The number of bank relationships and the cost of borrowing. An empirical study.*

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Abstract

We construct a unique dataset containing 17.516 Portuguese small, medium and large firms and spanning from 1996 to 2004. Using this dataset we study the impact of the number of banks a firm borrows from on the cost of bank loans. We find that the average Portuguese firm borrows from three banks. The firm's interest rate on bank loans lowers as the firm borrows from more banks, controlling

for relevant firm characteristics. When a firm borrows from one more bank, the interest rate on bank loans for this firm becomes 12 to 33 basis points lower, on average. This pattern holds across firm size categories. Our results are consistent with bank competition and bank risk diversification.

EFM Codes: 110, 140, 550

JEL Codes: G21, G32

Keywords: banks, relationship banking, borrowing costs

1 Introduction

A frequently visited question by banking researchers is: what is the optimal number of banks for a firm to borrow from? This question is also important to firm managers because the answer to it is related to how to obtain the lowest cost of loans and how to ensure easy access to bank loans. In this study, we focus on the relationship between the interest rate charged by banks and the number of banks that the firm borrows from.

The classical delegated monitoring argument introduced by Diamond (1984) and tested by Petersen and Rajan (1994) says that in the presence of asymmetric information between firms and investors, a firm is best off borrowing from only one bank where the cost of borrowing is minimized. However, many other empirical works find that firms rarely keep exclusive bank relationships. For example, Ongena and Smith (2000) in a survey including 1079 firms across 20 European countries find that the majority of firms (85%) use more than one bank. They find that firms in countries with the French legal system, such as France, Italy, Spain and Portugal, have on average more than 10 different bank relations. This observation has also been found in D'Auria, Foglia and Reedtz (1999). In our dataset we also find that the majority of Portuguese firms, including micro firms, borrow from several banks.

What makes monogamy with a bank undesirable? There are many theories attempting to provide an explanation, some of them with implications for borrowing costs.

First, in an exclusive bank relationship, the informationally privileged bank might exploit its bargaining power over the firm and extract rents from loan contracts (Sharpe 1990, Rajan 1992). This implies that micro and small firms with a unique lender pay a higher cost of borrowing.

Second, the refusal of a credit from the firm's only lender may provide a negative signal to the market which makes the exclusive bank relationship undesirable (Berger and Udell, 1998). Detragiache, Garella, and Guiso (2000) show that this is especially true in economies with high bankruptcy costs and low fragility of the banking sector .

Third, some predict that multiple bank relationships will occur when banks face financial constraints or monitoring costs (Dewatripont and Maskin 1995, Holmstrom and Tirole 1997, Carletti, Cerasi and Daltung 2007).

Fourth, multiple bank relationships might prevent the firm manager from strategic default by holding up the renegotiation process (Bolton and Scharfstein 1996).

Fifth, in the face of fierce competition, multiple arms-length lending might substitute relationship lending as analyzed by Boot and Thakor (2000). The authors predict that bank competition will lead to lower interest rates and that firms will not commit to exclusive bank relationships. On the other hand, relationship lending might protect banks from price competition.

Sixth, multiple bank relationships allow banks to diversify their lending risk (Carletti et al. 2007). The authors 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.

To answer the aforementioned question we use a unique dataset that spans from 1996 to 2004 and includes 42.263 Portuguese firm-year observations, referring to 17.516 different firms. We find that an average Portuguese firm borrows from three banks. The firm's interest rate on bank loans lowers as the firm borrows from more banks, controlling for relevant firm characteristics. When a firm borrows from one more bank, the interest rate on bank loans for this firm becomes 12 to 33 basis points lower, on average. This

pattern holds regardless of the firm size. Moreover, we take seriously the idea that the number of bank relationships and the cost of borrowing may be simultaneously determined, introducing an endogeneity problem in our empirical analysis. For instance, the managerial ability may jointly influence the choice of the number of banks and the interest rate that banks charge. We address this issue by using an instrumental variable approach and find that our previous findings are robust.

Our finding is consistent with Carletti et al. (2007) that banks benefit from risk diversification brought by multiple-bank lending. The decreasing interest rate reflects that the reduction in risk level overcomes free-riding and duplication of monitoring costs. However, to the contrary of the prediction of Carletti et al. (2007) that the benefit of diversification is stronger with small opaque less profitable firms, we find that the negative correlation between the number of banks and the interest rate holds robust across firm sizes. Specifically, even large mature profitable firms benefit from multiple lending.

The finding that the interest rate decreases in the number of banks can also be consistent with the competition argument by Boot and Thakor (2000) that when banks compete to gain clients, firms are able to borrow from multiple banks at lower costs. The Portuguese banking sector has experienced a high degree of liberalization during the past two decades, including most of the state-owned banks becoming privatized and the penetration of the domestic banking market by foreign banks (Ribeiro 2007). These developments should have contributed to increased competition in the Portuguese banking system, thus allowing firms to borrow from multiple banks at a lower cost.

Our results are comparable to findings from similar studies using European datasets. Degryse and Ongena (2007) literature review shows that in several European countries

the cost of bank loans is either unaffected or reduced by 1 to 10 basis points per additional relationship, while in the US the cost of bank loans typically increases with the number of bank relationships.

Finally, this study is related to Farinha and Santos (2002) who also investigated the number of bank relationships in Portugal. They focus on one special event during a firm's borrowing history, i.e. when the firm switches from single to multiple bank relationships. The authors examine some of the determinants and implications of this corporate event and report that almost all firms start borrowing only from a single bank, but soon afterwards they diversify their creditor structure, most notably when growth opportunities are stronger. Our study is different in several ways. First, we look at the number of bank relationship rather than at the event of switch from one to multiple banks. Second, we focus on the implication of bank relations on the firm's cost of borrowing which was not examined previously for Portugal.

Our paper proceeds as follows. In section 2 we describe the datasets used and present some relevant summary statistics. In section 3 we discuss the results obtained under a regression analysis framework, evaluating how does the number of bank relationships influence borrowing costs. In section 4 we discuss possible endogeneity problems in the regressions, given that the number of relationships and interest rates may be simultaneously determined, and we try to overcome this issue using an instrumental variable approach. Finally, in section 5 we present some concluding remarks.

2 Data and summary statistics

Two large datasets were 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 (e.g. whether there is debt overdue). This information sharing mechanism may have important implications in reducing the asymmetric information problem in a borrower-lender relationship[1]. Unfortunately, this database does not include any information regarding loan maturity, collateral or interest rates. Given that our main objective is to evaluate the role of the number of bank relationships in firms' borrowing costs, 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 is not compulsory and, as a consequence, this 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[2]. 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.

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[1]It is 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.

[2]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 aggregated loans by firm, in order to count the number of bank relationships. Hence, each record is defined as a firm-year pair.

Even though both databases were created before 1996, several important fields of the Central Balance Sheet Database are available only from 1996 onwards, thus imposing this year as a starting point for our analysis.

In our study, we only analyse lending relationships between firms and banks, excluding all lending relationships with non-monetary credit institutions, such as leasing companies[3].

To measure the cost of borrowing, we construct different implicit interest rates using the firms' balance sheet information. We perform several checks to evaluate the reliability of our interest rate measures. Our preferred measure of the interest rate is i_{it}, defined as:

$$i_{it} = \frac{I_{it}}{D_{it}},$$

where I_{it} is the interest payments on bank loans and D_{it} total debt to credit institutions of firm i.

We provide a detailed description of our filters in the data appendix. Our final dataset is an unbalanced panel data containing 42.263 observations, 17.516 firms, between 1996 and 2004.

Figure 1 shows the average, median and weighted mean of our measure of interest rate against the aggregate interest rate on all outstanding debts to non-financial corporations in Portugal disclosed by Banco de Portugal. The weighted average of the implicit

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[3]Non-monetary credit institutions are usually small and specialized credit institutions (sometimes included in 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 firms' deposits.

interest rate appears to track remarkably well the aggregate interest rate statistics. The correlation between the two series is 0.96.

The upper panel of Figure 2 shows histograms of both the implicit bank interest rate and the implied spread over the entire sample. The implied spread on banks loans is defined as the difference between the implicit interest rate and a money market interest rate (3-month Euribor). In the lower panel of Figure 2 we present the histograms of both the implicit interest rate and the spread for each year in our sample[4]. Overall the relatively high correlation between our measure and the aggregate interest rate on loans makes us confident about our measure of interest rate on bank loans.

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. Figure 3 shows that the average number of bank relationships did not vary significantly over time, ranging between 2.8 and 3.3 across the sample period[5].

Figure 4 shows that the number of lending relationships increases steadily with the firm age. Start-up firms have, on average, 2 or 3 lending relationships, whereas older firms hold a more diversified creditor structure. Furthermore, younger firms pay higher interest rates than older firms, as expected.

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[4]The results reveal that the distribution of interest rates and spreads across firms changed significantly between 1996 and 2004. Whereas in the earlier years of the sample period interest rates and spreads 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.

[5]The figure shows that the average number of bank relationships exhibits an increasing trend starting in 1998. The observed decrease in 2001 is probably due to the strong merger and acquisition activities during this period in the Portuguese banking system.

Table 1 reports the distribution of the number of bank relationships together with the implicit interest rate and proxies for firm size and maturity such as the number of employees and firm age[6]. Columns two and three show that firms with a single banking relationship pay a higher interest rate than firms with 2 or 3 relations. Columns four to seven show that the number of bank relationships is positively related to size proxied by firm age and the number of employees.

We further 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[7]. 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 implicit interest rate for these four categories. Micro and small firms hold respectively, on average, 2 and 3 bank relationships, medium-sized firms borrow from more than 4 banks, while larger firms have 6 different bank relationships. Table 2 also shows that the implicit interest rate decreases with the firm size.

Table 3 shows the average and median number of bank relationships and the implicit interest rate across economic sectors. The lowest average number of relationships is seen in agriculture (2.5), fishing (2.8) and tourism (3). In turn, the highest average number of relationships is recorded by mining (4.6), manufacturing (4.4) and public services (4.4) firms. Agriculture and transport firms apparently have to pay interest rates above those of other firms (9.2 percent on average in our sample), whereas utilities (5.9), real estate firms (6.4) or public services (6.8) firms face lower debt servicing costs.

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

[7]Micro firms are defined as those than less 10 employees and less than 2 millions euros of sales volumes. Small firms are those with less than 50 employees and less than 10 millions euros of sales volumes. Medium firms are those with less than 250 employees and less than 50 millions euros of sales volumes. All remaining firms are considered to be large firms.

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). Table 4 reports that in the full sample 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. Both for micro and for small firms, interest rates are statistically higher for firms with fewer relationships. For medium-sized firms, the mean comparison tests performed suggest that there are no significant differences in interest rates for firms in the 1st and in the 4th quartile of the distribution of the number of relationships. Finally, for large firms interest rates are significantly higher with many bank relations.

3   Regressions

The descriptive analysis performed above suggests that firms that have one or few lending relationships pay, on average, higher interest rates, most notably if they are smaller firms. In this section, we perform regression analysis and control for several firm characteristics which may influence interest paid on bank loans and have been extensively used in similar studies. For instance, it is reasonable to consider that profitability, collateral, leverage or the firm's credit risk are taken into account by banks when pricing loans. We define *Turnover* as sales and services as a percentage of the firm's assets and use it as a proxy for the firm profitability. More profitable firms 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 to credit institutions over

assets to control for the influence of the outstanding debt on the interest rate. *Credit risk* is a dummy variable which takes the value 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. In the regressions, all firm-specific variables are lagged by one year. This choice is motivated by the fact that banks can only observe the previous year balance sheet. Table 5 reports summary statistics for the dependent and independent variables. Table 6 contains the correlation matrix of the regressors.

The sample period corresponds to a time of structural change in the Portuguese banking sector as well as to the convergence and the access to the European Monetary Union. These developments contributed to the steady downward trend seen in interest rates during this period. At the same time the Portuguese economy went through a full business cycle. To capture the convergence and the macroeconomic conditions we include in the regressions the *3-month Euribor* and a set of time dummies.

We estimate the following fixed-effects model:

$$i_{it} = \alpha_i + \delta N_{it} + \beta X_{it} + \delta X_{it-1} + \gamma Z_t + u_{it}$$

where i_{it} is the implicit interest rate, N_{it} 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.

Our panel data contains information for 17.516 firms over 9 years (from 1996 until 2004). This is a unbalanced panel and each firm has on average 2.4 years of data. In order to avoid that the results are 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 Table 7 we present our first estimates of how the number of bank relationships influences firms' borrowing costs, measured by our implicit bank interest rate. We begin by regressing the implicit bank interest rate on the number of bank relationships and time dummies with firm fixed-effect. The results, shown in the first column of Table 7, give support to the hypothesis that the number of bank relationships does influence firm's borrowing costs. 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 basis points. The time dummies display large and significant negative coefficients, that mainly capture the downward trend in interest rates during the sample period. In column 2 we include the *3-month Euribor* as an explanatory variable in the regressions to disentangle the convergence towards EMU from other macroeconomic conditions. The coefficient on the number of bank relationships remains unchanged while the time dummies coefficients now reflect the business cycle.

Next we control for the firm characteristics, including *Turnover*, *Tangible assets as % of debt*, *Leverage*, *Credit risk*, *Debt coverage*, *Firm age* and *Log Assets*. The number of observations is reduced by approximately half because of the inclusion of the lagged variables. All coefficients show up with the expected sign when statistically significant. *Turnover*, *Tangible assets as % of debt* and *Log Assets* reduce interest rates, while *Leverage* and *Credit risk* have the opposite effect[8]. The coefficients on *Debt coverage* and *Firm Age* are not statistically significant at a 10% confidence level. The results regarding the number of bank relationships are very similar to the previous set of regressions without

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[8]Instead of using bank leverage, we also tested total leverage, but the former has a stronger explanatory power. In this sample, loans from credit institutions account for 36 per cent of debt and debt to suppliers accounts for 30 per cent of total debt.

the firm controls: one additional relationship should decrease interest rates by 12 basis points. The time dummies and the money market interest rate are highly significant, suggesting that it is important to control for macroeconomic and financial developments.

Given that firm size may influence interest rates non-linearly, in the fourth column of Table 7 we add to the regression $(Log\ Assets)^2$. The coefficient for this variable is positive, thus implying a convex effect of firm size on interest rates.

In order to better explore differences across firm size, we repeat the same regression for each size category. We find that *Number of relationships* decreases the cost of debt for all firm sizes, even though the effect is not statistically significant for micro firms at a 10% confidence level. The largest slope coefficient is obtained for large firms: an additional bank relationship reduces the interest rate on average by 20 basis points for large firms and by 17 and 13 basis points for small and medium firms, respectively.

Firm age fails to be significant in all 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. 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 have an age above the median age. The results are displayed in the last two columns of Table 7. On average one additional relationship for older firms significantly decreases interest rates by 14 basis points. For younger firms, this effect is only significant at a 10% confidence level, amounting to 13 basis points. Older firms which hold, on average, a larger number of bank relationships, should benefit more from the diversification in lending sources.

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As a robustness test, we decide to construct a different measure of the number of bank relationships. More specifically, we define *Concentration in Lending (HHI)* and construct it as a Herfindahl Index of the amount 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*. Table 8 shows regression results with this alternative measure of the bank relationship. Our previous 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 larger firms. If large firms concentrate all their lending in one bank, they should 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 are loan amounts distributed across those relationships.[9].

For robustness purposes, several different specifications were considered. First, we took into account the possibility of changes in the degree of bank competition affecting interest rates over time. However, different measures of bank competition did not prove to be significant in explaining changes in interest rates, including measures related to competition from foreign banks operating in Portugal. We also tested whether lending from state-owned banks influenced borrowing costs, but the effect was also not statistically significant. The maturity structure of firms' debt was also considered, though it did not lead to conclusive results. Moreover, we controlled for differences in firms' with exports, both inside and outside the European Union, but the estimations performed did not point to significant differences. Finally, concerning the number of bank relation-

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[9]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.

ships, we also tested the possibility of non-linear effects, as well as the effect of having one versus multiple relationships. These estimations also did not lead to statistically significant results.

To summarize, we find strong evidence that the number of bank relationships is significantly negatively related to the interest rate that banks charge. Thus in Portugal the benefit of keeping an exclusive bank relationship does not seem to reduce the cost of borrowing, at least in the last decade.

4   Endogeneity

We are seriously concerned with the idea that the number of bank relationships and the cost of borrowing may be simultaneously determined, which introduces an endogeneity problem in our empirical analysis. For instance, the unobservable managerial ability may jointly influence the choice of the number of banks and the interest rate that banks charge. A manager with good negotiation skills may be able to maintain strong relationships with multiple banks and at the same time be able to bargain a lower cost of debt.

We address this issue by using an instrumental variable approach. We instrument the number of bank relationships by the change in the number of bank relationships from the previous year, i.e. *Number of Bank Relationships(t)- Number of Bank Relationships(t-1)*. A good instrument must be uncorrelated with the residual and simultaneously have some explanatory power on the endogeneous variable. We consider that the change in the number of bank relationships should be a good instrument because this variable should influence borrwing costs only through the number of bank relationships, other firm characteristics controlled for.

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In Table 9, we run the same set of regressions using the above-mentioned instrument for *Number of Bank Relationships* and find that our previous findings are robust. The slope coefficient for *Number of Bank Relationships* is larger: an additional bank relationship reduces the cost of debt by 33 basis points on average, more than doubling the previously obtained coefficient. Moreover, this finding holds significant across all firm size categories, whereas before this coefficient was not significant for the smallest firms in the sample. In fact, the effect of the number of bank relationships on interest rates is larger for micro firms (44 basis points) and for large firms (43 basis points).

In Table 9 we also report the results for the first step regressions, which confirm that the change in the number of bank relationships significantly influences the endogenous variable, other firm characteristics controlled for.

To validate whether this instrumental variable approach is correctly dealing with the potential endogeneity problem, we test for the endogeneity of regressors. This test compares the instrumental variable estimates with least square estimates. If there is in fact an endogeneity problem, these estimates will not be consistent (Cameron and Trivedi, 2005). This Hausman-type test evaluates whether $\gamma = 0$ in the regression

$$y = x_1' \beta_1 + x_2' \beta_2 + \hat{x}_1' \gamma + u$$

where x_1 is the potentially endogenous variable, x_2 is a vector of exogeneous variables and $\hat{x}_1$ is the predicted value of the endogenous regressors x_1 from the first step regression. This test is an augmented version of the Hausman test because the panel data stucuture requires the use of heteroskedastic-consistent estimates of the variance matrix. For all the instrumental variable regressions present, this test clearly rejects the null, indicating that the endogeneity problem was indeed affecting the results.

5   Concluding remarks

We construct a unique dataset containing 17.516 Portuguese small, medium and large firms and spanning from 1996 to 2004. Using this dataset we study the impact of the number of banks a firm borrows from on the cost of bank loans. The results obtained suggest that holding several bank relationships significantly decreases borrowing costs. We find that the average Portuguese firm borrows from three different banks, which is a relatively high number of relationships by international standards, but typical among countries with the French law system. Firms pay lower interest rates if they diversify their pool of lenders. When a firm has one additional bank relationship, the interest rate on bank loans for this firm becomes 12 to 33 basis points lower, on average.

Our findings are clearly against the predictions of the delegated monitoring theory, even for the smallest firms in our sample, which are expected to face the most severe information problem in the economy. This might have to do with the fact that the Central Credit Register allows Portuguese financial institutions to share crucial information on their clients, e.g. the amount of debt overdue and the repayment record of the firm, regardless of the firm size. The results seem to suggest that information sharing mechanisms such as the Central Credit Register can partially substitute the benefit of relationship banking in overcoming the information asymmetry problem and reduce the need to maintain exclusive relationships with banks.

Our finding is consistent with Carletti et al. (2007), who find that banks benefit from risk diversification brought by multiple-bank lending. The decreasing interest rate reflects that the reduction in risk level overcomes free-riding and duplication of monitoring costs. However, to the contrary of the prediction of Carletti et al. (2007) that the benefit of diversification is stronger with small opaque less profitable firms, we find

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that the negative correlation between the number of banks and the interest rate holds robust across all firm sizes. Specifically, even large mature profitable firms benefit from multiple lending.

In addition, firms with many relationships should have more bargaining power in their relations with banks, given that they may easily obtain funding from other banks if they are not offered competitive conditions. The stronger is bank competition, the more should a firm profit from having many relationships, as banks may be more willing to beat their rivals bids to lock in a customer. In fact, the finding that the interest rate decreases in the number of banks is consistent with the competition argument by Boot and Thakor (2000) that when banks compete to gain clients, firms are able to borrow from multiple banks at lower costs.

References

[1]Berger, A. N., and G. F. Udell (1998), The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle, *Journal of Banking and Finance*, 22, 613–673.

[2]Bolton, P. and D. Scharfstein (1996), Optimal debt structure and the number of creditors, *The Journal of Political Economy*, 104, 1-25.

[3]Boot, A. and A. Thakor (2000), Can relationship banking survive competition?, *The Journal of Finance*, 55, 679-713.

[4] Cameron, A. and P. Trivedi (2005), *Microeconometrics: methods and applications*, Cambridge University Press.

[5]Carletti, E., V. Cerasi, and S. Daltung (2007), Multiple-bank lending: Diversification and free-riding in monitoring, *Journal of Financial Intermediation*,16, 425-451.

[6]D'Auria, C, A. Foglia and P. M. Reedtz (1999), Bank interest rates and credit relationships in Italy, *Journal of Banking and Finance*, 23, 1067-1093.

[7]Degryse, H. and S. Ongena (2007), Competition and Regulation in the Banking Sector: A Review of the Empirical Evidence on the Sources of Bank Rents, in Thakor, A. and A. Boot (eds), Handbook of Financial Intermediation and Banking (Elsevier), *forthcoming.*

[8]Detagriache, E., P. Garella and L. Guiso (2000), Multiple versus single banking relationships: theory and evidence, *The Journal of Finance*, 55, 1133-1161.

[8]Dewatripont, M., and E. Maskin (1995), Credit and efficiency in centralized and decentralized economies, *Review of Economic Studies*, 62, 541-555.

[10]Diamond, D. (1984), Financial intermediation and delegated monitoring, *Review of Economic Studies*, 51, 393-414.

[11]Farinha, L. and J. A. C. Santos (2002), Switching from single to multiple bank lending relationships: Determinants and implications, *Journal of Financial Intermediation*, 11, 124–151.

[12]Holmstrom, B., and J. Tirole (1997), Financial intermediation, loanable funds, and the real sector, *Quarterly Journal of Economics*, 112, 663-691.

[13]Ongena , S. and D. Smith (2000), What determines the number of bank relationships? Cross-country evidence, *Journal of Financial Intermediation*, 9, 26-56.

[14]Petersen, M. and R. Rajan (1994), The benefits of lending relationships: Evidence from small business data, *The Journal of Finance*, 49, 3-37.

[15]Rajan, R. (1992), Insiders and outsiders: The choice between informed and arm's-length debt, *The Journal of Finance*, 47, 1367-1400.

[16]Ribeiro, N. (2007), "Debt growth: factors, institutional issues and implications - the Portuguese case" in C. Enoch and I. Otker-Robe, eds: *Rapid Credit Growth in Central and Eastern Europe: Endless Boom or Early Warning?*, Palgrave

[17]Sharpe, S. (1990), Asymmetric information, bank lending and implicit contracts: A stylized model of customer relationships, *The Journal of Finance*, 45, 1069-1087.

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 equalled zero, given that it would not make sense to compute implicit interest rates in such cases. We also excluded all firms which 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 5st 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 with 42.263 observations between 1996 and 2004.

Tables and figures

Figure 1
Implicit interest rate measures
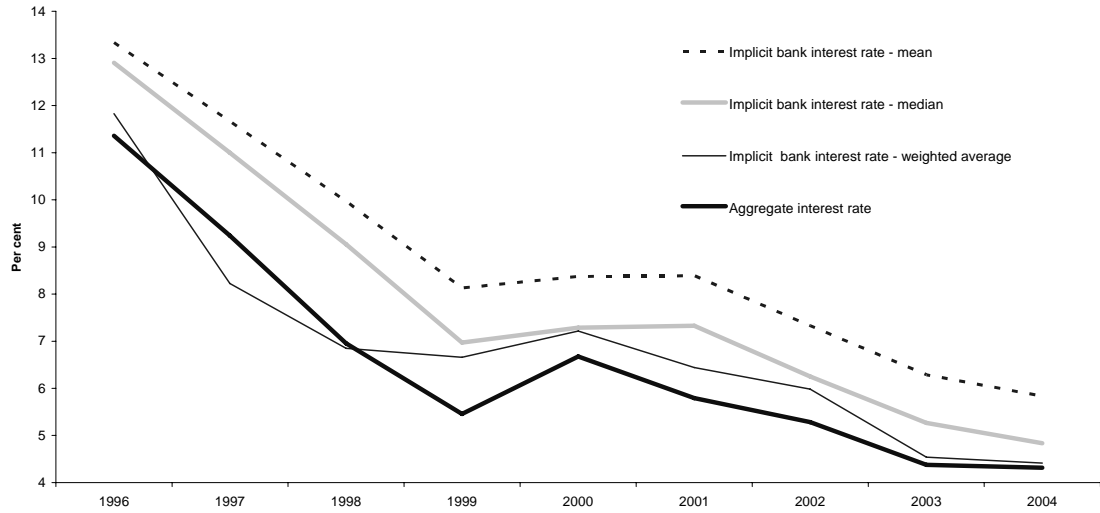
Notes: The aggregate interest rate is the interest rate on outstanding amounts of loans to non-financial corporations disclosed by Banco de Portugal in its Monetary and Financial Statistics. This interest rate is a weighted average of interest rates reported by banks. Implicit interest rates were computed 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
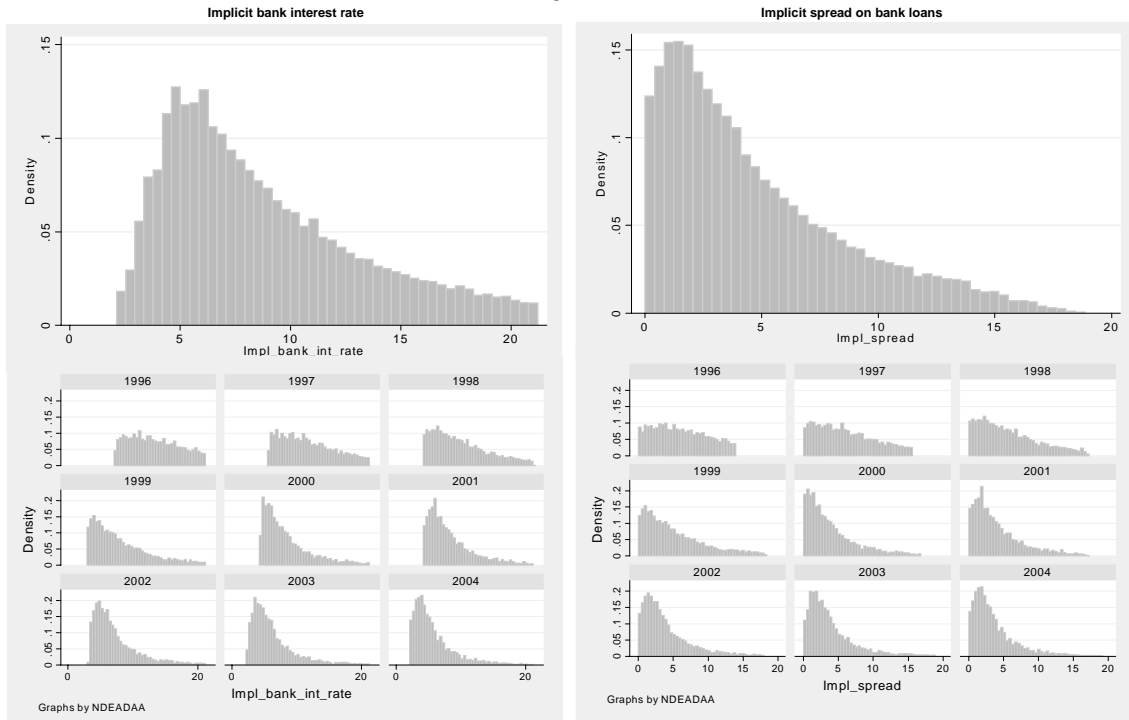
Note: Empirical distribution of the implicit interest rate on bank loans, computed as interest paid to banks as a percentage of total debt to credit institutions for each firm. As interest rates show a steady downward trend during our sample period, we also present the empirical distribution of the implied spread on banks loans, defined as the difference between the implicit interest rate and a money market interest rate (3-month Euribor).

Figure 3
Number of relationships and implicit bank interest rates

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. These two databases were matched, which means that these two indicators refer to the same sample of firms.

Figure 4
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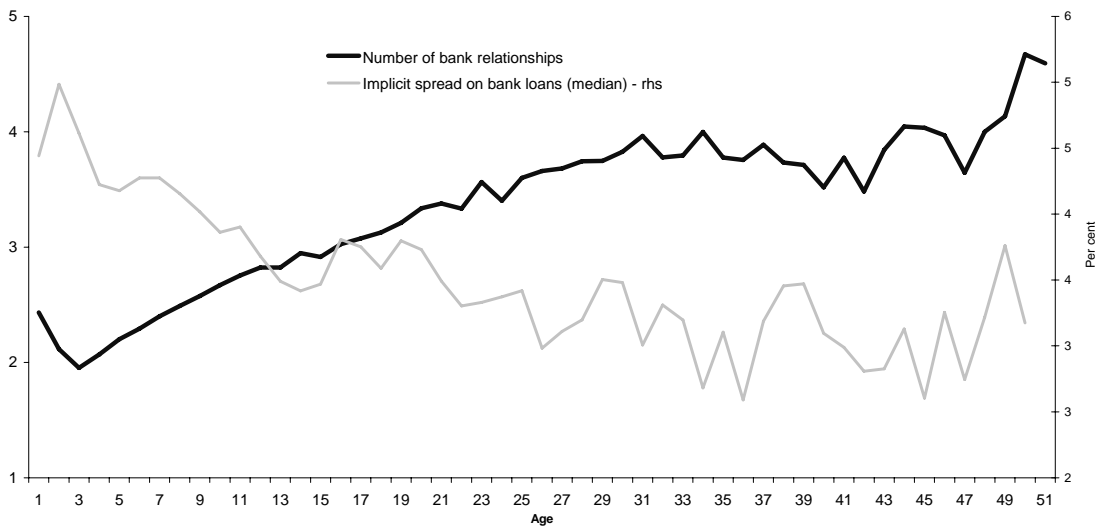 spread on banks loans was defined as the difference between the implicit interest rate and a money market interest rate (3-month Euribor). The number of relationships was computed using information from the Central Register of Banco de Portugal, which includes data on all loans granted in Portugal above 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. These two databases were matched, which means that these two indicators refer to the same sample of firms.

Table 1

Number of bank relationships	Obs.	Implicit bank interest rates		Age		Employees	
		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	42263	8.8		18.6		66	

Notes: Interest rate were 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 observations	Number of bank relationships			Implicit bank interest rate	
		Mean	Median		Mean	Median
Micro	12417	1.8	2.0		9.6	8.7
Small	18703	2.8	2.0		8.9	7.8
Medium	8918	4.4	2.0		7.8	6.6
Large	2225	6.2	6.0		7.3	6.2
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. 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 were defined as those with less than 10 employees and less than 2 million euro of business volume; small firms were those with less than 50 employees and less than 10 million euro of business volume; medium firms were those with less than 250 employees and a business volume below 50 million euro. All remaining firms were considered to be large firms.

Table 3
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 4
Mean comparison tests

	Average interest rate for firms with few relations	Average interest rate for firms with many relations	Mean comparison test Ho: diff = 0		
			diff	t-ratio	Pr(|T| > |t|)
All firms	9.5	8.2	1.27	22.44	0.00
Micro	9.9	9.4	0.44	5.44	0.00
Small	9.0	8.7	0.29	3.92	0.00
Medium	7.9	7.8	0.04	0.43	0.67
Large	6.9	8.1	-1.17	-5.54	0.00

Note: 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 5
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	25.5	51.7	0.0	3.4	11.5	21.1	34.0	60.6	7892	118.6	16686.5
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 to credit institutions 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 6 - Correlation matrix

	Implicit bank interest rate	Number of bank relations	Turnover	Tangible assets as % debt	Leverage	Credit risk	Debt coverage	Age	Log assets
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	-0.2080*	0.1564*	-0.1243*	-0.1377*	1				
Credit risk	0.0363*	0.0908*	-0.0955*	-0.0163*	0.0339*	1			
Debt coverage	0.0306*	-0.0416*	0.1465*	0.0584*	-0.2377*	-0.0850*	1		
Age	-0.1073*	0.2603*	-0.0849*	0.0843*	-0.0246*	0.0164*	-0.0156	1	
Log assets	-0.2894*	0.6268*	-0.2309*	0.1399*	0.0808*	0.0532*	0.0273*	0.3197*	1

Notes: An asterisk means that the pairwise correlation is significant at a 5 per cent confidence level. Turnover represents sales and services over assets. Leverage is defined as debt to credit institutions 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 7 - 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
Number of bank relationships $_t$	-0.142	-0.142	-0.124	-0.122	-0.255	-0.175	-0.130	-0.203	-0.134	-0.138
	-5.51	*-5.51*	*-3.12*	*-3.07*	*-1.30*	*-2.37*	*-1.94*	*-2.05*	*-1.62*	*-2.92*
Turnover $_{t-1}$	-	-	-0.01	-0.005	-0.008	-0.004	0.002	-0.003	-0.007	-0.005
	-	*-*	*-4.00*	*-4.05*	*-2.40*	*-1.95*	*0.78*	*-0.50*	*-3.56*	*-2.61*
Tangible assets as % of debt $_{t-1}$	-	-	-0.005	-0.005	0.007	-0.011	-0.007	0.001	-0.005	-0.003
	-	*-*	*-2.12*	*-2.02*	*0.84*	*-2.76*	*-1.99*	*0.09*	*-1.21*	*-1.10*
Leverage $_{t-1}$	-	-	0.033	0.032	0.054	0.030	0.022	0.015	0.042	0.035
	-	*-*	*6.36*	*6.30*	*3.83*	*4.04*	*2.29*	*0.62*	*4.76*	*5.05*
Credit risk $_{t-1}$	-	-	0.450	0.457	0.378	0.906	0.056	0.129	0.301	0.586
	-	*-*	*2.02*	*2.05*	*0.62*	*2.30*	*0.14*	*0.24*	*0.74*	*2.07*
Debt coverage $_{t-1}$	-	-	-0.002	-0.001	0.000	-0.002	-0.006	-0.003	0.002	-0.005
	-	*-*	*-1.08*	*-1.05*	*0.06*	*-0.83*	*-1.84*	*-0.63*	*0.79*	*-2.52*
Firm age $_{t-1}$	-	-	0.420	0.561	0.850	-0.201	1.252	2.691	-	-
	-	*-*	*0.96*	*1.27*	*0.63*	*-0.30*	*1.27*	*1.24*	*-*	*-*
Assets $_t$	-	-	-1.750	-5.901	-	-	-	-	-5.264	-9.697
	-	*-*	*-9.37*	*-3.58*	*-*	*-*	*-*	*-*	*-2.02*	*-3.75*
Assets $_t^2$	-	-	-	0.143	-	-	-	-	0.126	0.261
	-	*-*	*-*	*2.58*	*-*	*-*	*-*	*-*	*1.39*	*3.07*
3-month Euribor $_t$	-	1.342	1.387	1.414	1.605	1.578	1.569	1.436	1.288	1.365
	-	*60.55*	*18.88*	*19.18*	*5.63*	*13.65*	*12.17*	*5.32*	*13.10*	*20.87*
1997	-1.844	0.384	-	-	-	-	-	-	-	-
	-17.33	*4.25*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
1998	-3.642	0.438	0.100	0.124	0.516	0.295	-0.020	0.325	-0.043	0.106
	-33.35	*5.07*	*0.78*	*0.96*	*1.26*	*1.46*	*-0.09*	*0.63*	*-0.21*	*0.66*
1999	-5.622	0.163	-0.004	0.041	0.497	0.310	-0.132	-0.152	-0.203	-0.012
	-53.16	*1.97*	*-0.03*	*0.27*	*1.01*	*1.33*	*-0.49*	*-0.24*	*-0.89*	*-0.08*
2000	-5.189	-1.324	-1.759	-1.766	-2.320	-1.840	-1.731	-1.550	-1.649	-1.854
	-47.19	*-16.27*	*-14.48*	*-14.57*	*-5.98*	*-10.02*	*-7.88*	*-3.21*	*-7.80*	*-12.08*
2001	-4.937	-0.897	-1.095	-1.111	-1.642	-1.381	-1.148	-0.875	-1.031	-1.064
	-44.75	*-11.19*	*-8.47*	*-8.61*	*-3.89*	*-7.09*	*-4.95*	*-1.66*	*-4.75*	*-6.69*
2002	-5.859	-0.558	-0.703	-0.707	-1.039	-0.880	-0.686	-0.584	-0.588	-0.708
	-53.00	*-7.38*	*-6.70*	*-6.75*	*-3.20*	*-5.48*	*-3.61*	*-1.59*	*-2.94*	*-5.54*
2003	-6.628	0.002	-0.013	-0.001	0.198	-0.007	-0.188	0.208	0.003	-0.024
	-59.54	*0.02*	*-0.14*	*-0.02*	*0.69*	*-0.05*	*-1.23*	*0.59*	*0.01*	*-0.21*
2004	-6.926	-	-	-	-	-	-	-	-	-
	-60.55	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Constant	13.764	4.007	28.081	57.311	1.495	4.343	-1.438	-5.059	53.332	89.524
	116.22	*30.31*	*9.43*	*4.72*	*0.34*	*1.93*	*-0.42*	*-0.66*	*2.86*	*4.55*
Number of observations	38764	38764	16804	16804	3780	7836	4204	984	7584	9220
Number of firms	16014	16014	7700	7700	2174	3822	1875	435	4043	4115
R^2 within	0.268	0.268	0.203	0.204	0.139	0.199	0.234	0.172	0.180	0.218
R^2 between	0.265	0.265	0.187	0.194	0.047	0.161	0.149	0.035	0.156	0.180
R^2 overall	0.259	0.259	0.160	0.170	0.049	0.157	0.143	0.021	0.145	0.151

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 to credit institutions 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. The excluded year dummy variables were 1996 and 1997.

Table 8 - 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
Concentration in lending (HHI)$_t$	0.537	0.537	0.493	0.447	1.169	0.630	0.326	4.329	0.682	0.410
	3.04	*3.04*	*1.68*	*1.52*	*1.43*	*1.46*	*0.56*	*2.92*	*1.38*	*1.05*
Turnover$_{t-1}$	-	-	-0.005	-0.005	-0.008	-0.004	0.002	-0.003	-0.007	-0.005
	-	*-*	*-3.94*	*-3.99*	*-2.36*	*-1.87*	*0.86*	*-0.46*	*-3.55*	*-2.53*
Tangible assets as % of debt$_{t-1}$	-	-	-0.005	-0.005	0.007	-0.011	-0.007	-0.001	-0.005	-0.003
	-	*-*	*-2.11*	*-2.01*	*0.87*	*-2.75*	*-1.99*	*-0.07*	*-1.17*	*-1.12*
Leverage$_{t-1}$	-	-	0.032	0.032	0.054	0.029	0.020	0.008	0.042	0.034
	-	*-*	*6.24*	*6.17*	*3.85*	*3.92*	*2.12*	*0.30*	*4.72*	*4.89*
Credit risk$_{t-1}$	-	-	0.445	0.452	0.320	0.910	0.064	0.024	0.292	0.577
	-	*-*	*2.00*	*2.03*	*0.53*	*2.31*	*0.16*	*0.04*	*0.72*	*2.03*
Debt coverage$_{t-1}$	-	-	-0.001	-0.001	0.000	-0.002	-0.006	-0.004	0.002	-0.005
	-	*-*	*-1.04*	*-1.01*	*0.08*	*-0.79*	*-1.82*	*-0.91*	*0.82*	*-2.47*
Firm age$_{t-1}$	-	-	0.328	0.468	0.787	-0.262	1.157	2.309	-	-
	-	*-*	*0.75*	*1.06*	*0.59*	*-0.39*	*1.17*	*1.08*	*-*	*-*
Assets$_t$	-	-	-1.812	-5.914	-	-	-	-	-5.062	-9.842
	-	*-*	*-9.75*	*-3.58*	*-*	*-*	*-*	*-*	*-1.94*	*-3.80*
Assets$_t^2$	-	-	-	0.141	-	-	-	-	0.117	0.263
	-	*-*	*-*	*2.55*	*-*	*-*	*-*	*-*	*1.29*	*3.10*
3-month Euribor$_t$	-	1.341	1.360	1.387	1.597	1.567	1.546	1.347	1.284	1.338
	-	*60.35*	*18.75*	*19.03*	*5.64*	*13.52*	*12.06*	*5.57*	*13.10*	*20.78*
1997	-1.849	0.377	-	-	-	-	-	-	-	-
	-17.38	*4.17*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
1998	-3.629	0.447	0.100	0.124	0.522	0.303	0.002	0.413	-0.035	0.119
	-33.21	*5.17*	*0.78*	*0.96*	*1.28*	*1.49*	*0.01*	*0.82*	*-0.17*	*0.74*
1999	-5.624	0.155	-0.041	0.004	0.479	0.296	-0.165	-0.220	-0.208	-0.044
	-53.14	*1.87*	*-0.28*	*0.03*	*0.97*	*1.26*	*-0.61*	*-0.37*	*-0.91*	*-0.28*
2000	-5.185	-1.324	-1.736	-1.743	-2.311	-1.826	-1.707	-1.417	-1.641	-1.822
	-47.09	*-16.25*	*-14.28*	*-14.37*	*-5.97*	*-9.94*	*-7.77*	*-2.98*	*-7.75*	*-11.84*
2001	-4.913	-0.877	-1.046	-1.063	-1.640	-1.073	-0.661		-1.019	-0.992
	-44.52	*-10.95*	*-8.18*	*-8.31*	*-3.90*	*-6.96*	*-4.67*	*-1.36*	*-4.71*	*-6.30*
2002	-5.836	-0.540	-0.672	-0.676	-1.030	-0.858	-0.635	-0.476	-0.575	-0.660
	-52.74	*-7.14*	*-6.43*	*-6.47*	*-3.19*	*-5.35*	*-3.35*	*-1.32*	*-2.89*	*-5.17*
2003	-6.614	0.010	-0.007	0.004	0.196	0.003	-0.172	0.233	0.009	-0.009
	-59.32	*0.13*	*-0.08*	*0.04*	*0.68*	*0.02*	*-1.13*	*0.65*	*0.05*	*-0.08*
2004	-6.919	-	-	-	-	-	-	-	-	-
	-60.35	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Constant	12.978	3.230	28.611	57.546	0.262	3.653	-1.811	-6.258	51.450	90.509
	92.08	*22.47*	*9.57*	*4.73*	*0.06*	*1.62*	*-0.52*	*-0.81*	*2.75*	*4.59*
Number of observations	38764	38764	16804	16804	3780	7836	4204	984	7584	9220
Number of firms	16014	16014	7700	7700	2174	3822	1875	435	4043	4115
R^2 within	0.267	0.267	0.203	0.203	0.139	0.198	0.232	0.188	0.180	0.216
R^2 between	0.263	0.263	0.190	0.196	0.046	0.159	0.154	0.040	0.157	0.185
R^2 overall	0.256	0.256	0.164	0.172	0.048	0.155	0.146	0.034	0.146	0.156

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 as Herfindahl index using bank shares at the firm level. Turnover represents sales and services over assets. Leverage is defined as debt to credit institutions 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. The excluded year dummy variables were 1996 and 1997.

Table 9 - Regression results

Instrumental variables regressions

	Instrument: change in the number of bank relations					Memo: 1st stage regressions				
	All firms	Micro firms	Small firms	Medium firms	Large firms	All firms	Micro firms	Small firms	Medium firms	Large firms
Number of bank relationships $_t$	-0.328	-0.444	-0.385	-0.306	-0.431					
	-5.49	*-2.06*	*-3.76*	*-3.18*	*-3.00*					
Change in number of bank relationships $_t$						0.481	0.479	0.492	0.470	0.486
						64.35	*33.05*	*44.99*	*30.95*	*15.76*
Turnover $_{t-1}$	-0.005	-0.008	-0.004	0.002	-0.003	-0.001	-0.001	-0.002	-0.002	-0.003
	-5.35	*-3.46*	*-2.73*	*0.85*	*-0.76*	*-4.09*	*-2.93*	*-4.89*	*-2.72*	*-1.57*
Tangible assets as % of debt $_{t-1}$	-0.005	0.007	-0.011	-0.008	0.000	-0.001	0.000	-0.001	-0.001	-0.005
	-2.53	*1.05*	*-3.61*	*-2.23*	*-0.05*	*-2.50*	*0.08*	*-1.88*	*-0.85*	*-1.76*
Leverage $_{t-1}$	0.033	0.054	0.032	0.024	0.013	0.009	0.004	0.011	0.020	-0.007
	8.51	*5.86*	*5.28*	*2.99*	*0.76*	*8.82*	*3.10*	*8.47*	*7.29*	*-0.95*
Credit risk $_{t-1}$	0.458	0.397	0.908	0.037	0.198	0.114	0.151	0.093	0.029	0.422
	2.45	*0.72*	*2.83*	*0.12*	*0.38*	*2.34*	*1.96*	*1.34*	*0.28*	*1.83*
Debt coverage $_{t-1}$	-0.002	0.000	-0.002	-0.006	-0.003	-0.001	0.000	0.000	-0.001	-0.001
	-1.65	*0.09*	*-1.14*	*-2.96*	*-0.93*	*-3.14*	*0.19*	*-1.14*	*-1.76*	*-0.64*
Firm age $_{t-1}$	0.739	0.900	-0.112	1.408	3.229	1.170	0.483	0.665	1.348	3.253
	1.98	*0.87*	*-0.20*	*1.67*	*1.77*	*12.18*	*3.32*	*5.47*	*4.76*	*4.09*
Assets $_t$	-5.578	-	-	-	-	1.152	-	-	-	-
	-4.44	*-*	*-*	*-*	*-*	*3.54*	*-*	*-*	*-*	*-*
Assets $_t^2$	0.138	-	-	-	-	-0.017	-	-	-	-
	3.21	*-*	*-*	*-*	*-*	*-1.51*	*-*	*-*	*-*	*-*
3-month Euribor $_t$	1.466	1.605	1.588	1.603	1.617	0.265	0.022	0.076	0.240	0.746
	23.06	*7.36*	*16.58*	*14.78*	*6.92*	*16.53*	*0.71*	*3.68*	*6.68*	*8.28*
1998	0.112	0.515	0.259	-0.060	0.318	0.129	-0.012	-0.019	0.054	0.873
	1.06	*1.71*	*1.61*	*-0.32*	*0.77*	*4.64*	*-0.27*	*-0.55*	*0.83*	*4.56*
1999	0.110	0.515	0.314	-0.081	0.186	0.335	0.054	0.032	0.303	1.435
	0.86	*1.38*	*1.61*	*-0.35*	*0.36*	*10.19*	*1.03*	*0.75*	*3.96*	*6.81*
2000	-1.809	-2.306	-1.857	-1.766	-1.602	-0.103	0.083	-0.035	-0.049	0.169
	-17.42	*-7.55*	*-12.01*	*-9.76*	*-3.90*	*-3.85*	*1.93*	*-1.04*	*-0.81*	*0.93*
2001	-1.216	-1.629	-1.430	-1.268	-1.213	-0.319	0.060	-0.148	-0.405	-0.648
	-10.77	*-4.85*	*-8.66*	*-6.36*	*-2.65*	*-11.21*	*1.26*	*-4.16*	*-6.32*	*-3.47*
2002	-0.771	-1.024	-0.908	-0.771	-0.788	-0.276	0.038	-0.158	-0.427	-0.654
	-7.80	*-3.72*	*-6.07*	*-4.42*	*-2.18*	*-10.93*	*0.99*	*-4.89*	*-7.54*	*-4.35*
2003	-0.015	0.205	-0.021	-0.216	0.195	-0.051	0.046	-0.052	-0.153	-0.057
	-0.15	*0.79*	*-0.14*	*-1.28*	*0.60*	*-2.01*	*1.27*	*-1.57*	*-2.70*	*-0.39*
Constant	53.828	1.754	4.703	-1.192	-5.672	-13.859	0.680	0.949	-0.441	-5.385
	5.90	*0.53*	*2.47*	*-0.40*	*-0.87*	*-5.87*	*1.45*	*2.31*	*-0.44*	*-1.86*
Number of observations	16804	3780	7836	4204	984	16804	3780	7836	4204	984
Number of firms	7700	2174	3822	1875	435	7700	2174	3822	1875	435
R^2 within	0.201	0.138	0.197	0.230	0.160	0.358	0.418	0.352	0.341	0.468
R^2 between	0.183	0.046	0.154	0.133	0.025	0.371	0.056	0.087	0.086	0.091
R^2 overall	0.159	0.048	0.150	0.130	0.012	0.385	0.078	0.095	0.092	0.103

Notes: t-statistics in italics. 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 to credit institutions 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. The excluded year dummy variables were 1996 and 1997.