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Documentos de Trabajo
N.º 1003

BANCO DE ESPAÑA
Eurosistema

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(*) Research support from the US National Science Foundation, the National Institute of Health, John Templeton Foundation, the Gates Foundation through the University of Chicago Consortium on Financial Systems and Poverty and the Social Sciences and Humanities Research Council is gratefully acknowledged. This paper is the sole responsibility of its authors and the views presented here do not necessarily reflect those of Banco de España or the Eurosystem. We thank V. Salas for his comments and suggestions on preliminary versions of this paper. We also appreciate theexcellent comments received from the Editor and an anonymous referee of the Banco de España Working Paper Series,the 2009 Far East Meeting of the Econometric Society and the 24th Annual Congress of the European EconomicAssociation. Any remaining errors are our own.

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2010

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ISSN: 0213-2710 (print)
ISSN: 1579-8666 (on line)
Depósito legal: M. 14140-2010
Unidad de Publicaciones, Banco de España

Abstract

This paper examines whether financial constraints affect firms' investment decisions for older (larger) firms. We compare a group of unbanked firms to firms that rely on formal financing. Specifically, we combine data from the Spanish Mercantile Registry and the Bank of Spain Credit Registry (CIR) to classify firms according to their number of banking relations: one, several, or none. Our empirical strategy combines two approaches based on a common theoretical model. First, using a standard Euler equation adjustment cost approach to investment, we find that single-banked firms in our sample are most likely to exhibit cash flow sensitivity while unbanked firms are not. Second, using structural maximum likelihood estimation, we find that unbanked firms have a financial structure which is close to credit subject to moral hazard with unobserved effort, whereas single-banked firms have a financial structure which is more limited, as in an exogenously imposed traditional debt model. Firms in the unbanked category do not rely on bonds, equity, or formal financial markets, but rather on other firms in a financial or family-tied group (with either pyramidal or informal structure). We are among the first to document the importance of such groups in a European country. We control for reverse causality by treating bank relationships as endogenous and/or by appropriate stratifications of the sample.

Keywords: inancial constraints, bank lending, investment Euler equations, moral hazard, structural estimation and testing.

JEL classification: C61, D82, D92, G21, G30.

1 Introduction

Over the past two decades the bulk of the literature on investment, at the micro level, has focused on the influence of financial constraints on firms' investment decisions.[1] Theorists have used models of information and incentive problems in capital markets to motivate the role and origin of financial constraints. Both adverse selection due to asymmetric information between the borrower and potential lenders about the quality of the investment project and moral hazard (due to the costly monitoring of managers' allocation of resources) can introduce a wedge between the cost of internal and external finance.[2] Ultimately, this results in limited access to external finance, so that firms have to restrict investment when internal cash is insufficient to invest at the first-best level.[3]

The empirical literature has documented that, in addition to the fundamentals determining investment dynamics (expected future profitability and the user cost of capital), firms' internal funds affect in a positive and significant manner their investment decisions, with more intensity for firms affected by capital market imperfections. Since the seminal paper of Fazzari, Hubbard and Petersen (1988), an extensively used empirical strategy consists of separating "constrained" and "unconstrained" firms according to a priori assumptions on the likelihood that firms are subject to information or incentive problems, then testing whether the neoclassical investment equation derived under the assumption of perfect capital markets with adjustment costs describes the behaviour of financially unconstrained firms but not that of financially constrained firms.[4] Some firm characteristics used in this stratification as a priori proxies of the importance of capital market imperfections are firm's size, age, and dividend policy.[5] A few stratify by relationship with industrial or financial groups, and this turns out to be related to our findings here.[6]

In parallel, a literature on relationship banking has developed based on the idea that information about borrowers is extremely important in the lending process, especially for small firms who are considered "informationally opaque".[7] Banks are thought to have a comparative advantage in producing information about borrowing firms [Diamond (1984); Bond (2004)]. To the extent that bank relationships mitigate asymmetric information

1. Schiantarelly (1996) and Hubbard (1998) provide extensive reviews of the literature.

2. On adverse selection see Jaffee and Russell (1976) or Stiglitz and Weis (1981). Myers and Majluf (1984) focus on informational problems affecting equity financing. The effects of moral hazard are treated in Jensen and Meckling (1976). Williamson (1987) derives the possibility of credit rationing in the context of optimally designed contracts under the assumption that profit outcomes can only be observed at a cost. On costly state verification see also Townsend (1979) and Diamond (1984).

3. The gap between the cost of external debt and of internal funds can be explained by information costs but it could also be due to tax factors or other transaction costs.

4. There are two main empirical approaches, pioneered by Fazzari, Hubbard and Petersen (1988) and Bond and Meghir (1994) respectively. The first approach is based on the estimation of the Q model of investment, extended by including a proxy for the availability of internal funds and testing for differences in the sensitivity of investment to cash flow between "constrained" and "unconstrained" firms. The second approach estimates the standard investment Euler equation which should be valid for unconstrained firms but mis-specified for constrained firms. In both cases, the investment equations are derived from the neoclassical model under the assumptions of perfect competition, constant returns to scale, and quadratic adjustment costs.

5. Schiantarelli (1996) provides an exhaustive list of the criteria employed in the literature to partition firms according to their likelihood of being subject to financial constraints and discusses the empirical literature for every criterion.

6. Although, we do not stratify by relationship with industrial or financial groups, we find that a sizeable number of older, larger firms are unbanked. A major source of funds for these firms is debt with other enterprises in a financial group and persistently unbanked firms tend to be family-tied (in either pyramidal or informal structures).

7. For a comprehensive review of the literature on relationship banking see Boot (2000) and Elyasiani and Goldberg (2004).

problems between creditors and borrowers and facilitate monitoring, the incidence of financial constraints on firms' investment decisions and, consequently, on the sensitivity of investment to cash flow, could differ across groups of firms classified according to the strength of their banking relationships.[8]

Although empirical research evaluating the costs and benefits of banking relationships has been extensive, papers connecting differences in firms' investment behaviour with bank-firm relationships are relatively scarce.[9] In most cases, the results suggest that close bank relationships are associated with reduction in the sensitivity of investment to cash flow [Elston (1996), for Germany; García-Marco and Ocaña (1999), for Spain;[10] and Houston and James (2001), for the USA]. In one case the authors find no significant effects of bank relationships [Fuss and Vermeulen (2006), for Belgium]. In another case the result is the opposite [Fohlin (1998), for Germany during the formative years of universal banking].[11]

Our empirical findings are in line with those of Fohlin (1998) who documents that investment is less sensitive to internal resources in unbanked firms, contrary to what is reported in the rest of the papers for other countries, including Spain. One reason is that most of the authors compare banked and unbanked firms defined according to the presence of banks in the list of shareholders or on the board. This is a valid but, in our opinion, restrictive way of distinguishing banked vs. unbanked firms. In this paper, we define unbanked firms simply as those not borrowing from any bank. In contrast to the few papers which define bank relationships the same way we do, we also study unbanked firms and not just a comparison between single- and multiple-banked firms[12].

With respect to the literature on Spanish firms [García-Marco and Ocaña (1999)], discrepancies in the results are likely due to differences in the definition of bank relationships, differences in the size and composition of the sample which was limited to a few large and listed manufacturing firms, and/or differences in the sample period.

Another substantial difference we have with the previous literature is that we restrict attention to firms that are at least ten years old. Our sample thus features unbanked firms that are older, if not larger, than small start-ups and young firms without credit history, possibly unbanked for that reason. The latter group is a priori likely to be more constrained than any other group, and we do not want to mix such firms in our sample of unbanked

8. The strength of firms' banking relationship has been defined in the literature as: the relationship's *length* ([Petersen and Rajan (1994); Harhoff and Körting (1998); Berger and Udell, 1995 and Degryse and Van Cayseele (2000)], the relationship's *scope*, i.e., type and number of financial services [Petersen and Rajan (1994) and Degryse and van Cayseele (2000)], bank's ownership [Elston (1996); García-Marco and Ocaña (1999); Fohlin (1998) and Chirinko and Elston (2006)], and the *number of banks* [Petersen and Rajan (1994); Harhoff and Körting (1998); Houston and James (2001) and Fuss and Vermeulen (2006)].

9. With the exception of Houston and James (2001) and Fuss and Vermeulen (2006) who differentiate between single and multiple banked firms, the rest of the papers only consider the presence of banks as shareholders or on the board of directors.

10. Carbó, Rodríguez and Udell (2008) use a disequilibrium model to classify Spanish firms as constrained and unconstrained and find that investment is predicted by bank loans for unconstrained firms and by trade credit for constrained ones. Although not specifically focused on the influence of banking relationships, the influence of financial constraints on investment decisions for Spanish firms has also been previously analysed by Alonso-Borrego (1994), Estrada and Vallés (1998) and Hernando and Tiorno (2002).

11. Other papers investigate differences in the role of bank relationships in alleviating financial constraints in different stages of the credit cycle. As an example, see Vickery (2005), which presents evidence that benefits of relationships are higher when credit conditions are poor or deteriorating.

12. On the determinants of the number of bank relationships see Ongena and Smith (2000) and Guiso and Minetti (2007).

firms, which may be unbanked because, in contrast, they have other sources of finance and choose not to borrow.

We use data from the Spanish Mercantile Registry and the Bank of Spain Credit Registry (CIR) to classify firms according to whether they have borrowed from a single Spanish credit institution, from several institutions, or from none. We restrict our attention to firms that are at least ten years old and not listed on the stock exchange. We find that a significant number of those firms (more than 3,500 firms every year, or 10% of our sample) are unbanked, that is, they do not borrow from any bank (domestic or foreign branch) in Spain. These firms' debt is non-trivial, but it comes in large part from trade credit and from other firms which are members of a group of family-related firms. Banked firms are in turn divided into single-banked and multiple-banked according to the number of banks from which they borrow. We then examine whether there are financial constraints for each of these types of firms using two related but distinct empirical approaches, both based on a common overall theoretical model.

Our first approach is based on the standard Euler equation adjustment cost approach to investment, [Bond and Meghir (1994)]. We find that single- and multiple-banked firms are most likely subject to financial constraints. Unbanked firms are not. Our results are consistent with the literature which argues that bond markets are accessible only for larger firms. Yet in Spain higher levels of finance beyond bank borrowing comes not from bonds but from trade credit and the Spanish analogue to chaibols or keiretzu business groups [Hoshi, Kashyap and Scharfstein (1990)]. Though these relationships are not necessarily official nor formal in many cases, we find evidence of the importance of family ties.[13] Specifically, we find that firms which persistently finance their investment projects not relying on banks, bonds, or other financial markets tend to be linked to other firms through family connections. We draw this conclusion from several case studies in which we tediously construct cross-firm relationships for several large persistently unbanked firms. In spite of the variety in situations, a common pattern is that unbanked firms are part of formal or informal family groups.[14] Although the importance of family firms has been widely studied,[15] we are among the first to find the importance of unbanked financial groups in a European country.[16]

Naturally, banking relationships, or the lack thereof, are likely to be endogenous and it is difficult to establish the direction of causality. Firms that are unconstrained may be happy within business groups as they do not need to worry about financing, for example. The group may not be playing an active role in alleviating constraints. Likewise, constrained firms may be precisely those that are unable to participate in a group and thus are likely to

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13. Other authors have also suggested that group membership relaxes financial constraints, see Schiantarelli (1996) for a review and Samphantharak (2003) for an application to Thailand. Additionally, other papers recognise the existence of “tunnelling” (transfer of resources across firms in a pyramidal structure from a lower level firm to a higher level firm) and “propping” (transfer of resources in the opposite direction) and its impact on the relationship between controlling shareholders and minority ones (e.g., see Bertrand, Mehta and Mullainathan, 2002).

14. We label formal those structures in which firms are linked by a pyramidal structure through shareholder/subsidiary relationships and with one or more individuals of the same family being at the same time shareholders and members of firms' boards. We label informal relations those cases in which several firms, not linked in a pyramidal structure, have common shareholders or boards, which tend to be members of the same family. On the nature of the agency problems within pyramids see Bertrand and Mullainathan (2003).

15. Bertrand and Schoar (2006) provide a survey of empirical world-wide evidence on family controlled businesses. At the same time, they contrast theoretical arguments for the higher efficiency of family firms vs. ‘cultural’ theories sustaining the contrary.

16. The literature on family firms in European countries includes Cronqvist and Nilsson (2003) for Sweden, Sraer and Thesmar (2004) for France and Maury (2006) for a sample of western European countries, among others.

go to a bank. In that sense, limited observed finance by single banks per se may not be the cause of the constraint. The Bond and Meghir approach allows the econometrician to control for the endogeneity of bank relationships using appropriate lags of this variable as instruments in GMM estimation.

In our second approach, we estimate structural models of four financial regimes (autarky, non-contingent debt, moral hazard constrained credit and full information / complete markets), using simulated maximum likelihood methods. The advantage of this structural approach is that we can get inside the "black box" of the credit relationship. Indeed, we first see how far we can get without imposing adjustment costs, so that all the "action" is in the explicitly modelled financial or information constraints. In effect, we combine theoretical dynamic models of credit constraints in investment with applied empirical work. We then allow both adjustment costs and distinct financial regimes. Without adjustment costs we find that risk-neutral unbanked firms have a financial structure that is close to moral hazard with unobserved effort (full information comes second), while risk-neutral single-banked firms have a financial structure which is more limited, essentially as in an exogenously imposed traditional debt model. The non-contingent debt model also fits the data best for the whole sample. Allowing for quadratic adjustment costs in each regime weakly improves their fit with the data, but reassuringly the best-fitting regimes in each data sub-sample by number of banking relationships remains the same as without adjustment costs.

To control for endogenous bank relationships in this second approach we feature firms that have been continuously in a single category for the entire sample. For these firms the dynamic programming problems imply that they would behave approximately as if they were destined to be in that category forever, especially if at the end of the sample they are still not near making a transition. The latter assumption cannot be tested, however. Further, firms in one category of relationships may be substantially different from those in another category for other reasons, and such heterogeneity is not yet incorporated into our models. But at least we follow literally the dictates of the theory that does allow for some (if not all) heterogeneity.

Though the sensitivity of investment to cash flow has been widely interpreted as evidence of the existence of financial constraints determining firms' investment decisions, the literature is not without controversy. As argued by Kaplan and Zingales (1997 and 2000)[17], a firm is either constrained or unconstrained, a binary variable, and the degree of cash flow sensitivity does not necessarily indicate the severity of the financial constraint. Recent work by Gomes (2001), Cooper and Ejarque (2003) and others have challenged the Fazzari et al. (1988) interpretation and demonstrated that financing constraints can be neither necessary nor sufficient for cash flow effects.[18] On the other hand, Schmid (2009) shows that, in a model with endogenously incomplete financial markets due to limited commitment, the cash flow term is significant and thus suitably modelled financial frictions can indeed rationalize the evidence on cash flow sensitivity.

Our results contribute to this debate given that we look at both sensitivity to cash flow and estimation of the underlying financial regime. Our complementary structural estimation results for groups of firms differentiated according to the number of banking

17. For a response to the critique of Kaplan and Zingales, see Fazzari, Hubbard and Petersen (2000).

18. Papers that reject the linear relationship between cash flow sensitivity and financial constraints include Fohlin (1998), Cleary (1999), Houston and James (2001), and Fuss and Vermeulen (2006).

relations reinforces the interpretation that the cash flow sensitivity of single-banked firms is associated with stricter financial constraints on investment decisions. To our knowledge, this combination of approaches is unique to our paper and, again, provides consistent evidence of financial market imperfections for banked firms.

2 The model

The firm maximizes its 'utility' function, $u(c,z)$ where c is dividends to the owner, similar to consumption and z is labour effort in management and production, as if the firm were run by a single person or were a conglomerate with perfect markets within, so that we have Gorman aggregation. The utility $u(c,z)$ is separable in c and z and we allow it to be linear in c, hence accommodating risk neutrality.

Specifically, under the functional form $u(c,z) = \frac{c^{1-\sigma}}{1-\sigma} - \zeta z^{\theta}$, parameter $\sigma \geq 0$ is the risk aversion parameter (with σ=0 corresponding to risk neutrality), parameter ζ is the utility trade-off between consumption and effort, and parameter θ is the curvature of the disutility of effort.

The firm's production function maps effort, z and capital, k into output, q. The general notation is $q = F(k,z,\theta^q)$, where θ^q is a firm-specific productivity shock. The firm's net profit, q, equals revenues less hired labour and other material costs, which we do not write explicitly. This general setup allows the shock θ^q to be auto-correlated, but we focus the exposition here on the case where shocks are i.i.d. over time, and over firms. Specifically, supposing net profits q can take on a finite number of realizations, q_i, i = $L, \ldots$, #Q, then for q_i at it lowest value q_L

$$\text{Prob}\,(q = q_{\text{L}} \mid z,k) = 1 - (\eta k^{\rho} + (1-\eta) z^{\rho})^{\frac{1}{\rho}}.$$

For any other q_i, i=L+1,,…, #Q, or $i \neq$L, we have,

$$\text{Prob}\,(q = q_{\text{i}} \mid z,k) = \frac{1}{\#Q-1} (\eta k^{\rho} + (1-\eta) z^{\rho})^{\frac{1}{\rho}}.$$

There are constant returns to scale. For simplicity, assume $q_{\text{L}} > 0$ so that some borrowing is always possible, with the loan being repaid out of earnings, even when the firm is in the worst q_L state forever. Note that with #Q=2 (so that either $q = q_{\text{L}}$ or $q = q_{\text{H}}$) expected profits are CES, with ρ the elasticity of substitution: $\rho < 0$ means effort z and capital k are substitutes, $\rho = 0$ is the Cobb-Douglas special case, and $\rho > 0$ implies inputs are complements.

Capital depreciates at rate δ so we have the usual law of motion for capital, with I_t denoting investment, namely, $k_{t+1} = (1-\delta)k_t + I_t$. In our preferred specification, investment I_t adds at the end of the period to capital used in the following period.[19]

There is a marginal cost, $g \geq 0$ of adjusting away from the current capital level. It is subtracted from firm's profits q. Under the standard quadratic functional form assumption, we write:

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19. In Bond and Meghir (1994) investment is available for use immediately and subtracted as a cost in the net profit function. Note also that our q, as net profits, is already net of wages and other costs. In Bond and Meghir (1994), this non-capital input decision is explicit.

$$g(I,k;\theta^I)=\frac{1}{2}bk\left[\frac{I}{k}-\varsigma-\theta^I-b_j\right]^2$$

Here, θ^I is a shock to the investment adjustment cost, b_j is a firm-j specific term, and b and ς are parameters to be calibrated or estimated.

The firm discounts future profits with factor β. Sometimes we take β as the inverse of the market rate for borrowing and lending, 1/R, where $R=1+r$ is the gross rate of interest, but more generally, we allow β and 1/R to differ, for example, $R \geq 1/\beta$, so that the firm can achieve higher utility in the future by saving at the market rate. Further, we can introduce two rates, one (R^B) for borrowing and the other (R^S) for saving, with $R^B \geq R^S$. Finally, we could also let the schedule of borrowing rates depend on the amount borrowed B through some marginal cost function, $\Psi(B)$.

To gain intuition, consider first a two-period, t_0 and t_0+1, specialized version of the model with risk neutrality and effort z supplied inelastically at $z=\bar{z}$. Let the initial, period t_0 conditions for capital k_{t_0}, "previous" savings S_{t_0-1}, and "previous" borrowing B_{t_0-1} be given. Then, the firm's problem is:

$$\max_{S_{t_0},B_{t_0},I_{t_0},c_{t_0},c_{t_0+1}} \quad c_{t_0}+\beta E_{t_0}(c_{t_0+1})$$

subject to:

$$\begin{aligned} c_{t_0}= \quad & k_{t_0}(1-\delta)+F\left(k_{t_0},\bar{z},\theta^q_{t_0}\right)-k_{t_0+1}-R^B B_{t_0-1}+B_{t_0}+ \\ & +R^S S_{t_0-1}-S_{t_0}-\Psi\left(B_{t_o}\right)-g(k_{t_0},I_{t_0},\theta^I_{t_0}) \end{aligned}$$

$$c_{t_0+1}=k_{t_0+1}(1-\delta)+F(k_{t_0+1},\bar{z},\theta^q_{t_0+1})-R^B B_{t_0}+R^S S_{t_0}-g(k_{t_0+1},0,\theta^I_{t_0+1})$$

where S_{t_0+1}, B_{t_0+1} and I_{t_0+1} are all zero; $F\left(k_{t_o},\bar{z},\theta^q_{t_0}\right)$ denotes net profits; and where $c_{t_0}\geq 0$, $c_{t_0+1}\geq 0$, $S_{t_0}\geq 0$, $B_{t_0}\geq 0$ and $I_{t_0}=k_{t_0+1}-(1-\delta)k_{t_0}$. Suppose the firm starts with a low level of capital k_{t_o}, so that the marginal product of capital (net of the adjustment cost), at t_0+1 is sufficiently high,

$$E\frac{\partial F\left(k_{t_0+1},\bar{z},\theta^q_{t_0+1}\right)}{\partial k_{t_0+1}}-E\frac{\partial g\left(k_{t_0+1},0,\theta^I_{t_0+1}\right)}{\partial k_{t_0+1}}+(1-\delta)>R^B\geq R^S\geq\frac{1}{\beta},$$

Such a firm would like to invest, but is bounded by current period resources. Thus, $c_{t_0}=0$ and $c_{t_0+1}\geq 0$. The constraint that dividends, c at t_0 be non-negative is binding, with a positive Lagrange multiplier, $\lambda_{t_0}>0$. To augment resources for investing further, the firm will borrow up to the point where the expected net marginal product of capital is equated to the marginal cost of borrowing,

$$E\frac{\partial F\left(k_{t_0+1},\bar{z},\theta^q_{t_0+1}\right)}{\partial k_{t_0+1}}-E\frac{\partial g\left(k_{t_0+1},0,\theta^I_{t_0+1}\right)}{\partial k_{t_0+1}}+(1-\delta)=\frac{R^B}{1-\Psi'\left(B_{t_0}\right)}.$$

Evidently, with increasing marginal borrowing costs, the tendency is for the firm to stay small and grow slowly.

On the other hand, suppose the firm starts with relatively high level of capital,[20] say at the steady state value,

$$E\frac{\partial F\left(k_{t_0+1},\bar{z},\theta^q_{t_0+1}\right)}{\partial k_{t_0+1}} - E\frac{\partial g\left(k_{t_0+1},0,\theta^I_{t_0+1}\right)}{\partial k_{t_0+1}} + (1-\delta) = R^B \geq R^S \; .$$

Such firm would only invest to replace depreciated capital and does not borrow. If $R^B = R^S$, the firm is also indifferent about the path of dividends, and so $\lambda_{t_0} = 0$. These large size and older firms would show up as unconstrained.

Bond and Meghir (1994) establish more generally that investment is sensitive to profits (cash flow) precisely when $\lambda_{t_0} > 0$. They also allow for default on debt with a bankruptcy cost, a variety of taxes on dividends received by owners, and advantages for interest paid to lenders and for capital gains. Here, we follow Bond et al. (2003) assuming that there are no cash flow constraints or tax considerations and test empirically whether the unconstrained benchmark with a zero Lagrange multiplier on dividends is rejected against the alternative.

Formally, let $\Pi(k,I,\bar{z},\theta^q,\theta^I) \equiv F(k,\bar{z},\theta^q) - g(k,I,\theta^I)$. The firm maximizes expected present discounted value at time t of current and future cash flows,

$$\max_{\{k_{t+j}\}} E_t\left(\sum_{j=0}^{\infty}\beta^j \Pi(k_{t+j},I_{t+j},\bar{z},\theta^q,\theta^I)\right)$$

subject to: $k_{t+j} = (1-\delta)k_{t+j-1} + I_{t+j}$ for all j.

This implies the following benchmark Euler equation characterizing the optimal investment path for any $t_0 \geq t$,

$$-\left(\frac{\partial \Pi}{\partial I}\right)_{t_0} = -(1-\delta)\beta E_{t_0}\left(\frac{\partial \Pi}{\partial I}\right)_{t_0+1} + \left(\frac{\partial \Pi}{\partial k}\right)_{t_0} .$$

Assuming constant returns to scale (inclusive of labour and other inputs), competitive markets, and using the quadratic form for the adjustment costs function *g*, we obtain,

$$\left(\frac{I}{k}\right)_{t_0} - \alpha_1\left(\frac{I}{k}\right)^2_{t_0} = \alpha_2 E_t\left(\frac{I}{k}\right)_{t_0+1} + \alpha_3\left(\frac{q}{k}\right)_{t_0} + \alpha_0$$

20. The adjustment cost function *g* is increasing in I_{t_0} which implies that the left hand side is increasing in k_{t_0}.

Current investment is positively related to expected future investment and to current average profits reflecting the marginal productivity of capital. Thus, all expectation terms are captured by the one-step-ahead forecast. To implement this equation empirically, replace the expectation by its realised value $\left(\frac{I}{k}\right)_{t_0+1}$ plus a forecast error, move this term to the left-hand side and backdate. Adding the subscript *j* for firm-specific variables and generalising the time index to *t,* we obtain the following empirical specification,

$$\left(\frac{I}{k}\right)_{jt} = \beta_1\left(\frac{I}{k}\right)_{jt-1} + \beta_2\left(\frac{I}{k}\right)^2_{jt-1} + \beta_3\left(\frac{q}{k}\right)_{jt-1} + \beta_4\left(\frac{y}{k}\right)_{jt-1} + d_t + \eta_j + \varepsilon_{jt} \qquad [1]$$

The output-to-capital ratio term, $\left(\frac{y}{k}\right)_{jt-1}$ is introduced to allow for either non-constant returns to scale or monopolistic competition in the product market. The term d_t captures common components in expectations, e.g., commonly observed aggregate shocks and, finally, η_j is a firm-specific effect. Equation [1] is the specification that we use extensively in this paper. Under the null of no financial constraints, Bond et al. (2003) argue that $\beta_1 \geq 1$, $\beta_2 \leq -1$, $\beta_3 < 0$ and (under constant returns to scale), $\beta_4 \geq 0.$

On the other hand, firms could be risk averse and, even under risk neutrality, there could be other credit market imperfections not captured by limited debt with borrowing costs, as assumed above. As in Karaivanov and Townsend (2009), we capture this here by considering a larger number of financial regimes. One extreme is autarky in which there is no borrowing and no saving. A second financial regime we consider is a borrowing (non-contingent debt) without default (i.e., no risk contingencies of any kind).

Further, to study more complex credit regimes which allow for risk-contingent premia, transfers, and debt, we write the firm's objective function

$$u(c,z) + \beta W',$$

where $c = \tau + (1-\delta)k - k'$ and where primes denote next period variables. Here it is as if all profits go to the lender, but some part of these profits is then returned to the firm via the (contingent) transfer τ. The firm also bears changes in the capital stock, i.e., pays for investment, but assuming full observability, *k* and *I* are under the control of the lender. The variable *W'* reflects next period promised utility, that is, discounted expected future utility. In the risk neutral case it equals expected dividends from next period onward. Importantly, effort *z* is not observed by the lender, and so the firm must be given incentives to perform —a moral hazard problem is present.

Writing *c* as a function of observed profits, $c(q)$ as in a profit sharing arrangement, we have, for all *k* and all $\hat{z} \neq z$ the following incentive compatibility constraints,

$$\sum_q \text{Prob}(q \mid z,k)[u(c(q),z) + \beta W'(q)] \geq \sum_q \text{Prob}(q \mid \hat{z},k)[u(c(q),\hat{z}) + \beta W'(q)] \qquad \text{(ICC)}$$

Generally, it is easier to compute solutions to this moral hazard regime by using the joint probability distribution $\pi(\tau, q, z, k', W')$ and writing the problem as a dynamic linear program in the probabilities π [see Karaivanov and Townsend (2009) for more details]. We assume all variables *(τ, q, z, k, W)* belong to discrete finite grids. With a large number (continuum) of firms, π will also be the histogram, or frequency distribution we see in the data, if all variables were observed. In practice, we see only *k*, *k'* and *q* so their joint distribution is obtained from the model by integrating out the unobservables. In terms of these joint probabilities, the moral hazard constraints (ICC) can be written for $\forall k$, $\forall \bar{z}, \hat{z}$ as

$$\sum_{\tau,q,k',W'} \pi(\tau, q, \bar{z}, k', W'|W, k)[u(\tau+(1-\delta)k-k',\bar{z})+\beta W'] \geq \sum_{\tau,q,k',W'} \pi(\tau, q, \bar{z}, k', W'|W, k)\frac{\text{Prob}(q|\hat{z},k)}{\text{Prob}(q|\bar{z},k)}[u(\tau+(1-\delta)k-k',\hat{z})+\beta W']$$

Here W denotes the promised utility in the entering period (capturing past history). This promise must be met, so for $\forall k$ we must have ("promise keeping"):

$$\sum_{\tau,q,z,k',W'} \pi(\tau, q, z, k', W'|W, k)[u(\tau+(1-\delta)k-k',z)+\beta W'] = W$$

For consistency, we also compute the solutions to the autarky and borrowing regimes using the same linear programming numerical method. In the fourth and final regime we drop the incentive constraint on effort (ICC), which corresponds to the full information (full insurance, perfect credit markets) setting.

The lender (or collection of lenders) is modelled as a risk neutral principal maximizing discounted expected returns when facing a long-term contract with a firm of type *(W, k):*

$$V(W,k) = \sum_{\tau,q,z,k',W'} \pi(\tau,q,z,k',W'|W,k)\left[q-\tau+\frac{1}{R}V(W',k')\right]$$

This objective function is maximised subject to the above promise keeping constraint, the incentive constraint (ICC) (for the moral hazard regime only), and, in addition, to the Bayes-rule compatibility constraints,

$$\sum_{\tau,k',W'} \pi(\tau, \bar{q}, \bar{z}, k', W'|W, k) = \text{Prob}(\bar{q}|\bar{z},k) \sum_{\tau,q,k',W'} \pi(\tau, q, \bar{z}, k', W'|W, k) \quad \text{for all } \bar{q}, \bar{z}$$

and an "adding-up" constraint for the joint probabilities:

$$\sum_{\tau,q,z,k',W'} \pi(\tau, q, z, k', W'|W, k) = 1.$$

In sum, the financial regimes range from most constrained (autarky) to least constrained (full information) in terms of availability of credit and, if firms are risk averse, insurance. We study these four regimes and their implications for firms' investment behaviour and sensitivity to cash flow using structural estimation techniques in Section 4.2.

We could also make the interbank market less than perfect, to distinguish the situation of the lender. The more difficult it is for the lender to acquire funds and pass along risk, the less can be done for the borrower.

Finally, though this goes beyond the scope of the empirical analysis in the current paper, we can allow transitions across financial regimes. The Euler equation approach is already consistent with this, in the sense that λ_t^D can vary with t, including taking on the value of zero, that is, the firm is constrained at some times and not at other times. As noted in the example above, there is a tendency for this to happen over time as small firms pay out no dividends and have λ_t^D positive, while large unconstrained firms have $\lambda_t^D = 0$. Likewise, the Karaivanov and Townsend approach can be generalized to allow for transitions. Imagine that there is a fixed cost $f^B(\theta_t^{FB})$ for banking with formal financial institutions and a cost $f^U(\theta_t^{FU})$ for the "unbanked" regime. In some specifications, firms have less reason to borrow from the formal sector as they get larger, because their needs are smaller, as illustrated earlier. In this case, with $f^U = 0$ and $f^B > 0$, they exit the banked sector at some point. In the extreme, the costs $f^U(\theta_t^{FU})$ may be persistently low relative to $f^B(\theta_t^{FB})$ and the firm will never be observed to be borrowing from the formal sector.

On the other hand, there could be a cost of exiting the banking system or, equivalently, cost to joining an alternative financial arrangement. Still, one can formalize the overall problem. Returning to the earlier borrowing model, for example, if remaining in the banking system at t, but facing that decision again next period

$$W^B\left(k_t, \theta_t^q, B_{t-1}, S_{t-1,} \theta_t^I\right) = \max_{I_t, B_t, S_t} c_t + \beta E \max\left[W^U(.), W^B(.)\right]$$

where

$$c_t = k_t(1-\delta) + F(k_t, \bar{z}_t, \theta_t^q) - k_{t+1} - R^B B_{t-1} + B_t + R^S S_{t-1} - S_t - \Psi_B(B_t) - g(k_t, I_t, \theta_t^I) - f^B(\theta_t^{FB}).$$

If when transitioning at time t to regime "U" (unbanked) previous debt obligations are met, then only current investment need be decided:

$$W^U\left(k_t, \theta_t^q, B_{t-1}, S_{t-1,} \theta_t^I\right) = \max_{I_t} c_t + \beta E \max\left[W^U(.), W^B(.)\right]$$

where

$$c_t = k_t(1-\delta) + F(k_t, \bar{z}_t, \theta_t^q) - k_{t+1} - R^B B_{t-1} + R^S S_{t-1} - g(k_t, I_t, \theta_t^I) - f^U\left(\theta_t^{FU}\right),$$

and where $k_{t+1} = k_t(1-\delta) + I_t$ throughout.

Though there may be long run tendencies to move toward the unbanked state, shocks to profits, adjustment costs and entry or exit costs will motivate some transitions. On the other hand, if those transitions are distant in expectation and time, the value functions W^B and W^U can be approximated by imagining that the firm is in one status or the other forever [see Townsend and Ueda (2007), for an illustration].

3 Data and descriptive analysis

3.1 The dataset on bank-firm relationships

The overall database contains information drawn from two main micro-datasets. The first source is SABI-INFORMA that mainly provides economic and financial information reported annually by Spanish firms in their public financial statements deposited at the Spanish Mercantile Registry. In addition, SABI-INFORMA provides static[21] information on some firm characteristics such as location (province), age, and business activity (4-digit CNAE-93 code, 488 industries in total) of the firm. Additionally, using information drawn from SABI-INFORMA, firms are categorised into private/public and listed/unlisted.

The second source of data we use is the Credit Register (CIR) of Banco de España (the Spanish Central Bank). This database is a census of the loans granted by Spanish credit institutions (mainly, commercial banks, savings banks and credit cooperatives) or subsidiaries and branches of foreign banks operating in Spain to Spanish firms.[22]

The combination of these two data sets allows a categorization of firms according to their number of credit relationships with banks (those included in the SABI-INFORMA sample that have at least one loan registered at CIR) vs. firms that are unbanked (otherwise). In the case of banked firms, we further differentiate between single-banked and multiple-banked firms. The resulting database contains annual information on economic characteristics and banking relationships for a large sample of Spanish non-financial firms during the period 1992-2004. In the rest of the paper, we refer to this database as SABI-CIR[23]. It is an unbalanced panel, as a consequence of entry and exit of firms. These are due, first, to the natural processes of "births" and "deaths"; second, to changes in the composition of the firms' portfolio for which INFORMA collects information from the Spanish Mercantile Registry and, finally, to the filtering[24] we implemented on the raw data that could lead to dropping some, but not necessarily all, observations for a given firm. The complete database contains approximately 3,621,000 observations, corresponding to around 773,000 firms which are observed in different time intervals over the period 1992-2004.

Since government-owned firms' investment decisions could be taken according to different criteria than those used by private firms, we do not include firms owned by central, regional or local governments in our analysis. This means dropping around 1,200 firms, which represent only 0.33% of the non-financial firms in the SABI-CIR sample. Additionally,

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21. Information is static in the sense that it reflects the status of the firm at the moment the information was drawn which does not necessarily coincide with the status of the firm over the years -though we do construct a panel and use it, below.

22. The Bank of Spain Credit Registry (CIR) contains monthly information on all credits over a minimum threshold granted by credit institutions operating in Spain to Spanish borrowers. Given that the minimum threshold has been very low over the whole period, especially after 1995 (6,000 euros), this database can be considered as a census of the banking loans granted to non-financial firms. For a detailed analysis of the characteristics of this database see the *Memoria de la Central de Información de Riesgos*, published by Banco de España since year 2005 as well as Jiménez et al. (2006) and Jiménez et al. (2009).

23. An exhaustive list of all variables contained in our dataset and their definitions is provided in Appendix 1.

24. We have dropped, for any given year, observations corresponding to firms declaring interest payments equal or higher than the amount of total debt and negative equity. Moreover, we have dropped the value of a variable if the variable is, for example by definition, non-negative, but the firm declares a negative value for it. To be precise, we have applied this type of filter to the following variables: sales, total assets, tangible assets, financial income, financial expenses, short term debt, long term debt, commercial debt and cash.

we exclude publicly listed firms (around 165 firms) since we think that their access to funds from capital equity markets, as an alternative to bank loans, could have shown up as a different financing mechanism and would blur the overall sample.

A priori, the properties of the unbalanced panel, characterised by a wide coverage of age, size and industry categories,[25] make it attractive for studying the existence of financing restrictions influencing investment patterns. Of particular interest is the role of banking relationships in alleviating, or not, financial constraints on Spanish non-financial firms which, as non-listed companies, tend to be informationally opaque. Nevertheless, in practice, initial results based on the entire panel, including young and small firms, were rather unsatisfactory. We were mixing two very distinct categories of unbanked firms, young start-ups with older, more established entities. Thus we decided to concentrate on the latter, older group.

In sum, we focus on the balanced panel of firms that, by construction, excludes start ups entering after 1997. In particular, we have selected those firms for which we have information on the dependent and the explanatory variables (the list of explanatory variables includes lags and squared lags of the firm's relative investment) for all years between 1997 and 2004.[26] The selection procedure generates a balanced panel containing information on 44,644 firms observed each year between 1996 and 2004.[27]

Second, we have filtered the sample by eliminating firms younger than ten years old in 1997. The resulting sample represents 18% of the firms in the balanced panel.[28] We extend the information in the database for those firms selected according to the above-described procedure including observations corresponding to the period 1993-1995 (1993 is the first year for which investment level can be computed). The latter is necessary to construct the lags of the predetermined variables in the Euler equations.

The final dataset we use contains 410,882 observations corresponding to all firms in the SABI-CIR database with ten or more observations available for period 1993-2004 that, in year 1997, are at least ten years old (from now on we refer to this sample as the "selective sample"). Table 1 provides the distribution of firms in our sample according to the number of years in which the firm is present in the dataset. Firms in this selective sample represent, on average, 10.6% of the firms in the SABI-CIR database, covering around 25% of aggregate total assets, aggregate debt and aggregate banking debt. With respect to the whole population of Spanish non-financial firms, the coverage of our sample is, on average,

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25. In terms of age, the SABI-CIR sample is mostly composed of firms not older than 10 years (63% of total firms). In terms of the size of the firms, the data base contains a high proportion of small firms with an average percentage of 93% of the firms in the sample, where small firms are defined as those with total assets not higher than €5 million or total sales not exceeding €7 million.

26. 1997 is the earliest year available to estimate the investment equations using 3- and/or 4-year lags of the variables on the right-hand side of equation [1] as instruments for the predetermined variables in the first-difference equation.

27. Note that picking out just those firms with complete data could cause sample selection bias because the probability of having complete data is likely higher for larger firms which possibly assign more resources to satisfy the informational requirements of the Mercantile Registry. For a comparison of the distributions across age, size and industries in the balanced and the unbalanced datasets, see Appendix 2.

28. Most of the firms in the INFORMA database do not report information on their date of founding. Consequently, to filter by age we have only considered the age for those firms reporting this information (around 40% of the firms in the balanced panel) but, generally, we kept in our sample all the firms that do not report their age.

around 16% of the aggregate total assets and around 17% of the total amount of loans given by Spanish credit institutions[29] to Spanish non-financial firms.

Below we investigate the association of banking relations with firm's investment decisions. For this purpose, we distinguish among three groups of firms depending on the number of banking relations maintained by the firm in a given year. The number of banking relations is defined as the number of banks reporting at least one loan to the Bank of Spain Credit Registry (CIR) for this firm and time period. According to this definition of banking relations, the firms in our sample can be separated, each year, into the categories of "unbanked firms", those with no banking loans registered in CIR), and "banked firms", those with at least one loan registered at CIR. Additionally, within the category of banked firms, we distinguish between firms with loans to a single bank only ("single-banked firms") and firms funded by two or more banks ("multiple-banked firms").

Alternatively, we use a second criterion to classify firms according to their number of banking relations over the whole studied period (1997-2004). In particular, we classify firms in the categories of "continuing unbanked", "continuing banked" and "switching-status". Within the group of continuing banked firms we sometimes also differentiate among continuing single-banked firms, continuing multiple-banked firms and other continuing banked firms.

3.2 Descriptive analysis

In this section we present descriptive statistics on the composition of our selective sample by firm types defined according to the number of banking relations in a given year and according to the time trajectory in this number over the studied period. Second, we examine the differences and similarities in i) firms' characteristics (i.e. age, size and activity); ii) investment patterns; and, iii) firms' economic and financial ratios for unbanked, single-banked and multiple-banked firms. Finally, at the end of the section, we explore how unbanked firms finance their activity.

The year-by-year composition of the sample according to the number of firms' relations with banks is shown in Table 2. The most remarkable feature is the predominance of firms maintaining simultaneous relations with two or more different banks, which represent around 72% of the firms in the sample. In this category, approximately one half of the firms have banking debt granted by no more than four banks.[30] Around 18% of the firms have a unique bank relationship. Finally, around 10% of firms are unbanked.

This distribution of firms across the three categories defined by the number of banking relations is stable over time and is very similar for homogenous groups of firms in terms of age. Table 3 provides the distribution of the number of banking relations conditioned on firm age. In particular, we show the distribution across types for firms with ages in the intervals [10, 20), [20, 30), older than 30 years and, for firms that do not report age. The numbers in the table indicate no remarkable differences in the distribution of firms across the categories of unbanked, single-banked and multiple-banked. Only the

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29. Commercial banks, savings banks, credit cooperatives and credit financial establishments. Credits to Spanish firms granted by branches and subsidiaries of foreign banks in Spain have also been taken into account.

30. The importance of the main bank in multiple banked firms is decreasing with the number of banking relations. In particular, the weight of the main bank for the median multiple banked firm goes from around 80%, in firms with two relations, to around 30%, in firms with 10 or more relations.

category of medium-aged firms differs slightly in composition from the rest of groups with a somewhat higher fraction of multiple banked firms (75.2%).

The banking status of the firm is highly persistent over time, as shown in the transition matrices presented in Table 4. Persistence is especially remarkable for the category of multiple-banked firms in which an average percentage of 93.6% remains in the same category one year later. This percentage decreases only slightly with the time horizon to 86.4% five years ahead. Firms that leave the category of multiple banked firms are more likely to go into the single-banked category than into the unbanked category.

Persistence is somewhat lower but also high in the category of unbanked firms for which 72.5% of the firms remain in this category one year later, around 63% two years later and almost one-half five years later. A majority of the firm's exiting this category go to the category of single-banked firms (around three-quarters after one year). Nonetheless, the fraction of firms moving to the category of multiple-banked firms increases progressively with the time horizon (almost 40% after five years). This suggests a trajectory from unbanked status toward single-banked or eventually multiple-banked.

In contrast, having a single bank relation is, on average, a relatively more transitory status. In particular, the percentage of single-banked firms that remain in the same category in subsequent years varies from 68%, after one year to around 43%, after 5 years. Additionally, a great majority of single-banked firms switching to other categories moves to the multiple-banked status (above 67%). In spite of that, a significant fraction of single-banked firms turn unbanked.

Table 5 reports the distribution of the number of years in which the firm is classified in the unbanked category over the period 1997-2004. Remarkable is the presence of a large fraction of firms in the sample, 76.7% on average, that are always, in all eight years, classified as "continuing banked" (zero years unbanked). At the other extreme, only 2.4% of the firms in the sample are continuously unbanked during the analysed period.

Within the group of continuously banked firms, a large fraction remains multiple-banked over the entire period. Firms in this sub-category, labelled "continuing multiple-banked", represent 68% of all continuously banked firms. In contrast, firms remaining single-banked firms in all years (that is, "continuing single-banked" firms) represent only a small fraction (3.3%) of continuously banked firms. The residual subcategory, named "other continuing banked" firms, includes all continuing banked firms that change from the single to the multiple-banked category or vice versa at least once in the period and represents around 29% of the sample of continuing banked firms.

A further important category contains firms that switch their banked/unbanked status at least once between 1997 and 2004. These firms are around twenty percent of the sample. As shown further in Table 6, within this category, most firms (more than 50%) change their banked/unbanked status once or twice in the sample period (switching three times adds another 13%, four times -6% and the rest of the numbers are negligible).

3.2.1 DIFFERENCES AMONG UNBANKED, SINGLE-BANKED AND MULTIPLE-BANKED FIRMS

3.2.1.1. Firm characteristics

According to Table 7, multiple-banked firms tend to be slightly older than unbanked and single-banked firms, as revealed by, first, their median age of 19.5, that is 1.5 years higher than the medians for the other two groups[31] and, second, the higher dispersion in the upper tail of the age distribution, suggesting that older firms in the whole sample tend to be concentrated in the category of multiple-banked firms.

In terms of size, measured by total assets, there are important differences among the three compared groups (Table 8). Multiple-banked firms are the largest, followed by single-banked firms. Unbanked firms are the smallest. As shown in Table 8, the firm-level distribution of total assets for multiple-banked firms is shifted to the right relative to that for single-banked firms, which in turn is shifted to the right relative to the distribution for unbanked firms. Finally, the distribution of firms across industries is similar in the three categories, as can be seen in Table 9. Perhaps the most remarkable features of the data are the presence of the older unbanked firms we study in all industries and the higher relative weight of manufacturing and quarrying for multiple-banked firms.

3.2.1.2 Investment patterns

Table 10 reports the averages, over the period 1997-2004, of the firm-level distributions of relative investment, defined as the ratio of absolute investment to capital (for definitions of all variables see Appendix 1) for the entire (selective) sample of firms and for the sub-samples defined according to the number of bank relations. Most remarkable is the wide heterogeneity in investment across firms in any category. Focusing on the entire sample, the median firm invests, on average, an amount that represents 18.5% of the value of its fixed assets.

Firms' investment ratios range, on average, from a minimum value of -0.58, indicating the presence of firms with negative investment[32], to a maximum of 1.4. Based on banking status, the 25th, 50th, and 75th percentiles of the investment ratio are higher for multiple-banked firms than for the rest of the firms in the sample. Additionally, compared to single-banked firms, the investment ratio distribution percentiles for unbanked firms are lower. Differences in the investment patterns suggest that there may be distinctive technologies across firm categories and/or the influence of financial constraints affecting firms from different groups in a different manner. For example, unbanked firms may operate technologies that require less investment and hence demand less outside finance. This is, of course, an empirical question. When we stratify by bank status we implicitly allow for different technologies across firms.

Regarding gross investment (Table 11), the most remarkable feature is the existence of differences in the fractions of firms choosing gross investment equal to zero across groups. Among unbanked firms this fraction raises to 11.5%, which is around 5 percentage points higher than the corresponding fraction for the single-banked firms and more than 9 percentage points higher than that for multiple-banked firms. Unfortunately the theory does not distinguish investment events on the extensive margin versus the size of investment on the intensive margin. This would require a fixed cost that makes the model

31. Note that the distribution of age in the selective sample is rightwardly-biased due to the exclusion of new firms entering the market after 1996 and also, to the exclusion of firms younger than 10 in 1997. The conclusions about the differences in the age composition of the sub-samples of unbanked, single-banked and multiple-banked firms that can be drawn considering the unbalanced panel are analogous to that for the selective balanced panel. In particular, the median firms are 8.3, 6.1 and 5.8 years old, in the categories of unbanked, single-banked and multiple-banked firms, respectively. In this case, there are also remarkable differences in the same direction in the lower tale of the distribution, as illustrated by differences in the first quartile equal to 2 in unbanked firms, 2.9 in single banked firms and 4.4 in multiple banked firms.

32. Investment has been defined as the sum of the absolute variation in physical assets and depreciation. So, negative values of investment correspond to sales of physical assets.

less tractable. We report this here as a priori evidence that unbanked firms may be less constrained, i.e., they choose not to expand.

Autocorrelation analysis of relative investment (not reported in the tables) shows that investment decisions are more persistent for multiple-banked firms than for unbanked and single-banked firms. The former is consistent with adjustment costs, if not different demand shocks. Additionally, there are narrow differences between unbanked and single-banked firms with changing sign depending on the time horizon (results available upon request).

3.2.1.3 Economic and financial ratios

As shown in Table 12 (first row), all percentiles of the distribution of the leverage ratio for multiple-banked firms are higher than those for single-banked firms which in turn are higher than those for unbanked firms. To illustrate these differences, the leverage ratio of the median multiple-banked firm equals 66.4%, which is 15 and 29 percentage points higher than that for single-banked and for unbanked firms, respectively. This indicates that, naturally, firms' leverage tends to increase with the number of banks providing them with funds. In spite of having lower leverage ratios than the rest of the firms, unbanked firms do obtain external funds from non-bank creditors (such as associated or affiliated companies and trade credit)[33] in a significant amount, which for 50% of the firms varies between 20% (25th percentile) and the 58% (75th percentile) of their assets. Thus, one should not think of unbanked firms as necessarily needing less credit, but rather as them obtaining credit from alternative sources.

Single-banked and multiple-banked firms also exhibit clear differences in their degree of dependence defined as the ratio of banking debt to total debt (second row of Table 12). In particular, multiple-banked firms tend to rely more heavily on banking debt than single-banked firms. The median is 44.2% in the first group, more than twice that of the second group. The wide dispersion of the distributions of this ratio in both groups indicates that firms within each group are highly heterogeneous in terms of their dependence on banking debt as a source of external funds.

Next, the cross-group comparison of the distribution of the liquidity ratio (short term assets-to-short term liabilities, third row of Table 12) suggests that unbanked firms tend to hold higher liquidity levels than firms in the other two categories, with a ratio of 43.8% for the median unbanked firms. Additionally, within the banked firms there are wide differences related to the number of bank relations. Liquidity is much lower for multi-banked firms (with a median ratio around 8%) than in single-banked firms (with a median above 23%). In sum, the liquidity ratio moves inversely with the intensity of banking relations.

There are no remarkable differences among the three groups in terms of the cash-flow to capital ratio, which is a proxy for the availability of internal funds, the sales to capital ratio, which proxies the output level relative to firms' tangible assets (i.e., the productivity of assets), and the return on assets (ROA) ratio, a measure of the profitability of the firm.

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33. *Debt with associated and affiliated companies* and, to a lower extent, *trade credit, are* the two main sources of funds for unbanked firms. For instance, in 1997 both types of debt represent around 72% and 10% of unbanked firms' debt, respectively. This conclusion is drawn from the aggregated balance sheets built with data for the subsample of firms that report to the Spanish Commercial Register detailed information on the itemization of debt, which represent around 1% of the firms in our SABI-INFORMA database for 1997. The numbers are similar for other years.

Finally the last row of Table 12, presents the default ratio (on banking debt).[34] Here, there are notable differences. For the median firm, the default ratio is higher in single-banked firms (100%) than in multiple-banked firms (35.3%). The default ratio is computed conditioning on the subsamples of firms that default on their banking loans. The fractions of firms in this situation are very small (below 1%) in both single- and multiple-banked firms.

3.2.2 HOW DO UNBANKED FIRMS FINANCE THEIR INVESTMENT PROJECTS?

As the above results indicate, the unbanked firms in our sample do invest. Consequently, a pertinent question is how unbanked firms obtain the necessary funds, in addition to internal resources, to finance their projects? In this section, we provide more detailed evidence on this point via two complementary approaches. First, we use SABI-INFORMA to itemize debts available in the firms' public financial statements and draw some conclusions from the aggregated numbers. Second, we performed several detailed "case studies" of formal and informal relationships with other firms for several large, continuously unbanked firms in our sample. For these case studies, we mainly explore information provided by SABI-INFORMA on the members of the firms' boards and the firms' shareholders and subsidiaries.[35]

3.2.2.1 Aggregated debt

Information about the itemization of debt as reported in financial statements is non-existent for most firms because by law only audited firms must report such detailed information. Still, given our interest in unbanked firms, and our estimation results below, it is crucial to do our best to find out more about the structure of these firms' debt. In particular, taking as an example 1997, we have data on the itemization of debt for 2,468 firms out of a total of 236,301.[36] That is, only around 1% of the firms in the SABI-INFORMA dataset report detailed financial statements and, consequently, detailed information on the itemization of their debts. Within this set of firms, a further 1% (248 firms) report no borrowing from banks.[37] Restricting attention to this subsample of unbanked firms, we aggregate their debt and its itemization to learn about the sources of funds used by unbanked firms to finance investment projects. Results are presented in Table 13.

On the aggregate, around 72% of unbanked firms' debt is provided by other associated and affiliated companies. The next important source of funds is trade credit,[38] followed by government funding (for example, delay in tax payments), which represent 10.5% and 3.5% of aggregate debt, respectively. In contrast, the two most important sources of funds for banked firms are bank loans and trade credit representing approximately one-third of total debt each. The third most important source of funds is 'other firms in the group', which represents around 17.1% of aggregate debt in banked firms, much less than the number for the unbanked group. It is followed by government funds that represent 9.5%. Again, these numbers come from a relatively low number of firms but represent our most accurate firm debt decomposition data.

34. The default ratio is a measure of the amount of non-performing bank loans expressed in terms of the total amount of banking loans.

35. This information is static in SABI-INFORMA in the sense that it is available only for the last information reported by the firm. Results presented in this section are based on the October, 2009 update of the database.

36. Structural characteristics are stable over time.

37. Here we refer to the information on bank loans reported in firms' public financial statements.

38. Carbó, Rodriguez and Udell (2008) report evidence on the use of bank loans by unconstrained firms to finance trade credit provided to other firms.

3.2.2.2 Case Studies

We thoroughly studied 18 large continuing unbanked firms randomly drawn from the list of the 25 largest continuing unbanked firms, according to total assets in year 2004. The results are presented in Appendix 3. For each firm, we used the report available in the SABI-INFORMA database that contains all available financial and non-financial information for that firm. In particular, the report provides lists of all firm's shareholders and subsidiaries. When a shareholder or subsidiary is also contained in the SABI-INFORMA database, the reports were linked. Thus, manually combining these reports allows recovering networks of formally related firms (e.g., in a pyramid structure). In addition, we discovered relations across firms, taking into account connections across their Boards (e.g., whether the president and/or chief executive are the same, or whether they are family members) and other coincidences such as, common address and telephone number (a more "informal" group structure). For firms in any such (formal or informal) structure, we complemented the information drawn from SABI-INFORMA with that from CIR to check whether or not these related firms are banked.

The above procedure, while time-consuming, allows us to conclude that persistently unbanked firms in our sample belong, to a significant extent, to a formal complex structure of firms. Another frequent pattern is for linked firms to be owned and/or managed by the same person or by members of the same family. These familial structures of firms can be pyramidal (in which predominant ties across the firms are of the type shareholders-subsidiaries) or "informal". In the latter case we call firms "informally related" if board members are the same or belong to the same family or if the firms report the same address or telephone/fax number.

In general, these family firms are very well capitalized and do not need banks' funding to develop their business plans, although occasionally some firms within their structure get loans from banks. Finally, looking at the object of business of these firms, there is significant diversity not only across them but also across members of the same group. Appendix 3 provides detailed description of our findings for one illustrative case.

4 Results

4.1 Estimation results based on the investment Euler equations

4.1.1 EMPIRICAL STRATEGY

We adopt the standard Euler equation approach to examine whether firms' investment behaviour and sensitivity to cash flow fluctuations varies with the firm's number of banking relations. For this purpose we rely on the version of the Euler equation presented in Equation [1], which is based on the model of Bond and Meghir (1994) and has been previously applied by Bond et al. (2003).

As Bond and Meghir (1994) show, under the presence of financial constraints, the basic Euler Equation given by [1] is mis-specified and, in particular, the predicted negative sign on the cash flow term may be expected to fail. The explanation is that, in the presence of financial constraints, the cash flow term reflects, in addition to the marginal productivity of capital, the influence of financing restrictions, manifested in a positive correlation between investment and cash flow.[39] In essence, our approach consists of specifying different Euler equations for firms with different numbers of banking relations, and testing whether or not the differences in parameter estimates corresponding to different sub-samples of firms are significant. Our main interest is the coefficient on the cash-flow term.

As a first step, we generalize the basic Euler Equation in [1] to allow for differences in the model parameters for the categories of unbanked and banked firms, so as not to focus all differences on the cash flow term, as in Equation [2],

$$\left(\frac{I}{k}\right)_{jt} = \beta_1\left(\frac{I}{k}\right)_{jt-1} + \beta_2\left(\frac{I}{k}\right)^2_{jt-1} + \beta_3\left(\frac{q}{k}\right)_{jt-1} + \beta_4\left(\frac{y}{k}\right)_{jt-1} + \delta_1\left(\frac{I}{k}\right)_{jt-1} \times D0_{jt} + \delta_2\left(\frac{I}{k}\right)^2_{jt-1} \times D0_{jt} + \delta_3\left(\frac{q}{k}\right)_{jt-1} \times D0_{jt} + \delta_4\left(\frac{y}{k}\right)_{jt-1} \times D0_{jt} + d_t + \eta_j + \varepsilon_{jt}. \qquad [2]$$

where $D0_{jt}$ denotes a dummy variable which equals one if firm *j* is banked in year *t,* and zero otherwise. The parameters β_l, l=1,…,4, characterise the dynamics of investment in the reference group of unbanked firms, while the parameter δ_l, l=1,…, 4, quantifies differences in β_l between the group of banked and unbanked firms.

Second, we generalize the theoretical model to allow for differences in investment patterns within the category of banked firms, since we distinguish between single and multiple-banked firms in the data. To estimate and test the differences in the investment Euler equations across unbanked, single-banked and multiple-banked firms, we consider an extended version of the Euler equation that includes interactions of the four observable

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39. Under the null of no financial constraints, Bond and Meghir (1994) demonstrates that $\beta_1 \geq 1$, $\beta_2 \leq -1$ and $\beta_3 < 0$ (depending on the magnitude of the adjustment costs). The output-to-capital ratio term controls for possible imperfect competition in the output market or non-constant returns to scale. Under constant returns to scale and perfect competition, we must have $\beta_4 = 0$. Otherwise, the sign of β_4 is determined by the relative sizes of the markup and the parameter for returns to scale.

explanatory variables with two dummy variables: *DS, S* = 1, 2, where *D1 (D2)* equals 1 if the firm has only one (more than one) bank relation in a given year, and 0 otherwise:

$$\left(\frac{I}{k}\right)_{jt}=\beta_1\left(\frac{I}{k}\right)_{jt-1}+\beta_2\left(\frac{I}{k}\right)^2_{jt-1}+\beta_3\left(\frac{q}{k}\right)_{jt-1}+\beta_4\left(\frac{y}{k}\right)_{jt-1}+\sum_{s=1,2}\left[\delta_1^s\left(\frac{I}{k}\right)_{jt-1}\times DS_{jt}+\delta_2^s\left(\frac{I}{k}\right)^2_{jt-1}\times DS_{jt}+\delta_3^s\left(\frac{q}{k}\right)_{jt-1}\times DS_{jt}+\delta_4^s\left(\frac{y}{k}\right)_{jt-1}\times DS_{jt}\right]+d_t+\eta_j+\varepsilon_{jt}. \qquad [3]$$

where, as in [2] above, the coefficients β_l, l = 1,…, 4, are parameters for the reference group of unbanked firms, the coefficients $\delta^1{}_l$, l = 1,…, 4, quantify differences in the corresponding β_l between single-bank relation firms and unbanked firms, and the $\delta^2{}_l$, l = 1,…, 4, quantify differences in the corresponding β_l between unbanked and multiple-banked firms.

The inclusion of firm-specific effects in Euler Equations [1], [2] and [3] implies that the lagged values of relative investment on the right-hand side are correlated with these firm-specific effects. Therefore, consistent estimation of the model parameters requires employing accurate panel data techniques, such as the GMM method applied by Arellano and Bond (1991) to control for biases due to unobservable firm-specific effects (the η_j) and endogenous explanatory variables. The method requires estimating a first-differenced specification of Equation [1] to remove firm-specific effects. Then, in the first-differenced model, predetermined variables (the lagged investment, cash flow and output ratios) become endogenous and, therefore, should be instrumented. Following Arellano and Bond (1991), the first differences of the predetermined variables *(I/k, q/k* and *y/k)* are instrumented with suitable lags of those same variables. Under the assumption that ε_{it} is serially uncorrelated, the error term in first differences is MA(1) and lagged variables dated *t-s,* for s≥2, will be valid instruments for predetermined and endogenous variables. If the error term in levels is itself MA(1), only instruments dated t-3 and earlier will be valid and so on. In practice, very remote lags are unlikely to be informative instruments and, hence, not all the available moment restrictions are used. We test the validity of the instruments used[40] by reporting both the direct test of serial correlation in the residuals and the over-identifying restrictions Hansen-J test (robust to heteroskedasticity and autocorrelation).[41]

4.1.2 ESTIMATION RESULTS

Table 14 provides the parameter estimates for Equation [1] and their p-values (in brackets) for the whole sample. The results indicate that the coefficients associated with the first lags of relative investment and squared relative investment satisfy the restrictions imposed by the theory. In particular, the coefficients associated with $(I/k)_{jt-1}$ and $(I/k)^2_{jt-1}$ are significant for any conventional significance level and have the correct sign. Moreover, the 95% confidence intervals for both parameters include a range of values higher than 1 in absolute value. The coefficient of the sales-to-capital ratio is positive and significant, consistent with absence of perfect competition in the output market.

40. We find evidence of first and second order autocorrelation in the error term corresponding to the first differenced equation. This is consistent with the use of instruments dated *t*-3 and earlier. In particular, we have used the third and fourth lags of *I/k* and other endogenous or predetermined variables, such as, *q/k* and *y/k.* Older lags have not been included in the instruments matrix because they tend to be uninformative and unnecessarily increase the size of the number of orthogonality conditions and the computation time, which given the large size of the sample is very high.

41. The null hypothesis of the autocorrelation test is the absence of autocorrelation of a given order. The null hypothesis of the Hansen-J test of the over-identifying restrictions is the global validity of the instruments.

The most remarkable departure from the restrictions imposed by the theory on the parameters in Equation [1] is that the estimate of the cash flow coefficient reported in Table 14 is positive and significant at the 1% level. This is contrary to the theoretical prediction that, under the null of no financial restrictions, the coefficient for the cash flow variable should be negative. This excess sensitivity of investment to cash flow is usually interpreted as preliminary evidence in favour of the presence of some firms in the sample being financially constrained and, consequently for which the standard Euler equation does not hold. The low p-values associated with the Hansen-J over-identifying restrictions test, in spite of the absence of autocorrelation in the errors of the first-differenced equation for orders higher than 2, can be interpreted as further evidence of model misspecification.[42]

We hypothesize that the presence and number of banking relationships affects the ability of the firm to get external funds to finance its investment projects. Consequently, distinguishing across categories of firms defined by the number of banking relationships could be a useful criterion to separate the unobservable categories of financially constrained and financially unconstrained firms. We assume that the decision whether to have or not have a banking relationship and the decision on the number of those relationships are determined endogenously with the level of investment in period t.

Table 15 provides the Arellano and Bond GMM estimates[43] of the investment Euler equation for several alternative specifications. Columns (1) and (2) provide coefficient estimates for the specifications in Equations [2] and [3], respectively, which differentiate between the parameters of the Euler equation for unbanked and banked firms, in the former case, and among those for unbanked, single-banked and multiple-banked firms, in the latter case.[44] The results in column (1) of Table 15 indicate that, overall, the coefficients for the reference category of firms in Equation [2], i.e., unbanked firms *(D0*=0), satisfy the restrictions imposed by the Bond and Meghir model. In particular, the 95% confidence intervals for the parameters associated with $(I/k)_{jt-1}$ and $(I/k)^2_{jt-1}$ include a range of values higher than 1 and, second, the coefficient associated with the cash flow term, *q/k*, is negative and significant for standard significance levels, in line with the null of absence of financial constraints. Further, the coefficient associated to the output term is positive and significant, consistent with imperfect competition in the output market.

Differences in the parameters of the Euler equation for banked firms (D0=1) relative to unbanked firms are significant for all four coefficients, suggesting different models behind firms' investment decisions for the two categories. In particular, in contrast to that for unbanked firms, the coefficient for the cash-flow rate for banked firms is significantly positive, traditionally interpreted as suggestive for the existence of financial constraints affecting firms in the banked category.[45] The autocorrelation and Hansen-J tests validate the use of third and further lags of the endogenous and predetermined variables as instruments. We interpret the relatively low p-value of the Hansen-J test statistic (3.7%) as consequence of some misspecification due to the restriction in model [2] that there are no differences between single- and multiple-banked firms.

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42. Bond and Meghir (1994) argue that the overidentifying restrictions test statistic has some power to detect misspecification in this type of models.

43. The instruments matrix has been built using the 3rd and 4th lags of *I/k*, *q/k* and *y/k*. Additionally, the dummy variable in the first-differenced model [2], that is $\Delta D0$, have been instrumented with the 3rd lag of the firm's number of banking-relationships.

44. Every year, firms are assigned to a group, depending on the number of bank-relationships maintained by the firm in the year.

45. The coefficients on the time dummy variables are assumed to be equal across unbanked and banked firms.

Column (2) of Table 15 provides the results from GMM estimation of Equation [3],[46] which allows estimating in a single regression the basic Euler equation for the reference group of unbanked firms, as well as differences in the parameters of the investment equation for the categories of single-banked and multiple-banked firms relative to unbanked firms. After relaxing the assumption of equality between single-banked and multiple-banked firms the p-value for the Hansen-J test rises to 12.7%. This fact, together with the autocorrelation tests results, analogous to those discussed for column (1), validates the set of instruments for endogenous and predetermined variables and supports our conclusion of misspecification problems in the model estimated in column (1) due to differences between the investment models for single-banked and multiple-banked firms.

The results for unbanked firms, used as the reference group ($D1$=0 and $D2$=0), are similar to those discussed for column (1). Nonetheless, the coefficients on $(I/k)_{jt-1}$ and $(I/k)^2_{jt-1}$ become non significant. The coefficients measuring the difference in parameters between the Euler equations for single- and multiple-banked firms relative to unbanked firms (δ^1_i and δ^2_i) suggest the existence of investment differences within the category of banked firms, depending on the number of banking relations. The coefficient on the cash flow term is, in both cases, significantly positive and higher in absolute value than that for unbanked firms, suggesting the presence of financial constraints in both groups. Further, the estimate for the parameters measuring cash flow sensitivity is higher for single-banked firms (the coefficient associated to cash flow is 0.10, the sum of -0.16 and 0.26) than for multiple-banked firms (that coefficient is 0.05, the sum of -0.16 and 0.21). These results appear to indicate that financial constraints affecting investment decisions could be more important for single-banked firms than for multiple-banked firms, although the difference between the groups in this parameter is non-significant (p-value of 0.63).[47] The rest of the estimates for coefficients measuring differences for single- and multiple-banked firms, relative to unbanked firms are not significant.

In column (3) of Table 15, we report results from the GMM estimation of a restricted version of Equation [3] after imposing the null of no differences in the parameters of the Euler equation for single-banked firms with respect to unbanked firms, except for the cash flow term (i.e., we impose $\delta^1_i = 0,$ for i=1, 2 and 4).[48] These results are similar to those for column (2) with the exception of that, as expected, the p-values diminish.[49] All parameters are significant for conventional significance levels. As before, cash flow sensitivity appears to be higher for single-banked firms (the coefficient associated with cash flow is 0.06, the sum of -0.14 and 0.20) than in multiple-banked firms (that coefficient is 0.05, the sum of -0.14 and 0.19) but, in this case the difference is narrower and non-significant (p-value of 95%). Finally, although the coefficients for $(I/k)_{jt-1}$ and $(I/k)^2_{jt-1}$ for multiple-banked firms are significantly different from those for unbanked and single-banked firms they are not significantly different from 0 (p-values of 31.3% and 21.5%, respectively). Nonetheless, the theory restrictions on the coefficients of the Euler equation under the null of no financial constraints appear not to hold for multiple-banked firms.[50]

46. Dummy variables in first-differenced model [3] ($\Delta D1$ and $\Delta D2$), have been instrumented with the 3rd lag of the firm's number of banking relationships. The coefficients associated with the time dummy variables are assumed to be equal for the categories of unbanked, single-banked and multiple-banked firms.

47. Our results, suggesting that financial constraints are stricter when bank relationships are closer (a single bank), contrasts with the findings in other papers analysing bank relationships, such as Petersen and Rajan (1994), Detragiache, Garella and Guiso (1997) and Houston and James (2001).

48. The p-value associated to the test statistic for this hypothesis is 79.97%.

49. Under the null δ_1=0, δ_2=0 and δ_4=0 imposed in Equation [3], the efficiency of the parameter estimates improves.

50. The p-value for the null that the parameter measuring the sensitivity of investment to cash flow for multiple banked firms is equal to zero (H_0: $\beta_3+\delta^2_3=0$) is 6.94%. Consequently, this parameter can be considered positive and significant.

Finally, the autocorrelation and the Hansen-J tests confirm the validity of the list of instruments.

4.1.2.1 Differences across firms with different trajectories in and out of the unbanked status

In Table 16, firms are grouped in four categories: continuing unbanked firms, continuing single-banked firms, continuing multiple-banked firms and rest of the firms. We define as continuing unbanked firms those that are unbanked for most of the years in the sample (six or more years).[51] The category of the rest of the firms, including both "switching" firms and "other continuing banked firms," is the reference group (for definitions see Section 3).

The first column of Table 16 reports the parameters for the investment Euler equation corresponding to the reference group of firms (switching and other continuing banked firms). The remaining three columns report the differences between the parameters for a given category of firms relative to those for the reference group.

Results in the first column indicate that, for the reference group, all theoretical restrictions on the parameters of the Euler equation are satisfied except for that on the sign of the coefficient on the cash flow term, which is positive and significant (p-value 0.014) suggesting the presence of financially constrained firms in that group.

The results for continuing unbanked firms (the second column in Table 16) indicate significant differences (p-value 0.033) in the coefficient associated with the cash flow term. It is negative and higher in absolute value than the coefficient for the reference group. This implies that the parameter associated with the cash flow term is significantly negative in continuing unbanked firms (-0.31, equal to the sum of 0.15 and -0.46), suggesting the absence of financial constraints for firms in this category. In sharp contrast, the results reported in the third column imply no significant differences between single-banked firms and the reference group. This suggests that continuing single-banked firms are financially constrained.

Finally, the results in the fourth column of Table 16 indicate significant differences in the Euler equation for continuing multiple-banked firms relative to the reference group, except for the coefficients associated with the cash flow and output terms. In particular, the absence of significant differences at standard significance levels in the cash flow sensitivity parameter with respect to that for the reference group (p-value 0.125) indicates that continuing multiple-banked firms are also constrained. This interpretation is reinforced by the fact that the coefficients for $(I/k)_{jt-1}$ and $(I/k)^2_{jt-1}$ do not satisfy the theory restrictions on both parameters under the null of no financial constraints. In particular, the 95% confidence intervals do not include the values 1 and -1, respectively. The autocorrelation and Hansen-J tests validate globally the specification and the list of instruments.

4.2 Structural Estimation

4.2.1 EMPIRICAL METHODOLOGY

In this section we estimate the four models of credit access from Section 2 (autarky, hereafter A, borrowing, B, moral hazard, MH, and full information, FI) using the structural

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51. Although we do not report the results in Table 16, we also did estimation runs where we defined continuing unbanked firms more strictly as never banked in the studied period. The results are similar but the significance of the estimates deteriorates as the number of observations goes down.

techniques from Karaivanov and Townsend (2009). To save space we describe only the basic methodology here.

Essentially, we write down a likelihood function criterion that measures the goodness of fit between each of the alternative models of financial markets and the data. We then use the maximized likelihood value for each model (i.e., at the best fitting parameters) and perform a statistical test [Vuong (1989)] to try and distinguish between the models. That is, we approach the data as if we do not know which theoretical model fits best and let the data determine this. In the process, we use the full structure of the models, i.e. the fit is based on an overall likelihood (given available data) between each of the theoretical regimes and the data.

More specifically, our panel data are $\{\hat{k}_{jt}, \hat{i}_{jt}, \hat{q}_{jt}\}$ for j=1,...,n and t=0,...,T, where subscripts *j* and *t* denote firm and time, respectively; *k* is capital, *i* is investment, and *q* is cash flow. We use the first period data $\{\hat{k}_{j0}\}$ to form the initial frequency distribution over the asset grid K, $H_0(\hat{k}) \equiv \{h_0(k_1),...,h_0(k_{\#K})\}$ and initialize our dynamic models. For the unobservable state variables, b (debt) and W (promised utility) we assume that they are drawn (independently of *k)* from some parametric initial distribution (e.g., Normal or mixture of Normals) the parameters of which will be estimated.

What we do next is take (a subset of) the data, $\{\hat{y}_j\}_{j=1}^n$, i.e., the triple $\{\hat{k}_{jt}, \hat{i}_{jt}, \hat{q}_{jt}\}$ for some time period *t*, and form the likelihood function. Specifically, suppose that our model grids imply *M* mutually exclusive frequency "cells" over which we approximate (discretize) the joint distribution of the data. Call these cells *Ym*. For example, in our baseline estimation runs we use grids of five points for each of *k*, *i* and *q*, so that we have 125 mutually exclusive cells (a 5-by-5-by-5 grid over *k, i* and *q*), the observed frequencies over which the data approximate the joint probability distribution of the data $\hat{y}_j$.

Now suppose the model we estimate (one of A through FI) generates the probability distribution function $f(y \mid \phi, H_0(\hat{k}))$ over the variables y (e.g., *k, i, q)* which we are fitting, given the parameters, ϕ (these include the model's structural parameters and the distributional parameters for the unobserved state variables *d* and *W*), and the initial distribution over the observable state, $H_0(\hat{k})$. We also allow for additive measurement error in the model variables with a mean of zero and a standard deviation parameterized by γ_{me} —also a parameter included in ϕ .

The likelihood of the observed data (assuming they are i.i.d. over firms) is:

$$L(\phi) = \prod_{j=1}^{n} f(\hat{y}_j \mid \phi, H_0(\hat{k}))$$

Taking logs, we can rewrite the above as:

$$\Lambda(\phi) = \sum_{j=1}^{n} \ln prob(y \in \hat{Y}_j \mid \phi, H_0(\hat{k}))$$,

i.e., the probability of the vector of variables *y* from the model belonging to the cell $\hat{Y}_j$ (one of Y_1 through Y_M) to which data point $\hat{y}_j$ belongs, given the initial observable state distribution and given the parameters ϕ (above in the example M=125). Rewriting the above sum by joint probability cells, we obtain the log-likelihood criterion that we maximize by choice of the parameters ϕ :

$$\Lambda(\phi) = \sum_{j=1}^{n}\sum_{m=1}^{M} I(\hat{y}_j \in Y_m) \ln prob(y \in Y_m \mid \phi, H_0(\hat{k})) \tag{LL}$$

We maximize the criterion (LL) for each of the four structural models (A, B, MH, and FI) from Section 2. Standard errors are computed via bootstrap, repeatedly drawing with replacement from the data up to the original sample size.

After we estimate and obtain the maximized likelihood (LL) for each model, we follow Vuong (1989) to compute an asymptotic test statistic (a modified likelihood-ratio type test) that we use to formally distinguish (in bilateral comparisons) across the alternative theoretic financial regimes. The Vuong test's most attractive feature for us is that it does not require that either of the compared models be correctly specified. In addition, if the two compared models are non-nested, the Vuong test statistic is normally distributed under the null that the two models are equally close to the data. If the null is rejected (the Z-statistic is large enough in absolute value) we say that the higher likelihood model is closer to the data than the other.

4.2.2 STRUCTURAL ESTIMATION RESULTS

To compute the four models we set β=0.95, R=1/0.95; η=0.5; and ζ =1. We also set δ=0.16 which equals the median asset depreciation computed from the data.[52] In principle, we can estimate all model parameters but this becomes extremely heavy computationally, so we focus on and estimate only a subset of the parameters. Given that our primary objective is distinguishing across the models and not so much on the parameter values themselves, we think that this compromise is justified. We also assume that the unobserved states for debt/savings (*d* in the B model) and promised utility (*W* in the MH, FI models) are normally distributed with mean μ_b (or μ_w) and variance γ_b (γ_w). Altogether, this implies that we estimate six parameters (included in ϕ), namely γ_{me}, σ, θ, ρ, $\mu_{b/w}$ and $\mu_{b/w}$.[53]

To estimate, we first convert the data into model units by dividing all currency values for *k, i* and *q* by the 90-th percentile of the (tangible) assets distribution. We then put the data on the grids *K, I* and *Q* to create the cells, *Yj,* form the log-likelihood criterion (LL), and perform the MLE estimation. Namely, the normalized asset values are placed on the five-point grid {.015, .05, .12, .3, 1}.[54] The grid spacing is chosen to capture the skewness of the asset distribution in the data, with numerous small and few large values. For cash flow *q* we use a five-point grid on the interval [.007, .42] and for investment *i* we use a five-point grid on the interval [.0004,.22]. The grid bounds and spacing were chosen to reflect the actual data relative magnitudes and quintiles and to try ensure a sufficiently large number of observations in each joint KxQxI grid cell. Finally, to be consistent with the Euler equation approach and our baseline investment model, we focus (Table 17) on the case of

52. We have estimated the empirical distribution function of the firm-level depreciation rates (measured by firm's accountant depreciation expressed as percentage of firm's tangible fixed assets) for years 1997-2004 based on firms in the selective sample (36,585 firms). For each year, we obtain the median depreciation rate and we set the value of parameter δ equal to the average of these median depreciation rates.

53. Naturally, in the autarky regime only the first four of these parameters are estimated.

54. We use a standard histogram function based on distance to the closest grid point (Matlab's command *hist).* Our methods can handle much finer grids at the cost of computation time.

risk neutral firms (i.e., we set σ=0 and do not estimate it), but in Table 18 we also report results allowing for risk-averse firms.

Table 17 contains the model comparison results. We maximize the likelihood between each of the four models and the data based on the joint probability/frequency distribution of current period assets *(k),* investment *(i),* and cash flow *(q).* That is, we evaluate the model fit based on firms' investment behavior jointly with cash flow *(q)* conditional on firm's asset *(k).* Each column of Table 17 contains the test statistics of the Vuong test for our baseline specification comparing a pair of the four models (six possible pairs in total). A statistically significant test statistic (in the table we report 1%, 5%, and 10% significance levels) indicates that we reject the null hypothesis of both models being equally close to the data, i.e., the model listed in the parentheses fits the data better than the alternative model with which we compare.

The first section of Table 17 uses data from 1997, the initial year of our panel. For these baseline runs we also impose risk neutrality, i.e., we set $\sigma = 0$. The findings indicate that in the whole sample the models rank in terms of best to worst as: borrowing (B), moral hazard (MH), full information (FI) and autarky (A). That is, the non-contingent debt borrowing model comes closest to the data in terms of its likelihood based on the joint distribution of *(k, i, q)* in 1997.

More importantly, the results from the same exercise when the data are stratified by firm type according to the number of bank relations reveal patterns that confirm and reinforce our results from the Euler equation GMM analysis in Section 4.1. We compare the fitness of the financial regimes with the data across four categories of firms, defined according to the number of relations with banks over the entire period 1997-2004. Specifically, we explore differences among the categories of "continuing unbanked" firms,[55] "continuing single-banked" firms and "continuing multiple-banked" firms. Additionally, we consider a fourth category that includes the remainder of the firms in the sample (this group is used as the reference group in the Euler equation estimates presented in Table 16 and includes "switching firms" and "other continuing banked firms"), referred to in Table 17 as "rest of the firms". Our results reveal that for continuously unbanked firms the moral hazard (MH) specification fits the data best, with full information coming a close second and indistinguishable at the 5% confidence level. This result is coherent with the significantly negative cash flow sensitivity parameter in the Euler equations approach presented in Section 4.1.2.

In stark contrast, continuing single-banked firms, continuing multiple-banked and firms in the residual category of rest of the firms are revealed to be the more financially constrained, with the borrowing, non-contingent debt model coming out on top in terms of fit with the data, relative to the moral hazard, full information or autarky models. Though the borrowing regime fits the data best for single-banked, multiple-banked and rest of the firms, the estimated parameter values vary across the regimes, which is the way the structural model accommodates the diversity in the data across the firms. These results confirm the evidence of financial constraints affecting these three categories relying on the Euler equations framework (Table 16 in Section 4.1.2).

55. Here we use the less restrictive definition of continuing unbanked firms that includes firms that are unbanked six or more years during the period 1997-2004.

We obtain very similar results for the four firm types by number of banking relationships when we use 2004 data (see Section 2 of Table 17). The only difference is that now the full information, perfect credit markets regime is not so close to the moral hazard constrained credit regime for the unbanked firms.

To check robustness, we also estimate and carry out the Vuong tests when we allow for quadratic adjustment costs, risk aversion, and a coarser cash flow grid (Table 18). We first explicitly include quadratic adjustment costs to investment in each of the four financial regimes using the equation for $g(I, k; \theta)$ from Section 2. We estimated the adjustment cost parameter b and, for simplicity, set $ç$, θ_I and b_I to zero. Our previous results reported above (without allowing adjustment costs) can be interpreted as fixing b=0. Including explicit adjustment costs improves the fit to the data for the B and A financial regimes for the groups of continuously "unbanked" and "others". However, allowing for adjustment costs interestingly did not improve the fit of the moral hazard and full information regimes (the likelihood maximization chose to set the parameter b to zero corresponding to no adjustment costs). As a result, the best fitting regimes when such exogenous adjustment costs are allowed do not change compared to our no-adjustment cost benchmark —compare Table 17, section 1 and Table 18, section 1.

Section 2 of Table 18 shows that our results for the group of continuously unbanked firms can be sensitive to the assumption of risk neutrality, which seems to be implicit but key in the Euler equations approach and most of the literature. Specifically, when we allow for risk aversion and let the risk aversion coefficient σ to vary by including it in the list of estimated parameters, we find that the borrowing model is best fitting for all firm groups. Even though the best fitting regime does not vary, the actual best fitting parameter estimates differ significantly across the firm types.

Finally, we also performed runs with a simpler specification of the cash flow process in the model, consisting of only two possible values —"high" (equal to 0.1) and "low" (equal to 0.03). The Vuong test statistics are presented in section 3 of Table 18. We find that the coarser cash flow grid inhibits the ability of the models to distinguish among themselves relative to the common data, and our ability to statistically distinguish across the alternative financial regimes. This deterioration is especially pronounced in the group of single-banked firms for which our sample size is the smallest. Still, the results we obtain are consistent with our baseline runs, giving indication for the best fit of the B and MH regimes. The moral hazard regime achieves the highest likelihood (although it is statistically tied with B) for unbanked firms, while the non-contingent debt (B) regime achieves highest likelihood for the multiple-banked firms.

5 Summary and conclusions

We use data from the Spanish Mercantile Registry and from the Bank of Spain Credit Registry (CIR) to classify firms according to whether they have loans from a formal Spanish credit institution, from several institutions, or from none. We restrict attention to firms that are at least ten years old and find, nevertheless, that a significant number are unbanked. We find evidence that firms' debt is non-trivial, but it comes in part from borrowing from other firms which are members of the same group. In the case of persistently unbanked firms, we document that many firms belong to family groups, which facilitate funding through channels alternative to formal bank credit. We then examine the existence and magnitude of financial constraints for each firm type (unbanked, single-banked or multiple-banked) using two related but distinct approaches based on a common overall model.

First, we use a standard Euler equation approach to investment. We find that single-banked firms are most likely to exhibit investment cash flow sensitivity. Unbanked firms are not. What we find is consistent with the literature arguing that access to bond markets comes only for larger firms. But in Spain higher level finance beyond bank loans is not obtained issuing bonds but, instead, from the Spanish analogue to *chaibols* and *keiretzu* (i.e., large and diversified groups of firms). Our results also provide weak evidence for differences in cash flow sensitivities among single-banked and multiple-banked firms suggesting that the intensity of financial constraints affecting firms' investment decisions is higher for single-banked firms.

In our second approach, we estimate four structural dynamic models of non-nested financial regimes ranging from complete markets to financial autarky for firms with different numbers of banking relations using maximum likelihood methods. Our results from this structural approach are much in line with the results from the Euler equations approach. In particular, we find that continuously unbanked firms have a financial structure that fits best the moral hazard constrained credit model, whereas continuously single- and continuously multiple-banked firms have a financial structure that best fits the non-contingent borrowing regime.

Our contribution in this paper is two-fold. First, to the best of our knowledge, our combination of empirical approaches, Euler and structural, is unique. Second, the two approaches give us a consistent story of financial market imperfections: single-banked firms are more severely financial constrained than older unbanked firms.

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Table 1. Distribution of firms in the selective sample according to the number of years with available information

Number of years	10	11	12
Frequency	7,571	12,299	16,715

Spanish non-financial firms: public and quoted firms excluded.

Table 2. Distribution of firms in the selective sample according to the number of relations with banks

	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
unbanked	10.5	9.9	9.7	9.5	10.0	10.6	10.8	10.3	10.2
single banked	18.3	18.1	17.7	18.1	18.0	17.7	18.1	18.7	18.1
multiple banked	71.2	72.1	72.6	72.3	71.9	71.7	71.1	71.0	71.7
2 banks	19.2	18.8	19.0	19.6	19.1	18.7	18.5	18.9	19.0
3 banks	15.4	15.4	15.2	15.5	15.2	14.7	15.0	14.5	15.1
4 banks	10.8	10.7	10.8	10.8	10.6	10.7	10.7	10.8	10.7
5 banks	7.6	8.0	7.8	7.8	7.8	7.9	7.5	7.4	7.7
6 banks	5.3	5.3	5.5	5.5	5.5	5.4	5.2	5.3	5.4
7 banks	3.7	3.8	3.7	3.8	3.8	3.9	3.9	3.7	3.8
8 banks	2.6	2.7	2.8	2.7	2.9	2.9	2.8	2.9	2.8
9 banks	1.7	2.0	1.9	1.8	1.8	2.0	2.0	2.0	1.9
10 or more banks	4.9	5.3	5.8	4.9	5.2	5.5	5.5	5.5	5.3
Number of non financial firms[1]	36,585	36,585	36,585	36,585	36,585	36,585	36,585	36,585	36,585

[1]Spanish non-financial firms: public and quoted firms excluded.

Table 3. Distribution of firms in the selective sample[1] according to the number of relations with banks conditioned on the age category (%).

Age group	Number of banking relations group	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
[10,20)	unbanked	9.8	9.2	9.4	9.4	10.9	10.9	10.8	11.1	10.2
[10,20)	single-banked firms	18.2	18.3	17.7	18.5	17.7	18.5	20.5	19.5	18.6
[10,20)	multiple-banked firms	72.0	72.5	72.9	72.1	71.4	70.6	68.8	69.4	71.2
[20,30)	unbanked	7.5	8.0	8.0	9.1	9.2	9.6	9.8	9.6	8.9
[20,30)	single-banked firms	15.1	14.6	15.5	15.4	16.4	16.1	16.5	17.8	15.9
[20,30)	multiple-banked firms	77.4	77.4	76.5	75.6	74.4	74.3	73.7	72.5	75.2
[30,∞)	unbanked	11.1	10.4	10.1	9.8	10.1	10.8	11.1	10.5	10.5
[30,∞)	single-banked firms	18.8	18.5	18.1	18.6	18.5	18.0	18.3	15.1	18.0
[30,∞)	multiple-banked firms	70.1	71.1	71.8	71.7	71.4	71.1	70.6	76.4	71.8
n.a	unbanked	11.1	10.4	10.1	9.8	10.1	10.8	11.1	10.5	10.5
n.a	single-banked firms	18.8	18.5	18.1	18.6	18.5	18.0	18.3	19.1	18.5
n.a	multiple-banked firms	70.1	71.1	71.8	71.7	71.4	71.1	70.6	70.4	71.0

[1]Spanish non-financial firms: public and quoted firms excluded

Table 4. Transition matrices across unbanked firms, single-banked firms and multiple-banked firms (%)

One-year time horizon

		category in year t-1			
		single banked	multiple banked	unbanked	Total
category in year t	single banked	67.8	5.3	20.0	18.1
	multiple banked	21.3	93.6	7.5	71.8
	unbanked	10.9	1.1	72.5	10.1
	Total	100.0	100.0	100.0	100.0

Two-year time horizon

		category in year t-2			
		single banked	multiple banked	unbanked	Total
category in year t	single banked	56.2	7.5	25.2	18.1
	multiple banked	29.5	90.7	11.9	71.8
	unbanked	14.3	1.8	62.9	10.2
	Total	100.0	100.0	100.0	100.0

Five-year time horizon

		category in year t-5			
		single banked	multiple banked	unbanked	Total
category in year t	single banked	43.2	10.3	29.8	18.2
	multiple banked	38.9	86.4	20.5	71.2
	unbanked	17.9	3.3	49.7	10.6
	Total	100.0	100.0	100.0	100.0

Average percentages in period 1997-2004.

Table 5. Distribution of firms in the selective sample[1] according to the number of years in which the firm is classified as unbanked during period 1997-2004

	Number of years	Absolute frequency[1]	Relative frequency[2]	Relative frequency[3]
Continuing banked	0	28,050	76.7	100.0
Continuing single-banked	0	914	2.5	3.3
Continuing multiple-banked	0	19,083	52.2	68.0
Other continuing banked firms	0	8,053	22.0	28.7
Switching firms	1	2,440	6.7	31.9
	2	1,459	4.0	19.1
	3	1,096	3.0	14.3
	4	838	2.3	11.0
	5	709	1.9	9.3
	6	617	1.7	8.1
	7	480	1.3	6.3
	[1,7]	7,639	20.9	100.0
Continuing unbanked	8	896	2.4	
All firms		36,585	100.0	

[1]Spanish non-financial firms: public and quoted firms excluded.
[2]Relative to all the firms.
[3]Relative to the number of firms in the subtotal (continuing banked firms or switching firms).
Annual averages for period 1997-2004.

Table 6. Distribution of switching firms according to the number of changes in the banked/unbanked status over the studied period

Number of changes	Absolute frequency	Relative frequency[2]	Relative frequency[3]
1	3,264	42.7	8.9
2	2,856	37.4	7.8
3	964	12.6	2.6
4	440	5.8	1.2
5	94	1.2	0.3
6	21	0.3	0.1
7	0	0.0	0.0
Switching firms	7,639	100.0	20.9
All firms[1]	36,585		100.0

[1]Spanish non-financial firms: public and quoted firms excluded
[2] Relative to the subsample of switching firms.
[3] Relative to the entire sample of firms.

Table 7. Descriptive statistics for the distribution of age in unbanked, single-banked and multiple-banked firms (%)

	number of observations[1]	mean	standard deviation	min. value	p5	p25	p50	p75	p95	max. value
All firms	9,956	22.4	10.9	13.5	13.5	15.5	18.5	25.5	42.5	130.5
Single-banked firms	1,700	21.4	10.1	13.5	13.5	15.4	17.9	23.8	40.0	103.0
Multiple-banked firms	7,329	22.8	11.3	13.5	13.5	15.5	19.5	26.3	43.6	130.5
Unbanked	927	21.1	9.4	13.5	13.5	15.0	18.0	23.6	38.3	89.4

[1]Spanish non-financial firms: public and quoted firms excluded.
Annual averages for period 1997-2004.

Table 8. Descriptive statistics for the distribution of size (in terms of total assets) in unbanked, single-banked and multiple-banked firms (thousand Euros)

	number of observations[1]	mean	standard deviation	min. value	p5	p25	p50	p75	p95	max. value
All firms	36,585	7,447	61,195	11	235	659	1,462	3,652	20,718	4,294,316
Single-banked firms	6,619	2,608	21,493	23	171	431	877	1,942	7,773	1,510,737
Multiple-banked firms	26,244	9,505	70,824	42	319	847	1,836	4,722	27,051	4,294,316
Unbanked	3,722	1,599	3,942	11	125	341	718	1,557	5,622	124,397

[1]Spanish non financial firms: public and quoted firms excluded.

Table 9. Distribution of firms across industries in the groups of unbanked, single-banked and multiple-banked firms (%)

	single banked	multiple banked	unbanked
Agriculture and fishing	2.46	1.42	2.67
Manufacturing ans quarrying	31.36	41.13	26.62
Electricity, gas and water supply	0.52	0.27	0.69
Construction and real estate developers	12.81	12.55	14.46
Wholesale and retail trade	35.56	31.94	37.63
Hotels and restaurants	4.14	1.93	5.55
Transport, storage and commuynications	4.30	4.67	2.55
IT, R&D and others	5.05	4.16	6.30
Other non financial industries	3.81	1.94	3.54

[1]Spanish non-financial firms: public and quoted firms excluded.
Annual averages for period 1997-2004.

Table 10. Descriptive statistics for the investment-to-capital ratio: All firms, unbanked firms, single-banked firms and multiple-banked firms (units per unit of capital)

	number of observations[1]	mean	standard deviation	min. value	p5	p25	p50	p75	p95	max. value
All firms	36,585	0.253	0.257	-0.575	0.000	0.062	0.185	0.387	0.776	1.407
Single-banked firms	6,619	0.237	0.262	-0.570	0.000	0.041	0.155	0.368	0.786	1.389
Multiple-banked firms	26,244	0.264	0.256	-0.575	0.000	0.075	0.200	0.400	0.778	1.404
Unbanked	3,722	0.204	0.250	-0.551	-0.006	0.020	0.121	0.321	0.728	1.388

[1]Spanish non financial firms: public and quoted firms excluded.
Relative investment is defined as the ratio of (gross) investment on capital.
Annual averages for period 1997-2004.

Table 11. Distribution of firms according to the sign of gross investment. All firms, unbanked firms, single-banked firms and multiple-banked firms (%)

	number of observations[1]	negative investment	zero investment	positive investment
All firms	36,585	4.39	3.89	91.73
Single-banked firms	6,619	4.42	6.42	89.17
Multiple-banked firms	26,244	4.20	2.16	93.64
Unbanked firms	3,722	5.65	11.50	82.85

[1]Spanish non-financial firms: public and quoted firms excluded.
Annual averages for period 1997-2004.

Table 12. Descriptive statistics for some economic and financial ratios

(% and units per unit of capital)

	number of observations[1]	mean	standard deviation	min. value	p5	p25	p50	p75	p95	max. value
					single-banked firms					
Leverage ratio (%)	5,984	51.3	22.9	0.7	14.0	33.5	51.4	69.2	88.1	135.6
Bank debt-to-total debt ratio (%)	5,856	26.4	23.4	0.0	1.4	7.3	19.2	39.9	75.1	100.0
Liquidity ratio (%)	6,523	51.6	118.0	0.0	0.0	7.3	23.4	55.1	174.1	2280.0
Cash flow-to-capital ratio	6,612	0.8	1.2	-1.7	0.0	0.2	0.4	0.9	2.9	11.8
Sales-to Capital ratio	6,610	14.1	21.8	0.1	0.4	2.6	6.4	15.8	54.5	225.3
Return on Assets (%)	6,612	7.8	9.2	-53.2	-3.6	2.8	6.3	11.6	23.7	72.7
Default ratio* (%)	12	88.9	21.9	36.7	40.9	83.8	100.0	100.0	100.0	100.0
					multiple-banked firms					
Leverage ratio (%)	25,217	64.1	20.2	1.7	27.3	50.6	66.4	79.4	92.1	150.6
Bank debt-to-total debt ratio (%)	23,914	44.7	23.8	0.0	7.0	26.0	44.2	62.1	85.9	100.0
Liquidity ratio (%)	25,687	20.8	54.3	0.0	0.0	2.3	8.2	22.3	75.5	2280.0
Cash flow-to-capital ratio	26,230	0.7	1.0	-1.7	0.0	0.2	0.4	0.9	2.6	12.1
Sales-to Capital ratio	24,505	12.9	19.4	0.1	0.9	3.0	6.3	14.0	47.6	225.0
Return on Assets (%)	26,216	7.7	7.4	-55.2	-1.2	3.7	6.5	10.6	20.6	72.7
Default ratio* (%)	218	40.7	29.3	5.1	6.2	13.4	35.3	64.0	93.0	100.0
					unbanked firms					
Leverage ratio (%)	2,993	40.1	24.2	0.0	5.1	20.1	37.3	58.1	83.6	99.5
Bank debt-to-total debt ratio (%)	---	---	---	---	---	---	---	---	---	---
Liquidity ratio (%)	3,693	95.9	202.7	0.0	2.1	17.9	43.8	94.8	318.4	2280.0
Cash flow-to-capital ratio	3,713	0.9	1.4	-1.7	-0.1	0.2	0.5	1.1	3.5	11.9
Sales-to Capital ratio	3,710	17.1	24.7	0.1	0.3	3.0	8.5	20.5	63.9	218.9
Return on Assets (%)	3,717	8.7	10.6	-50.5	-3.8	2.8	6.9	13.2	27.3	72.7
Default ratio* (%)	---	---	---	---	---	---	---	---	---	---

[1]Spanish non-financial firms: public and quoted firms excluded.
* Subsample of firms in default.
Annual averages for period 1997-2004.

Table 13. Decomposition of aggregate debt[1] (%)

	Banked firms	Unbanked firms
Bank debt	33.9	0.0
Debt with associated and affiliated companies	17.1	71.8
Trade credit	28.6	10.5
Government	9.5	3.5
Commercial paper	3.4	0.3
Deposits and guarantees	0.6	0.4
Accounts receivable	2.1	1.0
Deffered debts on shares	0.1	0.2
Provisions for current assets	1.2	1.5
Bonds	0.1	0.0
Other debts*	3.3	10.8
Aggregate short and long term debt	100	100
Sample size	2,220	248

[1] Statistics based on the sample of firms that report to the Spanish Mercantile Registry detailed financial statements which contain the itemization of debt (2,468 firms). Specifically, figures in this table refer to 2,220 firms reporting positive banking debt ("banked") and 248 firms reporting no borrowing from banks ("unbanked"). Information referred to year 1997.
* For banked firms, this category includes an adjustment of -2 percentage points which allows that the sum of items equals 100% of debt. For unbanked firms, it includes unexplained aggregate debt that represents 0.6% of total debt.

Table 14. GMM parameter estimates of investment Euler equation. All firms. Period 1997-2004

Dependent variable: $(I/k)_t$	
$(I/k)_{t-1}$	1.1414
	(0,000)
$(I/k)_{t-1}^2$	-0.8071
	(0,000)
$(q/k)_{t-1}$	0.0397
	(0,000)
$(y/k)_{t-1}$	0.0024
	(0,000)
AR(1)	-18.93
	(0,000)
AR(2)	10.94
	(0,000)
AR(3)	1.36
	(0,175)
Hansen-J test	68.68
	(0,008)
Number of observations	276,174
Number of firms	36,585

I/k, q/k and y/k denote respectively the ratios of gross investment, cash-flow and output to capital.
List of instruments: third and fourth lags of *I/k, q/k* and *y/k.*
Specification includes time dummy variables.
The number of observations corresponds to the selective panel dataset, over period 1997 to 2004.

Table 15. GMM parameter estimates of Investment Euler equations across groups of firms with different numbers of banking relationships. Period 1997-2004

Dependent variable: $(I/k)_t$

	(1)	(2)	(3)
$(I/k)_{t-1}$	1.4541	0.8268	0.9624
	(0.000)	(0.185)	(0.000)
$(I/k)_{t-1}^2$	-1.8685	-0.7269	-1.0050
	(0.001)	(0.369)	(0.002)
$(q/k)_{t-1}$	-0.1902	-0.1597	-0.1401
	(0.005)	(0.023)	(0.017)
$(y/k)_{t-1}$	0.00876	0.0084	0.0055
	(0.027)	(0.049)	(0.005)
$(I/k)_{t-1}*D0_t$	-1.1669		
	(0.008)		
$(I/k)_{t-1}^2*D0_t$	2.0937		
	(0.001)		
$(q/k)_{t-1}*D0_t$	0.2504		
	(0.001)		
$(y/k)_{t-1}*D0_t$	-0.0080		
	(0.086)		
$(I/k)_{t-1}*D1_t$		0.3493	
		(0.728)	
$(I/k)_{t-1}^2*D1_t$		-0.6684	
		(0.639)	
$(q/k)_{t-1}*D1_t$		0.2612	0.2007
		(0.019)	(0.003)
$(y/k)_{t-1}*D1_t$		-0.0057	
		(0.425)	
$(I/k)_{t-1}*D2_t$		-0.5614	-0.7234
		(0.366)	(0.011)
$(I/k)_{t-1}^2*D2_t$		1.0619	1.3594
		(0.202)	(0.001)
$(q/k)_{t-1}*D2_t$		0.2100	0.1954
		(0.015)	(0.015)
$(y/k)_{t-1}*D2_t$		-0.0078	-0.0054
		(0.098)	(0.103)
AR(1)	-20.07	-17.05	-19.75
	(0.000)	(0.000)	(0.000)
AR(2)	6.83	6.56	7.04
	(0.000)	(0.000)	(0.000)
AR(3)	0.94	0.71	0.75
	(0.347)	(0.475)	(0.450)
Hansen J test	65.71	53.71	56.77
	(0.037)	(0.127)	(0.133)
Number of observations	276,174	276,174	276,174
Number of firms	36,585	36,585	36,585

I/k, q/k and y/k denote respectively the ratios of gross investment, cash-flow and output to capital.. D0 denotes a dummy variable that equals 1 if the firm has one or more banking relationships and 0, otherwise. D1 denotes a dummy variable that equals 1 if the firm has a unique bank relationship and 0, otherwise. D2 is a dummy variable that equals 1 if the firm has more than one bank relationship and 0 otherwise.

The number of bank relations, and consequently D0, D1 and D2, are treated as endogenous.

List of instruments: third and fourth lags of *I/k*, *q/k* and *y/k* and third lag of the number of bank relations.

All specifications include time dummy variables.

The number of observations corresponds to the selective panel dataset, over period 1997 to 2004.

P-values in parenthesis.

Table 16. Differences in investment patterns among continuing unbanked firms, continuing single-banked firms continuing multiple-banked firms and rest of the firms. GMM parameter estimates of investment Euler equation

Dependent variable: $(I/k)_t$

	Reference group[1]	Differences respect to the reference group		
		continuing unbanked	continuing single-banked	continuing multi-banked
$(I/k)_{t-1}$	1.8415	-0.8439	-2.9426	-1.7046
	(0,000)	(0.660)	(0.385)	(0.010)
$(I/k)_{t-1}^2$	-1.9669	2.1953	2.3051	2.4894
	(0,002)	(0.360)	(0.503)	(0.005)
$(q/k)_{t-1}$	0.1535	-0.4645	-0.0820	-0.1705
	(0,014)	(0.033)	(0.745)	(0.125)
$(y/k)_{t-1}$	0.0036	0.0143	-0.0155	-0.0024
	(0,350)	(0.392)	(0.518)	(0.737)
AR(1)	-10.89			
	(0,000)			
AR(2)	4.74			
	(0,000)			
AR(3)	0.26			
	(0,792)			
Hansen-J test	45.09			
	(0,232)			
Number of observations	276,174			
Number of firms	36,585			

[1]The reference group includes *switching firms* (i.e., firms changing their status from unbanked to banked or *vice versa* at least once in the analysed period) and *other continuing banked firms* (i.e. continuing banked firms that change from single-banked to multiple-banked or *vice versa* at least once in the analysed period).
I/k, q/k and y/k denote respectively the ratios of gross investment, cash-flow and output to capital.
List of instruments: third and fourth lags of *I/k, q/k* and *y/k* and third lag of the number of bank relations.
Time dummy variables included.
The number of observations corresponds to the selective panel dataset, over period 1997 to 2004.
P-values in parenthesis.

Table 17. Baseline financial regime comparisons, Voung test Z-statistics[1,2,3]

Comparison	MH v FI	MH v B	MH v A	FI v B	FI v A	B v A	Best Fit
1. using 1997 (k,i,q) data							
1.1. risk neutrality							
Whole sample (n = 36,585)	54.1***(MH)	-7.25***(B)	14.5***(MH)	-10.5***(B)	13.8***(FI)	13.3***(B)	B
- Continuing unbanked (n = 1,993)	1.87*(MH)	15.0***(MH)	14.5***(MH)	14.1***(FI)	14.0***(FI)	1.17(tie)	MH
- Continuing single-banked (n = 914)	-6.89***(FI)	-11.0***(B)	11.4***(MH)	-10.4***(B)	11.9***(FI)	12.1***(B)	B
- Continuing multi-banked (n = 19,083)	-53.5***(FI)	-34.4***(B)	28.2***(MH)	-27.1***(B)	44.8***(FI)	35.9***(B)	B
- Rest of the firms (n = 14,595)	-10.1***(FI)	-44.8***(B)	37.4***(MH)	-43.0***(B)	35.4***(FI)	48.6***(B)	B
2. using 2004 (k,i,q) data							
2.1. risk neutrality							
Whole sample (n = 36,585)	27.9***(MH)	-38.8***(B)	23.5***(MH)	-41.0***(B)	17.5***(FI)	39.3***(B)	B
- Continuing unbanked (n = 1,993)	5.47***(MH)	12.5***(MH)	12.4***(MH)	13.4***(FI)	13.3***(FI)	0.00(tie)	MH
- Continuing single-banked (n = 914)	-7.84***(FI)	-7.52***(B)	12.3***(MH)	-6.98***(B)	13.0***(FI)	9.23***(B)	B
- Continuing multi-banked (n = 19,083)	-74.2***(FI)	-41.5***(B)	19.8***(MH)	-25.3***(B)	53.4***(FI)	37.8***(B)	B
- Rest of the firms (n = 14,595)	-45.1***(FI)	-33.9***(B)	38.0***(MH)	-28.8***(B)	47.0***(FI)	38.2***(B)	B

[1] ***=1%, **=5%, *=10% two-sided significance level, the "winning" regime is in the parentheses.
[2] Voung Z-statistics' cutoffs: 2.575 = ** 1.645 = * "tie"
[3] All results in this table are computed under the assumption of risk neutrality (σ=0).
B = borrowing or lending in non-contingent debt.
MH = moral hazard constrained credit/insurance.
FI = full information/complete markets.
A = no access to credit (autarky).

Table 18. Financial regime comparisons - robustness, Voung test Z-statistics

Comparison	MH v FI	MH v B	MH v A	FI v B	FI v A	B v A	Best Fit
1. allowing for quadratic adjustment costs							
Continuing unbanked (n = 1,993)	1.86*(MH)	15.4***(MH)	7.41***(MH)	8.69***(FI)	7.21***(FI)	6.62***(B)	MH
Continuing single-banked (n = 914)	-6.89***(FI)	-11.0***(B)	11.4***(MH)	-10.4***(B)	11.9***(FI)	12.1***(B)	B
Continuing multi-banked (n = 19,083)	-53.5***(FI)	-34.4***(B)	27.9***(MH)	-27.1***(B)	44.7***(FI)	35.8***(B)	B
Rest of the firms (n = 14,595)	-10.1***(FI)	-44.8***(B)	37.4***(MH)	-43.0***(B)	35.4***(FI)	48.6***(B)	B
2. allowing for risk aversion							
Continuing unbanked (n = 1,993)	1.04(tie)	-4.48***(B)	7.52***(MH)	-5.09***(B)	7.34***(FI)	13.6***(B)	B
Continuing single-banked (n = 914)	-5.34***(FI)	-10.4***(B)	11.8***(MH)	-10.4***(B)	11.9***(FI)	12.1***(B)	B
Continuing multi-banked (n = 19,083)	-0.91(tie)	-27.4***(B)	35.1***(MH)	-27.4***(B)	35.0***(FI)	34.5***(B)	B
Rest of the firms (n = 14,595)	-3.24***(FI)	-43.1***(B)	35.5***(MH)	43.0***(B)	31.3***(FI)	47.5***(B)	B
3. coarser cash flow grid (#Q = 2)							
Continuing unbanked (n = 1,993)	3.54***(MH)	1.37(tie)	5.23***(MH)	-7.84***(FI)	3.19***(FI)	6.51***(B)	MH,B
Continuing single-banked (n = 914)	0.61(tie)	-0.81(tie)	-3.24***(A)	-1.25(tie)	-7.12***(A)	0.20(tie)	all tied
Continuing multi-banked (n = 19,083)	-21.4***(FI)	-23.6***(B)	0.00(tie)	-40.0***(B)	21.3***(FI)	23.6***(B)	B
Rest of the firms (n = 14,595)	18.1***(MH)	-1.46(tie)	17.9***(MH)	-19.5***(B)	-61.4***(A)	19.3***(B)	B,MH

[1] ***=1%, **=5%, *=10% two-sided significance level, the "winning" regime is in the parentheses.
[2] Voung Z-statistics' cutoffs: 2.575 = ** 1.645 = * "tie"
[3] All results in this table are computed with 1997 data.
B = borrowing or lending in non-contingent debt.
MH = moral hazard constrained credit/insurance.
FI = full information/complete markets.
A = no access to credit (autarky).

Appendix 1: Variable definitions

Firm characteristics

— Age (relative to the constitution date).

— Industry (3 and 4 digit CNAE-93 classifications). Financial firms have been excluded. Using this information, we have aggregated the activities into: 1) agriculture and fishing; 2) manufacturing and quarrying; 3) electricity, gas and water supply; 4) construction and property development; 5) wholesale and retail trade; 6) hotels and restaurants; 7) transport, storage and communication; 8) IT, R&D and other; 9) other non-financial industries. We build up a set of dummy variables controlling for heterogeneity across industries in empirical models. Using the 3 digit CNAE-classification would imply estimating a large number of parameters which is not viable because of capacity constraints.

— Location (province).

Firm-level economic variables

— Capital (k_t): The stock of capital in year *t* is measured by the book value of tangible fixed assets. This variable has been deflated using the gross fixed capital investment deflator.

— (Gross) Investment (I_t): Defined as the sum of the absolute increase in the stock of tangible fixed assets between *t* and *t-1* and the depreciation in year *t*. Deflated using the gross fixed capital investment deflator.

— Cash flow (q_t): It is defined as the sum of operating profits/losses (+/-) and depreciation. Deflated using the GDP deflator.

— Output (y_t): It is measured using total sales. Deflated using the GDP deflator.

Economic and financial ratios

— Relative Investment (I/k): defined as the ratio of gross investment (I) to capital (k). The univariate series of relative investment has been truncated dropping out the 5% of observations contained in the upper and the lower tails of the distribution, which will greatly distort the results of the estimation of Euler equations. This data treatment is applied before picking up firms in the selective sample.

— ROA: Profitability ratio, profits before interests and taxes divided by total assets (winsorized 1%, before picking up firms in the selective sample).

— Leverage (ratio): Amount of debt with explicit cost divided by total assets (winsorised 1%, before picking up firms in the selective sample).

— Liquidity (ratio): cash to short term debt ratio (winsorised 1%, before picking up firms in the selective sample).

Firm credit risk

— Banking debt: amount of debt contracted with any Spanish credit institution. Aggregation, at firm level, of the amounts of banking debt registered by Spanish credit Institutions in CIR.

— Default banking debt: amount of non-performing loans (more than three month in arrears) and doubtful loans (low repayment probability despite of being performing). It is constructed by aggregating, at the firm level, the amounts of non-performing and doubtful loans registered by Spanish credit Institutions in CIR.

— Firm-level default ratio: defined as the proportion of banking debt that is non-performing or doubtful, if this proportion exceeds 5%. If it is below this threshold, the default ratio is assumed equal to zero and default banking debt is imputed as zero.[56]

— Default dummy: dichotomic variable that equals one if firm-level default ratio is higher than 5% and zero otherwise.

Firm's banking relationships

— Number of relations: number of different Spanish credit institutions granting a loan to the firm. According to the current number of relations, we distinguish year by year three types of firms: unbanked, in single banking relationship and in multiple banking relationships. According to the trajectories across these three categories over the whole period 1997-2004, we distinguish among continuing unbanked, continuing banked and switching firms. Within the category of continuing banked firms we differentiate among continuing single-banked, continuing multiple-banked and other continuing banked firms. Empirically, for analysing differences across groups of firms defined according to their trajectories in and out of the unbanked status, we consider for categories: continuing unbanked, continuing single-banked, continuing multiple-banked and rest of the firms (included both switching firms and other continuing banked firms).

56. The minimum threshold of 5% allows filtering "technical defaults" and mistakes, which are unrelated to the level of credit risk of the firms. This filter has been applied in other papers that use the CIR database [e.g. Jiménez and Saurina (2004)].

Appendix 2: Descriptive statistics based on the unbalanced panel dataset

Table A2.1 exhibits the sample sizes for every cross-section in the SABI-CIR database. Additionally, it shows some statistics about the coverage of the database relative to the population of Spanish non-financial firms in terms of the aggregate figures of total assets and banking loans. On average, the gross number of firms in the sample is over 297,000 firms per year. The coverage of SABI-CIR has tended to increase over time, from a minimum of around 32%, in terms of assets, and 36.4%, in terms of banking debt, in 1994, to a percentage that reaches a maximum close to 72% of total assets and 71.3% of aggregate banking debt in Spanish non-financial firms, in year 2002. This increase in the coverage is explained by the expansionary strategy of INFORMA that has widely increased the number of firms for which it buys public statements deposited at the Mercantile Registry.

SABI-CIR database has a wide heterogeneity of the sample in terms of firms' age, activity and size. In terms of age, the sample is mostly composed of firms not older than 10 years, which exceed 63%. In this category, firms are concentrated to a large extent below 5 years old (34.2%). Retail, construction, real estate development and manufacturing are the industries in which three-quarters of all firms are concentrated. In terms of firms' size, measured by total assets, the database contains a high proportion of small firms. In particular, an average percentage of 93.4% of the firms in the sample correspond to the smallest firms' category, which includes firms with an amount of total asset not higher than 5 million € or with total sales not higher than 7 million €. This characteristic differentiates this dataset from alternative datasets relative to Spanish non-financial firms, which tend to under-represent small firms (see Tables A2.2, A2.3 and A2.4).

A comparison of the selective and the unbalanced samples

Table A2.5 shows the distribution of firms across the categories of small-size, medium-size and large-size over the period 1997-2004.[57] As in the unbalanced sample, most of the firms in the selective sample belong to the category "small firms", with an average weight of 83%. Still, compared with the composition of the unbalanced sample, the selective sample tends to over-represent the categories of medium-sized firms and large-sized firms, with average fractions of 14.9% and 2.1%, respectively, which are more than twice the corresponding percentages for the entire SABI-CIR sample.

Additionally, as shown in Table A2.6, our sample is also more homogeneous than the population in terms of firm age. On average, more than three quarters of the firms in the sample[58] are older than ten years. Moreover, the homogeneity of the sample in terms of age is increasing over time, with the percentage of firms in the category of firms younger than 10 years being below 4%. In the entire SABI-CIR sample, firms are almost equally distributed across the three age categories (Table A2.2) over the analysed period. This is explained by the exclusion of new cohorts of entering firms as a consequence of the selection criteria requiring complete information for period 1997-2004.

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57. Firm size classification follows EU recommendations (Bulletin EU 1/2-1996), which defines as small firms those with total assets lower than 5 million Euros or sales lower than 7 million Euros and as large firms those with total assets higher than 27 million Euros or sales higher than 40 million Euros.

58. The statistics about the age distribution of the firms in the sample are computed from the subsample of firms with data available on the age of the firm, which reaches only 40% of the firms in the sample.

The higher homogeneity of the sample of firms included in the selective panel is also evident in the distribution of firms across industries.[59] Statistics presented in A2.7 indicate that firms in the selective sample are concentrated in the industries of *Manufacturing and Quarrying*; *Wholesale and Retail Trade* and *Construction and Real State Developers* to a larger extent than in the non-selective sample of firms. These three industries concentrate 84% of the firms in the sample against the 74% in the non-selective sample. The rest of the firms are spread over the rest of industries.

Table A2.1. Coverage of the SABI-CIR sample of private and unquoted firms (million € and %)

	sample size[1]	coverage in terms of:	
		bank loans[2]	total assets[3]
1993	101,290	44.5	
1994	96,519	36.4	32.3
1995	170,346	58.9	51.6
1996	214,449	64.2	54.1
1997	224,811	66.3	61.9
1998	266,059	67.1	56.3
1999	306,453	66.3	60.2
2000	341,350	67.0	64.1
2001	429,952	69.8	67.3
2002	505,235	71.3	71.9
2003	515,722	72.0	68.8
2004	400,299	60.9	58.4

1. Private and non-quoted Spanish non-financial firms (after filtering).
2. Coverages in terms of bank loans are relative to the aggregated values of banking debt for Spanish non-financial firms (public and quoted firms included) computed using CIR data.
3. Coverages have been computed over the aggregated value of total assets corresponding to Spanish non-financial firms (public and quoted firms included) published in the annual reports of Central de Balances (Banco de España).

59. Classification of firms across industries according to the information provided by INFORMA is static in the sense that it provides a unique CNAE code for every firm that does not vary over time.

Table A2.2. Distribution of firms in the SABI-CIR database across age categories

	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
[0, 5)	36.8	37.4	35.6	33.2	33.9	34.5	33.3	29.3	34.2
[5-10)	27.9	26.9	28.2	30.5	31.3	30.5	30.2	28.7	29.3
[10,∞]	35.4	35.7	36.1	36.4	34.8	35.0	36.5	42.0	36.5
Number of non financial firms[1]	91,507	109,114	126,401	141,344	179,170	210,905	215,240	167,515	155,150

[1]Spanish non-financial firms: public and quoted firms excluded.
[2]Statistics presented in this table are computed after excluding firms with no data available on age.

Table A2.3. Distribution of firms in the SABI-CIR database across industries

	1997	1998	1999	2000	2001	2002	2003	2004	Average 1997-2004
Agriculture and fishing	2.39	2.30	2.23	2.29	2.54	2.57	2.50	2.16	2.37
Manufacturing ans quarrying	23.77	22.02	20.87	20.08	18.35	16.71	15.99	16.84	19.33
Electricity, gas and water supply	0.37	0.37	0.37	0.38	0.37	0.36	0.37	0.37	0.37
Construction and real estate developers	23.81	24.28	25.21	25.94	26.87	28.42	29.31	28.83	26.59
Wholesale and retail trade	30.44	29.72	29.25	28.60	27.31	25.79	25.08	26.13	27.79
Hotels and restaurants	2.64	3.09	3.55	3.83	4.40	4.59	4.37	4.12	3.82
Transport, storage and commuynications	4.95	4.99	4.92	4.86	4.69	4.52	4.39	4.34	4.71
IT, R&D and others	8.48	9.68	9.91	10.10	11.08	12.20	13.05	12.81	10.91
Other non financial industries	3.15	3.54	3.68	3.91	4.40	4.84	4.94	4.41	4.11
Number of non financial firms[1]	224,120	265,647	306,074	341,082	429,439	504,586	515,221	399,960	373,266

[1]Spanish non-financial firms: public and quoted firms excluded.

Table A2.4. Distribution of firms in the SABI-CIR database across size categories[2]

	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
small-sized firms	93.5	93.6	93.5	93.2	93.8	94.1	93.6	92.3	93.4
medium-sized firms	5.9	5.8	5.8	6.1	5.6	5.3	5.8	6.9	5.9
large-sized firms	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.8	0.7
Number of non financial firms[1]	224,811	266,059	306,453	341,350	429,952	505,235	515,716	400,299	373,734

[1]Spanish non-financial firms: public and quoted firms excluded.
[2]Small-sized firms: sales not higher than €7 million or total assets not higher than €5 million; medium-sized firms: sales higher than €7 million but not higher than €40 million or total assets higher than €5 million but not higher than €27 million; large-sized firms: sales higher than €40 million or total assets higher than €27 million.

Table A2.5. Distribution of firms in the selective panel across size categories[2] (%)

	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
small-sized firms	88.2	86.8	85.1	83.4	82.1	80.9	79.5	78.0	83.0
medium-sized firms	10.4	11.6	13.1	14.5	15.6	16.7	17.9	19.1	14.9
large-sized firms	1.4	1.6	1.8	2.1	2.3	2.4	2.6	2.9	2.1
Number of non financial firms[1]	44,644	44,644	44,644	44,644	44,644	44,644	44,644	44,644	44,644

[1]Spanish non-financial firms: public and quoted firms excluded.
[2]Small-sized firms: sales not higher than €7 million or total assets not higher than €5 million; Medium-sized firms: sales higher than €7 million but not higher than €40 million or total assets higher than €5 million but not higher than €27 million; Large-sized firms: sales higher than €40 million or total assets higher than €27 million.

Table A2.6. Distribution of firms across age categories in the selective panel (%)

	1997	1998	1999	2000	2001	2002	2003	2004	average 1997-2004
[0, 5)	15.2	9.8	3.6	0.1	0.0	0.0	0.0	0.0	3.6
[5-10)	29.5	28.7	28.7	27.1	21.1	15.2	9.8	3.6	20.5
[10,∞]	55.3	61.5	67.7	72.9	78.8	84.8	90.2	96.4	75.9
Number of non financial firms[1]	18,009	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,014

[1]Spanish non-financial firms: public and quoted firms excluded. Subsample of firms with age data.

Table A2.7. Distributions of firms across industries in the selective panel (%)

Agriculture and fishing	1.71
Manufacturing ans quarrying	36.75
Electricity, gas and water supply	0.33
Construction and real estate developers	13.26
Wholesale and retail trade	34.00
Hotels and restaurants	2.68
Transport, storage and commuynications	4.29
IT, R&D and others	4.57
Other non financial industries	2.42
Number of non financial firms[1]	44,644

[1]Spanish non-financial firms: public and quoted firms excluded.

Appendix 3: Case study

Firm A is an example of a continuing unbanked firm that, as can be seen in Chart A3.1, is part of a relatively complex group of firms which are directly or indirectly owned by one person (*Mr. X*) and other members of the same family (wife, sons, daughters and mother).[60] To the best of our knowledge,[61] the structure is composed of 11 family firms, which are heterogeneous in terms of their age,[62] size[63] and activities.[64]

Figure A.3. provides in four separated panels the evolution over the period 1997-2004 of four key variables: total assets, Return on Assets (ROA), the investment-to-capital ratio, and the debt-to-total assets ratio for the target firm (*Firm A*) and also the 25th, 75th and 95th percentiles describing the distribution of these variables in the whole sample of firms (i.e., mature firms in the balanced or selective sample).

Firm A is a large firm in terms of total assets that exhibits an increasing trend over the analysed period. Compared to the rest of the firms in the sample under study, the firm is located in the upper tail of the distribution. In particular, the level of assets of this firm is comparable to that for the 95th percentile of the firm level distribution of this variable over the entire analysed period.

The profitability of the studied firm is, with the exception of year 2000,[65] very close to the 25th percentile of the distribution of this variable in the sample. Leverage, measured by the ratio of debt to total assets, is low, particularly after a sharp decrease in 2000 from an average ratio of around 51% in 1997-1999, which is close to the 25th percentile of the sample distribution of firms' leverage ratio to an average ratio of 3.5% in period 2000-2004, which is even lower than the 5th percentile (in average, it is around 18%). Finally, the average investment-to-capital ratio is 11.5% for the analysed firm which is about the 25th percentile of the sample distribution of this variable.

Firms related with *Firm A* are very heterogeneous in terms of the weight of shareholders' funds as a percentage of total assets and also in terms of the composition of their liabilities. As shown in Table A.3.1 the average ratio of shareholders' funds-to-total assets varies in a wide range across firms from 26.1% to 100%. Nonetheless, except in one case (where it is 26.1%), the shareholders' funds ratio is higher than the (average) 75th percentile of the firm-level sample distribution of this ratio. Consequently, it can be

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60. In Spain, family names are composed by a first surname from the father and a second surname from the mother. It allows drawing conclusions about family relationships just from the direct comparison of the two surnames.

61. We have built the structure of family related firms using SABI-INFORMA. This database provides for every firm a summary report that, among other information, contains the list of shareholders and the list of subsidiaries. When shareholders or subsidiaries are firms contained in the database, reports are linked. Thus, the whole structure can be built taking into account the information reported by "linked" firms. Nonetheless, this apparent structure would be incomplete because a given shareholder could own other "non-linked" firms, that is, firms that are not shareholders or subsidiaries. In this case, trying to discover relationships across firms is a more handcrafted task based on the study of clues such as similarities in firms' names, common addresses, fax or telephone numbers, etc. In this case, we have not identified more related firms.

62. Constitution dates ranges from 1979 to 1994.

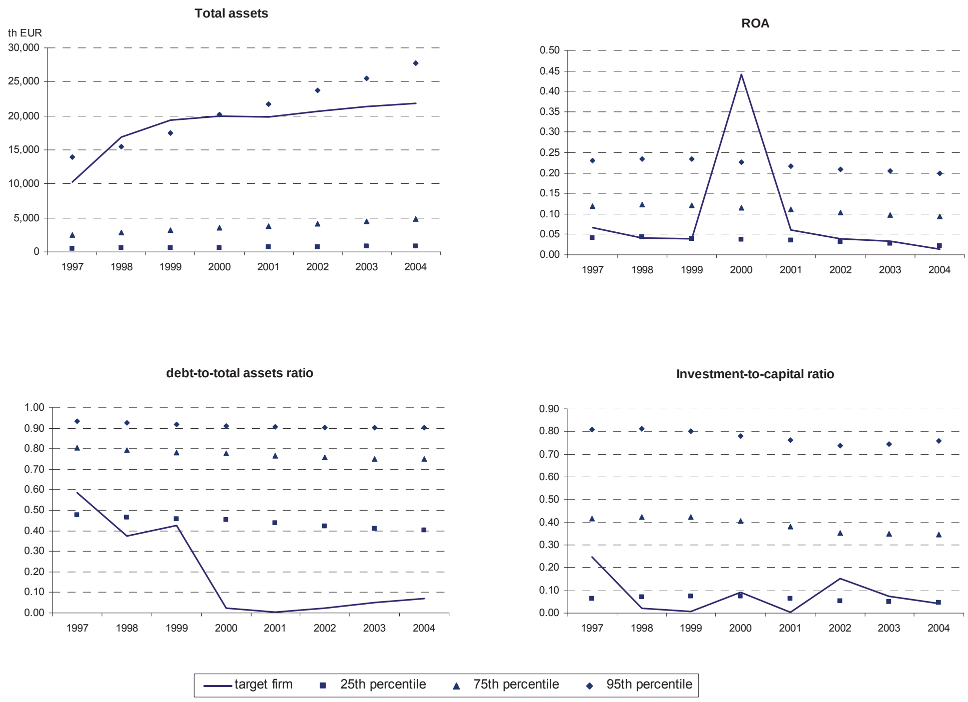
63. Comparing the averages of the total assets in period 1997-2004 of every firm with the average percentiles of the distribution in the sample of total assets, two of them are below the 5th percentile, four between the 5th and the 25th percentile, two between the 25th and the 50th percentile and two between the 75th and the 95th percentile.

64. According to our classification of industries: four of them are devoted to manufacturing (CNAE 2009 codes: 2599, 1103, 2599 and 2370); three to IT, R&D and others (CNAE 2009 codes: 7022), two to wholesale and/or retail trade (CNAE 2009 codes: 1979 and 4669); and two to agriculture (CNAE 2009 code 0161) and to financial intermediation (CNAE 2009 code 6492), respectively.

65. The anomalously high ROA in year 2000 is explained by the very high financial revenues in that year.

concluded that the firms in the structure are highly capitalised. In aggregated terms (that is, for the pseudo-firm that results from aggregating all the firms in the structure), the average shareholders' fund ratio is above 70%.

Figure A.3 Compared evolution of total assets, ROA, investment-to-capital ratio and debt-to-capital ratio in the target firm (Firm A) and in the 25th, 75th and 95th percentiles of the firm-level sample distributions of these variables



These high solvency ratios are associated with a low dependence on banking debt. Figures reported in Table A.3.2 indicate that taking all the firms in the structure as a group, banking debt represents, on average, approximately 2% of total assets. This aggregated figure is the result of a combination of firms that rely on banks' loans in different degrees. Most of them (seven) are always (or in almost all years) unbanked during the period. Some of them are continuously (two) or intermittently (two) banked. It is remarkable that, within the subset of banked firms, bank debt as a percentage of total assets does greatly vary across firms and even for the same firm over the years. Firms with higher banking debt ratios compared with the rest of the firms in the structure (i.e., the cases of *Firm K* and, in year 2004, *Firm J*) also exhibit the relatively lower shareholders' ratios.

Table A.3.1. Shareholders' funds-to-total assets ratio (%)

	Shareholder funds/Total assets (%)								
Name	1997	1998	1999	2000	2001	2002	2003	2004	average
FIRM A	41.4	62.5	57.6	97.7	99.5	97.5	94.9	93.1	80.5
FIRM D		99.7	99.7	96.4	99.6	99.5	99.7	99.7	99.2
FIRM E		100	100	100	100	100	100	100	100
FIRM F	16.0	13.4	85.2	68.7	80.2	69.7	69.1	57.9	57.5
FIRM G	61.3	65.8	71.6	69.8	66.7	67.5	65.6	66.5	66.8
FIRM C	55.2	61.3	60.0	59.1	68.5	75.9	76.8	80.3	67.1
FIRM I		100	100	100	100	22.8	21.3	20.2	66.3
FIRM B*									
FIRM K	26.0	21.0	27.1	31.0	39.8	37.2	20.2	6.7	26.1
FIRM H	95.0	95.0	95.0	95.0	96.6	98.6	99.3	99.3	96.7
FIRM J	99.5	94.4	92.3	100	100	100	100	2.1	86.0
Aggregated firm*	22.6	34.4	73.9	88.2	93.2	86.5	84.9	78.1	70.2

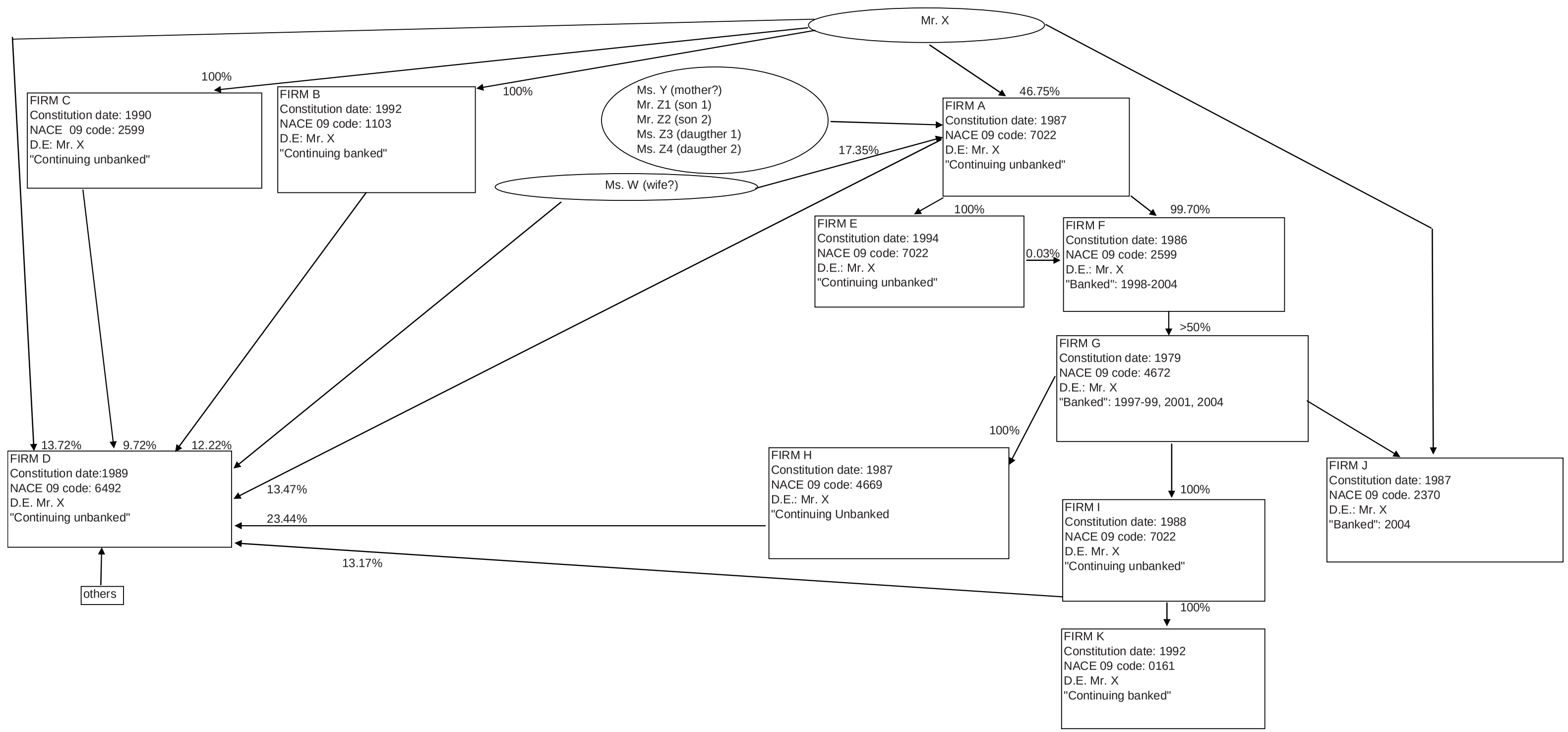
* Firm B is excluded because it reports negative shareholder funds.
Firms' names are fictitious

Table A.3.2. Bank debt-to-total assets ratio (%)[1]

	Bank debt/Total assets (%)								
	1997	1998	1999	2000	2001	2002	2003	2004	average
FIRM A	0	0	0	0	0	0	0	0	0.0
FIRM D		0	0	0	0	0	0	0	0.0
FIRM E		0	0	0	0	0	0	0	0
FIRM F	0	0.1	0.2	2.1	0.6	8.5	16.5	10.0	4.7
FIRM G	3.9	7.0	3.0	0	2.1	0	0	3.2	2.4
FIRM C	0	0	0	0	0	0	0	0	0.0
FIRM I		0	0	0	0	0	0	0	0.0
FIRM B	20.6	31.9	39.1	39.2	14.8	14.1	10.7	10.7	22.6
FIRM K	22.9	20.8	66.5	50.0	39.8	29.6	23.0	42.9	36.9
FIRM H	0	0	0	0	0	0	0	0	0.0
FIRM J	0	0	0	0	0	0	0	43.6	5.4
Aggregated firm	0.5	0.7	1.5	2.0	1.0	2.9	4.8	4.5	2.2

[1]Information on banking debt has been drawn from CIR.
Firms' names are fictitious.

Chart A3: An example of family firms' structure:



Percentages associated to arrows indicate the direct ownership percentage of a shareholder (arrow origin) in a given firm (arrow end).
D.E: Director executive.
Names are fictitious.

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