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Determinants of Access to External Finance: Evidence from Spanish Firms

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ABSTRACT

Access to external finance is a key determinant of a firm's ability to develop, operate and expand. To date, the literature has examined a variety of macroeconomic and microeconomic factors that influence firm financing. In this paper, we examine access by Spanish firms to external financing, both from bank and non-bank sources. We use dynamic panel data estimation techniques to estimate our models over a sample of 60,000 firms during the period from 1992 to 2002. We find that Spanish firms are quite dependent on short-term non-bank financing (such as trade credit), which makes up about 65 percent of total firm debt. Our results indicate that this type of financing is less sensitive to firm characteristics than short-term bank financing. However, we also find that short-term bank debt seems to be accessed more during economic expansions, which may suggest a substitution away from non-bank financing as firm conditions improve. Short-term bank debt also seems to be accessed more as funding rates rise, possibly again suggesting a substitution away from higher-priced non-bank alternatives. Using data from the Spanish Credit Register maintained by the Banco de España, we find that the impact of funding costs on access to external financing, whether from banks or non-banks, is affected by the nature of borrowing firms' bank relationships and collateral. In particular, we provide evidence of a potential hold-up problem in loan markets. Moreover, collateral plays a key role in making long-term finance available to firms.

Key words: external finance, bank relationships, hold-up, business cycle

JEL: E32, G18, G21

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ABSTRACT

Access to external finance is a key determinant of a firm's ability to develop, operate and expand. To date, the literature has examined a variety of macroeconomic and microeconomic factors that influence firm financing. In this paper, we examine access by Spanish firms to external financing, both from bank and non-bank sources. We use dynamic panel data estimation techniques to estimate our models over a sample of 60,000 firms during the period from 1992 to 2002. We find that Spanish firms are quite dependent on short-term non-bank financing (such as trade credit), which makes up about 65 percent of total firm debt. Our results indicate that this type of financing is less sensitive to firm characteristics than short-term bank financing. However, we also find that short-term bank debt seems to be accessed more during economic expansions, which may suggest a substitution away from non-bank financing as firm conditions improve. Short-term bank debt also seems to be accessed more as funding rates rise, possibly again suggesting a substitution away from higher-priced non-bank alternatives. Using data from the Spanish Credit Register maintained by the Banco de España, we find that the impact of funding costs on access to external financing, whether from banks or non-banks, is affected by the nature of borrowing firms' bank relationships and collateral. In particular, we provide evidence of a potential hold-up problem in loan markets. Moreover, collateral plays a key role in making long-term finance available to firms.

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I. Introduction

Access to external finance is a key determinant of a firm's ability to develop, operate and expand. To date, the literature has examined a variety of macroeconomic and microeconomic factors that influence firm financing. For example, the availability of external finance is likely to vary with changes in the macroeconomic environment and monetary policy shocks. A well documented discussion of how such changes impact the real economy is found in the so-called "balance sheet credit channel" literature, which argues that firms' access to credit via the financial sector is the principle mechanism linking central banks' interest rate policies and the real economy. Early empirical research on this topic, such as Kashyap *et al.* (1993, 1996) and Oliner and Rudebusch (1996), focused on the impact monetary policy changes had on firms' access to bank lending, measured as the ratio of their bank funding to total external financing. These early studies used firm size (i.e., total assets) as the only relevant firm-specific variable in examining access to external finance.

This key characteristic of firm-level behavior and performance has been addressed by several papers at the microeconomic level; specifically, see Atanasova and Wilson (2004) and Bougheas *et al.* (2006). In the latter, the authors present a modified theoretical model of access to external finance and test a variety of its implications. Within this model, monitoring is costly, which leads firms with less healthy balance sheets to use banks to fund themselves. Healthier firms can access the capital markets for some or all of their funding. Since monetary policy actions influence everyone's funding costs, the model identifies firm characteristics that help explain the differing magnitudes of these effects. Note that this is known as the "broad" channel of monetary policy since all firms, including banks, face higher funding costs. Specifically, the model proposes that more financially vulnerable firms (i.e., smaller, younger, riskier, and more indebted firms) should be more severely affected by monetary tightening. The authors confirm the model's conclusions using a dataset of 16,000 manufacturing firms based in the United Kingdom for the period from 1989 to 2000.[2]

The composition of external finance has also attracted the attention of both theoretical and empirical papers. The arm's-length relationships found between firms and market-based providers of funds (either from equity or debt markets) contrast with the close nature of the firm-lender

2 Note that several studies have examined external financing needs at the sectoral level; see Rajan and Zingales (1998) as

relationships; see Rajan (1992). As described by Diamond (1991), banks contribute to the resolution of asymmetric information problems in lending through their monitoring advantage and thus play a significant role in shaping firms' liabilities. However, as pointed out by Sharpe (1990) and Rajan (1992), a close firm-lender relationship may lead to an information quality capture that results in a "hold-up" problem in which banks are able to extract rents from borrowing firms. Empirically, Denis and Mihov (2003) and references therein, show that the credit quality of the borrower is a key determinant of the type of external financing it uses; that is, their choice of public debt, bank debt and non-bank private debt. Berger and Udell (1995), Harhoff and Korting (1998) and Jiménez and Saurina (2004), among others, provide evidence on the impact that bank-firm relationships have on firm access to bank external funds. However, apart from public debt and bank debt, Petersen and Rajan (1996) show that trade credit plays also a crucial role among external sources of funds for firms.

In this paper, we examine access by Spanish firms to external financing, both from bank and non-bank sources. The primary data in this paper comes from the combination of two different databases, the so-called Informa dataset and the Banco de España Credit Register (*Central de Información de Riesgos*, CIR). The former has yearly firm-level information from balance sheets and profit and loss accounts. The second one has monthly loan-level information on all credits, above a certain threshold, granted by Spanish credit institutions (banks, savings banks, cooperatives and credit finance establishments). Our final estimation sample of firms is based on the intersection of firms appearing in both datasets and meeting certain sample criteria.

We use dynamic panel data estimation techniques to estimate our models over a sample of about 60,000 Spanish firms during the period from 1992 to 2002. We find that Spanish firms are quite dependent on short-term non-bank financing, which makes up about 65 percent of their total firm debt. Our results indicate that this type of financing is less sensitive to firm characteristics than short-term bank financing. However, we also find that short-term bank debt seems to be accessed more during economic expansions, which may suggest a substitution away from non-bank financing as firm conditions improve. Short-term bank debt also seems to be accessed more as funding rates rise, possibly again suggesting a substitution away from higher-priced non-bank alternatives. Using

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well as Braun and Larrain (2005).

data from the CIR, we find that the impact of funding costs on access to external financing, whether from banks or non-banks, is affected by the nature of borrowing firms' bank relationships (i.e. number and length) and collateral. In fact, collateral is shown to be an important factor influencing long-term bank borrowing by Spanish non-financial firms, as pointed out by Jiménez *et al.* (2006).

We contribute to the literature on firms' external financing in several ways. First, we focus on Spain, a country that, until very recently, has had quite underdeveloped public and private debt markets and that is characterized by a strong banking system with significant involvement in financing Spanish firms. By merging traditional non-financial firm databases with the Credit Register database, we can control for credit quality explicitly and, more importantly, analyze the role played by bank-firm relationships in firm access to external finance. Therefore, we go beyond the empirical results of Bougheas *et al.* (2006) to show that the degree of bank competition and collateral available has important effects on external funding.

Secondly, we have a very large sample of firms (close to 200,000 year-firm observations) and, more importantly, it is a sample that contains a very high proportion of small firms. For instance, the average total asset size of the firms is only €1.3 million, (i.e., $2 million). The upper fifth percentile of our sample contains companies with total assets above €5.3 million and up to €11.4 million, while the lower fifth percentile ranges from €123 thousand to a minimum value of only €82 thousand. To our knowledge, this is the first time that such a large sample of small firms has been studied regarding external finance behavior. Berger and Udell (1995), using a random stratified sample of 863 firms, and Harhoff and Korting (1998), based on a survey of 1,399 small and medium sized German firms, contain a significant percentage of small firms, but their studies focus on the cost of the credit lines and on whether such credit lines are collateralized or not.

Finally, we use dynamic panel data estimation techniques which allow us to properly estimate models where the endogenous variable is lagged one year. We find that there is a significant amount of persistence in the liability structure of Spanish firms, as one would expect given that it is not easy to change the funding structure of a firm. Thus, Arellano and Bond (1991) estimators are needed to avoid significant biases in the parameter estimates. Here, we depart from the existing empirical papers that use ordinary least squares techniques with fixed effects.

II. Literature review

Much of the extant literature regarding firms' access to external financing has focused directly on macroeconomic issues, such as the existence of a bank lending channel of monetary policy transmission. A primary reason why macroeconomists were drawn to the topic is that the availability of external financing varies with changes in the business cycle conditions and with changes in monetary policy. Kashyap *et al*. (1993) first examined the impact that monetary policy actions had on firms' financing mix. Their results for U.S. firms over the period from the early 1960's to the late 1980's show that monetary policy contractions lead to a concurrent reduction in firms' access to bank loans and an increased issuance of commercial paper.

Oliner and Rudebusch (1995, 1996a, 1996b) extended this analysis in two directions. First, as suggested by Gertler and Gilchrist (1994), they argued that firm size was an important factor in examining the impact of monetary policy on firms' financing choices. Second, since small firms have little access to the commercial paper market, they included in their analysis other non-bank sources of external financing, such as trade credit and accounts payable. From their empirical results based on the period from 1973 to 1991, they concluded that a bank lending channel was unlikely to exist since their financing mix variable was not impacted by monetary policy changes. However, they also concluded a broad lending channel did exist since small firms had significantly reduced access to external financing during monetary contractions.

While Kashyap *et al*. (1996) argued with several elements of this analysis, their conclusion that "there is probably much more to be learned from careful analysis of a variety of micro data, at the level of individual banks and individual firms" corresponded with an alternative avenue of research into firms' access to external finance that was based on firm-level data. Whited (1992) found that financial constraints and hence, a diminished ability to access external financing, directly impacted firms' capital investment plans. This result was based on U.S. firms over the period from 1975 to 1986. Using firm-level data from 1989 to 1999 for the United Kingdom, Atanasova and Wilson (2004) examined financially constrained firms, where financing here was defined as access to internally generated funds, bank lending and accounts payable (or trade credit), using a disequilibrium model of lending. Their empirical analysis suggests that firm total assets, as a proxy for available collateral, is an important determinant of bank loan availability. With respect to

monetary policy factors, they found that tight monetary conditions lead to increased demand for bank financing, but a reduced supply. In addition, they found that although trade credit was the least desirable funding option, firms tend to have a higher rate of substitution between loans and trade credit than between loans and internally generated funds. They conclude that trade credit plays a special role in alleviating credit rationing since firms switch from bank credit to trade credit when faced with borrowing constraints.

The second major study of firms' access to external finance was conducted by Bougheas *et al*. (2006) also using data from U.K. manufacturing firms over the period from 1989 to 1999. Their measures of external financing were the ratio of a firm's short-term debt to total external debt, which they assume is a measure of bank financing, and the ratio of a firm's total external debt to its total liabilities, which more closely tracks overall access to external financing. The authors found that several firm-specific characteristics, such as size, collateral, riskiness, age and profitability were important determinants of access to short-term and long-term credit. In addition, they found monetary policy conditions had a greater impact on smaller, riskier and younger firms.

Our research is also grounded in the microeconomic approach for studying firms' access to external finance. We use firm-level, balance sheet data for Spanish non-financial firms from 1992 to 2002. In addition, we are able to use detailed data on their bank borrowing provided by Spanish banks to the Banco de España Credit Register. This dataset allows us to decompose bank lending more accurately into short-term (i.e., maturities of less than one year) and long-term lending and to accurately decompose total lending into bank and non-bank sources. In addition, it allows us to expand the set of explanatory variables in our analysis to include bank-firm relationship variables, such as a firm's number and average length of banking relationships.

The literature on banking relationships is quite extensive and suggests a direct impact on firms' access to external finance. Theoretical models on the topic hinge on information asymmetries between borrowers, especially smaller borrowers. Overall, these models suggest that a borrower should have a few, long-term lending relationships with banks. However, as summarized in Castelli *et al*. (2006), empirical work on the topic has generated a variety of results. Petersen and Rajan (1994) found for small U.S. firms that fewer lending relationships led to greater availability of financing and a small benefit in terms of financing costs. However, Houston and James (1996) found

for public U.S. firms that firms with one banking relationship face more credit constraints than firms with multiple relationships. Our empirical results provide support for the Petersen and Rajan result.

Similarly, with regard to the length of banking relationships, theory suggests that longer-term relationships should reduce informational asymmetries between a borrower and a lender and enhance access to credit. However, the possibility of "bank hold-up" should increase as well, which should raise the cost of financing and also possibly diminish access. Berlin and Mester (1998) show empirically using U.S. banking data that loan rate smoothing in response to interest rate shocks is part of an optimal long-term contract between a bank and a firm. Berger and Udell (1995) found again for U.S. firms that borrowers with long-term banking relationships pay lower interest rates and are less likely to pledge collateral. In contrast, Petersen and Rajan (1994) found that "the length of an institution's relationship with the firm seems to have little impact on the rate." In fact, Angelini *et al*. (1998) found for Italian firms that lending rates increased with the length of the banking relationship under certain circumstances, providing evidence for the bank hold-up theory. Our empirical results suggest that there might be some hold-up problems for Spanish firms.

III. Data description, model specification and econometric methodology

III.A. Data description

The datasets available for our study of Spanish firms consist of the Informa dataset of firm accounting information and the Banco de España Credit Register (*Central de Información de Riesgos* or CIR). The former dataset has yearly firm-level information from balance sheets as well as profit and loss accounts, while the second one has monthly loan-level information on all credits, above a certain threshold, granted by Spanish banking institutions. Our final estimation sample is based on the intersection of firms appearing in both datasets and meeting certain sample criteria. In this section, we describe the two databases and our filtering procedure. We also discuss the endogenous and explanatory variables that we examine as well as give some intuition about their expected effect on firms' financing decisions.

The firm-level accounting data is derived from the Informa dataset provided by the data vendor INFORMA, a subsidiary of Bureau van Dijk. This annual dataset is based on the balance

sheet and income information reported to the Spanish *Boletín Oficial del Registro Mercantil* (BORME), as required by law. The Informa database does not include all the BORME filings, but it is representative and increasing in its coverage over time; currently, over 50% of registered firms are included. For our analysis, we focus on non-financial Spanish firms during the period 1992 to 2002.

We applied several data filters to remove firms with inconsistent accounting information. Specifically, we removed, in the order presented below, firm-year observations for firms reporting: financial expenses greater than their total debt outstanding (both short and long-term), negative equity, negative operating revenues, negative values for balance sheet items that are defined to be non-negative (such as total assets), subcategory amounts greater than the category total (such as short-term non-bank debt greater than total short-term debt), and missing values for key variables. We also removed firms with discontinuous records across the sample period.

The banking database we use in this study is the CIR. While this database contains monthly information, we only use CIR data from December of each sample year in order to match the Informa dataset. Given that the minimum loan threshold to be included in the CIR has been at a value of €6,000 since 1996, the database is effectively a census of Spanish corporate bank borrowing.[3] The CIR includes information on the characteristics of each loan, such as amount, maturity and collateral, as well as certain information on the borrower, such as industry sector and province of headquarters. For this study, we aggregate loan level data up to the firm level since a firm can have multiple loans with a single bank or across several banks.[4]

Once the two databases are merged, the final filter is to drop firms whose banking debt recorded in the CIR dataset is higher than its total debt as recorded in the Informa dataset. The sample after matching the two datasets, applying the aforementioned filters and winsorizing the data at the upper and lower 5% tails, contains almost 60,000 firms for the period 1992-2002. The number of observations available is large and has grown continuously throughout the period studied; overall, there are data on almost 200,000 observations for the ten years analysed.[5]

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3 The threshold prior to 1996 was set at €24,000, although banks provided information on loans between €6,000 and €24,000 on a voluntary basis.

4 A more detailed description of the CIR database is in Jiménez and Saurina (2004) and in Jiménez *et al* (2006).

5 Note that this description of the dataset is for the data available before we apply the first-differencing and lagged dependent variables as instruments used in the GMM procedure.

As shown in Table 1A, firm coverage in the intersection of the Informa and CIR databases increases dramatically over our sample period. For the first year of the sample, we have roughly about 2 percent of the full sample, whereas for the last year of the sample, we have over 20 percent of the sample. In fact, more than half of our observations are recorded in the last three years of the sample. This is due to the fact that Informa has been increasing its coverage over time.

In Table 1B, we present another descriptive table that shows how many consecutive annual observations these firms have up to a maximum of eleven years (i.e., the firms are present throughout our whole sample period). Approximately 56% of the firms in the sample have less than three years of consecutive observations, suggesting that many of the firms in our sample are young. In fact, the average age of the firms in the sample is 8 years with the median age at 6 years.

III.B. Variables of interest

Prior studies regarding firms' access to external finance have examined a small number of financing measures as endogenous variables. For example, Bougheas *et al.* (2006) used two measures of external financing for their study of the U.K. market; specifically, the ratios of short-term debt to total debt and total debt to total liabilities. They assert that these ratios correspond to measures of access to bank and total external financing, respectively. For the Spanish case, we demonstrate that those ratios do not have the same interpretation, since short-term debt does not correspond to banking debt in the same way as in the UK case. In our paper, we can take advantage of the merged datasets to examine four financing measures; for a complete description, see Table 2A.

The first financing measure is the ratio of short-term debt, regardless of financing source, to total debt, which we denote as SD/TD. Note that short-term debt is defined as an outstanding debt obligation with a maturity of less than one year. By construction, long-term debt as a ratio of total debt is simply (1-SD/TD); hence, while we have this variable available in our dataset by definition, we will not present empirical results for it, although we will discuss it in our analysis as appropriate. Both of these variables are drawn from the annual balance sheet data in the Informa-SABI database.

The second and third financing measures are a decomposition of the short-term debt measure

into its bank and non-bank (specially, trade credit) components. The variable SDB/TD is the ratio of short-term bank debt to total debt, where the numerator is drawn from the CIR dataset. The variable SDN/TD is the ratio of short-term non-bank debt to total debt, and the numerator is based on the difference between short-term debt from the Informa-SABI database and short-term debt drawn from the CIR dataset. The fourth measure we examine is the ratio of total bank debt to total debt, which is denoted as BD/TD. Again, the numerator comes from the CIR dataset.[6]

These financing measures give an overview of the external financing of Spanish firms over this time period. Based on the averages of our financing measures, we found that about 77% of total debt is short-term debt and that short-term bank debt and short-term non-bank debt constitute roughly 12% and 65% of total debt, respectively. Since bank debt makes up about 42% of total debt on average, we can conclude that long-term bank debt constitutes roughly 30% of total debt.[7] Since, on average, the summed shares of short-term debt SD/TD (i.e., 77%) and long-term bank debt (i.e., 30%) are greater than 100% of total debt, we can conclude that long-term non-bank debt financing is very low in our dataset and hence not relevant for our analysis. As mentioned in the introduction, the development of debt markets in Spain has been very limited until recently. Debt issuance in Spain has been traditionally limited to a few and very large public companies. In fact, Spanish non-financial firms with rating assessments have been quite limited (around 100 or less) during the period analyzed. Moreover, the size of the firms included in our sample also contributes to explain the low weight of long-term non-bank debt issuance.[8]

Based on this rough decomposition of Spanish external financing data, three stylized facts are apparent. First, focusing on short-term bank debt, we see in Table 2.A that SDB/TD has a median

6 In fact, the Informa-SABI database only has the bank/non-bank debt breakdown for a few firms which is another reason why we merge both databases. The advantage of that merge is that we can go beyond the analysis in Bougheas *et al.* (2006) and contribute to the literature on bank relationships and, in particular, to the study of very small firms. However, there is a small caveat in doing that since, given that both databases come from significantly different sources, the matching of both is not always perfect. The differences come mainly from the Informa database, which is less subject to systematic scrutiny, than from the CIR database, used regularly to perform bank credit risk monitoring by supervisors (i.e. Banco de España inspectors) and the banks themselves, as the CIR is also a tool for monitoring credit risk at each bank level. In any case, we do believe that the advantages of being able to analyze such a large population of firms clearly outweigh the limited matching problems between both databases.

7 In mathematical notation, SD/TD = 77% = (SDN/TD + SDB/TD) = 65% + 12%, and LDB/TD = 30% = (BD/TD - SDB/TD) = 42%-12%.

8 As mentioned in footnote 6, there is not a perfect matching of CIR and Informa databases which helps explain why the percentages do not add up exactly to 100%. In any case, the results are reasonable and qualitatively in line with the sample characteristics and the development in debt and rating markets in Spain during the period analyzed.

value of zero; in fact, the first non-zero observation arises in the 53rd percentile of the sample. The average of SDB/TD is 13% due to a small number of firms for whom short-term bank debt makes up more than half of their total debt. This empirical fact stands in contrast to the dataset of U.K. firms used by Bougheas *et al.* (2006), who claim that "the majority of short-term debt is bank finance". Second, on the whole, Spanish firms rely much more heavily on non-bank debt financing since about 84% of short-term debt is drawn from non-bank sources.[9] Denis and Mihov (2003) provide evidence, for a sample of U.S. firms, that the lowest quality firms rely more on non-bank debt finance, although in our case, it is mainly trade credit instead of private placements of debt. The size of our firms reinforces both facts (i.e. trade credit dominance and, on average, lower quality of the firms).

Third, Spanish firms use bank financing primarily at longer maturities since, as we pointed out above, long-term non-bank debt financing is very small. Table 2.B shows a high and positive simple correlation coefficient between total short-term debt and non-bank short-term debt (i.e., 0.70) while a high but negative correlation between short-term bank debt and short-term non-bank debt (i.e.,-0.49).

Turning to our explanatory variables, note that in order to reduce the influence of outliers on our results, we removed observations corresponding to the upper and lower 5% tails of several of our variables. This procedure removed between slightly less than 900 observations to more than 12,000 observations, leaving still a large sample of year-firm observations. In Table 3.A, we present the number of observations for each explanatory variable as well as a descriptive statistical analysis. In Table 3.B, we present some statistics of the variables before we removed the tails to, effectively, show that the whole sample contained really extreme values of the variables that would have significantly distorted our estimation results (see, for instance, the minimum and maximum values for ROE or size). The statistics we mention below are making reference to the explanatory variables once the tails have been dropped.

The first set of explanatory variables is related to accounting variables drawn from the Informa-SABI dataset. The first explanatory variable is firm size, measured as the natural logarithm of firm total assets in thousands of euros and denoted as LN_SIZE. As discussed previously, firm

9 Again, in mathematical notation, SDN/SD = (SDN/TD)/(SD/TD) = 0.65/0.77 = 0.84.

size was found to be a factor influencing firms' financing decisions by Gertler and Gilchrist (1994), Oliner and Rudebusch (1996), Kashyap *et al.* (1996), Atanasova and Wilson (2004), and Bougheas *et al.* (2006). Theoretical models, such as that presented in Bougheas *et al.* (2006), commonly suppose that firm access to long-term debt and non-bank debt should increase with size, and their empirical results support this hypothesis with a negative coefficient estimate. As mentioned in the introduction, we focus on small firms since the smallest firm in our sample has €82,000 in total assets, the median €615,000 and the 95th percentile is €5.4 million. These firms rely strongly on suppliers' trade credit but, nevertheless, they also have strong and durable bank relationships, as we will see below.

The second variable is the natural logarithm of one plus the firm age, denoted as LN_AGE. Our measure of firm age is the difference between the current year and the "set up" date that appears in the Informa-SABI database for each company. Usually, older firms have established track records that all lenders can evaluate, and these reputation effects should lead to less reliance on just bank lending. Thus, theoretical models would suggest a negative relationship between firm age and reliance on bank debt. However, some empirical studies, such as Bougheas *et al.* (2006), show a positive relationship with both short-term and long-term debt ratios, suggesting that older firms simply have more access to external financing of all kinds. Our sample of firms is relatively young with 6 years old for the median firm and only 23 years old for the firm in the 95th percentile.

The third explanatory variable is the ratio of firm tangible assets to total assets, denoted as TANGIBLE ASSETS, and it is intended to be a proxy measure of firms' available collateral. Several models, such as that of Bougheas *et al.* (2006), suppose that firms with more tangible assets as a percentage of total assets have easier access to non-bank credit, such as from the capital markets, implying a negative relationship with bank financing. As it is shown in Table 3A, on average, one fourth of total assets could potentially used as collateral.

The fourth variable is the ratio of firm profits to equity capital, as a measure of firm profitability; specifically, we calculate firm return on equity (ROE) as the ratio of annual income to shareholder equity. Bougheas *et al.* (2006) suggest that firms with greater profit potential should have less need for short-term debt and hence a negative relationship with short-term financing measures. However, their empirical result suggests a positive relationship, suggesting that more

profitable firms are able to get more financing overall, regardless of funding source. Although from Table 3.A, average ROE seems quite high (15%), the median ROE is almost 3 percentage points lower and a significant number of observations show a negative value. Spain had high nominal interest rates until the euro-zone convergence process started in the second half of the 1990's. Therefore, the high ROE accounts for a high risk-free interest rate plus the risk premium inherent to real activities.

The fifth explanatory variable is a measure of firm leverage, which we measure as the ratio of total debt to shareholder equity and denote as GEARING. Various theoretical models suggest that firms with higher levels of indebtedness are more likely to rely on bank financing, which should imply a positive relationship with our bank debt dependent variables; yet, empirical results have been mixed. This variable, as expected, shows significant dispersion.

Our sixth firm-specific variable, which we denote as LIQUIDITY, is the ratio of liquid assets to current liabilities. In general, firm liquidity is a direct substitute for external financing, suggesting a negative relationship with our external financing measures.

The seventh firm-specific variable used in our study is a measure of firm risk. For their study, Bougheas *et al.* (2006) were able to use a commercial default probability known as QuiScore. However, since we did not have available an equivalent measure of firm default (and coverage of rating agencies of Spanish firms is scant), we use a default measure based on information available in the CIR database.[10] A default on payment is noted in the database when a debt balance remains unpaid for more than three months or when there are reasonable doubts expressed by the lender as to possible repayment. We define a company as defaulted in year *t* when at least 5% of its total CIR debt is in default.[11] The DEFAULT variable is a binary variable equal to one if 5% of the firms' CIR loans were in default over the prior year. In fact, instead of relying on predictions of the quality of the firms that might be subject to error, we use an effective measure of the level of riskiness of the firm. We include this variable lagged by one year in order to avoid any spurious correlation with the endogenous variables. Moreover, since the CIR database is shared among banks, the lagged variable should be a reasonable, if discrete, indicator of ex-ante firm riskiness. Theoretical models typically

10 This variable was already used by Jiménez *et al.* (2006).

11 The 5% threshold is arbitrary but seems reasonable in order to remove technical defaults that are sorted out quickly.

suggest that access to external finance by riskier firms is more likely focused on short-term bank debt; hence, the model expects a negative coefficient. However, Denis and Mihov (2003) find that the lower the quality of the firms, the more inclined to issue private non-bank debt (trade credit in our case). The percentage of firms in default is rather low in our sample (0.9%); in any case, their quality is also proxied by GEARING, LIQUIDITY and ROE variables.

We also include macroeconomic variables in our analysis to account for changing economic conditions during our sample period and to link back to the macroeconomic literature described earlier; see Graph 1. Whereas various studies have used the GDP growth rate as the main indicator of economic conditions, we found that changes in the industrial production (IP) index were more appropriate for our dataset, because it is more directly related to activity in the corporate sector. Hence, the first macroeconomic variable we use is the year-over-year, real IP growth rate. Note that to better capture the dynamics of the macroeconomic environment, we include contemporaneous and lagged IP growth rates.

The second macroeconomic variable we use is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market, which we denote as RATE. Note then that for our analysis, the RATE variable is a proxy for the cost of borrowing, which is a function of several things, including overall monetary policy, banks' market power, and the risk of the non-financial firm. For convenience, we consider an increase in the RATE variable as a rise in the cost of firm borrowing, regardless of whether the increase is due to monetary policy actions or not. In any case, we expect a negative relationship since the bank lending channel theory, whether narrow or broad, suggests that a monetary tightening restricts firms' access to external financing, regardless of firms' characteristics. In this case, we also introduce its lagged value as an explanatory variable since it seems that the changes of the interbank interest rates may take some time to be transferred into the actual interest rates that firms face when borrowing from banks.

A contribution of our paper to the literature on firms' access to external finance is to introduce information on firms' banking relationships, as derived from the CIR database, into our analysis. We examine whether such variables have an effect on the transmission of the cost of borrowing to firms. Specifically, we examine the impact of three CIR variables only in terms of their impact on firms' funding costs; that is, these variables are introduced into our empirical specification

by interacting them with our RATE variable. The primary reason for this specification is that these variables probably impact a firm's access to external financing most directly through their borrowing costs. For instance, having more or longer bank relationships should more directly impact a firm's cost of credit as opposed to its access to credit.

As we have already advanced, the first CIR variable of this kind is the number of banking relationships which we interact with RATE (denoted as RATE*RELATIONS). The sign on this coefficient does not appear to be clear ex-ante. In theory, having more banking relationships could be seen as a measure of firm transparency and thus a proxy for ability to access the capital markets; in which case, a negative relationship might be appropriate with external financing, both banking debt or trade credit. On the other hand, having more bank relationships could be a sign of poor firm performance, which might imply a positive relationship with bank and non-bank financing.[12] In any case, Table 3.A shows that the average number of bank relationships is around 3.2, being 3 for the median firm and as large as 29.

The second CIR explanatory variable is the weighted length of firms' banking relationships, using as weights the loan percentages in relation to firms' total bank financing, interacted with RATE (denoted as RATE*LENGTH). We include this variable since it appears to be relevant in the empirical literature. In theory, longer banking relationships should alleviate some of the standard information asymmetry problems between lenders and borrowers. Hence, a longer banking relationship is expected to provide firms with greater access to both bank and external financing (see Jiménez *et al.* (2006) as well as Chakraborty and Hu (2006) for further discussion). In fact, Berger and Udell (1995) found that borrowers with longer banking relationships pay lower interest rates and are less likely to pledge collateral. Yet, it is also possible that if the firm has had a long banking relationship, the bank might extend better credit terms to assist the firm. We need to test empirically what the effect of this interacted variable might be. Note that, by construction, this variable has a maximum value of 10 (years) since we do not have information on the CIR about when the relationship started. On average, the bank and the firm have been operating together for almost three years.

The third CIR variable we use is COLLATERAL, which is constructed as the weighted

12 See Castelli *et al*. (2006) for empirical results and a survey of the correlation between the number of bank

percentage of the borrower's outstanding loans covered by pledged collateral. As before, we interact it with the interest rate (denoted RATE*COLLATERAL). On average, 81% of loans recorded in the CIR dataset are not secured by collateral. The value of the COLLATERAL variable for a firm in a given quarter is the weighted average of the loan collateral values, where the weights are based on the loan sizes. The impact of our collateral measure on pricing of external financing should be negative in that a borrower with more collateral should receive more advantageous borrowing terms, ceteris paribus. Further note that Jiménez *et al.* (2006) found that in periods of higher real interest rates, the use of collateral is less likely and hence lowers a firm's chances of acquiring external financing.

Note that this variable is different from the TANGIBLE ASSETS variable described above; specifically, the COLLATERAL variable is the actual amount of collateral pledged, while TANGIBLE ASSETS is a measure of possible collateral. This distinction is important for our analysis since we use the latter measure as an explanatory variable for determining the level of firm's access to external financing, and we use the former measure as an explanatory variable interacted with RATE to help determine the price of external debt that a firm faces.

III.C. Econometric methodology

The appropriate framework for analyzing the relationship between firms' financing choices and their specific characteristics is a dynamic panel model, since it appears to be reasonable that their choices are affected by their prior decisions. In addition, it is necessary to take account of firm heterogeneity since firms could have different predispositions to take on more banking debt or trade credit. In fact, Bougheas *et al.* (2006) acknowledge that the appropriate estimation technique would be dynamic panel GMM methods as proposed by Arellano and Bond (1991). However, the GMM instrument requirements posed a problem for their study. Since the only period of tight monetary policy in their sample occurred in the first few years, the use of lagged values as instruments would remove this period from their analysis. Hence, their results would only be indicative of access to credit during a benign period of monetary policy. Instead, the authors used OLS regression with

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relationships and firm performance.

fixed effects which does not permit them to account for persistence in the dependent variable and causes all of the explanatory variables to be considered strictly exogenous.

To avoid these estimation issues, we estimated a dynamic panel data model as proposed by Arellano and Bond (1991), which allows consistent estimation of the model parameters when lagged values of the dependent variable are included among the regressors. We treat all the independent variables as exogenous, except ROE, which we treat as predetermined.[13] Our model estimations pass the Sargan test of over-identifying restrictions and the Arellano-Bond test for the absence of second-order autocorrelation in the residuals. Note that we use the minimum number of instruments in the GMM estimation procedure, as suggested by Bowsher (2002) and in order to preserve as many observations as possible.

Our starting point is to estimate a model that only includes accounting and macroeconomic variables. The empirical "baseline" specification is the following:

$$\begin{aligned} \ell y_{it} &= \rho \ell y_{it-1} + \beta_1 LN\_SIZE_{it} + \beta_2 LN\_AGE_{it} + \beta_3 TANGIBLE\_ASSETS_{it} + \\ &+ \beta_4 ROE_{it} + \beta_5 GEARING_{it} + \beta_6 TREASURY_{it} + \beta_7 DEFAULT_{it-1} + \\ &+ \gamma_1 \Delta IP_t + \gamma_2 \Delta IP_{t-1} + \gamma_3 RATE_t + \gamma_4 RATE_{t-1} + \varepsilon_{it}. \end{aligned} \qquad (1)$$

where ℓy_{it} is the log-odds transformation of our financing measure of interest and ε_{it} is a standard normal random variable. The log-odds transformation is

$$\ell y_{it} = \ln\left(\frac{y_{it}}{1-y_{it}}\right),$$

which changes the support of our dependent variable y_{it} from the unit interval to $(-\infty, +\infty)$.

In our second specification, we include the interactions of the CIR relationship variables with the contemporaneous RATE variable. As mentioned, these variables are only interacted with the

13 Even thought a specific test does not exist to determine if a variable is strictly exogenous or predetermined, by means of the Sargan test one can get an idea of which is the best specification for a variable. In our case, the only variable that we treat as endogenous is ROE.

current RATE value since we are interested in the current external financing decision. The model is:

$$\begin{aligned} \ell y_{it} &= \rho \ell y_{it-1} + \beta_1 LN\_SIZE_{it} + \beta_2 LN\_AGE_{it} + \beta_3 TANGIBLE\_ASSETS_{it} + \\ &+ \beta_4 ROE_{it} + \beta_5 GEARING_{it} + \beta_6 TREASURY_{it} + \beta_7 DEFAULT_{it-1} + + \gamma_1 \Delta IP_t + \gamma_2 \Delta IP_{t-1} \\ &+ (\gamma_3 + \phi_1 RELATIONS_{it} + \phi_2 LENGTH_{it} + \phi_3 COLLATERAL_{it}) RATE_t + \gamma_4 RATE_{t-1} + \varepsilon_{it}. \end{aligned} \qquad (2)$$

IV. Estimation results

IV.A. Baseline specification

The results of our empirical analysis are summarized in Table 4. Column 1 refers to the first examined measure of external financing, the transformed ratio of short-term debt to total debt (SD/TD). As discussed before, the SD/TD variable can be decomposed into short-term bank debt (SDB/TD) and short-term non-bank debt (SDN/TD). The empirical results for these transformed ratios are in columns (2) and (3). In column (4), we present the empirical estimates when the endogenous variable is the ratio of bank debt to total debt.

Regarding SDB/TD, the standard model diagnostics, such as the Sargan test for over-identifying restrictions and the error autocorrelation test, suggest that the model does not fit the data well. We believe that the primary reason for these misspecification results is the large percentage of zero values in our SDB/TD variable which introduce a high degree of heterogeneity in the sample (i.e. censoring the data). If we reduce the sample size to just the non-zero values, the specification results presented in column (2') are appropriate, despite the fact that the sample size declines significantly. Similarly, results for BD/TD based just on non-zero values appear in column (4'). From here on, we will focus on the columns (2') and (4'), while presenting also the columns (2) and (4) results.

The parameters on the lagged endogenous variables range from about 0.15 to 0.30, with 0.29 being the highest value of SD/TD and 0.17 being the lowest value of SDN/TD. In all cases the parameters are statistically significant and suggest that there is some persistence in these external financing variables.[14]

14 While we have not been able to find a comparable parameter estimate in the literature, our estimates are similar in

Turning first to the firm-specific accounting variables from the Informa database, we found that, as found in prior studies, firm size has a negative relationship with access to external financing.[15] With respect to firm age, our results suggest a positive relationship with short-term financing and short-term bank financing. As also found by Bougheas *et al*. (2006), this result suggests that older firms are more likely to avail themselves of short-term debt. This result could be viewed as support for the theory that older firms have longer track records and perhaps longer relationships with lenders that facilitate access to external credit. The relationship with short-term non-bank debt is insignificant, as are several of the other Informa variables, suggesting that trade credit is accessed widely by Spanish firms, regardless of their age. Finally, in column 4' it seems that older firms are more reliant on bank financing overall (i.e., the coefficient for BD/TD is positive), which might point out that the monitoring advantage of banks only starts once the firm has a certain track record and that, conversely, for really new firms, suppliers have a competitive advantage in monitoring the firm.

With respect to tangible assets, our results suggest a negative relationship with short-term non-bank financing and the overall short-term debt measure. On the contrary, total bank debt is positively related to this ratio, while short-term bank-debt financing is not statistically significant. This result is in line with the prior literature and suggests that firms with greater access to collateral generally do not require as much short-term debt financing. These firms may rely more on long-term bank debt, which explains the positive coefficient.

The coefficients for ROE, GEARING and LIQUIDITY are negative and statistically significant for all financing measures, except SDN/TD as alluded to above. This result implies that firms that are more profitable (i.e., higher ROE), more leveraged (i.e., higher GEARING) and more liquid (i.e., higher LIQUIDITY), have less of a need for external financing.

Finally, our DEFAULT indicator has a positive relationship with SD/TD, but it is not statistically significant with respect to either of its components or total bank debt. One interpretation

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rank as the parameter reported in Flannery and Rangan (2006) for the market debt ratio, which was defined as the ratio of a firm's total debt to the sum of its total debt and shareholder equity, of publicly-traded U.S. non-financial firms. Using a variety of econometric techniques, these authors found the first-order correlation for their variable to be around +0.33.

15 The coefficient is not statistically significant in columns 2 and 4, but is in columns 2' and 4'.

of these results might be that this overall lack of significance points towards DEFAULT as a poor proxy for firm risk. Risky (but non-defaulted) firms obviously can still access external funds, but the impact of the DEFAULT indicator is more likely captured in the loan pricing that we cannot observe. However, although not significant, the coefficients for short-term bank debt and total bank debt are negative while total short-term debt and non-bank short-term debt are positive and significant (at the 5% and 10% levels, respectively), which is in line with the Denis and Mishov (2003) results.

With respect to our macroeconomic variables, we found a negative relationship between the lagged and contemporaneous values of IP growth for the ratios of short-term debt and the non-bank short-term to total debt, which accounts for about 85% of short-term debt. A positive sign is found for the short-term bank debt variable (column (2')). These results suggest that an improvement in macroeconomic conditions, proxied for by an increase in IP growth, leads to less reliance by firms on short-term debt financing. However, this does not hold for bank debt, either short-term or total. A possible interpretation is that when macroeconomics conditions improve, firms reduce their short-term debt, especially trade credit that is more expensive, but increase their use of bank debt (mainly long-term, but maybe in relative terms, short-term bank debt as well). Alternatively, in a downturn, firms rely on relatively more trade credit than bank lending. This conclusion is in accordance with Petersen and Rajan (1996), who found that firms use trade credit relatively more when bank credit from financial institutions is less available, such as during recessions. During these periods, suppliers can afford to extend credit to firms that financial institutions will not because of a comparative advantage in acquiring borrower information more cheaply, a better ability to liquidate financial assets, or a greater implicit equity stake in these firms' survival. As before, when we analyzed the DEFAULT results, but now with significant coefficients, it seems that banks behave cautiously regarding small firms, being more reluctant to lend in bad times. That might also explain why trade credit is usually more expensive, as the risk and the demand from the borrower are higher.

Another aspect of macroeconomic conditions relevant to the firms' access to external finance is the cost of such financing. Using our variable RATE and its lag as proxies for the cost of external funds, we again find different relationships depending on the type of financing. For short-term debt to total debt and for short-term non-bank debt to total debt, we found a negative relationship with the

current and lagged values of RATE, even though the current value is not significant for SD/TD. The ratio of short-term bank debt to total debt has a positive relationship with the lagged and the current values of RATE, although only the former is significant. These results imply that as funding costs rise, short-term non-bank financing decreases, while short-term bank financing increases. On the whole, if the cost-of-borrowing proxy increases, we estimate a decline in total short-term debt driven not by a decline in short-term bank debt but by short-term non-bank debt. On the other hand, while short-term bank financing increases, total bank financing does not change (column (4')). A plausible explanation for these results is that firms avoid raising funds during downturns, but if funds are required, they turn more to their banks and they prefer to do it with a short maturity, maybe expecting that the financing costs will decrease in the long run. Since the transformed BD/TD variable has a weak, negative and no significant relationship with RATE, whereas the SDB/TD exhibits a positive relationship with it, these two results together may suggest that the sensitivity of total bank debt to the RATE variable is primarily driven by long-term bank debt; that is, as the financing costs rise, firm access to bank debt declines primarily due to a decline in long-term bank financing, since short-term bank financing seems to increase.

To sum up the effect of the macroeconomic variables, we find that when the industrial production increases, total short-term debt falls (Column 1). This must be due to a drop in non-bank short financing (Column 3), since short-term bank financing and total bank debt increase (Columns 2' and 4'). We find this to be in accordance with the general result that firms use trade credit when bank credit is less available, as during recessions. On the other hand, when the costs of financing increase (i.e., $RATE_t$ and $RATE_{t-1}$), total short-term debt falls, again mainly due to the non-bank portion, since bank short-term debt appears to increase. Nevertheless, in this case, total bank debt does not change too much (i.e., insignificant coefficients in column 4'), which means that long-term bank debt must decrease.

Since improvements in economic activity are often accompanied by decreases in the interest rates, this last result may seem to contradict the previous one for the IP growth variable, explained when interpreting the coefficients on the IP variable. However, this correlation is more applicable when we think of GDP growth, which is negatively correlated with our RATE measure with a value of -0.83. The IP growth rate is also negatively correlated with RATE but with a lower value of -0.43.

Therefore, we could talk about the IP measure more precisely as a proxy for financing needs and less as a measure of the business cycle.

That is, when industrial production increases, firms need to take on more debt in order to buy more raw materials, face higher employment expenses, etc. In these situations, they access bank debt more since it is probably cheaper than trade credit with either a short or a long maturity, perhaps depending on the final use of funds. However, when funding costs rise, since trade credit becomes more expensive in relative terms, bank short-term debt again increases. The difference now is that total bank debt falls, mainly driven by a drop in the bank long-term debt. Logically, firms do not want to get into long-term debt when getting funds become more expensive.

IV.B. Interacted specification

To incorporate the firm-specific CIR variables, we estimated our baseline model with the contemporaneous RATE variable interacted with those variables. These results are presented in Table 5, which has the same structure as Table 4. Again, for short-term bank debt and total bank debt, we found that standard model diagnostics, such as the Sargan test for over-identifying restrictions, suggest that the interacted model does not fit the data well. As we mentioned, we believe that the primary reason for these misspecification results is the large percentage of zero values in our SDB/TD and BD/TD variables. Thereby, if we reduce the sample size to just the non-zero values, the specification results presented in columns 2' and 4' are appropriate.

With some minor exceptions, the results for the non-interacted variables in the interacted specification are similar to those in the baseline model. In this section, we focus on how the interactions with the CIR relationship variables affect the impact of the contemporaneous RATE variable on our four financing measures.

The RATE variable experiences some changes of sign here, as might be expected given the introduction of the interacted RATE variables. In the baseline specification, SD/TD and SDN/TD had a negative relationship with both the current and lagged RATE variables. For SDB/TD, the lagged RATE coefficient was positive and significant, but the contemporaneous value was not. Table 5 shows that the signs now differ. For SD/TD, the contemporaneous value has a positive coefficient, and the lagged value has a negative coefficient. The reverse is true for SDB/TD (Column

2'). The results for BD/TD (Column 4') are unchanged.

Looking first at the number of banking relationships, the interacted term is negatively correlated with ratios of total short-term debt (SD/TD) and short-term non-bank debt (SDN/TD), while it is positively correlated with bank debt (BD/TD), regardless of its maturity. This result suggests that for a given value of the RATE variable, firm's access to bank financing would tend to increase if it had more banking relationships, which might point towards a hold-up problem. In addition, a firm's access to short-term, non-bank financing would decrease at a given value of the RATE variable if it had more banking relationships, probably because trade credit is more expensive and would lead firms to borrow from banks whenever possible.

The coefficients on the interacted LENGTH variable are significant only for SD/TD and BD/TD, although they are of opposite signs. For a given level of the RATE variable, firms with longer banking relationships are less likely to access short term debt, but to increase their total bank debt. This result suggests that these firms may be able to take advantage of this relationship to access longer-term financing.

The COLLATERAL variable when interacted with RATE is negatively correlated with aggregate short-term debt as well as both its bank and non-bank components. However, it is positively correlated with total bank debt, which is predominantly long-term debt. This result suggests that for a given level of RATE, firms that have pledged collateral typically access less short-term debt and more bank debt, especially longer-term bank debt. Collateral is an institution that allows firms to decrease their dependence on short-term funding (in particular, on trade credit). Conversely, banks are more willing to lend long-term provided that they can get collateral. This result is consistent with Jiménez *et al* (2006) who find that a significantly large proportion of long-term loans carry collateral. The higher risk of long-term operations seems to be behind this stylized fact.

Within this model specification, the overall effect of the contemporaneous RATE term on our financing measures must now be examined in terms of the interacted term $(\gamma_3 + \phi_1 RELATIONS_{it} + \phi_2 LENGTH_{it} + \phi_3 COLLATERAL_{it})RATE_t$. We examine each endogenous variable individually. For total short-term debt (SD/TD), the coefficient on the RATE variable itself is +0.052. According to Table 3.A, the mean value of the COLLATERAL variable is

about +0.19, which when multiplied by its coefficient of -0.22 results in a contribution of -0.042, an amount that offsets roughly 80% of the direct RATE effect. With average values of RELATIONS and LENGTH at about 3.2 and 2.9 respectively, their net contributions is close of zero given their offsetting signs ((-0.012*3.2) + (+0.010*2.9)). Therefore, the net impact of the total RATE term is negligible (+0.0006). As the cost of funds increases, firms access short-term debt more. However, having more collateral or more banking relationships than average decreases this sensitivity and having longer bank relationships than average increases that sensitivity. Given that our short-term debt variable is composed roughly of 84% non-bank debt and 16% bank debt, we need to examine the results for these subcomponents to better understand the whole.[16]

As for short-term bank debt (SDB/TD), the coefficient on the RATE variable in Column 2' is -0.055. The average value of the COLLATERAL variable (+0.19) multiplied by its coefficient of -0.23 results in a contribution of approximately -0.044, bringing the sum to -0.099. With average values of RELATIONS at about 3.2 banks, the positive component of the interacted term is +0.05 (+0.017*3.2). Therefore, given that the interaction with LENGTH is not significant, the net impact of the total RATE term is about -0.045, which is a little lower than the effect of the contemporaneous value of RATE if we did not take into account the interaction variables. Hence, as the cost of funds increases, firms in general access less short-term bank debt, especially if they have collateral already pledged. However, having several bank relationships dampens this effect. In light of the results presented for total short-term debt and, in contrast to the baseline model where the coefficient on the contemporaneous RATE variable alone was not significant, these results suggest that banks may reduce access to short-term credit when rates rise and even more so for firms that have pledged collateral. However, firms that have established more banking relationships than average seem to be more able to access short-term bank funds, perhaps due to competition between bank lenders. This conclusion seems to be supported by the lack of significance of the LENGTH variable.

Turning to short-term non-bank debt (SDN/TD), the overall impact of the RATE variable is

16 Note that the average values for the firms with positive bank debt of the number of bank relationships and collateral are different from those of the whole sample (3.6 and 0.11, respectively). However, for comparability reasons we use the whole sample averages in this section of the paper. In any case, given the former values, the results change qualitatively in the sense that collateral is less important and banking competition more.

negative. The average value of COLLATERAL of about +0.19, when multiplied by its coefficient of -0.07, gives an impact of -0.013. As for the interaction with RELATIONS, since the average value of RELATIONS is 3.2, its contribution to the interacted term is -0.064 (= -0.02*3.2). Given the +0.051 coefficient on the contemporaneous RATE variable itself, the net impact of an increase in the RATE variable would be -0.026. Hence, as rates rise, firms access trade credit more (as found for total short-term debt and contrary to the baseline model), but this sensitivity is reduced if the firm has pledged more collateral than average and greatly reduced if the firm has more banking relationships than average. This result suggests that when rates rise, firms seem to avoid bank lending in favor of trade credit, unless they have a large number of banks competing for their business.

Finally, for total bank debt (BD/TD), the net effect of the interacted terms with RATE, using the average values of the explanatory variables, is +0.067 (= (+0.021*3.2) + (-0.006*2.9) + (+0.093*0.19)). When combined with the -0.099 parameter on the contemporaneous RATE variable, we have a net impact of -0.032, in contrast with the baseline model where the current RATE variable was not significant. As the cost of funds increases, firms in general access less bank financing. However, having longer bank relationships and more collateral dampens this effect greatly. Since about 70% of bank debt is long-term debt, these factors suggest that collateral and competition among banks increases long-term bank finance for non-financial firms.

All in all, the interaction results suggest the importance of including bank relationship variables as well as loan contract characteristics when external finance determinants are analyzed. Many of the results of the baseline model change when bank-firm relationship and interactions are considered.

IV.C. Robustness checks

An important component of the Informa database is the sectoral data available for Spanish firms. This information allowed us to conduct two robustness checks of our empirical results. First, we removed agricultural firms from the sample, since, given the unique and seasonal borrowing patterns typically exhibited by such firms, we thought that they might impact the results. However, the qualitative results were not affected since agricultural firms only accounted for 259 firms and

793 firm-year observations.

Second, we divided our sample into sub samples of manufacturing and services firms. Since firms in these two sectors exhibit important differences in size, tangible assets and leverage, we thought that the results might differ across the sectors. For our sample, 4,047 firms were slotted into the manufacturing sector accounting for 16,523 firm-year observations, and 20,762 firms were slotted into the services sector accounting for 46,903 firm-year observations. Note that columns (2) and (4) in Tables 6 and 7 show, again, specification problems as pointed out by the Sargan test. Therefore, we again present columns (2') and (4'), taking into account that the reduction in the number of observations is quite high. Focusing on columns (1), (2'), (3) and (4'), it can be seen that, in general, the baseline model results hold for both manufacturing or services firms as well as the model that incorporates the interaction variables. Taken together, these robustness checks suggest that industry sector is not a driving variable in explaining Spanish firm's access to external financing.

Regarding total short-term debt over total debt for manufacturing firms, ROE and SIZE seem to have a larger impact, while DEFAULT is positive but not significant (Tables 6.A and 7.A). Service-industry firms' short-term non-bank debt over total debt (Column 3) is significantly more sensitive to macroeconomic variables. When interest rates rise, the decline in trade credit is one third higher for service-industry companies, while an expansion in the economy also reduces trade credit significantly more for these companies. Looking at the interaction results (Tables 6.B and 7.B), it seems that, given that the impact of the number of bank relationships is larger on short-term financing when interest rates rise, the hold-up problem is higher for service-industry companies. In terms of collateral, there seems to be no difference between manufacturing and services firms.

V. Conclusions

In this paper, we examine access by Spanish firms to external financing, both from bank and non-bank sources (typically trade credit). Using dynamic panel data estimation techniques over a sample of about 60,000 Spanish firms during the period from 1992 to 2002, we examined four measures of external financing: the ratios of short-term debt, regardless of financing source, to total debt; short-term *bank* debt to total debt; short-term *non-bank* debt to total debt; and total bank debt

(both short-term and long-term) to total debt. Following the literature, we include both macroeconomic variables (business cycle and interest rates) and firm characteristics (size, age, profitability and risk) in our regressions.

So far, the empirical literature has focused specially on the U.S. and U.K. markets, both with highly developed markets for public equity and debt as well as private debt placements. Our paper examines Spain, where public and private debt markets were underdeveloped until very recently and were not considered as available funding alternatives for the majority of Spanish non-financial firms. We focus on small firms (i.e., firms with total assets between €100,000 and €11 million . We are not aware of any study that has such a large sample of very small companies. We take advantage of the Credit Register maintained by Banco de España to extend the empirical literature focusing on the additional impact that bank-firm relationships and loan contract characteristics (i.e., collateral) might have on access to external finance.

We find that Spanish firms are quite dependent on short-term non-bank financing, which makes up about 65 percent of total firm debt. Our results indicate that this type of financing is less sensitive to firm characteristics than short-term bank financing. However, we also find that short-term bank debt seems to be accessed more during economic expansions, which may suggest a substitution away from non-bank financing as firm conditions improve. Short-term bank debt also seems to be accessed more as funding rates rise, possibly again suggesting a substitution away from higher-priced non-bank alternatives. Industry differences (i.e. manufacturing versus services firms) do not seem to play a significant role in explaining access to external finance.

Using Credit Register data, we find that the impact of funding costs on access to external financing, whether from banks or non-banks, is affected by the nature of borrowing firms' bank relationships and collateral. In particular, as the number of banks with which a firm interacts increases, access to external finance improves as interest rates rise. Thus, more bank competition in credit markets alleviates the funding constraints of firms. Alternatively, this evidence points towards a potential hold-up problem in non-financial firms relationships with banks. Finally, we find that collateral allows a better access of firms to long-term bank loans.

In conclusion, access to external finance seems to be driven by many variables impacting the supply of credit provided by banks and demand for credit by firms. Our results for the Spanish

banking system should provide many empirical results useful to both the empirical and theoretical literature on the topic.

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Table 1.A Number of firms per year over the sample period.

Year	Number of firms	Percentage
1992	2,840	1.45
1993	4,993	2.54
1994	5,248	2.67
1995	6,832	3.48
1996	8,491	4.33
1997	9,454	4.82
1998	11,105	5.66
1999	28,399	14.47
2000	35,720	18.20
2001	43,722	22.28
2002	39,415	20.09
Total	*196,219*	*100.00*

Note: 196,219 is the total number of year-firm observations.

Table 1.B Number of years that a firm is observable.

Number of consecutive years in the sample	Number of firms	Percentage
1	19,146	32.27
2	14,510	24.46
3	8,656	14.59
4	9,889	16.67
5	1,363	2.30
6	1,047	1.76
7	1,106	1.86
8	942	1.59
9	914	1.54
10	1,045	1.76
11	708	1.19
Total	*59,326*	*100.00*

Table 2.A Descriptive statistics of the non-transformed endogenous variables.

SD/TD stands for the ratio of short-term debt, regardless of financing source, to total debt; where short-term debt is defined as an outstanding debt obligation with a maturity of less than one year. SDB/TD is the ratio of short-term bank debt to total debt. SDN/TD is defined as the ratio of short-term non-bank debt to total debt. Finally, BD/TD denotes the ratio of total bank debt to total debt.

Statistics	**SD/TD**	**SDB/TD**	**SDN/TD**	**BD/TD**
Number of observations	*196,219*	*196,219*	*196,219*	*196,219*
Mean	0.77	0.12	0.65	0.42
Standard dev.	0.22	0.18	0.24	0.24
Minimum	0.00	0.00	0.00	0.00
1st percentile	0.12	0.00	0.06	0.00
5th percentile	0.32	0.00	0.20	0.06
25th percentile	0.64	0.00	0.47	0.24
Median	0.84	0.00	0.67	0.41
75th percentile	0.96	0.22	0.85	0.59
95th percentile	1.00	0.51	0.99	0.84
99th percentile	1.00	0.72	1.00	0.95
Maximum	1.00	1.00	1.00	1.00

Table 2.B Correlation matrix of endogenous variables.

Matrix of simple correlation coefficients amongst the four financing measures that we use as endogenous variables. see Table 2.B for a definition of the variables included in the Table.

(Number of observ. = 196,219)	**SD/TD**	**SDB/TD**	**SDN/TD**	**BD/TD**
SD/TD	1.00			
SDB/TD	0.28	1.00		
SDN/TD	0.70	-0.49	1.00	
BD/TD	-0.39	0.34	-0.60	1.00

Table 3.A Descriptive statistics of the explanatory variables from Informa-SABI and CIR.

The figures correspond to the incomplete panel database already filtered and having removed observations corresponding to the upper and lower 5% tails of several of our variables. The first set of explanatory variables is related to accounting variables drawn from the Informa-SABI dataset. LN_SIZE is measured as the natural logarithm of firm total assets in thousand of euros. The second variable, LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. The TANGIBLE ASSETS variable stands for the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is a measure of firm leverage which we measure as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. Information on firms' banking relationships, derived from the CIR database, includes: N. OF BANK. RELAT., which stands for the number of banking relationships that each firm has. LENGTH OF BANK. RELAT. is the weighted length of the firms' banking relationships, using as weights the loan percentages in relation to firm's total bank financing. COLLATERAL is constructed as the weighted percentage of the borrower's outstanding loans covered by pledged collateral; using the same weighting system as before.

Statistics	***LN_SIZE***	***LN_AGE***	***TANGIBLE ASSETS***	***ROE***	***GEARING***	***LIQUIDITY***	***N. OF BANK. RELAT.***	***LENGTH OF BANK. RELAT.***	***COLLATERAL***
N. observ.	196,219	196,219	192,577	195,135	195,389	184,555	196,219	196,219	196,219
Mean	6.52	1.90	25.65	14.99	6.78	0.08	3.16	2.94	0.19
Min.	4.41	0.00	0.29	-50.00	0.47	0.00	1.00	0.00	0.00
5th perc.	4.81	0.69	1.72	-9.38	0.84	0.00	1.00	0.00	0.00
Median	6.42	1.95	20.45	12.127	3.95	0.05	3.00	2.59	0.00
95th perc.	8.59	3.17	66.85	50.00	23.86	0.27	8.00	7.04	0.93
Max.	9.34	4.69	80.36	75.00	44.15	0.40	29.00	10.00	1.00

Table 3.B Minimum and maximum values before dropping observations below 5th and up the 95th percentile.

Given the really extreme values of SIZE, TANGIBLE ASSETS, ROE, GEARING and LIQUIDITY, these variables are the ones according to which we remove the upper and lower 5% tails. See Table 3.A for a definition of the variables included in the Table.

Statistics	***SIZE***	***TANGIBLE ASSETS***	***ROE***	***GEARING***	***LIQUIDITY***
Min.	0	-13.24	-205,950	0	-10
Max.	18.15	7922.71	513,920	45,190	314

Table 4. Baseline specification.

The empirical baseline specification corresponds to the estimation of equation (1) by GMM. In order to get a convenient specification and test results, we found that the only regressor to be treated as endogenous is ROE; the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. Column 1 refers to the estimation of model (1) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' dropping observations that have no bank debt.

Robust estimators	**Column 1 SD/TD**	**Column 2 SDB/TD**	**Column 2' SDB/TD**	**Column 3 SDN/TD**	**Column 4 BD/TD**	**Column 4' BD/TD**
N. of observ.	*69,822*	*69,822*	*12,036*	*69,822*	*69,822*	*12,036*
N. of groups	*26,663*	*26,663*	*5,604*	*26,663*	*26,663*	*5,604*
ℓy_{t-1}	0.288	0.166	0.230	0.174	0.255	0.226
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.618	-0.028	-0.485	-0.276	-0.026	-0.367
	(0.000)	(0.795)	(0.000)	(0.000)	(0.469)	(0.000)
LN_AGE_t	0.545	0.853	0.298	0.035	-0.135	0.273
	(0.000)	(0.000)	(0.002)	(0.608)	(0.007)	(0.004)
$TANGIBLE\_ASSETS_t$	-0.037	-0.004	0.000	-0.026	0.021	0.020
	(0.000)	(0.056)	(0.858)	(0.000)	(0.000)	(0.000)
ROE_t	-0.010	-0.008	-0.011	-0.001	-0.002	-0.007
	(0.000)	(0.113)	(0.000)	(0.570)	(0.251)	(0.007)
$GEARING_t$	-0.015	-0.020	-0.024	0.002	-0.012	-0.024
	(0.000)	(0.052)	(0.000)	(0.532)	(0.000)	(0.000)
$LIQUIDITY_t$	-0.852	-2.406	-1.010	-0.116	-0.899	-0.395
	(0.000)	(0.000)	(0.000)	(0.290)	(0.000)	(0.030)
$DEFAULT_{t-1}$	0.108	-0.025	-0.009	0.116	-0.061	-0.110
	(0.025)	(0.884)	(0.931)	(0.059)	(0.141)	(0.240)
$RATE_t$	-0.007	0.094	0.006	-0.038	-0.002	-0.004
	(0.277)	(0.000)	(0.437)	(0.000)	(0.580)	(0.627)
$RATE_{t-1}$	-0.042	0.108	0.018	-0.040	-0.010	0.007
	(0.000)	(0.000)	(0.029)	(0.000)	(0.025)	(0.373)
IP_t	-0.013	0.034	0.016	-0.015	0.001	0.009
	(0.000)	(0.000)	(0.000)	(0.000)	(0.628)	(0.021)
IP_{t-1}	-0.012	0.009	0.007	-0.008	0.002	0.010
	(0.000)	(0.149)	(0.013)	(0.000)	(0.197)	(0.002)
Sargan (2 steps)	*0.407*	*0.000*	*0.271*	*0.308*	*0.049*	*0.967*
Autocov. of order 2	*0.923*	*0.000*	*0.362*	*0.039*	*0.249*	*0.654*

Note: P-value in parentheses.

Table 5. Interacted specification.

The empirical baseline specification corresponds to the estimation of model (2) by GMM. We treat ROE as endogenous while the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. The additional regressors with respect to the baseline model (equation (1)) are the interaction of RATE with the number of banking relations (RATE_RELATIONS); the interaction of RATE with the average weighted length of the firm's banking relations (RATE_LENGTH); and the interaction of RATE with the weighted percentage of the borrower's outstanding loans covered by pledged collateral (RATE_COLLATERAL). Column 1 refers to the estimation of model (2) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' having get rid off observations that have no bank debt.

Robust estimators	**Column 1 SD/TD**	**Column 2 SDB/TD**	**Column 2' SDB/TD**	**Column 3 SDN/TD**	**Column 4 BD/TD**	**Column 4' BD/TD**
N. of observ.	*69,822*	*69,822*	*12,036*	*69,822*	*69,822*	*12,036*
N. of groups	*26,663*	*26,663*	*5,604*	*26,663*	*26,663*	*5,604*
ℓy_{t-1}	0.275	0.153	0.186	0.167	0.208	0.179
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.512	0.001	-0.461	-0.208	-0.134	-0.438
	(0.000)	(0.993)	(0.000)	(0.000)	(0.000)	(0.000)
LN_AGE_t	0.468	0.471	0.189	0.143	-0.656	0.231
	(0.000)	(0.007)	(0.048)	(0.045)	(0.000)	(0.014)
$TANGIBLE\_ASSETS_t$	-0.032	0.002	0.004	-0.024	0.019	0.018
	(0.000)	(0.378)	(0.016)	(0.000)	(0.000)	(0.000)
ROE_t	-0.008	-0.009	-0.011	0.001	-0.002	-0.010
	(0.000)	(0.087)	(0.000)	(0.787)	(0.166)	(0.000)
$GEARING_t$	-0.010	-0.019	-0.023	0.006	-0.012	-0.027
	(0.014)	(0.058)	(0.000)	(0.132)	(0.000)	(0.000)
$LIQUIDITY_t$	-0.742	-2.108	-0.877	-0.124	-0.846	-0.441
	(0.000)	(0.000)	(0.000)	(0.250)	(0.000)	(0.012)
$DEFAULT_{t-1}$	0.075	0.022	-0.011	0.081	-0.019	-0.091
	(0.126)	(0.896)	(0.913)	(0.191)	(0.647)	(0.320)
$RATE_t*RELATIONS_t$	-0.012	0.040	0.017	-0.020	0.032	0.021
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_t*LENGTH_t$	0.010	0.014	0.003	0.000	0.025	-0.006
	(0.000)	(0.000)	(0.143)	(0.880)	(0.000)	(0.010)
$RATE_t*COLLATERAL_t$	-0.220	-0.322	-0.226	-0.070	0.085	0.093
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_t$	0.052	-0.043	-0.055	0.051	-0.193	-0.099
	(0.000)	(0.036)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_{t-1}$	-0.029	0.115	0.017	-0.035	-0.011	-0.001
	(0.000)	(0.000)	(0.033)	(0.000)	(0.008)	(0.935)
IP_t	-0.012	0.037	0.017	-0.016	-0.001	0.010
	(0.000)	(0.000)	(0.000)	(0.000)	(0.458)	(0.006)
IP_{t-1}	-0.012	0.006	0.006	-0.007	-0.004	0.009
	(0.000)	(0.301)	(0.031)	(0.001)	(0.010)	(0.003)
Sargan (2 steps)	*0.710*	*0.000*	*0.422*	*0.234*	*0.000*	*0.944*
Autocov. of order 2	*0.833*	*0.000*	*0.340*	*0.107*	*0.738*	*0.952*

Note: P-value in parentheses.

Table 6.A Baseline specification; manufacturing industry only.

The empirical baseline specification corresponds to the estimation of equation (1) by GMM. In order to get a convenient specification and test results, we found that the only regressor to be treated as endogenous is ROE; the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. Column 1 refers to the estimation of model (1) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' dropping observations that have no bank debt. We only include manufacturing and quarrying firms.

Robust estimators	***Column 1 SD/TD***	***Column 2 SDB/TD***	***Column 2' SDB/TD***	***Column 3 SDN/TD***	***Column 4 BD/TD***	***Column 4' BD/TD***
N. of observ.	*16,523*	*16,523*	*3,110*	*16,523*	*16,523*	*3,110*
N. of groups	*4,047*	*4,047*	*972*	*4,047*	*4,047*	*972*
ℓy_{t-1}	0.291	0.135	0.250	0.111	0.253	0.229
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.856	-0.148	-0.578	-0.251	0.067	-0.437
	(0.000)	(0.522)	(0.000)	(0.009)	(0.354)	(0.002)
LN_AGE_t	0.508	0.673	0.422	0.115	-0.419	0.214
	(0.003)	(0.093)	(0.024)	(0.410)	(0.000)	(0.248)
$TANGIBLE\_ASSETS_t$	-0.035	-0.010	0.005	-0.022	0.020	0.020
	(0.000)	(0.061)	(0.147)	(0.000)	(0.000)	(0.000)
ROE_t	-0.016	-0.001	-0.007	-0.005	-0.007	-0.008
	(0.002)	(0.936)	(0.126)	(0.297)	(0.022)	(0.091)
$GEARING_t$	-0.017	-0.036	-0.025	0.009	-0.037	-0.042
	(0.153)	(0.206)	(0.020)	(0.347)	(0.000)	(0.004)
$LIQUIDITY_t$	-0.806	-2.743	-1.223	0.117	-0.815	-0.514
	(0.002)	(0.000)	(0.002)	(0.631)	(0.000)	(0.252)
$DEFAULT_{t-1}$	0.013	-0.090	0.019	0.044	-0.074	-0.111
	(0.826)	(0.761)	(0.893)	(0.595)	(0.187)	(0.378)
$RATE_t$	-0.010	0.085	0.012	-0.030	-0.014	0.005
	(0.389)	(0.002)	(0.352)	(0.004)	(0.036)	(0.665)
$RATE_{t-1}$	-0.044	0.119	0.030	-0.038	0.003	0.017
	(0.000)	(0.000)	(0.036)	(0.001)	(0.659)	(0.272)
IP_t	-0.011	0.019	0.023	-0.008	0.003	0.018
	(0.042)	(0.136)	(0.000)	(0.135)	(0.256)	(0.007)
IP_{t-1}	-0.014	0.014	0.014	-0.007	0.010	0.014
	(0.001)	(0.233)	(0.005)	(0.087)	(0.000)	(0.012)
Sargan (2 steps)	*0.236*	*0.002*	*0.228*	*0.190*	*0.508*	*0.993*
Autocov. of order 2	*0.324*	*0.318*	*0.803*	*0.014*	*0.050*	*0.692*

Note: P-value in parentheses.

Table 6.B Interacted specification; manufacturing industry only.

The empirical baseline specification corresponds to the estimation of model (2) by GMM. We treat ROE as endogenous while the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. The additional regressors with respect to the baseline model (equation (1)) are the interaction of RATE with the number of banking relations (RATE_RELATIONS); the interaction of RATE with the average weighted length of the firm's banking relations (RATE_LENGTH); and the interaction of RATE with the weighted percentage of the borrower's outstanding loans covered by pledged collateral (RATE_COLLATERAL). Column 1 refers to the estimation of model (2) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' having get rid off observations that have no bank debt. We only include manufacturing and quarrying firms.

Robust estimators	***Column 1 SD/TD***	***Column 2 SDB/TD***	***Column 2' SDB/TD***	***Column 3 SDN/TD***	***Column 4 BD/TD***	***Column 4' BD/TD***
N. of observ.	*16,523*	*16,523*	*3,110*	*16,523*	*16,523*	*3,110*
N. of groups	*4,047*	*4,047*	*972*	*4,047*	*4,047*	*972*
ℓy_{t-1}	0.281	0.126	0.215	0.106	0.214	0.180
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.778	-0.174	-0.593	-0.203	-0.011	-0.511
	(0.000)	(0.482)	(0.000)	(0.035)	(0.876)	(0.000)
LN_AGE_t	0.415	0.279	0.149	0.228	-0.838	0.158
	(0.016)	(0.494)	(0.431)	(0.110)	(0.000)	(0.395)
$TANGIBLE\_ASSETS_t$	-0.031	-0.005	0.006	-0.021	0.019	0.018
	(0.000)	(0.360)	(0.072)	(0.000)	(0.000)	(0.000)
ROE	-0.014	-0.004	-0.008	-0.003	-0.008	-0.011
	(0.005)	(0.768)	(0.072)	(0.555)	(0.008)	(0.017)
$GEARING_t$	-0.014	-0.040	-0.025	0.013	-0.039	-0.045
	(0.248)	(0.151)	(0.022)	(0.182)	(0.000)	(0.002)
$LIQUIDITY_t$	-0.712	-2.505	-1.130	0.092	-0.732	-0.660
	(0.006)	(0.000)	(0.002)	(0.704)	(0.000)	(0.124)
$DEFAULT_{t-1}$	-0.036	-0.071	-0.015	0.014	-0.048	-0.124
	(0.564)	(0.809)	(0.896)	(0.867)	(0.382)	(0.266)
$RATE_t*RELATIONS_t$	-0.007	0.035	0.016	-0.014	0.023	0.019
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_t*LENGTH_t$	0.009	0.008	0.011	0.000	0.016	-0.005
	(0.004)	(0.202)	(0.002)	(0.958)	(0.000)	(0.117)
$RATE_t*COLLATERAL_t$	-0.235	-0.277	-0.144	-0.056	0.042	0.088
	(0.000)	(0.000)	(0.000)	(0.001)	(0.008)	(0.007)
$RATE_t$	0.028	-0.052	-0.075	0.038	-0.150	-0.081
	(0.094)	(0.148)	(0.000)	(0.015)	(0.000)	(0.000)
$RATE_{t-1}$	-0.031	0.112	0.027	-0.030	-0.003	0.003
	(0.009)	(0.001)	(0.046)	(0.011)	(0.675)	(0.826)
IP_t	-0.011	0.020	0.022	-0.008	0.001	0.019
	(0.043)	(0.115)	(0.000)	(0.115)	(0.629)	(0.003)
IP_{t-1}	-0.014	0.009	0.011	-0.006	0.005	0.014
	(0.001)	(0.425)	(0.026)	(0.158)	(0.078)	(0.010)
Sargan (2 steps)	*0.274*	*0.001*	*0.668*	*0.157*	*0.069*	*0.978*
Autocov. of order 2	*0.350*	*0.032*	*0.873*	*0.073*	*0.581*	*0.905*

Note: P-value in parentheses.

Table 7.A Baseline specification; services sector only.

The empirical baseline specification corresponds to the estimation of equation (1) by GMM. In order to get a convenient specification and test results, we found that the only regressor to be treated as endogenous is ROE; the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. Column 1 refers to the estimation of model (1) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' dropping observations that have no bank debt. We only include services firms.

Robust estimators	***Column 1 SD/TD***	***Column 2 SDB/TD***	***Column 2' SDB/TD***	***Column 3 SDN/TD***	***Column 4 BD/TD***	***Column 4' BD/TD***
N. of observ.	*46,903*	*46,903*	*8,082*	*46,903*	*46,903*	*8,082*
N. of groups	*20,762*	*20,762*	*4,317*	*20,762*	*20,762*	*4,317*
ℓy_{t-1}	0.296	0.183	0.229	0.203	0.246	0.227
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.633	-0.115	-0.535	-0.285	-0.052	-0.400
	(0.000)	(0.362)	(0.000)	(0.000)	(0.223)	(0.000)
LN_AGE_t	0.564	1.055	0.244	-0.019	-0.063	0.249
	(0.000)	(0.000)	(0.032)	(0.817)	(0.282)	(0.027)
$TANGIBLE\_ASSETS_t$	-0.038	-0.003	0.001	-0.028	0.022	0.023
	(0.000)	(0.202)	(0.748)	(0.000)	(0.000)	(0.000)
ROE_t	-0.009	-0.008	-0.012	-0.001	0.000	-0.007
	(0.000)	(0.204)	(0.000)	(0.721)	(0.839)	(0.032)
$GEARING_t$	-0.014	-0.013	-0.025	0.001	-0.008	-0.021
	(0.003)	(0.275)	(0.000)	(0.821)	(0.014)	(0.000)
$LIQUIDITY_t$	-0.889	-2.039	-0.761	-0.295	-0.771	-0.254
	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	(0.217)
$DEFAULT_{t-1}$	0.119	0.267	-0.017	0.049	0.003	-0.154
	(0.076)	(0.224)	(0.899)	(0.557)	(0.961)	(0.212)
$RATE_t$	-0.016	0.110	-0.010	-0.044	0.000	-0.013
	(0.060)	(0.000)	(0.373)	(0.000)	(0.959)	(0.201)
$RATE_{t-1}$	-0.049	0.088	0.007	-0.040	-0.015	-0.004
	(0.000)	(0.000)	(0.528)	(0.000)	(0.011)	(0.685)
IP_t	-0.016	0.041	0.012	-0.020	0.001	0.003
	(0.000)	(0.000)	(0.024)	(0.000)	(0.720)	(0.506)
IP_{t-1}	-0.012	0.002	0.004	-0.008	0.000	0.006
	(0.000)	(0.776)	(0.273)	(0.010)	(0.866)	(0.109)
Sargan (2 steps)	*0.270*	*0.047*	*0.719*	*0.400*	*0.022*	*0.752*
Autocov. of order 2	*0.367*	*0.000*	*0.347*	*0.320*	*0.399*	*0.7601*

Note: P-value in parentheses.

Table 7.B Interacted specification; services sector only.

The empirical baseline specification corresponds to the estimation of model (2) by GMM. We treat ROE as endogenous while the rest of the explanatory variables are treated as strictly exogenous. ℓy_{t-1} is the lag of the endogenous variable. LN_SIZE is the natural logarithm of firm total assets in thousand of euros. LN_AGE, is the natural logarithm of (1 + firm age); where the firm age is the years since the firm was set up. TANGIBLE ASSETS is the ratio of firm tangible assets to total assets. ROE is the ratio of firm profits to equity capital, calculated as the ratio of annual income to shareholders' equity. GEARING is measured as the ratio of total debt to shareholder equity. LIQUIDITY is the ratio of liquid assets to current liabilities. DEFAULT is a binary variable equal to one if 5% of the firm's CIR loans were in default over the previous year. IP stands for the year-over-year growth rate of the industrial production index. Finally, RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the Spanish interbank market. The additional regressors with respect to the baseline model (equation (1)) are the interaction of RATE with the number of banking relations (RATE_RELATIONS); the interaction of RATE with the average weighted length of the firm's banking relations (RATE_LENGTH); and the interaction of RATE with the weighted percentage of the borrower's outstanding loans covered by pledged collateral (RATE_COLLATERAL). Column 1 refers to the estimation of model (2) where the endogenous variable is the log-odds transformation of the ratio of short-term debt to total debt (SD/TD). In column 2 the endogenous variable is SDB/TD, the ratio of short-term bank debt overt total debt. Column 2' corresponds to the same estimation as column 2 but dropping the zero-observations of SDB/TD. Column 3 shows the estimates when the endogenous variable is the ratio of short-term non-bank debt to total debt (SDN/TD). Finally, columns 4 and 4' show the estimates obtained when the endogenous variable is the transformed ratio of bank debt over total debt (BD/TD); in column 4' having get rid off observations that have no bank debt. We only include services firms.

Robust estimators	***Column 1 SD/TD***	***Column 2 SDB/TD***	***Column 2' SDB/TD***	***Column 3 SDN/TD***	***Column 4 BD/TD***	***Column 4' BD/TD***
N. of observ.	*46,903*	*46,903*	*8,082*	*46,903*	*46,903*	*8,082*
N. of groups	*20,762*	*20,762*	*4,317*	*20,762*	*20,762*	*4,317*
ℓy_{t-1}	0.283	0.169	0.179	0.195	0.195	0.182
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LN_SIZE_t	-0.513	-0.067	-0.493	-0.205	-0.180	-0.484
	(0.000)	(0.595)	(0.000)	(0.000)	(0.000)	(0.000)
LN_AGE_t	0.482	0.663	0.213	0.090	-0.648	0.212
	(0.000)	(0.001)	(0.066)	(0.299)	(0.000)	(0.063)
$TANGIBLE\_ASSETS_t$	-0.033	0.004	0.005	-0.027	0.020	0.019
	(0.000)	(0.181)	(0.008)	(0.000)	(0.000)	(0.000)
ROE_t	-0.007	-0.008	-0.012	0.000	0.000	-0.010
	(0.005)	(0.199)	(0.000)	(0.842)	(0.821)	(0.004)
$GEARING_t$	-0.009	-0.011	-0.024	0.004	-0.009	-0.024
	(0.057)	(0.329)	(0.000)	(0.394)	(0.009)	(0.000)
$LIQUIDITY_t$	-0.782	-1.730	-0.621	-0.299	-0.739	-0.276
	(0.000)	(0.000)	(0.001)	(0.018)	(0.000)	(0.162)
$DEFAULT_{t-1}$	0.097	0.323	-0.009	0.017	0.050	-0.116
	(0.156)	(0.137)	(0.944)	(0.835)	(0.363)	(0.346)
$RATE_t*RELATIONS_t$	-0.015	0.043	0.017	-0.023	0.037	0.023
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_t*LENGTH_t$	0.012	0.018	-0.000	0.000	0.030	-0.006
	(0.000)	(0.000)	(0.879)	(0.911)	(0.000)	(0.026)
$RATE_t*COLLATERAL_t$	-0.205	-0.334	-0.252	-0.066	0.104	0.099
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_t$	0.050	-0.029	-0.058	0.053	-0.219	-0.115
	(0.000)	(0.285)	(0.000)	(0.000)	(0.000)	(0.000)
$RATE_{t-1}$	-0.037	0.101	0.010	-0.037	-0.014	-0.010
	(0.000)	(0.000)	(0.361)	(0.000)	(0.013)	(0.329)
IP_t	-0.014	0.045	0.015	-0.020	-0.002	0.004
	(0.000)	(0.000)	(0.003)	(0.000)	(0.444)	(0.400)
IP_{t-1}	-0.011	0.001	0.004	-0.007	-0.007	0.005
	(0.000)	(0.925)	(0.231)	(0.026)	(0.001)	(0.165)
Sargan (2 steps)	*0.461*	*0.029*	*0.876*	*0.477*	*0.000*	*0.695*
Autocov. of order 2	*0.233*	*0.001*	*0.361*	*0.576*	*0.588*	*0.953*

Note: P-value in parentheses.

Graph 1. Macroeconomics variables over the sample period.

RATE is the annual average of a monthly index of interest rates paid on three-month deposits in the interbank market; IP stands for the year-over-year, real growth rate in Industrial Production; and GDP is the year-over-year GDP growth rate.