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THE NUMBER OF BANK RELATIONSHIPS, BORROWING COSTS AND BANK COMPETITION

Diana Bonfim
Qinglei Dai
Francesco Franco

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Please address correspondence to
Diana Bonfim
Economics and Research Department
Banco de Portugal, Av. Almirante Reis no. 71, 1150-012 Lisboa, Portugal;
Tel.: 351 21 313 0865, dbonfim@bportugal.pt

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The number of bank relationships, borrowing costs and bank competition.*

Diana Bonfim
Banco de Portugal and ISEG-UTL

Qinglei Dai
Universidade Nova de Lisboa

Francesco Franco
Universidade Nova de Lisboa

Abstract

This paper provides new evidence on the effect of bank competition on the cost of lending, in an environment of reduced information asymmetries between firms and banks. We construct a simple model linking the number of bank relationships, the cost of lending and bank competition. Banks are exposed to more competition if the firm has many ongoing bank relationships that improve her threat point when negotiating borrowing costs. Moreover, increased competition in the banking sector might mitigate (substitute) or amplify (complement) this effect. Using a unique data set from Portugal, we find that when a firm borrows from one additional bank, the interest rate on bank loans for this firm becomes 9 to 20 basis points lower on average. In addition, we find that when local bank competition is more intense firms can benefit more from simultaneously engaging in several banking relationships, hence providing evidence of complementarity between competition and the number of bank relationships. However, we do not observe these effects for the smallest and youngest firms.

JEL Codes: G21, G32

Keywords: banks, relationship banking, borrowing costs, bank competition.

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1 Introduction

Information asymmetries between borrowers and lenders play a crucial role in the banking literature. However, the existence of information sharing mechanisms may have important implications in reducing the asymmetric information problem in a borrower-lender relationship.[1] This paper studies a credit market with a public mandatory credit registry designed to facilitate information sharing. We first investigate the influence of the number of banks that a firm borrows from on the cost of loans in this environment. Then we focus our analysis on the indirect effect of credit market competition on the interaction between the number of bank relationships[2] and interest rates.

We explore an alternative framework to the classic asymmetric information model to explain the nexus between the number of bank relationships, competition and the cost of loans. To organize our thoughts, we construct a model in which a firm's cost of borrowing is the outcome of a negotiation between the firm manager and the banker. In our setup, the number of ongoing bank relationships the firm has plays the role of an outside option of funding and favorably affects the position of the manager in the negotiation. An increase in the number of bank relationships decreases the cost of loans. The model also shows that a change in the degree of bank competition can improve or lessen the impact of the number of bank relationships. The latter outcome will depend on the degree of complementarity between the number of bank relationships and the tightness of the credit market. On one hand, when there are more banks in the market it might be easier to switch banks even without maintaining ongoing bank relationships. On the other hand, in a more competitive market the threat to switch to another bank becomes

[1] See for instance Brown, Jappelli and Pagano (2009) and Brown and Zehnder (2007).

[2] In this study, the number bank of relationships corresponds to the number of banks a firm borrows from.

more credible. In the former case, the tightness of the credit market and the number of bank relationships are substitutes, while in the latter case they are complements. In the remainder of the paper we provide empirical evidence for the predictions of the model using Portuguese data.

The Portuguese banking sector provides an excellent laboratory for such an exercise. First, in Portugal, like in some other countries (for example, France, Spain and Italy), the Central Credit Register allows financial institutions to share crucial information about their customers. This information sharing mechanism is designed to reduce ex-ante information asymmetries between borrowers and lenders. The Portuguese Central Credit Register provides a comprehensive panel dataset that includes loan information on all loans above 50 euros. It contains firm level data on the total debt to credit institutions, the amount of debt overdue and the repayment record of the firm, regardless of the firm size. Second, Portugal has historically been a bank-based economy. Most external funding of non-financial corporations is provided by banks, with only a very small percentage of the economy raising capital in public markets.[3] Third, during the past decade, which coincides with our dataset, the Portuguese banking sector has experienced remarkable changes due to entries, mergers and acquisitions, providing sufficient variation in credit market conditions for our empirical analysis.

Our first observation is that on average a Portuguese firm borrows from three banks, which is a relatively high number of relationships by international standards, but typical among countries with the French law system, as reported for instance by Ongena and

[3]Bank loans represent almost 60 per cent of Portuguese firms external funding, whereas trade credit represents almost 20 per cent, as shown in Antão and Bonfim (2009).

Smith (2000). Large firms typically borrow from six banks or more, while the smallest firms in the economy borrow from two banks on average.[4]

We obtain several interesting results. First, the firm's interest rate on bank loans falls as the firm borrows from more banks, controlling for relevant firm characteristics. When a firm borrows from one additional bank, the interest rate on bank loans for this firm becomes 9 to 20 basis points (bps) lower, on average. This pattern holds for all firms except for micro and young firms, for which the impact of the number of banks on the cost of loans is never significantly different from zero. The first finding is similar to what is estimated for Italy, another country with a public mandatory credit register, where the cost of bank loans is reduced by 1 to 13 bps per additional relationship (e.g Conigliani, Ferri, and Generale (1997), D'Auria, Foglia, and Reedtz (1999), Ferri and Messori (2000)). These results are different from those found in the U.S., where the cost of bank loans typically increases with the number of bank relationships (e.g. Petersen and Rajan (1994) and Hao (2003)).[5]

Second, we find that the negative relationship between the number of banks and the cost of loans is amplified by the degree of local market concentration. The effect of the number of bank relationships on bank interest rates is stronger in areas with more intense local bank competition. Again, this pattern holds for all firms except for micro and young firms. The results for the micro and young firms suggest they do not benefit from diversifying their pool of lenders in terms of borrowing costs, possibly because of persisting information opaqueness despite the existence of the credit registry.

[4]The definition of firm size is based on the European Commission recommendation of 6 May 2003. Micro firms are defined as those with fewer than 10 employees and less than 2 million euros of sales volume. Small firms are those with fewer than 50 employees and less than 10 million euros of sales volume. Medium firms are those with fewer than 250 employees and less than 50 million euros of sales volume. All remaining firms are considered to be large firms.

[5]However, in Spain, Hernandez-Canovas and Martinez-Solano (2006) observe a positive relationship between the number of lending banks and interest rates.

This paper is related to various strands of literature. First there are many studies that discuss the incentives to keep multiple bank relationships.[6] Second, and closer to the focus of this paper, there is an ongoing debate regarding the influence of the number of bank relationships on the cost of borrowing. On one hand, Diamond's (1984) classical delegated monitoring theory argues that exclusive lending relationships minimize loan rates by avoiding duplication of monitoring costs. On the other hand, other authors predict that firms can reduce interest rates by borrowing from several banks. For example, Sharpe (1990) and Rajan (1992) hypothesize that in an exclusive bank relationship the informationally privileged bank might exploit its bargaining power over the firm and extract rents from loan contracts. This implies that micro and small firms having only a single lender should pay a higher cost of borrowing. More recently, Degryse and Ongena (2008) survey empirical findings from different countries and report that both the magnitude and the direction of the effect of the number of banks on interest rates change across countries.

Finally, our paper is also related to the strand of literature on the effect of credit market competition on lending relationships and borrowing costs. For example, Petersen and Rajan (1995) suggest that for financially distressed firms it is cheaper and easier to borrow from banks in a less competitive credit market. When banks can break even

[6] In addition to those who argue that multiple bank relationships may result in lower funding costs (e.g. Sharpe (1990) and Rajan (1992)), Berger and Udell (1998) argue that the refusal of credit from the firm's only lender may send a negative signal to the market, thus making the exclusive bank relationship undesirable. Detragiache, Garella, and Guiso (2000) show that this is especially true in economies with high bankruptcy costs and less fragile banking sectors. Bolton and Scharfstein (1996) consider that multiple bank relationships might prevent the firm manager from strategic defaulting by holding up the renegotiation process. Dewatripont and Maskin (1995), Holmstrom and Tirole (1997), and Carletti, Cerasi, and Daltung (2007) predict that multiple bank relationships will occur when banks face financial constraints or monitoring costs. Carletti et al. (2007) also suggest that multiple bank relationships allow banks to diversify their lending risk. They predict that banks are more attracted to multiple-bank lending when the bank has lower equity, when the cost of monitoring is high, and when the profitability of the firm is low. Finally, in a recent paper, Ioannidou and Ongena (2008) show that when firms change banks they benefit initially from lower interest rates. However, as time goes by, hold-up effects gradually emerge.

intertemporally, they are able to charge lower rates up-front, anticipating higher returns in the future when information asymmetry dissolves. However, market competition forces banks to break even in every period and, as a result, relationship banking becomes less feasible, leading to high interest rates and limited access to credit for financially distressed (young and low quality) firms. On the contrary, Boot and Thakor (2000) posit that low quality firms will always rely on relationship intensive lending, while higher quality firms can borrow at lower costs through transaction-based lending. When competition in credit markets is more intense, relationship lending becomes more important to banks, as they are able to extract rents from these relationships, shielding themselves from price competition. In our setting, a change in the degree of competition can improve or lessen the impact of relationship lending on the cost of loans, thus including the predictions of both Petersen and Rajan (1995) and Boot and Thakor (2000). Empirically we find that the interaction between market competition and the number of bank relationships lowers significantly the cost of loans across all firm sizes, except for micro and young firms. Our findings do not support (but do not reject) the hypothesis presented by Petersen and Rajan (1995), since we do not observe the predicted positive linkage between competition and interest rates for the smallest and youngest firms in our sample. Our results can be consistent with the predictions of Boot and Thakor (2000). These authors argue that micro and young firms who are more likely to be engaged in relationship banking benefit less from price competition, and that large and mature firms are more likely to use transaction-based multiple lending in competitive markets.

Our paper proceeds as follows. In Section 2 we present a model of bank relationships and bank competition. In Section 3 we describe the datasets used and present some relevant summary statistics, and in Section 4 we discuss the results obtained in a re-

gression analysis framework, evaluating how the number of bank relationships influences borrowing costs. In Section 5 we test how bank competition affects the impact of the choice of the number of bank relationships on loan interest rates. In Section 6 we present the results of some robustness tests. Finally, Section 7 summarizes our main findings.

2 The model

Our model formally abstracts from the conventional asymmetric information environment that is widely used to characterize relationship banking and focuses on a matching-bargaining framework. We think of the cost of a loan for a firm as the outcome of a negotiation between the firm manager and the banker. Our modeling choice is motivated by the existence of the Central Credit Register that is designed to reduce information asymmetries between financial institutions and borrowers. In our setup, the stock of existing bank relationships a firm has favorably affects the position of the firm during the negotiation. Furthermore, at a more systemic level, banking deregulation reduces rents and changes the contractual power of players. Banking sector deregulation therefore affects not only the position of firms at the bargaining table, but also the market outcome in terms of economic efficiency. To study these issues we build a model based on two central assumptions: a frictional credit market, which determines the size of rents; and a bargaining mechanism to determine the price of funding or how the rents are distributed between the firms and the banks.

The frictional credit market is composed of two elements[7]. The first is a search environment to make the contact between firms and banks non-trivial. The second is imperfect competition in the banking sector. To model the contact between a firm and

[7]This friction could also be interpreted as the non-modeled asymmetric information costs.

a bank we follow a standard search model[8]. We focus on the steady state solution. The specifics of the model are as follows.

Time is infinite and discrete. There are m firms indexed by i and n^b banks indexed by j. A firm i wants to borrow I_i from a bank j to initiate a project that has a flow return of z_i. Once the firm finds one bank, the firm value function of accepting a deal with that bank j, $J^A_{i,j}$, is:

$$J^A_{i,j} = z_i - r^L_{i,j} I_i + \beta \left((1 - \sigma_i) J^{A\prime}_{i,j} + \sigma_i J^{D\prime}_i \right),$$

where z_i is the per period cash flow from the investment, $r^L_{i,j}$ the interest rate on the loan, β a discount factor, σ_i the probability of default, and J^D_i the value of default. We have omitted time subscripts, and a prime denotes next period. For simplicity, we do not explicitly model default and simply assume an exogenous value of default for each firm J^D_i. If the two parties do not reach an agreement on the price of the loan, the value for the firm of walking away from the deal and looking for another bank in the following period is:

$$J^R_i = -c_i + \beta(f(\theta, n^r_i) J^{A\prime}_i + (1 - f(\theta, n^r_i)) J^{R\prime}_i),$$

where c_i is the cost per period of postponing, J^A_i is the expected value of $J^A_{i,j}$ and $f(\theta, n^r_i)$ is the probability of finding a bank in the next period to negotiate a deal, which depends positively on an aggregate measure of credit market tightness θ and on n^r_i, the number of relationships the firm has with different banks. The probability of finding a bank $f(\theta, n^r_i)$, or more appropriately the contact rate between a firm and a bank, corresponds to the search friction, which plays a central role in the model.

[8] See Diamond (1982) and Mortensen and Pissarides (1994).

The probability of finding a bank, $f(\theta, n_i^r)$, is derived through a matching function, M, that determines the number of contacts between firms and banks as a function of the number of firms, m, and the number of banks, n^b, as well as the average number of existing bank relationships n^r:

$$M(n^b, n^r m).$$

For simplicity, assume that M is homogenous of degree one in n^b and $n^r m$. The contact rate for a firm having n_i^r bank relationships is $f(\theta, n_i^r) \equiv n_i^r M(\theta, 1)$, where $\theta = \frac{n^b}{n^r m}$, thus representing the tightness of the banking sector.[9]

To model imperfect competition[10] we use the classic model of Salop (1979) in his banking version (see Freixas and Rochet (1997)). The model of the banking sector is then as follows. The n^b banks are equally spaced around a circle of size m.[11] The location of a firm on the circle is randomly assigned at the beginning of each period. There is a cost τ proportional to the distance between one firm and the closest bank. If the firm has an existing relationship with one bank, the cost to go to that bank is equal to the cost of reaching the closest non-relationship bank. Firms have to borrow to finance their investment I_i and banks charge an interest rate r^L. Banks borrow from an infinitely elastic supply of deposits offered by the depositors at a cost $r < r^L$, so that the profits

[9] We assume that $0 < f < 1$. It should be noted that m is exogenous in this model.

[10] The mere presence of search frictions introduces quasi-rents in the credit market. However, we prefer to explicitly add an imperfect competition environment in the banking sector.

[11] We assume that the size of the circle is equal to the mass of firms.

of bank j from firm i are[12]:

$$\Pi^b_{i,j} = (r^L_{ij} - r)\left[\frac{m}{n^b} - \frac{2r^L_{i,j} - r^L_{i,j-1} - r^L_{i,j+1}}{2\tau} I_i\right] I_i + \beta(1-\sigma_i)\Pi^{b\prime}_{i,j}.$$

When the firm meets a bank, they bargain over the cost of the loan. We assume firms and banks bargain each period and model the bargaining as a Nash Bargaining game:

$$\max_{r^L_{i,j}} \left(\Pi^b_{i,j}\right)^{\alpha} \left(J^A_{i,j} - J^R_i\right)^{1-\alpha}$$

where α is the bargaining power of the bank and for simplicity is the same across banks. Solving the bargaining game and considering that every neighboring bank will offer the same interest rate to firm i, we find that the cost of the loan $r^L_{i,j}$ is implicitly defined by the following equation:

$$r^L_{i,j} = r + \left(\frac{m}{n^b} - \frac{(1-\alpha)}{\alpha} \frac{\Pi^b_{i,j}}{m\left(J^A_{i,j} - J^R_i\right)}\right) \frac{\tau}{I_i}. \tag{1}$$

The first term inside the parenthesis, $\frac{m}{n^b}$, corresponds to the markup due to the imperfect competition environment. The second term can be interpreted as an adjustment to the markup due to the bargaining game: part of the rent goes to the firm as long as she has some bargaining power ($\alpha < 1$). We are now able to solve for the steady state

[12] In the credit market the indifference condition for a firm i at a distance $x \in [0, m/n^b]$ from bank j to borrow from bank j or bank $j-1$ is:

$$\tau x + r^L_{i,j} I_i = \tau(m/n^b - x) + r^L_{i,j-1} I_i$$

The demand of loans faced by bank j from firm i, $L_{i,j}$, is therefore:

$$L_{i,j} = \left[\frac{m}{n^b} - \frac{2r^L_{i,j} - r^L_{i,j-1} - r^L_{i,j+1}}{2\tau} I\right] I_i.$$

equilibrium and find the effects of an increase in the number of bank relationships on the cost of funding, namely $\frac{\partial r^L_{i,j}}{\partial n^r_i}$.

Proposition 1 *An increase in the number of bank relationships decreases the cost of the loan for the firm.* $\frac{\partial r^L_{i,j}}{\partial n^r_i} < 0$.

The proposition follows from simple algebra. The intuition is also straightforward: by having a greater number of bank relationships, the firm improves the value of its outside option[13] in the bargaining game and obtains a lower cost of funding. This simple reasoning provides an alternative channel to explain the linkage between the number of bank relationships and the cost of loans.

Credit market conditions might also affect the outside options of firms. To study the effect of deregulation in the banking sector we add a free-entry condition:

$$\Pi^b_j = \kappa,$$

where κ is entry costs per bank. For a given number of firms m, the free-entry condition gives the number of banks n^b. A decrease in κ increases the number of banks and lowers their market power (the first term in the parenthesis in 1) with a favorable effect on the cost of funding for the firm. Furthermore the lower rent decreases the share of the firm in splitting the surplus (the second term in the parenthesis in 1), potentially counteracting the effect of the decrease in the markup on the interest rate. In our setup there is also an indirect effect that comes from the matching function: an increase in the number of banks increases the contact rate and therefore the outside option of the firm, adding

[13] More precisely, its threat point changes.

another channel through which the increased competition lowers the interest rate. These arguments lead to our next proposition.

Proposition 2 *A decrease in κ, namely an increase in competition in the banking sector, has an ambiguous effect on the cost of loans $r^L_{i,j}$.*

An interesting point is the degree of complementarity between the credit market tightness θ and the number of bank relationships n^r_i. When θ and n^r_i are complements, an increase in the number of banks improves the effect of n^r_i on $f(\theta, n^r_i)$, and when θ and n^r_i are substitutes the effect is the opposite. An interpretation of the complementarity could be as follows: on one hand, when there are more banks in the market it might be easier to switch banks even without maintaining ongoing bank relationships; on the other hand, in a more competitive market the threat to switch to another ongoing bank relationship becomes more credible. In the former case the tightness of the credit market and the number of bank relationships are substitutes while in the latter case they are complements. Clearly this is an empirical question and we shall address it in our regressions. We summarize this argument in the following proposition:

Proposition 3 *A decrease in κ, namely an increase in competition in the banking sector, can increase or reduce the effect of the ongoing number of bank relationships, n^r, on the cost of loans $r^L_{i,j}$.*

The fact that $f(\theta, n^r_i)$ depends directly on individual firm characteristics suggests the idea that firms choose optimally the number of relationships n^r_i. The firm manager understands that the firm can use its outside option to improve its bargaining position and that the firm can alter the bargaining terms when it goes to a bank for a loan. It is possible to endogenize n^r_i in the model: in each period the firm can determine the desired

number of banks. The optimal choice of n_i^r is presented in the appendix, together with the derivation of our main empirical equation. In deriving the optimal choice of n_i^r, we assume a reasonable timing for the firm's actions, namely that interest payments are subsequent to initiating the relationship contract with the bank. This assumption allows us to abstract from simultaneity problems coming from n_i^r in the empirical exercises. The remainder of the paper is devoted to test the previous three propositions.

3 Data and summary statistics

Two large datasets are used in this work. All information concerning the number of bank relationships comes from the Central Credit Register of *Banco de Portugal*. This extensive database includes information on all credit exposures above 50 euros, reported monthly by all Portuguese credit institutions. The reporting is mandatory. The main objective of this database is to disseminate information among participating institutions in order to improve their credit risk assessment on current and potential borrowers. Participating banks can observe, for each borrower, the number of bank relationships this borrower has, the total outstanding debt, as well as the status of the loans [14]. This database does not include any information regarding loan maturity, collateral or interest rates. We obtain information on the cost of borrowing from another large dataset: the Central Balance Sheet Database of *Banco de Portugal*. This database provides detailed yearly accounting information, including firm age, economic sector, profitability, leverage, etc., for a large sample of Portuguese firms. Reporting to the Central Balance Sheet Database was not compulsory during the sample period and, as a consequence, this

[14] It is also possible to know whether credit has become overdue, if it was renegotiated or if it is an off-balance sheet risk, such as the unused part of a credit line or a bank guarantee.

database covers only a limited (but large) sample of Portuguese firms. Nevertheless, the sample is considered to be representative, though its representativeness may be somewhat poorer for smaller firms.

Using end of year data for the period comprised between 1996 and 2004, the Central Credit Register includes 3,990,802 records[15]. Taking into account data for the same period of time, the Central Balance Sheet Database includes 202,364 records. Merging the two databases, we obtain 154,682 common observations, comprising 38,342 firms. Even though both databases were created before 1996, the interest payments on bank loans of the Central Balance Sheet Database are available only from 1996 onward, constraining our sample to start in 1996.

In our study, we analyze only lending relationships between firms and banks, excluding all lending relationships with non-monetary credit institutions, such as leasing companies[16].

We define the interest rate r_{it}^{L} as:

$$r_{it}^{L} = \frac{IP_{it}}{D_{it}},$$

[15]Banks do not report information on a strict loan-by-loan basis, given that it is possible to aggregate loans granted to the same firm with similar status. We aggregate loans by firm, in order to count the number of bank relationships. Hence, each record is defined as a firm-year pair.

[16]Non-monetary credit institutions are usually small and specialized credit institutions (sometimes belonging to large universal banking groups), which do not offer checking accounts. Hence, even though these non-bank credit institutions can hold long-term relationships with the firms they grant credit to, they will hardly be able to establish exclusive relationships with firms, given that they can offer them only a limited set of financial services. Moreover, the pricing of debt granted by these institutions may be supported by standards very different from those applied by banking institutions, which can benefit from the monitoring of flows and balances of firms' deposits, as discussed by Mester, Nakamura and Renault (2006).

where IP_{it} is the interest payments on bank loans and D_{it} total debt to credit institutions of firm i.[17] r_{it}^L is therefore the average interest rate of firm i at time t across all of the firm's bank loans[18]. Our final dataset is an unbalanced panel data containing 42,263 observations, for 17,516 firms, between 1996 and 2004. Each firm has on average 2.4 years of data[19].

Figure 1 shows the average, median, and weighted mean of our measure of interest rate against the aggregate interest rate on all outstanding loans to non-financial corporations in Portugal disclosed by *Banco de Portugal*. The weighted average of the interest rate appears to track the aggregate interest rate rather well. The decreasing interest rate during the 1990s reflects the convergence and integration in the European Monetary Union and probably also changes in bank competition during the sample period[20].

The upper panel of Figure 2 shows a histogram of the bank interest rate over the entire sample. In the lower panel of Figure 2 we present the histograms of the interest rate for each year in our sample. The distribution of interest rates across firms changed significantly between 1996 and 2004. Whereas in the earlier years of the sample period interest rates showed an almost uniform distribution, exhibiting a large dispersion in borrowing costs across firms; in the latter years of the sample period the distribution became closer to a log-normal. In these latter years, there was not only a decrease in average interest rates paid by firms, but also a substantial decline in their dispersion.

[17] We considered different implicit interest rates definitions using the firms' balance sheet information, for instance using the average amount of debt in two years or the total amount of interest paid. We performed several checks to evaluate the reliability of our interest rate measures.

[18] We have truncated the right and left hand tails of the distribution of r_{it}^L, and provide a detailed description of our filters in the data appendix.

[19] Firm's entries and exits from the sample are not strictly associated with firm's creations and extinctions. They reflect primarily the voluntary nature of the survey sent to firms.

[20] An analysis of competition in the Portuguese banking market in this period may be found in Boucinha and Ribeiro (2009).

We now turn to some preliminary analysis on the linkage between the cost of debt and the number of bank relationships. Approximately one quarter (26 per cent) of the firms hold one exclusive lending relationship. Across time there was a significant drop in the percentage of firms with unique relationships: from almost 30 per cent in 1996 to nearly 20 per cent in 2004. The average number of bank relationships did not vary significantly over time, ranging between 2.8 and 3.3 across the sample period.

Figure 3 shows that the number of lending relationships increases steadily with the firm age. Start-up firms have, on average, two or three lending relationships, whereas older firms hold a more diversified creditor structure. Furthermore, younger firms pay higher interest rates than do older firms, as expected[21].

Table 1 reports the distribution of the number of bank relationships together with the interest rate and proxies for firm size and maturity such as the number of employees and firm age[22]. Columns 2 and 3 show that firms with a single banking relationship pay a higher interest rate than firms with two or three relationships. Columns 4 to 7 show that the number of bank relationships is positively related to firm age and to the number of employees.

We construct a measure of firm size following a definition suggested by the European Commission that uses the number of employees and sales volumes and that results in four different size categories: micro, small, medium and large[23]. We end up with 12,417 micro, 18,703 small, 8,918 medium and 2,225 large firms. Table 2 displays the number of bank relationships and the interest rate for these four categories. Micro and small firms hold respectively, on average, two and three bank relationships, medium-sized firms borrow

[21] Farinha and Santos (2002), who also investigated the number of bank relationships in Portugal, observe that almost all firms start borrowing only from a single bank, but soon afterward diversify their creditor structure, most notably when growth opportunities are stronger.

[22] To ease the reading of the table we exclude the firms with more than 15 relationships.

[23] See footnote 4.

from more than four banks, while larger firms have six different bank relationships. Table 2 also shows that the interest rate decreases with the firm size.

To conclude our descriptive analysis, we perform mean comparison tests to evaluate if interest rates are statistically different for firms with many relationships (above the 4th quartile of the distribution of the number of relationships) and for firms with few relationships (below the 1st quartile of the same distribution). As shown in Table 2, interest rates paid by these two groups of firms are indeed different. Firms with fewer relationships pay, on average, higher interest rates. We also performed these tests for the four size categories. For both micro and small firms, interest rates are statistically higher for firms with fewer relationships. For medium-sized firms, the mean comparison tests suggest that there are no significant differences in interest rates for firms in the 1st and 4th quartiles of the distribution of the number of relationships. Finally, for large firms, interest rates are significantly higher with many bank relations.

4 The number of bank relationships and borrowing costs

The descriptive analysis performed above suggests that firms that have one or few lending relationships pay, on average, higher interest rates, especially if they are smaller firms. In this section, we perform a regression analysis and control for several firm characteristics that may influence interest paid on bank loans and have been extensively used in related studies. For instance, it is reasonable to consider that profitability (in our model this would correspond to z_i), collateral, leverage or the firm's credit risk (σ_i) are taken into account by banks when pricing loans. We define *Turnover* as sales and services as a

percentage of the firm's assets. Firms with more turnover are able to generate larger cash-flows with their activity and may face lower funding costs. Next we define *Tangible assets as % of debt* to proxy for collateral. *Leverage* is defined as debt over assets to control for the influence of the outstanding debt on the interest rate. *Credit risk* is a dummy variable that takes the value of one whenever the firm is in default at the end of the year. *Debt coverage*, calculated as net profits over debt to credit institutions, is another measure of the firm's financial health. We also include size measured by *Assets* and the *Age* of the firm, the latter measured as the number of years since a firm's inception[24]. In the regressions, all firm-specific variables are lagged by one year, motivated by the fact that banks can only observe the previous year balance sheet when negotiating the loan and for obvious endogeneity problems. Table 3 reports summary statistics for the dependent and independent variables[25].

The sample period corresponds to a time of structural change in the Portuguese banking sector as well as to the period of convergence that led to the European Monetary Union accession. These developments contributed to the steady downward trend seen in money market interest rates during this period. At the same time the Portuguese economy went through a full business cycle. To capture all these time effects we include in the regressions a set of time dummies and, in a different specification, the *3-month Euribor*, the total number of banks granting credit in each year, n^b, and GDP growth.

We estimate the following fixed-effects model:

$$r_{it}^L = \alpha_i + \delta n_{it}^r + \beta X_{it} + \varphi X_{it-1} + \gamma Z_t + u_{it}$$

[24] *Age* defined as $\log(1 + age)$.

[25] In the data appendix we include the correlation matrix of the regressors.

where r_{it}^{L} is the interest rate, n_{it}^{r} is the number of bank relationships, X_{it} and X_{it-1} are vectors of contemporaneous and lagged firm-specific variables, and Z_t is a vector of time-varying variables[26].

In Table 4 we present our first set of econometric results. We begin by regressing the interest rate on the number of bank relationships and time dummies with firm fixed-effects. The results are shown in the first column of Table 4. The coefficient on *Number of bank relationships* is -0.142 with a t-statistic of -5.51. On average one additional bank relationship decreases the interest rate by 14 bps. This result is consistent with *Proposition 1* and also with the predictions of Sharpe (1990) and Rajan (1992), for instance.

In column 2 we control for the firm characteristics, including *Turnover*, *Tangible assets as % of debt*, *Leverage*, *Credit risk*, *Debt coverage*, *Firm age, Assets* and *(Assets)*^{2}. The number of observations drops by approximately half due to the inclusion of the lagged variables. All coefficients show up with the expected sign when statistically significant. *Turnover*, *Tangible assets as % of debt* and *Assets* reduce interest rates, while *Credit risk* has the opposite effect. The coefficients on *Leverage*, *Debt coverage* and *Age* are not statistically significant at a 5% level. The coefficient of $(Assets)^2$ is positive, thus implying a convex effect of firm size on interest rates. The coefficient of the *Number of bank relationships* is similar to the previous regression without the firm controls: one additional relationship should decrease interest rates by 11 bps. The time dummies are highly significant, suggesting that it is important to control for macroeconomic and financial developments.

[26]In order to avoid results driven by outliers we exclude from the regressions all observations below the 1st percentile and above the 99th percentile of the distribution of each firm specific variable.

In column 3, we include macroeconomic variables instead of the time dummies: the *3-month Euribor,* the *total number of banks* granting credit in each year and *GDP growth.* The coefficient of the *3-month Euribor* is significant and positive as expected. We control for the total number of banks because there were entries, exits, mergers, and acquisitions in the banking sector during this period. The number of banks can also serve as a proxy for the overall competition level in the credit market. The coefficient of the *total number of banks* is negative and significant. Finally *GDP growth* is not statistically significant. The coefficient of the *number of bank relationships* decreases slightly in this specification to 9 bps.

In order to better explore differences across firm size, we repeat the regression in column 2 for each size category. We find that the *Number of bank relationships* decreases the cost of debt for all firm sizes, with the exception of micro firms, for which the coefficient is not significantly different from zero.[27]. The largest statistically significant slope coefficient is obtained for large firms: an additional bank relationship reduces the interest rate on average by 21 bps for large firms and by 15 and 12 bps for small and medium firms, respectively. The differences in economic and statistical significance across firm sizes are consistent with the argument that larger firms have a stronger threat point[28].

We also estimated these regressions for different economic sectors.[29] The results are very significant for the construction sector: one additional relationship reduces the interest rate by 28 bps, on average. The effect of the number of bank relationships

[27]In fact, most regressors are not significant in explaining interest rates for micro firms. This may reflect some discrecionarity in loan pricing behavior for the smaller firms, as discussed by Cerqueiro, Degryse and Ongena (2007).

[28]The argument is also consistent with the more traditional asymmetric information story used in the relationship banking literature, which affirms that concentrated lending relationships are crucial to informationally opaque (small and young) firms, while they are of less importance to large firms.

[29]The results are not reported in the tables, but are available upon request.

on bank interest rates is not as large for manufacturing and trade firms and it is not statistically significant for agriculture, real estate or transport firms.

Firm age fails to be significant in the regressions estimated, even though the descriptive analysis presented in the previous section seemed to give support to the existence of an age effect in interest rates[30]. To further explore if firm age affects the linkage between the number of bank relationships and interest rates, we estimate the same regression for two different age groups: younger firms that have an age lower than the median age in our sample (14 years), and more mature firms that are above the median age. The results are displayed in the last two columns of Table 4. On average one additional relationship for older firms significantly decreases interest rates by 13 bps. Older firms, which have on average a large number of bank relationships, benefit from the diversification in lending sources. For younger firms, this effect is not significant.[31]

To summarize, we find strong evidence that the interest rate that banks charge is significantly and negatively related to the number of bank relationships, which is consistent with the first proposition of our model.

5 The role of bank competition

Our model predicts that market competition might affect how the number of bank relationships influences the cost of loans. According to our specification of the matching function M, the number of banks in the market, n^b, directly affects the contact rate between firms and banks. In turn, the number of banks is affected by entry costs and other

[30] This age effect is documented by Kim, Kristiansen and Vale (2007), who find that young firms benefit initially from lower interest rates, as banks compete to attract them. Once they are locked-in, markups on interest rates increase. However, as firms get older and information asymmetries become less severe, interest rate markups decrease again.

[31] For robustness purposes, we tested a different age threshold, distinguishing firms with more or less than 10 years. The results are consistent with those presented above.

market conditions and reflects the overall level of bank competition. A larger number of banks in the economy increases the probability of finding a bank and hence has an effect similar to that of the number of existing bank relationships of a firm. Furthermore, depending on the degree of complementarity between credit market tightness (θ in the model) and the number of existing bank relationships, n_i^r, a change in bank competition can either weaken or strengthen the effects of n_i^r on the interest rate, r_i^L.

In this section, we address this issue empirically, examining the extent to which bank competition influences the impact of the number of bank relationships on interest rates. As discussed in the introduction, there is a debate in the literature regarding the interaction of these variables. On one hand, Boot and Thakor (2000) argue that bank competition should lead to lower interest rates offered by arms-length lending and give banks incentives to focus more on relationship lending. In their model, relationship lending and arms-length can coexist in competitive credit markets, with the latter offering lower interest rates. On the other hand, Petersen and Rajan (1995) argue that, for credit constrained firms, market competition leads to higher interest rates, as banks may be forced to break even in every period.

Local bank competition measures may be more relevant than aggregate measures for our analysis. If a firm operates in a small town, there will be only a limited number of banks the firm can borrow from, whereas in a large urban area there will be many banks competing to offer loans to firms. Hence, differences in local bank competition may also be an important source of endogeneity if omitted, given that they may simultaneously influence the choice of the number of bank relationships (due to availability constraints) and the interest rate paid by firms (due to differences in competition intensity). Degryse and Ongena (2005) evaluate empirically the link between lending relationships,

distance, and competition and obtain evidence that supports the hypothesis of spatial price discrimination in bank lending[32].

We construct a measure of local bank competition using the Herfindahl index at each district[33], taking into account banks granting credit to micro, small, and medium firms. We exclude loans granted to large firms from this definition because we consider that these firms may easily obtain funding outside their district.

We distinguish between firms operating in districts with more or less intense local bank competition. We define three dummy variables: *Lower local bank competition* (first quartile of the distribution of the Herfindahl index), *Medium local bank competition* (second and third quartiles) and *Higher local bank competition* (fourth quartile). We take the *Medium local bank competition* as default and omit it from the regression.

We first test the direct effect of local bank competition on the cost of loans, in order to shed some light on Proposition 2. The results are shown in the first five columns of Table 5. The coefficients estimated on the competition dummies are marginally significant for small and large firms in the most competitive markets (small and large firms in districts with more intense local bank competition benefit from lower interest rates).

Second, we investigate the indirect effect of local bank competition by interacting the number of bank relationships with the intensity of local bank competition, in order to empirically test Proposition 3.[34] This is the effect that should come through a change in the outside option of the firm and indicate if bank market tightness and the

[32]Degryse and Ongena (2005) define the main local competitor as the bank branch with the 25th percentile traveling time in the same postal code as the borrower.

[33]A district is an administrative territorial unit and is matched with firms according to the location of firms' headquarters. There are 18 districts in Portugal.

[34]Montoriol-Garriga (2005) also runs a similar regression, but interacts a dummy variable (one versus multiple bank-relationships) with a measure of bank competition. The author finds that relationship lending is more likely when there is reduced banking market competition and firms hold a small number of bank relationships.

number of bank relationships are complements or substitutes. We run the regressions with interactions with all three dummies, thus transforming our estimation model into a piece-wise-linear regression, allowing the number of bank relationships to take a different coefficient under different market conditions.

The results are shown in the second group of columns of Table 5. When all firms are considered, we observe that the negative impact of the number of bank relationships on bank interest rates is definitely stronger in areas with more intense local bank competition: both the magnitude of the coefficient and the t-statistics are increasing in the level of market competition. This implies that, even though all firms seem to benefit from having multiple lending relationships, the effect becomes stronger when firms operate in less concentrated credit markets. Taking into account differences in firm size, we observe that this interaction between the number of relationships and the degree of competition is always statistically significant except once more for micro firms. All other firms benefit from holding multiple relationships in competitive settings. The results are more significant for larger and older firms, which should benefit from more bargaining power and suffer less from asymmetric information problems.

Our empirical findings show that there is some complementarity between market competition and the number of bank relationships. Our results are generally consistent with the predictions of Boot and Thakor (2000), who argue that informationally opaque firms (micro and young firms in our sample) who are more likely to be engaged in relationship banking seem to benefit less from price competition, and that market competition significantly brings down interest rates for large firms, which most likely borrow using transaction-based loans.

6 Robustness tests

6.1 Alternative specifications

For robustness purposes, we consider a different measure of the number of bank relationships. We define *Concentration in Lending (HHI)* and construct it as a Herfindahl Index of the value of loans from different banks at the firm level in order to control for the dispersion of borrowing, which is a feature not directly captured by *Number of Bank Relationships*.[35,36] Table 6 shows regression results with this alternative measure of the number of bank relationships. Our earlier results are confirmed by these regressions. When *Concentration in Lending (HHI)* increases, the cost of borrowing increases. However, this result is statistically significant only for large firms. If large firms concentrate all their lending in one bank, they face higher borrowing costs than if they diversify. For the remaining firms, what seems to matter most is the number of relationships, rather than how loan amounts are distributed across those relationships.[37]. Each additional relationship enhances the outside option of the firm, increasing its bargaining power. This outside option exists as long as there is some relationship between a firm and a bank, even if the amounts involved are not very large.

In Table 6 we also present the results of the interaction between *Concentration in Lending (HHI)* and the local bank competition variables. We obtain significant results only for the large firms.

[35]This measure is similar, to some extent, to the weighted number of bank relationships.

[36]The importance of considering the concentration of lending relationships is discussed by Ongena, Tumer-Alkan and Westernhagen (2007).

[37]Another potentially interesting way of measuring the importance of relationship lending would be to consider the length of the relationship. However, given that there were several mergers and acquisitions in the Portuguese banking system during the sample period, the use of this variable could entail some caveats.

Also for robustness purposes, we consider several different specifications. First, we try different measures of aggregate bank competition including measures related to competition from foreign banks operating in Portugal. Second, we test if lending from state-owned banks influences borrowing costs. Third, we consider the maturity structure of firms' debt (short versus long term). Fourth, we control for firms with exports, both inside and outside the European Union. None of these variables appear to be statistically significant and our previous results remain unchanged. Finally, we test the effect of having one versus multiple relationships, by considering a binary variable which takes the value of one when the firm has multiple relationships. This variable does not have a statistically significant impact on interest rates.

In addition, we also test the influence of having access to other funding sources, such as trade credit or bond issuance, which can also be considered as alternative outside options. We observe that when the proportion of non-bank debt is greater, the interest rate on bank loans becomes lower, other things controlled for. This result suggests that firms with access to non-bank funding sources may have more bargaining power in negotiating loan pricing. Another possible explanation for this result is that banks may find these firms less risky. This result is stronger for the smaller firms in the sample and is significant for both young and mature firms.

Another important issue is to verify if these results hold when we compute the number of bank relationships using consolidated bank data. So far, we have been counting as a bank relationship each relation a firm has with a different bank, regardless of the bank being part of a banking group or not. This choice implies that we consider that financial institutions manage their relationships with customers at the bank level and not at the bank group level. Nevertheless, banks within the same group can share some customer

information between themselves, thus affecting interest rates and other loan conditions. In order to be sure that our results are not affected by this choice, we performed the same estimations but counting the number of relationships as the number of relations with different banking groups. For 80 per cent of the firms in the sample, the number of bank relationships does not change under this specification. Overall, there is a slight decrease in the average number of bank relationships, from 3.1 to 2.9. The regression results remain broadly unchanged. The only differences worth noticing are that the effect of the number of relationships on interest rates is now slightly weaker for larger firms, whereas the effect becomes stronger for older firms.

Finally, we also test for the possibility of non-linear effects of the number of bank relationships on interest rates. Even though the addition of the squared number of bank relationships to the regressions does not change the results, the variable ln(*Number of Bank Relationships+1*) is significant and has a negative coefficient, as reported in the last column of Table 6, thereby giving some support to the possibility of non-linear effects on interest rates. Thus, the decrease in interest rates obtained with additional bank relationships should be more significant for firms with a small number of relationships.

6.2 Endogeneity

The number of bank relationships n_i^r is mainly a firm's choice. However, we think it is likely that n_i^r is determined before the bargaining with the bank occurs and therefore it is reasonable to assume n_i^r as a predetermined variable in the estimation[38]. More precisely, as stressed in Section 2, we assume interest payments are subsequent to initiating the relationship with the bank.

[38]In the appendix we show the maximization problem firm i solves to choose n_i^r.

It may also be argued that the firm control variables and the cost of borrowing may both be affected by some firm-specific omitted variables that change over time (a classic example is managerial ability). In addition, our interest rate measure possibly contains interest payments on past loans, making it potentially simultaneously determined with past balance sheet data. In this section, we address those issues by using data on managers instead of balance sheet data.

Firm's characteristics and the interest rate offered by banks may be simultaneously affected by the capabilities of the firm managers. On one hand, a good firm manager is capable of ensuring the successful operation of the business. On the other hand, this manager is also likely to have good negotiation skills and obtain a lower cost of borrowing from banks. In order to explore this possibility, we use another large micro dataset, *Quadros de Pessoal*[39]. This dataset is based on an annual mandatory survey conducted by the Portuguese Ministry of Employment. It gathers information on virtually all firms which have remunerated employees. From this dataset we collect information on all owner and manager characteristics which could proxy managerial ability, such as manager age, years of experience in the firm, gender, education level, and total remuneration (though there is no information regarding the remuneration of firm owners). We merge this dataset with the other two datasets used herein, the Central Credit Register and the Central Balance Sheet Database.

In Table 7 we present the results of using manager's characteristics as regressors, instead of the balance sheet data. We run the regressions for the full sample, and also by year. The education level attained by managers is the most significant regressor: firms with more educated managers benefit from lower bank interest rates. Furthermore, the

[39]For details, please see the data appendix.

coefficient on n_i^r remains negative and statistically significant during most of the sample period. This suggests that our earlier results were not affected by endogeneity problems arising from balance sheet information.

7 Concluding remarks

This paper studies the linkages between the number of bank relationships, bank competition and the cost of loans in a credit market with reduced information asymmetries. The low information asymmetries arise from the existence of a public mandatory credit registry designed to facilitate information sharing.

We construct a model to analyze how interest rates are set in an imperfectly competitive banking market, when firms can engage in multiple bank relationships. The cost of funding is determined by a bargaining game between the bank and the firm. The number of lending relationships held by the firm influences positively the outcome of the negotiation process. The model also shows that a change in the degree of competition can increase or lessen the impact of the number of bank relationships on the cost of loans. The outcome depends on the degree of complementarity between the number of bank relationships and the tightness of the credit market.

There are several empirical studies that evaluate the impact of relationship lending on firms' borrowing costs. This paper makes an additional contribution to this literature by investigating the extent to which the intensity of bank competition affects the interaction between the number of bank relationships and loan interest rates.

We begin the empirical analysis by looking at the effect of the number of banks a firm borrows from on the cost of bank loans. The results obtained suggest that firms pay significantly lower interest rates if they increase the number of lenders. When a firm

has one additional bank relationship, the interest rate on bank loans drops by 9 to 20 bps on average, except for micro and young firms. This magnitude is both economically and statistically significant.

We then extend our analysis to explore how the intensity of bank competition affects the impact of the number of bank relationships on interest rates. We find that firms operating in environments with more intense bank competition benefit more from diversifying their lenders than do the remaining firms. This effect is significant for all firms except for micro and young firms.

The difference in results between micro and young firms and the rest of the sample could be due to several factors, such as higher risks and persisting informational opaqueness despite the existence of an information sharing mechanism. Moreover, for micro firms the threat of the outside option might be less credible, resulting in a lower bargaining power. Therefore, the most informationally opaque firms may still have to rely on concentrated lending relationships, thus being less likely to benefit from lower interest rates brought by stronger competition.

Overall our results suggest that firms may improve their lending conditions when they borrow from several banks at the same time, resulting in improved bargaining power in the loan market. This effect becomes stronger when banks operate in a more competitive environment. Bank competition appears to play an important role in firms' funding conditions and ultimately on the economy's aggregate investment and efficiency.

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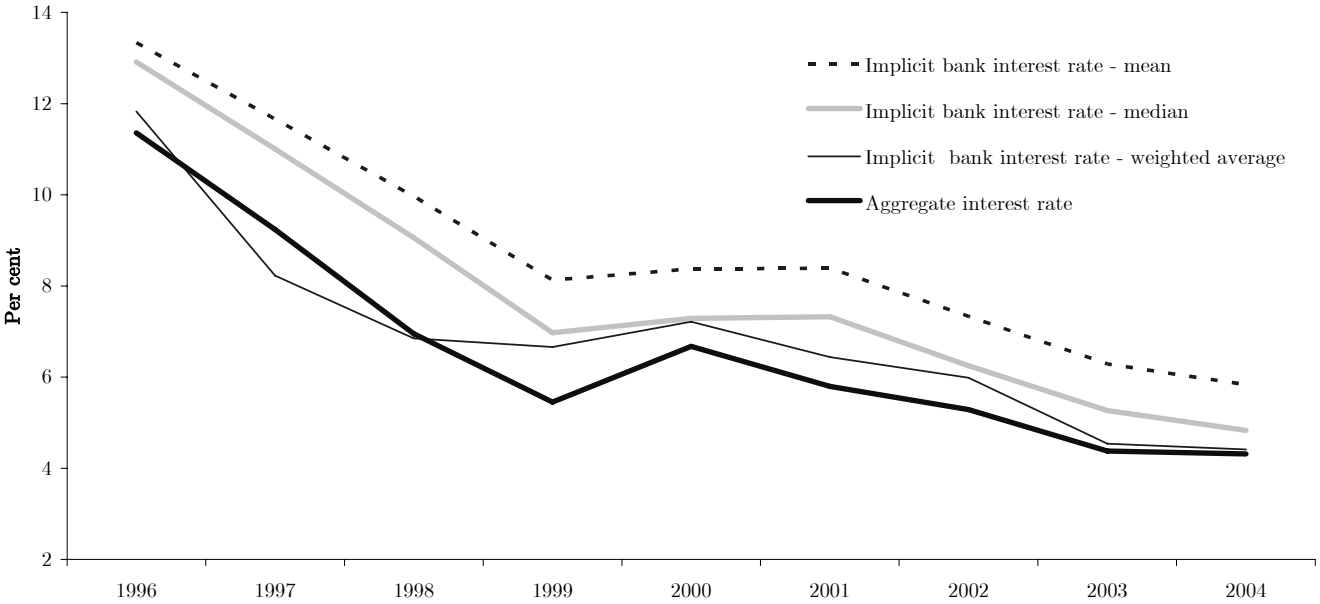
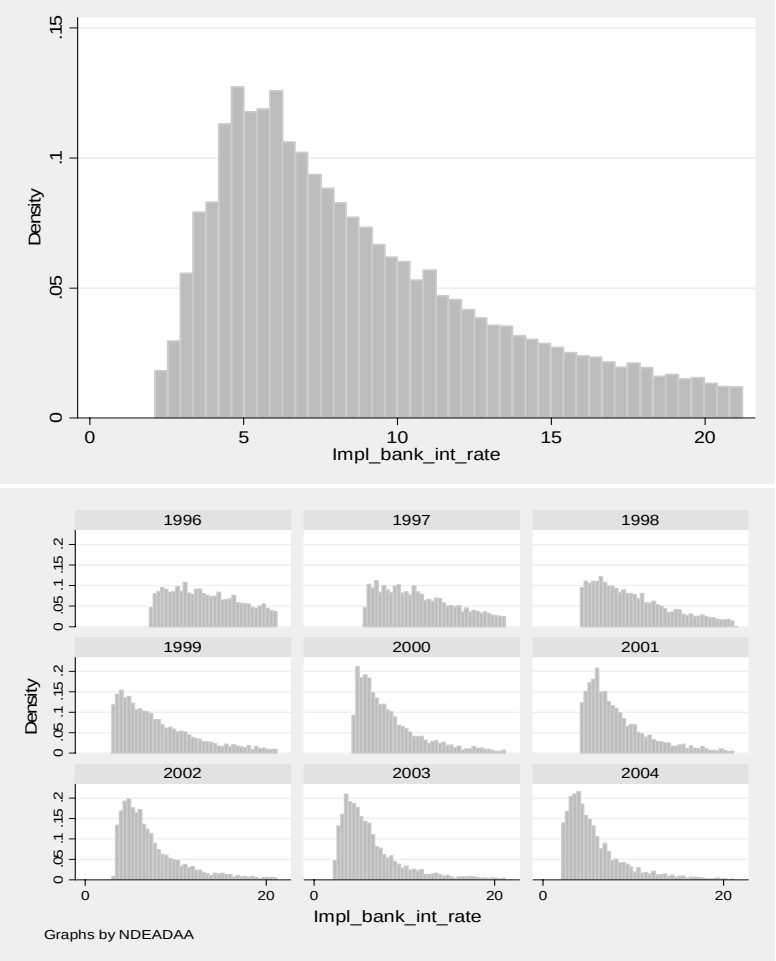
Tables and figures

Figure 1
Implicit interest rate measures



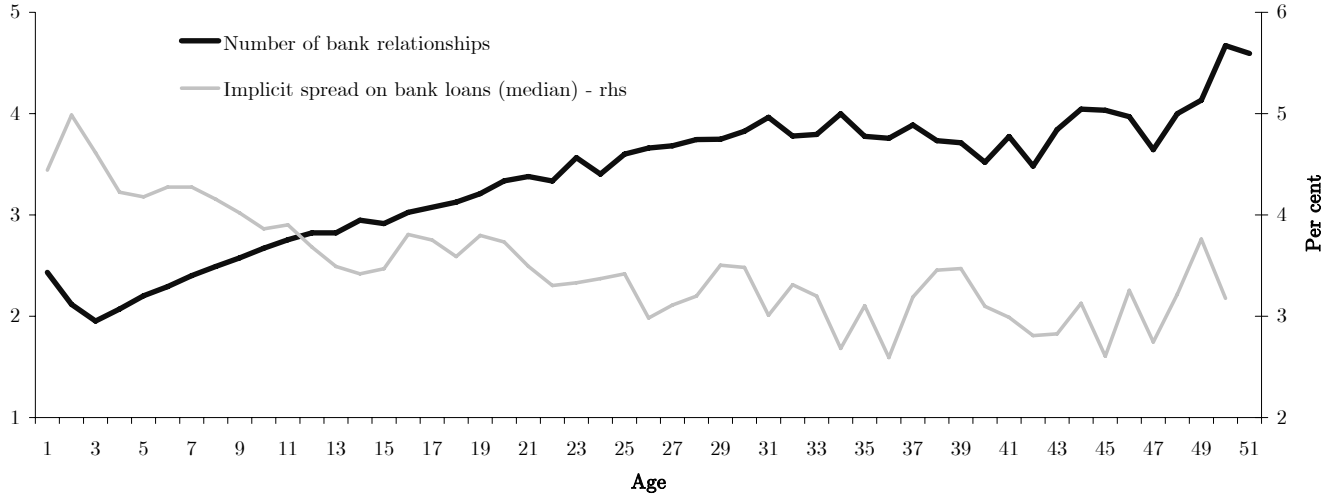
Notes: The aggregate interest rate is the interest rate on outstanding amounts of loans to non-financial corporations disclosed by Banco de Portugal in its Monetary and Financial Statistics. This interest rate is a weighted average of interest rates reported by banks. Implicit interest rates were computed using data from the Central Balance Sheet Database held by Banco de Portugal, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year.

Figure 2
Implicit bank interest rate



Note: Empirical distribution of the implicit interest rate on bank loans, computed as interest paid to banks as a percentage of total debt to credit institutions for each firm.

Figure 3
Number of relationships by age



Notes: The implicit interest rate was computed using data from the Central Balance Sheet Database held by Banco de Portugal, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The implicit spread on banks loans was defined as the difference between the implicit interest rate and a money market interest rate (3-month Euribor). The number of relationships was computed using information from the Central Register of Banco de Portugal, which includes data on all loans granted in Portugal above 50 euros. The number of bank relationships was computed as the number of different banks which were lending to a given firm at the end of each year.

Table 1

		Implicit bank interest rates		Age		Employees	
Number of bank relationships	Obs.	Mean	Median	Mean	Median	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	10,880	9.4	8.4	14.3	10	20	8
2	10,497	9.0	7.9	16.4	12	33	13
3	7,361	8.6	7.5	18.8	15	49	21
4	4,938	8.4	7.1	21.4	17	72	31
5	3,172	8.2	7.0	22.4	18	100	41
6	1,999	7.9	6.7	24.2	19	134	60
7	1,318	7.8	6.6	25.2	20.5	168	75
8	739	8.2	7.0	26.9	22.5	209	97
9	466	7.9	6.9	29.0	23	244	120
10	284	8.5	7.2	32.6	27	302	151
11	164	9.1	7.5	33.8	29	329	194
12	76	7.7	6.8	30.4	25	873	215
13	66	8.7	7.4	36.3	28.5	788	290
14	29	9.3	8.3	34.4	27	676	470
15	25	9.1	9.9	49.2	47	1143	828
Total	42,263	8.8		18.6		66	

Notes: The interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of relationships was computed as the number of different banks which were lending to a given firm at the end of each year. To ease the reading of the table we exclude firms with more than 15 relationships.

Table 2
Number of relationships and interest rates by firm size

		Number of bank relationships		Implicit bank interest rate		Mean comparison tests: Average interest rate for firms with few relations	Mean comparison tests: Average interest rate for firms with many relations	Mean comparison test Ho: diff = 0		
	Number of observations	Mean	Median	Mean	Median			diff	t-ratio	Pr(|T| > |t|)
Micro	12417	1.8	2.0	9.6	8.7	9.9	9.4	0.44	5.44	0.00
Small	18703	2.8	2.0	8.9	7.8	9.0	8.7	0.29	3.92	0.00
Medium	8918	4.4	2.0	7.8	6.6	7.9	7.8	0.04	0.43	0.67
Large	2225	6.2	6.0	7.3	6.2	6.9	8.1	-1.17	-5.54	0.00
Total	42263	3.1	2.0	8.8	7.7	9.5	8.2	1.27	22.44	0.00

Notes: The implicit interest rate was computed using data from the Central Balance Sheet Database held by Banco de Portugal, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of relationships was computed using information from the Central Register of Banco de Portugal. The number of bank relationships was computed as the number of different banks which were lending to a given firm at the end of each year. The definition of firm size was based on the European Commission Recommendation of 6 May 2003 (2003/361/EC), by taking into account the number of employees and sales volume. More precisely, micro firms are defined as those with less than 10 employees and less than 2 million euro of business volume; small firms are those with less than 50 employees and less than 10 million euro of business volume; medium firms are those with less than 250 employees and a business volume below 50 million euro. All remaining firms are considered to be large firms.

Firms with few relations were defined as those included in the first quartile of the distribution of the number of relationships. In turn, firms with many relations were considered to be those in the fourth quartile of the same distribution.

Table 3
Summary statistics for explanatory variables

	N	Mean	Std dev	min	p5	p25	p50	p75	p95	max	skewness	kurtosis
Implicit bank interest rate	42263	8.8	4.4	2.1	3.4	5.4	7.7	11.4	17.9	21.2	0.9	2.9
Number of bank relationships	42263	3.1	2.2	0.0	1.0	1.0	2.0	4.0	7.0	26.0	1.8	8.9
Turnover	42234	138.0	130.8	0.0	18.8	71.7	114.2	167.7	319.2	3343	6.2	80.6
Tangible assets as a % of debt	42241	53.0	122.2	0.0	1.5	13.4	36.1	69.4	143.5	14923	65.4	6867.2
Leverage	42234	78.4	133.5	1.1	39.6	62.5	75.3	87.5	112.9	21565	134.5	19953.7
Credit risk	42053	0.04	0.194	0.000	0.000	0.000	0.000	0.000	0.000	1.000	4.8	23.6
Debt coverage	42263	49.6	5727.3	-670093	-70.1	-0.2	4.1	18.6	119.5	818021	41.0	14880.4
Firm age	42160	18.6	16.4	0.0	3.0	8.0	14.0	23.0	52.0	248.0	2.4	11.4

Notes: The implicit interest rate was computed using data from the Central Balance Sheet Database held by Banco de Portugal, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of bank relationships was computed as the number of different banks which were lending to a given firm at the end of each year. Turnover represents sales and services over assets. Leverage is defined as debt over assets; credit risk is a dummy variable which takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions.

Table 4 - Regression results

Dependent variable: Implicit bank interest rate

	Fixed-effect regressions - controlling for firm characteristics								
	All firms			Micro firms	Small firms	Medium firms	Large firms	Young firms	Mature firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of bank relationships $_{t}$	-0.142	-0.110	-0.091	-0.241	-0.154	-0.119	-0.206	-0.111	-0.126
	-5.51	*-2.79*	*-2.31*	*-1.24*	*-2.11*	*-1.80*	*-2.06*	*-1.36*	*-2.68*
Turnover $_{t-1}$	-	-0.006	-0.005	-0.009	-0.004	0.002	-0.005	-0.008	-0.006
	-	*-4.57*	*-4.16*	*-2.56*	*-1.99*	*0.61*	*-0.75*	*-3.83*	*-3.10*
Tangible assets as % of debt $_{t-1}$	-	-0.007	-0.007	0.000	-0.009	-0.008	-0.002	-0.008	-0.005
	-	*-2.60*	*-2.72*	*0.00*	*-2.16*	*-1.96*	*-0.20*	*-1.53*	*-1.57*
Leverage $_{t-1}$	-	0.004	0.004	-0.006	0.014	0.007	-0.004	0.002	0.009
	-	*0.73*	*0.75*	*-0.57*	*1.71*	*0.65*	*-0.14*	*0.21*	*1.23*
Credit risk $_{t-1}$	-	0.446	0.461	0.428	0.881	0.053	0.104	0.310	0.551
	-	*2.01*	*2.05*	*0.69*	*2.25*	*0.14*	*0.19*	*0.77*	*1.95*
Debt coverage $_{t-1}$	-	-0.003	-0.002	-0.002	-0.002	-0.007	-0.004	0.001	-0.006
	-	*-1.79*	*-1.64*	*-0.67*	*-1.06*	*-1.98*	*-0.75*	*0.21*	*-3.00*
Firm age $_{t-1}$	-	0.455	-1.809	0.894	-0.211	1.210	2.543	-	-
	-	*1.04*	*-5.01*	*0.67*	*-0.32*	*1.23*	*1.16*	-	-
Assets $_{t}$	-	-6.107	-5.098	-	-	-	-	-5.382	-10.043
	-	*-3.70*	*-3.08*	-	-	-	-	*-2.04*	*-3.87*
Assets^2 $_{t}$	-	0.151	0.105	-	-	-	-	0.132	0.274
	-	*2.73*	*1.89*	-	-	-	-	*1.44*	*3.23*
3-month Euribor $_{t}$	-	-	0.582	-	-	-	-	-	-
	-	-	*9.69*	-	-	-	-	-	-
Number of banks $_{t}$	-	-	-0.030	-	-	-	-	-	-
	-	-	*-7.79*	-	-	-	-	-	-
GDP growth $_{t}$	-	-	-0.018	-	-	-	-	-	-
	-	-	*-0.68*	-	-	-	-	-	-
Constant	13.764	67.461	69.506	12.551	12.824	7.637	4.441	62.108	99.928
	116.22	*5.54*	*5.67*	*4.05*	*6.65*	*2.49*	*0.68*	*3.28*	*5.06*
Number of observations	38764	16804	16804	3780	7836	4204	984	7584	9220
Number of firms	16014	7700	7700	2174	3822	1875	435	4043	4115
R^2 within	0.268	0.198	0.178	0.121	0.195	0.231	0.171	0.170	0.212
R^2 between	0.265	0.211	0.154	0.072	0.199	0.176	0.045	0.182	0.196
R^2 overall	0.259	0.185	0.132	0.073	0.188	0.166	0.030	0.167	0.165

Notes: t-statistics in italics (using robust standard errors). The implicit interest rate was computed using data from the Central Balance Sheet Database, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of bank relationships was computed using information from the Central Register of Banco de Portugal, by counting the number of different banks which were lending to a given firm at the end of each year. Turnover represents sales and services over assets. Leverage is defined as debt over assets; credit risk is a dummy variable which takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions. Firm age defined as log(age+1). The definition of firm size was based on the European Commission Recommendation of 6 May 2003 (2003/361/EC), by taking into account the number of employees and sales volume. Young firms defined as those created within the last 14 years and mature firms defined as those with more than 14 years. All regressions were estimated using year dummies, except for the regression in column (3).

Table 5 - Local bank competition

	Dependent variable: Implicit bank interest rate					Dependent variable: Implicit bank interest rate						
	All firms	Micro firms	Small firms	Medium firms	Large firms	All firms	Micro firms	Small firms	Medium firms	Large firms	Young firms	Mature firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Number of bank relationships $_t$	-0.108	-0.246	-0.149	-0.122	-0.187	-	-	-	-	-	-	-
	-2.76	*-1.26*	*-2.04*	*-1.86*	*-1.85*	-	-	-	-	-	-	-
Higher local bank competition $_t$	-0.046	0.190	-0.265	0.027	-0.556	-	-	-	-	-	-	-
	-0.51	*0.71*	*-1.86*	*0.17*	*-1.74*	-	-	-	-	-	-	-
Lower local bank competition $_t$	0.087	-0.226	0.159	0.284	0.104	-	-	-	-	-	-	-
	0.94	*-0.83*	*1.11*	*1.67*	*0.28*	-	-	-	-	-	-	-
Number of relations * Higher competition $_t$	-	-	-	-	-	-0.122	-0.116	-0.204	-0.135	-0.225	-0.118	-0.148
	-	-	-	-	-	*-2.92*	*-0.52*	*-2.55*	*-1.95*	*-2.18*	*-1.32*	*-3.01*
Number of relations * Medium competition $_t$	-	-	-	-	-	-0.111	-0.260	-0.141	-0.135	-0.191	-0.119	-0.127
	-	-	-	-	-	*-2.78*	*-1.33*	*-1.93*	*-1.99*	*-1.89*	*-1.45*	*-2.64*
Number of relations * Lower competition $_t$	-	-	-	-	-	-0.084	-0.329	-0.114	-0.080	-0.156	-0.065	-0.091
	-	-	-	-	-	*-2.02*	*-1.56*	*-1.43*	*-1.18*	*-1.46*	*-0.75*	*-1.83*
Turnover $_{t-1}$	-0.006	-0.009	-0.004	0.002	-0.005	-0.006	-0.009	-0.004	0.002	-0.004	-0.008	-0.006
	-4.56	*-2.59*	*-1.99*	*0.63*	*-0.77*	*-4.56*	*-2.60*	*-1.99*	*0.65*	*-0.75*	*-3.85*	*-3.09*
Tangible assets as % of debt $_{t-1}$	-0.007	0.000	-0.009	-0.008	-0.002	-0.007	0.000	-0.009	-0.008	-0.003	-0.008	-0.005
	-2.58	*-0.02*	*-2.10*	*-1.86*	*-0.19*	*-2.59*	*-0.01*	*-2.13*	*-1.89*	*-0.29*	*-1.49*	*-1.59*
Leverage $_{t-1}$	0.004	-0.005	0.015	0.007	-0.004	0.004	-0.005	0.014	0.007	-0.006	0.002	0.008
	0.74	*-0.55*	*1.78*	*0.67*	*-0.13*	*0.73*	*-0.55*	*1.73*	*0.68*	*-0.23*	*0.23*	*1.20*
Credit risk $_{t-1}$	0.449	0.438	0.892	0.056	0.017	0.450	0.449	0.888	0.053	0.078	0.328	0.553
	2.03	*0.71*	*2.28*	*0.14*	*0.03*	*2.03*	*0.72*	*2.26*	*0.14*	*0.14*	*0.81*	*1.95*
Debt coverage $_{t-1}$	-0.003	-0.002	-0.002	-0.007	-0.003	-0.003	-0.002	-0.002	-0.007	-0.003	0.001	-0.006
	-1.79	*-0.65*	*-1.03*	*-1.95*	*-0.68*	*-1.79*	*-0.63*	*-1.04*	*-1.97*	*-0.74*	*0.22*	*-3.02*
Firm age $_{t-1}$	0.450	0.858	-0.199	1.195	1.987	0.444	0.890	-0.225	1.206	2.218	-	-
	1.03	*0.64*	*-0.31*	*1.22*	*0.90*	*1.01*	*0.67*	*-0.34*	*1.23*	*1.01*	-	-
Assets $_t$	-6.115	-	-	-	-	-6.080	-	-	-	-	-5.317	-10.021
	-3.71	-	-	-	-	*-3.68*	-	-	-	-	*-2.01*	*-3.85*
Assets^2 $_t$	0.152	-	-	-	-	0.151	-	-	-	-	0.130	0.273
	2.74	-	-	-	-	*2.72*	-	-	-	-	*1.41*	*3.21*
Constant	67.485	12.670	12.747	7.590	6.078	67.266	12.579	12.822	7.623	5.552	61.645	99.696
	5.54	*4.07*	*6.64*	*2.48*	*0.91*	*5.51*	*4.07*	*6.68*	*2.49*	*0.83*	*3.25*	*5.03*
Number of observations	16804	3780	7836	4204	984	16804	3780	7836	4204	984	7584	9220
Number of firms	7700	2174	3822	1875	435	7700	2174	3822	1875	435	4043	4115
R^2 within	0.199	0.122	0.197	0.233	0.178	0.199	0.123	0.196	0.233	0.175	0.170	0.213
R^2 between	0.211	0.073	0.196	0.177	0.055	0.211	0.071	0.197	0.176	0.052	0.182	0.197
R^2 overall	0.185	0.074	0.186	0.167	0.040	0.185	0.073	0.186	0.167	0.037	0.168	0.166

Notes: t-statistics in italics (using robust standard errors). The implicit interest rate was computed using data from the Central Balance Sheet Database. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. Turnover represents sales and services over assets. Leverage is defined as debt over assets; credit risk is a dummy variable which takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions. Firm age defined as log(age+1). The definition of firm size was based on the European Commission Recommendation of 6 May 2003 (2003/361/EC), by taking into account the number of employees and sales volume. Local bank competition defined as the HHI of the banks granting loans to micro, small and medium firms at each *district*. When the HHI is in the 1st quartile of each year distribution, we consider that there is higher local bank competition and when the HHI is in the 4th quartile we consider that there is lower local bank competition. Young firms defined as those created within the last 14 years and mature firms defined as those with more than 14 years. All regressions were estimated using year dummies and firm-fixed effects.

Table 6 - Robustness tests

Dependent variable: Implicit bank interest rate

	Fixed-effect regressions - controlling for firm characteristics												
	All firms	**Micro firms**	**Small firms**	**Medium firms**	**Large firms**	**Young firms**	**Mature firms**	**All firms**	**Micro firms**	**Small firms**	**Medium firms**	**Large firms**	**All firms**
	(1)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Concentration in lending (HHI) $_{t}$	0.433	1.036	0.579	0.346	4.512	0.621	0.424	-	-	-	-	-	-
	1.47	*1.26*	*1.34*	*0.59*	*3.17*	*1.25*	*1.08*	-	-	-	-	-	-
Concentration in lending * Higher competition $_{t}$	-	-	-	-	-	-	-	0.386	1.231	0.212	0.305	3.172	-
	-	-	-	-	-	-	-	*1.23*	*1.42*	*0.45*	*0.48*	*1.98*	-
Concentration in lending * Medium competition $_{t}$	-	-	-	-	-	-	-	0.410	1.035	0.590	0.256	5.017	-
	-	-	-	-	-	-	-	*1.36*	*1.26*	*1.33*	*0.43*	*3.29*	-
Concentration in lending * Lower competition $_{t}$	-	-	-	-	-	-	-	0.540	0.799	0.922	0.799	4.689	-
	-	-	-	-	-	-	-	*1.69*	*0.92*	*1.99*	*1.22*	*3.11*	-
Ln(number of bank relations+1) $_{t}$	-	-	-	-	-	-	-	-	-	-	-	-	-0.394
	-	-	-	-	-	-	-	-	-	-	-	-	*-1.93*
Turnover $_{t-1}$	-0.006	-0.009	-0.004	0.002	-0.004	-0.008	-0.005	-0.006	-0.009	-0.004	0.002	-0.004	-0.006
	-4.51	*-2.53*	*-1.93*	*0.68*	*-0.70*	*-3.83*	*-3.02*	*-4.51*	*-2.55*	*-1.92*	*0.70*	*-0.70*	*-4.56*
Tangible assets as % of debt $_{t-1}$	-0.007	0.000	-0.010	-0.008	-0.006	-0.008	-0.005	-0.007	0.000	-0.009	-0.008	-0.004	-0.007
	-2.62	*0.00*	*-2.16*	*-1.96*	*-0.59*	*-1.53*	*-1.59*	*-2.59*	*0.00*	*-2.10*	*-1.85*	*-0.42*	*-2.60*
Leverage $_{t-1}$	0.003	-0.006	0.014	0.006	-0.017	0.001	0.008	0.003	-0.006	0.014	0.006	-0.013	0.004
	0.65	*-0.61*	*1.66*	*0.55*	*-0.62*	*0.15*	*1.15*	*0.66*	*-0.60*	*1.72*	*0.57*	*-0.47*	*0.71*
Credit risk $_{t-1}$	0.442	0.377	0.885	0.060	0.029	0.301	0.544	0.445	0.383	0.907	0.068	-0.025	0.448
	1.99	*0.61*	*2.26*	*0.15*	*0.05*	*0.74*	*1.92*	*2.00*	*0.62*	*2.32*	*0.17*	*-0.05*	*2.02*
Debt coverage $_{t-1}$	-0.003	-0.002	-0.002	-0.007	-0.005	0.001	-0.006	-0.003	-0.002	-0.002	-0.007	-0.004	-0.003
	-1.76	*-0.67*	*-1.01*	*-1.96*	*-1.12*	*0.23*	*-2.95*	*-1.76*	*-0.66*	*-0.99*	*-1.93*	*-0.92*	*-1.78*
Firm age $_{t-1}$	0.373	0.833	-0.265	1.126	2.338	-	-	-	-	-	-	-	-
	0.85	*0.63*	*-0.40*	*1.15*	*1.09*	-	-	-	-	-	-	-	-
Assets $_{t}$	-6.109	-	-	-	-	-5.205	-10.146	-6.118	-	-	-	-	-6.052
	-3.70	-	-	-	-	*-1.97*	*-3.91*	*-3.70*	-	-	-	-	*-3.67*
Assets^2 $_{t}$	0.149	-	-	-	-	0.125	0.275	0.150	-	-	-	-	0.149
	2.70	-	-	-	-	*1.36*	*3.24*	*2.70*	-	-	-	-	*2.68*
Constant	67.452	11.444	12.157	7.181	2.928	60.439	100.445	67.490	11.535	12.051	7.164	4.187	67.499
	5.52	*3.65*	*6.32*	*2.36*	*0.45*	*3.18*	*5.08*	*5.52*	*3.68*	*6.29*	*2.37*	*0.63*	*5.54*
Number of observations	16804	3780	7836	4204	984	7584	9220	16804	9220	9220	9220	9220	16804
Number of firms	7700	2174	3822	1875	435	4043	4115	7700	4115	4115	4115	4115	7700
R^2 within	0.198	0.121	0.194	0.230	0.189	0.170	0.211	0.198	0.211	0.211	0.211	0.211	0.198
R^2 between	0.213	0.072	0.197	0.180	0.044	0.182	0.200	0.213	0.200	0.200	0.200	0.200	0.211
R^2 overall	0.187	0.073	0.186	0.168	0.039	0.167	0.169	0.187	0.169	0.169	0.169	0.169	0.185

Notes: t-statistics in italics (using robust standard errors). The implicit interest rate was computed using data from the Central Balance Sheet Database, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. Concentration in lending is an Herfindahl index using bank shares at the firm level. Turnover represents sales and services over assets. Leverage is defined as debt over assets; credit risk is a dummy variable which takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions. Firm age defined as log(age+1). The definition of firm size was based on the European Commission Recommendation of 6 May 2003 (2003/361/EC), by taking into account the number of employees and sales volume. Young firms defined as those created within the last 14 years and mature firms defined as those with more than 14 years. All regressions were estimated using year dummies.

Table 7 - Regression results - managerial ability

Dependent variable: Implicit bank interest rate

	All years	1996	1997	1998	1999	2000	2002	2003	2004
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of bank relationships $_t$	-0.153	-0.029	-0.057	-0.148	-0.156	-0.116	-0.112	-0.064	-0.038
	-4.87	*-0.92*	*-1.96*	*-4.57*	*-6.25*	*-4.50*	*-3.81*	*-2.07*	*-1.42*
Managers age $_t$	-0.198	-0.458	-0.526	-0.424	-0.630	-1.010	-0.171	-0.831	-0.835
	-0.52	*-1.01*	*-1.30*	*-1.03*	*-1.75*	*-2.61*	*-0.46*	*-2.10*	*-2.03*
Managers tenure $_t$	-0.005	0.214	-0.107	-0.146	-0.245	0.020	0.008	0.103	-0.021
	-0.05	*1.93*	*-1.07*	*-1.34*	*-2.53*	*0.21*	*0.09*	*1.10*	*-0.21*
Managers education $_t$	-0.073	-0.216	-0.288	-0.264	-0.248	-0.231	-0.193	-0.269	-0.329
	-1.64	*-4.78*	*-6.99*	*-6.33*	*-7.29*	*-5.49*	*-5.11*	*-6.64*	*-7.70*
Constant	14.948	15.599	15.243	13.389	12.454	13.484	9.100	10.624	10.740
	10.31	*9.33*	*10.25*	*8.79*	*9.45*	*9.28*	*6.52*	*6.91*	*6.83*
Number of observations	27173	2568	3485	3550	4696	3213	3435	3250	2976
Number of firms	12622	-	-	-	-	-	-	-	-
Firm-fixed effects	Y	N	N	N	N	N	N	N	N
R^2 within	0.298	-	-	-	-	-	-	-	-
R^2 between	0.276	-	-	-	-	-	-	-	-
R^2 overall	0.280	0.013	0.020	0.025	0.030	0.021	0.017	0.020	0.026

Notes: t-statistics in italics (using robust standard errors). The implicit interest rate was computed using data from the Central Balance Sheet Database, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of bank relationships was computed using information from the Central Register of Banco de Portugal, by counting the number of different banks which were lending to a given firm at the end of each year. Manager characteristics refer to firm owners and managers (there is no information for 2001). The regression for all years was estimated using year dummies and firm-fixed effects.

Model Appendix

We assume the following timing in the model: when the manager and the banker sit at the bargaining table, the number of existing relationships n_i^r is given. More precisely, the firm chooses how many relations to have at $t+\tau$, where $\tau \in [0,1]$, and the bargaining occurs later in the period at $t+\tau'$, where $\tau' > \tau$. Therefore the choice of n_i^r occurs conditional on the information set up to $t+\tau$. The program a firm has to solve is:

$$\begin{aligned}
& \max_{n_i^r} \; n_i E_{t+\tau}\left[J_i^A\right] - C(n_i^r) \\
& s.t. \\
E_{t+\tau}\left[r_{i,j}^L\right] &= E_{t+\tau}\left[r + \left(\frac{m}{n_b} - \frac{(1-\alpha)}{\alpha}\frac{\Pi_j^b}{m\left(J_i^A - J_i^R\right)}\right)\frac{\tau}{I_i}\right], \\
E_{t+\tau}\left[J_i^A\right] &= E_{t+\tau}\left[z_i - r_{i,j}^L I_i + \beta\left((1-\sigma_i)\left(J_i^A\right)' + \sigma_i\left(J_i^D\right)'\right)\right], \\
E_{t+\tau}\left[J_i^R\right] &= E_{t+\tau}\left[-c_i + \beta(f(\theta, n_i^r)\left(J_i^A\right)' + (1 - f(\theta, n_i^r))(J_i^R)')\right]
\end{aligned}$$

where $E_{t+\tau}$ is the mathematical expectation conditional on the information set up to $t+\tau$ and $C(n_i^r)$ is a convex function of n_i^r that represents the direct costs of initiating a relationship with a bank. It is easy to show that the optimality condition requires that

$$C_{n_i^r}(n_i^r) = n_i \frac{\tau\frac{(1-\alpha)}{\alpha}E_{t+\tau}\left[\frac{\Pi_j^b}{m\left(J_i^A - J_i^R\right)^2}\right]}{\left(1 + \tau\frac{(1-\alpha)}{\alpha}E_{t+\tau}\left[\frac{\Pi_j^b}{m\left(J_i^A - J_i^R\right)^2}\right]\right)}\beta E_{t+\tau}\left[f_{n_i^r}(\theta, n_i^r)\left[\left(J_i^A\right)' - (J_i^R)'\right]\right], \quad (2)$$

holds. Taking a first-order approximation of (2) and adding a white noise term one obtains:

$$n_{i,t}^r = a_0 + a_1 E_t\left(r_{i,j,t}^L\right) + a_2 E_t\left(X_{i,t}\right) + a_3 Y_t + u_{i,t}.$$

The main equation we estimate in the paper is

$$r_{i,t}^{L} = b_0 + b_1 n_{i,t}^{r} + b_2 E_t \left(X_{i,t} \right) + b_3 Y_t + \varepsilon_{i,t}.$$

As usual we assume that $\varepsilon_{i,t}$ and $u_{i,t}$ are orthogonal. The potential endogeneity problem is avoided because $\varepsilon_{i,t}$ is in fact $\varepsilon_{i,t+\tau'}$, where $\tau' > \tau$ and therefore orthogonal to the information up to $t + \tau$.

Data Appendix

Filters were applied in order to guarantee a reasonable quality of the data used, even if at the cost of a lower number of observations. The first step was to exclude all observations for which debt or interest paid was negative or equaled zero, given that it would not make sense to compute implicit interest rates in such cases. We also excluded all firms that had zero employees. Such firms should be mainly holding companies or firms in liquidation, though this may also reflect isolated reporting problems in the database. Additionally, we dropped all observations below the 5th percentile and above the 95th percentile of the implicit interest rates distributions. Moreover, we dropped all observations for which the estimated implicit interest rate was below the interbank money market interest rate. Finally, we excluded all firms for which we did not have any information on the Credit Register, given that it would be impossible to compute the number of bank relationships for those firms. After applying all these filters to the implicit bank interest rate, we were left with a database of 42,263 observations between 1996 and 2004.

In Section 6 we use an additional dataset, Quadros de Pessoal, to take into account manager's characteristics. All Portuguese firms with more than 10 employees must submit annually to the Ministry of Labour and Social Solidarity a report with information on all firm establishments and their employees, referring to October.

Data appendix tables

Table A
Number of relationships and interest rates by firm size

	Number of observations	Number of bank relationships		Implicit bank interest rate	
		Mean	Median	Mean	Median
Agriculture	1627	2.5	2.0	9.2	8.2
Commerce	12721	3.9	3.0	8.9	7.8
Construction	5526	4.2	3.0	8.9	7.8
Education	156	3.4	3.0	7.1	5.7
Fishing	155	2.8	2.0	8.7	7.5
Healthcare	156	4.0	3.0	7.3	6.4
Manufacturing	17145	4.4	4.0	8.9	7.8
Mining	505	4.6	4.0	8.4	7.1
Other public services	226	4.4	4.0	6.8	5.6
Real estate	1311	3.9	3.0	6.4	5.4
Tourism	638	3.0	2.0	7.8	6.6
Transports and communications	1900	4.3	3.0	9.2	8.1
Utilities	197	3.8	3.0	5.9	4.8
Total	42263	3.1	2.0	8.8	7.7

Notes: The implicit interest rate was computed using data from the Central Balance Sheet Database held by Banco de Portugal, which includes detailed accounting information for a large sample of Portuguese companies. This interest rate was computed as the amount of interest paid on bank loans as a percentage of total debt to credit institutions at the end of the year. The number of relationships was computed using information from the Central Register of Banco de Portugal. The number of bank relationships was computed as the number of different banks which were lending to a given firm at the end of each year.

Table B - Correlation matrix

	Implicit bank interest rate	Number of bank relations	Turnover	Tangible assets as % debt	Leverage	Credit risk	Debt coverage	Age	Log assets	3-month Euribor	Number of banks
Implicit bank interest rate	1										
Number of bank relations	-0.0907*	1									
Turnover	0.0949*	-0.1055*	1								
Tangible assets as % debt	-0.0516*	-0.0029	-0.1898*	1							
Leverage	0.0702*	-0.1011*	0.0636*	-0.4312*	1						
Credit risk	0.0363*	0.0908*	-0.0955*	-0.0163	0.0944*	1					
Debt coverage	0.0306*	-0.0416*	0.1465*	0.0584*	-0.2816*	-0.0850*	1				
Age	-0.1073*	0.2603*	-0.0849*	0.0843*	-0.1702*	0.0164	-0.0156	1			
Log assets	-0.2894*	0.6268*	-0.2309*	0.1399*	-0.2340*	0.0532*	0.0273*	0.3197*	1		
3-month Euribor	0.4840*	-0.0149	0.0618*	-0.0087	0.0502*	0.01	-0.0093	-0.0783*	-0.1352*	1	
Number of banks	-0.4162*	0.0032	-0.0392*	0.0094	-0.0340*	-0.005	0.0053	0.0596*	0.0978*	-0.8241*	1

Notes: An asterisk means that the pairwise correlation is significant at a 5 per cent level. Turnover represents sales and services over assets. Leverage is defined as debt over assets; credit risk is a dummy variable which takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions.

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