowers to monitor small firms, and for firms to provide information to their lenders. Nevertheless, as argued in Chatelain et al. (2001), size might not be a sufficient or even correct indicator of informational asymmetries for some countries.

In the recent literature, the hypothesis of the sensitivity of investment to the internal generation of resources has been tested using a wide range of econometric models of investment: from reduced-form models to the estimation of Euler equations. In all cases, the models are augmented with a variable measuring the self-financing capacity. The use of a reduced-form investment equation augmented with cash flow presents a basic limitation: it does not allow the sensitivity of investment to the internal generation of resources to be unequivocally associated with the prevalence of finance constraints or, more generally, with the existence of asymmetric information between borrowers and lenders. Under this approach the positive and significant coefficient of variables that approximate the self-financing capacity in investment equations may be explained by alternative hypothesis. Specifically, the most usual critique of these approaches is that the cash flow variable may, instead of giving evidence on liquidity constraints, be approximating future investment opportunities. Moreover, Giner and Salas (1997) show that the result of the sensitivity of investment to financial variables may be due not only to the existence of finance constraints but also to the imperfections in the control mechanism on capital which make possible the channelling of monetary flows towards investment projects that reduce the value of total assets. These authors indicate that when there are information asymmetries between shareholders and managers and the latter pursue a growth target, the firm will invest to excess. Moreover, they point out that the investment rate of the firm that invest to excess shows a greater sensitivity to the generation of resources than that of the firm which does not over-invest, for three reasons. First, because the external capital market will not provide monetary resources for the financing of projects that reduce the firm's market value. Second, firms' managers do not want to turn to debt financing because it would increase the probability of failure. Third, because the firm is less profitable, the internal generation of funds will also be lower and, thus, the finance constraint will be present in a greater number of cases.

In the context of the excess sensitivity tests, the structural investment models, like the Q model or the Euler equation, display an undeniable advantage with respect to reduced-form investment equations. Structural models explicitly control for expectational influences on the investment decision. That implies that if the model turns out to be mis-specified because a financial variable is significant, this should not be attributed to an expectational influence.

Nevertheless, the use of structural models for testing for the presence of financial constraints can be criticised. On one hand, the existence of serious measurement problems of some variables included in the structural models cast some doubt on the validity of the empirical implementation of these models. On the other, it has been claimed that adding financial variables to the structural models is a joint test of all the assumptions of the model and not only of the assumption of no financial constraints. Consequently, results from the empirical literature testing the excess sensitivity of investment to cash flow and other financial variables are consistent with the existence of significant financial constraints, but these tests could also be detecting other sources of mis-specification in the investment models used.

Some recent papers have tried to discriminate between alternative hypotheses that explain the significance in investment equations of the coefficient of variables measuring self-financing capacity. First, Fazzari and Petersen (1993) propose the additional inclusion of working capital[8], along with the above-mentioned variables, in a Q-model of investment. The rationale behind this proposal is as follows: if cash flow is measuring future investment opportunities, working capital -also positively correlated to sales and profits- should have a positive coefficient in the investment equation; conversely, if cash flow is evidencing finance constraints, working capital -which would be entering into competition with investment for a limited volume of resources- should have a negative coefficient in the investment equation. Second, Gilchrist and Himmelberg (1995) use a structural model to overcome the identification problem associated with distinguishing the role of cash flow as a proxy for future investment opportunities and as a means of alleviating credit constraints. The distinctive feature of their approach is the inclusion, among the determinants of investment,

[8] They define working capital as liquid assets and stock less liquid assets and short-term debt.

of a predictor of future investment opportunities -called Fundamental-Q- built from a set of relevant variables, including cash flow. Gilchrist and Himmelberg estimate, for different sub-samples, a specification that includes simultaneously the Fundamental-Q variable and cash flow, obtaining as a result that the latter only has an additional explanatory power for the sub-sample of firms identified a priori as financially constrained. Third, Gilchrist and Himmelberg (1998) construct and estimate a structural model which incorporates financial frictions and which is used to identify the "fundamental" versus the "financial" determinants of investment. They find that investment is responsive to both fundamental and financial factors and that small firms and firms without bond ratings show the strongest response to financial factors[9].

Overall, although the interpretation of the findings of the literature linking financial variables and investment is controversial, the empirical evidence available tends to favour the hypothesis of the existence of asymmetric information between borrowers and lenders[10]. Firms with relevant asymmetric information problems will face high external financing costs or constraints on the amount of credit demanded.

3. The model of investment

In this section we first present the main features of the theoretical model of investment derived in Bond and Meghir (1994) and we then describe their testing strategy to study the validity of the empirical implications of the model. The Bond and Meghir (1994) model (BM model in what follows) is based on the hierarchy of finance approach to corporate finance and provides a theoretical basis to justify the sensitivity of investment to the availability of internal funds usually found in the empirical literature. Basically, the BM model assumes a hierarchy of cost for the alternative sources of financing (i.e, internal funds have a lower cost than external funds) and implies a different characterisation of investment for firms facing different financial situations. More precisely, from the first-order conditions of the optimisation process of a standard neoclassical model of investment with quadratic costs of adjustment, they derive a Euler equation that relates investment rates in successive periods.

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9 Laeven (2001) and Love (2001) estimate structural models based on the Euler equation for investment using firm-level data from large sets of countries, following the approach in Gilchrist and Himmelberg (1998).

10 See Kaplan and Zingales (1995) for an exception to this result. These authors focus on the sample of firms that Fazzari et al. (1988) consider as financially constrained and, using off-balance-sheet information, analyse whether firms are not effectively constrained. Paradoxically, they found that firms effectively constrained are few and, moreover, for these firms, the sensitivity of investment to cash flow is lower. Kaplan and Zingales point out three possible explanations to these results: first, firms effectively constrained may be conditioned by creditors to reducing debt; second, the consideration of an intertemporal constraints framework may vary the allocation of resources generated between saving and investment; and, third, the existence of adjustment costs in the investment planned may condition the investment response to shocks on generated resources.

They show that for the firms which are liquidity-constrained, the standard Euler equation is not a valid model to describe investment behaviour. In the model, a firm is liquidity-constrained if it generates insufficient net revenue to finance all the investment it would be optimal at the cost of retained earnings and it does not find optimal to issue new shares. However, for those firms that are not liquidity-constrained, investment behaviour is described by the standard Euler equation, even if those firms face a hierarchy of financial costs.

To test the empirical implications of their hierarchy of finance model, Bond and Meghir follow a threefold testing strategy. First, they estimate the standard Euler equation for the whole sample of firms. A rejection of the model is expected due to the presence of liquidity-constrained firms in the sample that would lead to an excess sensitivity of investment to measures of internal finance. Second, they estimate the basic Euler equation augmented with dividends or new share issues. Again, the presence of liquidity-constrained firms would justify the significance of these variables in the investment equation. Third, they estimate the Euler equation model allowing all coefficients to vary depending on their allocation to the different financial regimes.

3.1. The theoretical model

As earlier mentioned, in this section we present the main features of the hierarchy of finance model derived in Bond and Meghir (1994).

The firm's managers are assumed to maximise the present value of net distributions to shareholders, subject to the flow of funds identity, to the equation of motion of the stock of capital and to non-negativity constraints on dividend payments and new share issues. Thus, the optimisation problem for the firm is:

$$V_t = \max_{\{K_{it}, B_{it}\}_0^\infty} E_t\left[\sum_{s=0}^{\infty} \beta_t^s \left(\gamma D_{it+s} - N_{i,t+s}\right)\right] , \qquad (3.1)$$

subject to:

$$D_{it} = p_{it}\left[F\left(K_{it-1}, L_{it}\right) - G\left(K_{it-1}, I_{it}\right)\right] - w_{it}L_{it} - p_{it}^I I_{\text{it}} + (1-f_t)N_{it} + B_{i,t} - \left(1+i_t\right)B_{it-1} \qquad (3.2)$$

$$I_{i,t} = K_{i,t} - \left(1-\delta\right)K_{it-1} \qquad (3.3)$$

$$D_{it} \geq 0 \qquad (3.4)$$

$$N_{it} \geq 0 \qquad (3.5)$$

where E_t is the expectations operator conditional on the time t information set Ω_t, $\beta_t^s = \prod_{k=1}^{s}(1+r_{t+k})^{-1}$ is the s-period discount factor, which discounts period $t+s$ to t, and r_t is the firm's nominal required rate of return between periods, D_{it} are dividends, γ is the tax discrimination parameter that determines the relative tax benefit of dividends against capital gains, f is a transaction charge that has to be paid per unit of new share issues, $F(.)$ is the firm's production function gross of adjustment costs, $G(.)$ is a convex adjustment cost function, L_{it} is the labour input, w_{it} is the price of labour, B_{it} is the firm's total debt, i_t is the interest payable on debt, N_{it} is the value of new shares issued, p_{it}^I is the price of investment goods and p_{it} is the price of output.

The main elements of the BM model may be summarised as follows:

- Two sources of discrimination between retained earnings and new share issues are introduced: a differential personal taxation on both sources of funds and transactions costs associated with new share issues. Thus, the cost of internal finance is lower than the cost of new share issues.

- The introduction of debt displays three main features: a) there is a probability of bankruptcy; b) both this probability of bankruptcy and the interest rate on debt depend positively on the amount borrowed; and c) there is a tax advantage to borrowing. Thus, depending on the amount borrowed, the cost of debt may be: 1) lower than the cost of internal finance; 2) between the cost of internal finance and the cost of new shares; and 3) higher than the cost of issuing new shares.

- The solution of the model allows for three possible financial regimes for a firm. In Regime 1 ($D_t>0$, $N_t=0$), firms generate enough cash flow to finance investment and pay dividends. They use debt to finance investment up to the point where the cost of borrowing equals the cost of internal funds. In Regime 2 ($D_t=0$, $N_t=0$), firms exhaust all their net revenue to finance investment and issuing shares is too costly for them. They can finance a higher level of investment only by borrowing. In regime 3 ($D_t=0$, $N_t>0$), firms exhaust their net revenue to finance investment but they have sufficiently attractive investment opportunities to finance part of their investment by issuing new shares[11].

[11] According to the BM model, firms should not simultaneously issue new shares and pay positive dividends. Bond and Meghir (1994) provide several explanations to justify this type of behaviour: cross-sectional heterogeneity of γ, transaction costs of trading shares and signaling role for dividends.

In this set-up, firms in Regime 2 are liquidity-constrained in the sense that a windfall increase in revenue would lead to a higher level of investment. However, firms in Regimes 1 or 3 would not change their optimal levels of investment when receiving extra revenue. In the first case, they would pay higher dividends. In the second case, they would reduce the volume of share issues and, thus, they would face a lower cost of financing but they would not change the level of investment.

3.2. The empirical model and the testing strategy

Bond and Meghir show that for firms in Regimes 1 and 3 a standard Euler equation model (without financial regimes) should describe their investment behaviour. To implement the above-mentioned empirical strategy, an empirical investment specification is needed. For this purpose, some additional assumptions are introduced:

- $F(.)$ is constant returns to scale, so that the marginal product of capital can be substituted without assuming a parametric form for the production function. We assume that the required time to build and install one unit of capital is one period.

- Imperfect competition in the product market is allowed for.

- The adjustment cost function $G(.)$ is of the form: $G(K_{i,t-1}, I_{it}) = \frac{b}{2}\left(\frac{I_{it}}{K_{i,t-1}} - a\right)^2 K_{i,t-1}$, where the parameter b reflects the importance of adjustment costs ($b > 0$).

- The assumption of rational expectations implies that $E_t(X_{it}) = X_{it} + \varepsilon_{it}$, where ε_{it} is a forecast error orthogonal to information available in period t.

Using these specifications yields the following Euler equation under the null of no liquidity constraints:

$$\frac{I_{i,t+1}}{K_t} = \beta_1 \frac{I_{it}}{K_{i,t-1}} + \beta_2 \left(\frac{I_{it}}{K_{i,t-1}}\right)^2 + \beta_3 \frac{Y_{it}}{K_{it-1}} + \beta_4 \frac{\Pi_{it}}{K_{it-1}} + \beta_5 \left(\frac{B_{it}}{K_{i,t-1}}\right)^2 + \eta_i + d_{t+1} + \varepsilon_{i,t+1} \qquad (3.6)$$

where the ratio of production to capital $\frac{Y_{it}}{K_{it-1}}$ controls for imperfect competition, and $\frac{\Pi_{it}}{K_{it-1}}$ is gross operating profit. The fixed firm-specific effect η_i can be interpreted as accounting for firms characteristics, as well as the time-invariant components of differences in, *e.g.*, product demand, capital intensity, and growth opportunities, whereas the time-specific effect d_{t+1} can be interpreted as capturing aggregate business cycles. Under the null of no financial constraints, it can be shown that $\beta_1 \geq 1$, $\beta_2 \leq -1$, $\beta_3 > 0$ (if imperfect competition), $\beta_4 < 0$ and $\beta_5 < 0$. Under the alternative of liquidity constraints, equation (3.6) is mis-specified because investment is related to financial conditions. More precisely, in the presence of liquidity constraints, investment spending should be positively influenced by revenue or cash flow. Thus, the expected negative sign for β_4 should not be obtained under liquidity constraints. This fact is the basic idea behind the testing strategy of the BM model. As has already been mentioned, the strategy is threefold and may be summarised as follows.

1) Estimation of the standard Euler equation for the whole sample of firms. A rejection of the model is expected due to the presence of liquidity-constrained firms in the sample that would lead to an excess sensitivity of investment to measures of internal finance. The usual criticism of the excess sensitivity tests (i.e. cash flow proxies future investment opportunities) is less relevant for the Euler equation approach since all relevant expectational influences should be captured by the one-step-ahead investment forecast.

2) Estimation of the basic Euler equation augmented with dividends or new share issues. Under the null of no liquidity constraints, the coefficient of the added variables should not be significant. Again, the presence of liquidity-constrained firms would justify the rejection of the null.

3) Estimation of the Euler equation model allowing all coefficients to vary depending on their allocation to the different financial regimes. For those firms that are not a priori liquidity-constrained, the coefficients should be in accordance with the predictions of the standard Euler equations.

To control for unobserved individual effects, endogeneity of explanatory variables and the introduction of the lagged dependent variable among the regressors, we estimate model (3.6) by transforming all variables in the model using the orthogonal deviations transformation (see Arellano and Bover, 1995) and using a Generalised Method of Moments (GMM) (see Arellano and Bond, 1991). If the error term ε_{it} is serially uncorrelated, lagged values of the right-hand variables dated t-2 and earlier would be valid instruments. However, if ε_{it} is MA(1), instruments dated t-2 are no longer valid.

4. The Samples: Descriptive Statistics

The empirical analysis is conducted on two panel data sets constructed from the harmonised balance sheets and profit and loss accounts of French and Spanish industrial firms. The French sample comprises 45111 observations (corresponding to 6965 firms) obtained from a database compiled by the Banque de France. The Spanish sample includes 13631 observations (corresponding to 2208 firms) obtained from a database compiled by the Banco de España. In both countries, the period considered is 1991-1999.

Table 1 displays the size composition in both samples. In general, taking the whole population of enterprises in both countries as a benchmark, large firms are over-represented in our samples. Nevertheless, although skewed towards larger firms, these samples may be considered as representative of the industry sector of each economy. In fact, they contain higher shares of small and unlisted companies than the standard databases used in the empirical literature. The median number of employees is 48 in France and 49 in Spain, and in both cases the fraction of listed companies is below 3%. Therefore, our samples seem to be well suited for addressing an empirical investigation of the relevance of financial frictions on investment decisions, since they contain a significant share of firms that are potential candidates to be liquidity-constrained.

The definitions and acronyms for the variables used in our analysis are presented in Table 2. Table 3 reports the descriptive statistics for these variables. Overall, although samples were cleaned of outliers by removing extreme percentiles from the variables used in the regression, there is still a wide dispersion in most of the variables. It is worth noting that the Spanish sample, despite being slightly more homogeneous in terms of size, displays a higher dispersion in some variables. Thus, the ratio of the standard deviation to the mean value is higher in the Spanish sample in almost all the variables. The exceptions are the number of employees, the external finance cost and the ratio of the gross operating profit to the stock of capital. The dispersion is significantly larger in the return on assets and in the cash stock.

Table 4 displays the median values for the main variables for the sub-samples of firms defined according to the splitting criteria that is used in the following section: payment of dividends in two consecutive periods. This descriptive evidence seems to suggest that those firms that do not pay dividends are potentially liquidity-constrained. First, this table is consistent with the existence of an external finance premium that reflects the monitoring costs that investment projects entail for lenders. The more pronounced the asymmetric information problems between a firm and their fund suppliers are, the larger this external finance premium should be. In our case, we have found that, in both countries, the median cost of debt is significantly higher for firms that do not pay positive dividends. In the French case, the difference in the median cost of debt between those firms that do not and those that do pay positive dividends is 0.5 p.p., whereas in the Spanish sample this difference is almost 2 p.p. Second, in both countries firms that do not pay positive dividends display a higher level of indebtedness. Again, this difference is larger in the Spanish sample. Third, in both countries firms that pay positive dividends have, in relative terms to their capital stock, a higher level of liquid assets and generate, again in relative terms to their capital stock, higher flows of internal funds (considering both gross operating profits or the cash-flow variable). Fourth, in both countries the median size of the firms paying positive dividends is larger. Finally, the ratio of investment to the stock of capital is again higher in both countries for firms paying positive dividends.

5. Empirical Results

As mentioned in section 3, Bond and Meghir (1994) present a direct test of the empirical implications of the hierarchy of finance model. Their model predicts that the same firm may be financially constrained in some periods but not in others; and that the firm's current dividend and new share issuing behaviour should signal which financial regime the firm is currently in. Thus, they claim that firms in the financially-constrained regime should be paying zero dividends and issuing no new shares in two consecutive periods, while firms in the unconstrained regimes should either be paying positive dividends or issuing new shares. In order to implement their testing strategy, we simplify the taxonomy of final regimes. We distinguish only two financial regimes[12]. Firms paying zero dividends in two consecutive periods are in the constrained regime; otherwise firms are classified as being in the unconstrained regime. We obviate the consideration of new shares issues, the main reason being that in both samples the proportion of firms issuing new shares is very small.

Table 5 displays the estimates for the basic Euler equations using the complete sample in both countries. As already mentioned in section 3, we use GMM, include a complete set of time dummies and, in order to solve the estimation problem stemming from the potential presence of unobserved individual effects, estimate the model using the orthogonal deviations transformation proposed by Arellano and Bover (1995). All the reported GMM estimates correspond to one-step estimates with asymptotic standard errors robust to heteroskedasticity. We present two columns for each country. In the first (column (1) for France and column (3) for Spain), the instrument set includes all the regressors dated from

[12] In fact, Bond and Meghir (1994) also use this simplification since the number of observations in their sample in Regime 3 is very low.

t-2 to t-4. In the second (column (2) for France and column (4) for Spain), we assume an MA(1) error and exclude instruments dated t-2. In both countries, there are important differences between the estimates in both columns. This is especially the case for the coefficients of the lagged investment terms (which, as Bond and Meghir argue, are more likely to be biased if the error term is serially correlated). Comparing both sets of estimates, we find that the exclusion of the most recent lags (those dated t-2) reduces the precision of the estimates. Nevertheless, in spite of this fact, given the tests of the validity of the instruments[13] and since the coefficients on the lagged investment terms, although correctly signed, are much smaller in absolute values than the predictions of the theoretical model in the absence of financial constraints, we rule out instruments dated t-2 and, in what follows, focus on the second set of results.

Focusing on the results in columns (2) and (4), we find that the coefficients of the lagged investment terms, although larger than in the estimates with instruments dated t-2, are still below the predictions of the theoretical model[14]. The coefficient of production is positive, indicating the existence of imperfect competition. The debt coefficient, although correctly signed, is far from being significant. Nevertheless, the major departure from the predictions of the theoretical model under the null of absence of financial frictions is the positive coefficient of the gross operating profit term[15]. The expected sign for this coefficient is a negative one because the gross operating profit is proxying the marginal productivity of capital. However, if the null hypothesis is incorrect, the availability of internal funds would positively affect the level of investment. Thus, a positive sign for the coefficient of the gross operating profit might be signaling the existence of liquidity constraints. Overall, the results in Table 5 provide evidence suggesting that the Euler equation model without financial regimes is mis-specified.

The second step in the BM testing strategy is to estimate the standard Euler equation augmented with the dividends to capital ratio. Under the null of no financial regimes this variable should not display any significant information content for the investment decision. As Table 6 shows the coefficient of the dividends to capital ratio is significant (although it is only marginally significant in the Spanish sample), while the remaining coefficients of the model do not significantly differ from those reported in columns (2) and (4) of Table 5. Thus, this

[13] In the French case, both the Sargan test in column (1) and the Sargan difference test support the rejection of the t-2 instruments. In the Spanish case, instruments dated t-2 cannot be rejected. Nevertheless, for the sake of comparability with the French results and given that the point estimates –reported in column (4)- for the lagged investment terms are closer to their theoretical values we also focus, for the Spanish sample, on results excluding instruments dated t-2. The pattern of results does not substantially differ when including them.

[14] Under the null of no financial constraints, the theoretical model predicts $\beta_1 \geq 1$ and $\beta_2 \leq -1$.

[15] This result is also obtained when using cash flow instead of gross operating profit to estimate the standard Euler equation model.

table provides some additional evidence (albeit somewhat weak) favourable to the rejection of the basic Euler equation model without financial regimes.

Finally, under the hypothesis of existence of financial regimes we should expect non-linear behaviour of investment in the sense that estimated coefficients in accordance with the predictions of the standard Euler equation model without financial regimes should be found only for those firms that are not liquidity-constrained. However, for liquidity-constrained firms estimates should reflect some degree of excess sensitivity of investment to financial variables. Thus, in the third step of their testing strategy, BM define a dummy variable S_{it} that takes the value 1 when the firm is liquidity-constrained and interact this variable with all the regressors. The coefficients for the unconstrained sample are those corresponding to the non-interacted terms. Analogously, for the constrained sample the parameters are the results of the sum of the non-interacted terms with the corresponding interaction terms.

To implement this test, in this paper we define a dummy variable S_{it} that is zero when dividends are positive in periods t and t-1[16]. As BM do, we consider that this variable S_{it} is endogenous and, consequently, we instrument it. Finally, we only add the interaction of this variable with the gross operating profit to capital, since this is the most direct test for the absence of financial constraints. Moreover, the introduction of the complete set of interaction terms substantially reduces the precision of the estimates. The results are reported in Table 7. When a different coefficient across observations in the two sub-samples is allowed for, we find that, in the Spanish sample, the point estimate for gross operating profit is zero for the unconstrained sub-sample and positive and significant for the constrained observations. In the French sample, the point estimate for gross operating profit is still positive and significant (although its size is smaller than in the model without the interaction term) for the unconstrained sub-sample, whereas the point estimate for the interaction term is also positive and significant suggesting that, as expected, the investment behaviour of firms in the constrained regime display a higher sensitivity to the internal generation of resources. Therefore, our results suggest that the rejection of a standard Euler equation model of investment without financial regimes comes from the presence in both samples of a sub-set of companies that are liquidity-constrained, in the sense that their investment is positively linked to the availability of internal finance.

The main findings of the study broadly reproduce those obtained by Bond and Meghir (1994) using a sample of quoted U.K. manufacturing firms over the period 1974-1986. Moreover,

[16] To allow for a signaling role for dividends, Bond and Meghir (1994) use two alternative criteria to classify a firm as being constrained: first, if current dividends are low relative to the firm's average payout; and second, if the firm cuts dividends.

our results are consistent with those found in Alonso-Borrego (1994). He estimates a similar model for a sample of Spanish firms over the period 1987-1990. The standard Euler equation model is rejected for the sample containing both dividend-paying observations and non-dividend-paying ones. Furthermore, when the coefficients are allowed to vary depending on the dividend policy, a higher degree of excess sensitivity to cash flow is found for those firms paying zero dividends. In addition, using a two-stage procedure to correct the potential sample selection bias, he estimates the standard Euler equation model for the sub-sample of firms paying positive dividends and confirms that the model is not rejected for that sub-sample.

Finally, it is worth noting that Chatelain et al. (2001), estimating a neoclassical model of investment for two samples of firms –French and Spanish- very similar to the ones used in this study, rejects that small firms display a higher degree of excess sensitivity of investment to cash flow relative to large firms. Our results seem to confirm, as was suggested in that paper, that size might not be a sufficient indicator, for some countries, of informational asymmetries.

6. Conclusions

This paper has analysed the role of financial constraints in explaining investment behaviour using two unbalanced samples of French and Spanish industry firms over the period 1991-1999. For this purpose, this chapter has closely followed the methodological approach implemented by Bond and Meghir (1994). These authors present an extended version of the standard Euler equation model of investment. This extended model assumes that the firm faces a hierarchy of costs for the alternative sources of finance and leads to different characterisations of investment behaviour for firms pursuing different financial policies.

Overall, our results suggest that there are significant differences in investment behaviour which are closely linked to the financial situation of firms. More precisely, our results corroborate the empirical finding that investment displays excess sensitivity to measures of internal finance for a sub-set of firms; in particular, the evidence found is consistent with the investment expenditure of firms paying zero dividends being constrained by the availability of internally generated funds.

Although our results display some slight departures from the theoretical predictions of the extended model, they provide an empirical basis for the excess sensitivity of investment to financial variables. Therefore, the evidence presented contributes to explaining the rejection of the standard Euler equation model of investment. This model is rejected on several grounds. First, in the estimates of the standard Euler equation for the whole sample of firms, a positive and significant coefficient is found for the internal funds variable that can be explained by the presence of liquidity-constrained firms in the sample that would lead to an excess sensitivity of investment to measures of internal finance. Second, in the estimation of the basic Euler equation augmented with dividends, this variable turns out to be significant. We argue again that the presence of liquidity-constrained firms in the sample justifies this result. Finally, in the estimation of the Euler equation model allowing all coefficients to vary depending on their allocation to the different financial regimes, a higher excess sensitivity to internal funds is found for the a priori liquidity-constrained firms. Nevertheless, the negative and significant coefficient for the internal funds variable for those firms that are not a priori liquidity-constrained is not found. A possible explanation for the latter result, as argued by Bond and Meghir (1994), is that the sample selection criteria used to identify the existence of liquidity constraints might be somewhat weak in the sense that firms could have incentives to pay positive dividends. Thus, firms could decide to pay positive dividends even if liquidity-constrained.

Finally, it is worth pointing out that the patterns of results in both countries do not seem to display significant differences (although a formal statistical test of the differences has not been conducted since the databases have not been pooled). What is more telling, our results broadly reproduce those obtained by Bond and Meghir (1994) for a very different sample, namely quoted U.K. manufacturing firms over the period 1974-1986. Thus, these results confirm that the analysis of the dividend policy of the firms is useful for identifying the potential presence of financial constraints on investment spending.

Table 1. Size Distribution of Firms and Observations by Mean Employment

France						
	n ≤ 20	**20<n ≤100**	**100< n ≤ 250**	**250<n≤500**	**n>500**	**Total**
No. of firms	1 083	3 894	1 141	450	397	6 965
	15.5%	55.9%	16.4%	6.5%	5.7%	100.0%
No. of obs.	6 611	25 319	7 581	2 984	2 616	45 111
	14.7%	56.1%	16.8%	6.6%	5.8%	100.0%

Spain						
	n ≤ 20	**20<n ≤100**	**100< n ≤ 250**	**250<n≤500**	**n>500**	**Total**
No. of firms	368	1180	353	168	139	2208
	16.7%	53.4 %	16.0 %	7.6 %	6.3%	100 %
No. of obs.	2190	7260	2259	1078	844	13631
	16.1 %	53.3 %	16.6 %	7.9 %	6.2 %	100 %

Percentage of Listed Companies (Firms and Observations)				
	France		**Spain**	
	Listed	**Total**	**Listed**	**Total**
No. of firms	117	6965	64	2208
	1.7%	100.0%	2.9 %	100 %
No. of obs.	773	45111	359	13631
	1.7%	100.0%	2.6 %	100 %

Table 2. Variable Acronyms and Definitions

Variable Acronyms	Description of Variable
I/K	Gross Investment / Capital = I(t)/K(t-1)
S/K	Sales / Capital = S(t)/K(t-1)
Y/K	Production / Capital = Y(t)/K(t-1)
CF/K	Cash Flow / Capital = CF(t)/K(t-1)
CS/K	Cash Stock / Capital = CS(t)/K(t-1)
GP/K	Gross Operating Profit / Capital = GP(t)/K(t-1)
B/K	Total Debt / Capital = B(t)/K(t-1)
YP	Number of Employees
ROA	Ordinary Return on Net Assets (R1)
EFC	External Finance Cost (R2)

Table 3. Descriptive Statistics

FRANCE							
Variable	**Mean**	**St. dev.**	**Percentiles**				
			Min	25%	50%	75%	Max
I/K	0.139	0.144	0.002	0.048	0.094	0.174	1.026
S/K	4.123	3.771	0.717	2.001	3.001	4.779	79.80
Y/K	3.718	3.488	-0.737	1.818	2.727	4.287	79.80
CF/K	0.332	0.312	-0.652	0.161	0.262	0.411	4.219
CS/K	0.284	0.634	0.000	0.017	0.086	0.302	26.50
GP/K	0.196	0.302	-2.637	0.047	0.122	0.256	5.92
B/K	0.592	0.651	0.013	0.219	0.402	0.709	9.78
YP	169	933	1	27	48	120	63258
ROA	0.116	0.422	-33.09	0.045	0.105	0.179	69.20
EFC	0.084	0.527	0.00	0.046	0.064	0.089	73.00

SPAIN							
Variable	**Mean**	**St. dev.**	**Percentiles**				
			Min	25%	50%	75%	Max
I/K	0.148	0.184	-0.156	0.035	0.092	0.193	1.285
S/K	4.477	4.673	0.370	1.808	3.032	5.362	64.359
Y/K	4.538	4.676	0.348	1.841	3.094	5.362	64.359
CF/K	0.339	0.444	-1.081	0.114	0.228	0.424	4.154
CS/K	0.370	0.895	-0.071	0.024	0.103	0.332	19.870
GP/K	0.409	0.441	-1.142	0.169	0.296	0.504	4.737
B/K	0.711	0.926	0	0.140	0.447	0.918	9.858
YP	199	769	1	26	49	131	15665
ROA	0.130	0.782	-29.727	0.056	0.111	0.188	79.5
EFC	0.178	0.610	0	0.064	0.105	0.161	40

Table 4. Descriptive Statistics (Median by Sub-samples)

	FRANCE		SPAIN	
Variable	**Dividends=0**	**Dividends>0**	**Dividends=0**	**Dividends>0**
Number of observations	30532	14579	10771	2860
S/K	2.938	3.138	3.016	3.100
Y/K	2.653	2.874	3.076	3.137
CF/K	0.222	0.351	0.194	0.377
CS/K	0.058	0.192	0.090	0.177
GP/K	0.134	0.216	0.273	0.396
B/K	0.444	0.323	0.515	0.223
YP	46	56	44	86
ROA	0.081	0.154	0.099	0.168
EFC	0.066	0.061	0.108	0.090

TABLE 5

The basic Euler equation model

	France		Spain	
	(i)	(ii)	(iii)	(iv)
$\frac{I_{i,t-1}}{K_{i,t-2}}$	0.132 (0.020)	0.529 (0.211)	0.211 (0.042)	0.456 (0.236)
$\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.170 (0.025)	-0.777 (0.346)	-0.190 (0.044)	-0.444 (0.325)
$\frac{GOP_{i,t-1}}{K_{i,t-2}}$	0.079 (0.012)	0.093 (0.031)	0.015 (0.019)	0.042 (0.044)
$\frac{Y_{i,t-1}}{K_{i,t-2}}$	0.014 (0.002)	0.008 (0.004)	0.014 (0.004)	0.018 (0.007)
$\left(\frac{B_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.004 (0.001)	-0.001 (0.003)	-0.002 (0.001)	-0.003 (0.003)
m_1	-32.96	-6.17	-16.54	-4.37
m_2	-0.28	-0.33	0.18	-0.44
Sargan	92.8	39.3	74.6	35.5
(p-value)	(0.04)	(0.50)	(0.33)	(0.67)
Difference-Sargan	53.5		39.1	
(p-value)	(0.00)		(0.12)	
Instruments	t-2, t-3, t-4	t-3, t-4	t-2, t-3, t-4	t-3, t-4

Notes: The estimation method is orthogonal deviations GMM. Time dummies are included. m_i is a serial correlation test of order i using residuals in first differences (asymptotically, this test follows a standard normal distribution). Sargan is a test of the over-identifying restrictions (asymptotically χ^2). Difference-Sargan is a test of the validity of the additional instruments (asymptotically χ^2). See Table 2 for the definition of the variables.

TABLE 6

Tests for the absence of financial effects

	France	Spain
	(i)	(ii)
$\frac{I_{i,t-1}}{K_{i,t-2}}$	0.517 (0.211)	0.491 (0.221)
$\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.717 (0.344)	-0.558 (0.267)
$\frac{GOP_{i,t-1}}{K_{i,t-2}}$	0.109 (0.032)	0.070 (0.045)
$\frac{Y_{i,t-1}}{K_{i,t-2}}$	0.008 (0.004)	0.016 (0.007)
$\left(\frac{B_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.002 (0.003)	-0.003 (0.003)
$\frac{D_{it}}{K_{it-1}}$	-0.232 (0.101)	-0.305 (0.170)
m_1	-6.59	-5.20
m_2	-0.11	0.10
Sargan	45.8	43.1
(p-value)	(0.56)	(0.67)
Instruments	t-3, t-4	t-3, t-4

See notes to Table 5.

TABLE 7

Tests for the absence of financial regimes

	France	Spain
	(i)	(ii)
$\frac{I_{i,t-1}}{K_{i,t-2}}$	0.490 (0.199)	0.449 (0.223)
$\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.681 (0.313)	-0.413 (0.285)
$\frac{GOP_{i,t-1}}{K_{i,t-2}}$	0.069 (0.031)	-0.001 (0.044)
$\frac{Y_{i,t-1}}{K_{i,t-2}}$	0.008 (0.004)	0.017 (0.007)
$\left(\frac{B_{i,t-1}}{K_{i,t-2}}\right)^2$	-0.002 (0.003)	-0.004 (0.003)
$S_{it}\ \frac{GOP_{it-1}}{K_{it-2}}$	0.041 (0.024)	0.106 (0.044)
m_1	-6.71	-5.21
m_2	-0.06	0.60
Sargan	40.8	43.2
(p-value)	(0.76)	(0.67)
Proportion of observations with S_{it} =0	0.32	0.21
Instruments	t-3, t-4	t-3, t-4

See notes to Table 5.

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