BANK RELATIONSHIPS AND BORROWING COSTS*

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1. INTRODUCTION

Firms may benefit from engaging in exclusive and lasting relationships with banks. Through these lending relationships, banks obtain important soft information regarding firms' performance, organization and strategy, which would be very hard to obtain otherwise. This information can be reflected in better funding conditions for firms, either through improved accessibility to credit or through better price conditions. However, firms may also be harmed by these relationships. For instance, banks can initially offer good conditions to attract customers, but once they are locked in the relationship banks may extract rents from these firms. There is a large theoretical and empirical literature debating the costs and benefits of relationship banking.[1]

In this article, we address a specific issue in this literature: how does the number of bank relationships affect borrowing costs. Given the arguments outlined above, this effect can either be positive or negative. Moreover, the results obtained so far provide mixed evidence (Degryse, Kim and Ongena, 2009).

Using a detailed dataset for Portuguese firms, we find that firms usually borrow simultaneously from several banks, even if they are small firms. The larger firms are, the more bank relationships they usually hold. Furthermore, we find that when firms increase the number of lenders, they benefit from a significant decrease in borrowing costs. This result is broadly valid regardless of firm size, except for the smallest firms in the sample. Moreover, the largest firms are those which benefit more from engaging in multiple bank relationships. Instead of considering only the number of bank relationships, we also analyze the impact of the distribution of loan amounts amongst different banks. We find that when firms concentrate their lending in fewer banks, their borrowing costs increase, what reinforces our previous findings.

This article proceeds as follows. In Section 2 we present a brief review of the relevant literature. In Section 3 we describe the data used and in Section 4 we present some summary statistics. In Section 5 we analyse our main econometric results. Finally, in Section 6 we present some concluding remarks.

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(1) For a recent and extensive survey, see Degryse, Kim and Ongena (2009).

2. LITERATURE REVIEW

According to Diamond's (1984) classical delegated monitoring theory, in a setting of asymmetric information between firms and investors, the former should be better off when they borrow from only one bank. This result derives from the fact that single bank relationships decrease overall monitoring costs, which in turn generate lower borrowing costs. This theory was empirically tested by Petersen and Rajan (1994), who found that the existence of multiple lenders increases loan interest rates and broadly reduces the availability of credit.

However, 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 per cent) borrow from more than one bank. These authors observe that firms usually maintain more bank relationships in countries with inefficient judicial systems and poor enforcement of creditor rights. D'Auria, Foglia and Reedtz (1999) obtain similar results for Italy. In our dataset we also find that the majority of Portuguese firms, including micro firms, borrow from several banks.

There are many theories attempting to provide an explanation for why firms may prefer to borrow from several different banks. According to Sharpe (1990) and Rajan (1992), 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 with a unique lender should face higher borrowing costs. In turn, 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 exclusive bank relationships undesirable. Detragiache, Garella, and Guiso (2000) show that firms borrowing from less fragile banks are more likely to engage into multiple bank relationships. Bolton and Scharfstein (1996) consider that multiple bank relationships might prevent the firm manager from strategic defaulting by holding up the renegotiation process. Furthermore, Dewatripont and Maskin (1995), Holmstrom and Tirole (1997), and Carletti, Cerasi and Daltung (2007) predict that multiple bank relationships will be more likely 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. Moreover, in the face of fierce competition, multiple arms-length lending might substitute relationship lending as analyzed by Boot and Thakor (2000). These authors predict that bank competition should lead to lower interest rates and that firms will not commit to exclusive bank relationships. On the other hand, they argue that relationship lending might protect banks from price competition. Finally, in a recent paper, Ioannidou and Ongena (2010) show that when firms change banks they initially benefit from lower interest rates. However, as time goes by, hold-up effects gradually emerge.

3. DATA

We use two large datasets 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. 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. This database does not include any information regarding collateral and interest rates, and includes only partial information on individual loans maturities.

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 database covers only a limited (but large) sample of Portuguese firms. The sample of firms covers to an acceptable degree the Portuguese universe, although some bias may exist towards larger firms, which are almost totally covered.

Using end of year data for the period comprised between 1996 and 2004, the Central Credit Register includes 3,990,802 records. 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. 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.[2] 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. We analyze only lending relationships between firms and banks, excluding all lending relationships with non-monetary credit institutions, such as leasing companies.

We define the interest rate r_{it} as:

$$r_{it} = \frac{IP_{it}}{D_{it}}$$

where IP_{it} are interest payments on bank loans and D_{it} is total debt to credit institutions of firm i. r_{it} is therefore the implicit interest rate of firm i at time t across all the firm's bank loans.

(2) Not all observations in the Central Balance Sheet Database can be matched with the Credit Register because a substantial percentage of firms do not rely on bank credit, as discussed in Antão and Bonfim (2008).

Several 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. In order to avoid results driven by outliers we also exclude all observations below the 1st percentile and above the 99th percentile of the distribution of each firm specific variable used in the regressions. Moreover, we dropped all observations for which the estimated implicit interest rate was below the interbank money market interest rate.

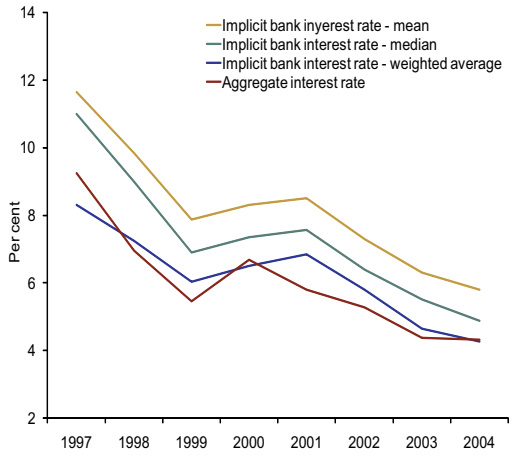
After these filters are applied, our final dataset is an unbalanced panel data containing 42,263 observations, for 17,516 firms, between 1996 and 2004. Each firm has on average 2.4 years of data. Firms' entries and exits from the sample are not strictly associated with firms' creations and extinctions. They reflect primarily the voluntary nature of the survey. If we consider only firms with two consecutive years of data and with information on all variables considered relevant for our analysis, we have a sample of 16,804 observations, covering 7,700 different firms. All summary statistics presented in the next section consider this restricted sample, which will be used for most of the regression analysis.

4. SUMMARY STATISTICS

Chart 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 (Monetary and Financial Statistics). The weighted average of the interest rate

Chart 1

IMPLICIT INTEREST RATE MEASURES



Sources: Banco de Portugal and authors' calculations.
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 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 weighted average of the implicit interest rate considers the total credit outstanding of each firm.

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.[3]

The upper panel of Chart 2 shows a histogram of the bank interest rate over the entire sample. In the lower panel of Chart 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 1997 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. As discussed in Antão *et al.* (2009), this lower dispersion results mainly from the decrease of interest rates for those firms with higher interest payments.

We observe that approximately one fifth (18 per cent) of the firms hold one exclusive lending relationship. Chart 3 shows that the average number of bank relationships did not vary significantly over time, ranging between 3.3 and 3.7 across the sample period. The chart 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.

Chart 4 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. 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.

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. 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 suggest that the number of bank relationships is positively related to firm age and to the number of employees.

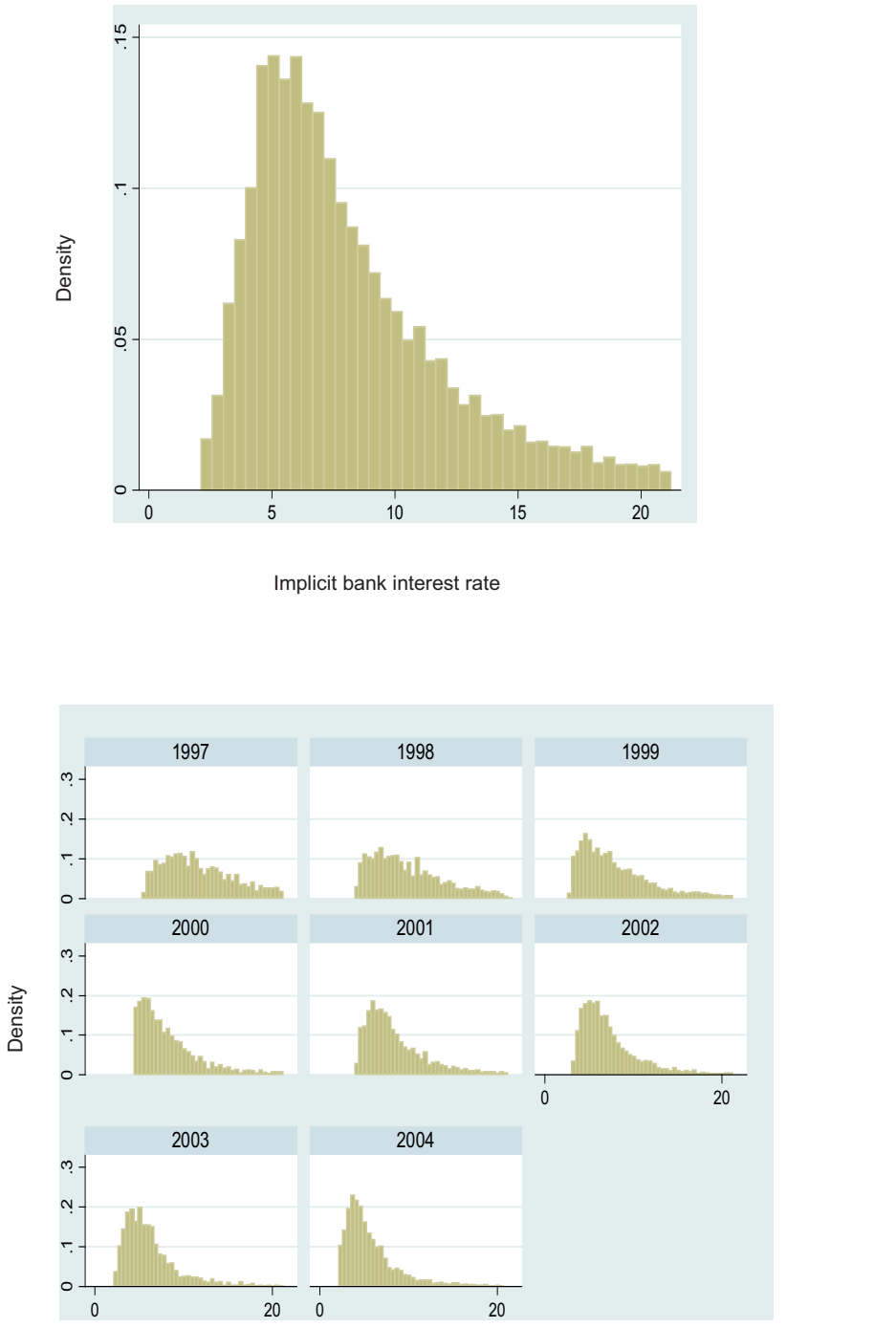
We construct a measure of firm size following a definition suggested by the European Commission that considers the number of employees and sales volumes to define four different size categories: micro, small, medium and large.[4] We end up with 3,780 micro, 7,836 small, 4,204 medium and 984 large firms. Table 2 displays the number of bank relationships and the interest rate for these four categories. On average, micro and small firms hold, respectively, two and three bank relationships, medium-sized firms borrow from more than four banks, while larger firms have more than six different

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

(4) More precisely, in the European Commission Recommendation of 6 May 2003 (2003/361/EC) micro firms are defined as those with fewer than 10 employees and less than 2 million euro of business volume; small firms are those with fewer than 50 employees and less than 10 million euro of business volume; medium firms are those with fewer than 250 employees and a business volume below 50 million euros. All remaining firms are considered to be large firms.

Chart 2

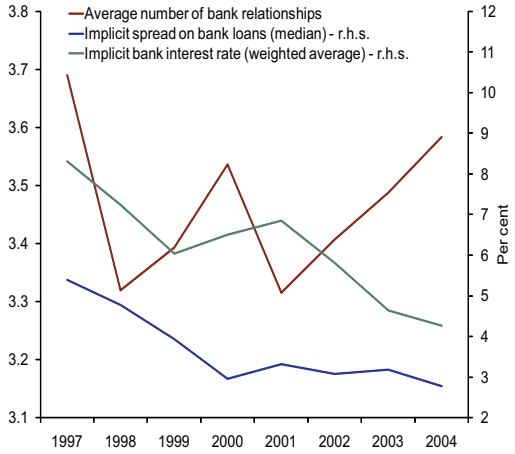
EMPIRICAL DISTRIBUTION OF THE IMPLICIT BANK INTEREST RATE



Sources: Banco de Portugal and authors' calculations.
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.

Chart 3

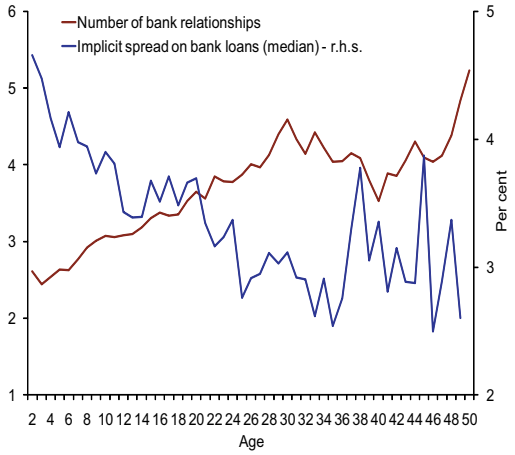
NUMBER OF BANK RELATIONSHIPS AND IMPLICIT BANK INTEREST RATE



Sources: Banco de Portugal and authors' calculations.
Notes: The implicit 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 bank relationships was computed as the number of different banks that were lending to a given firm at the end of each year.

Chart 4

NUMBER OF BANK RELATIONSHIPS BY FIRM AGE



Sources: Banco de Portugal and authors' calculations.
Notes: 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 bank relationships was computed as the number of different banks that were lending to a given firm at the end of each year.

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 relationships.

Table 1

NUMBER OF BANK RELATIONSHIPS

Number of bank relationships	Obs.	Implicit bank interest rates		Age		Number of employees	
		Mean	Median	Mean	Median	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	3 028	8.8	7.9	15.6	12	22	9
2	3 917	8.5	7.4	17.7	14	31	15
3	3 202	8.1	7.1	20.1	16	48	21
4	2 387	7.7	6.8	22.6	18	71	33
5	1 599	7.6	6.7	22.7	19	107	43
6	1 039	7.4	6.5	25.2	20	135	65
7	676	7.3	6.3	26.1	21	141	76
8	378	7.5	6.5	27.0	24	182	108
9	247	7.2	6.5	29.2	24	214	118
10	136	7.5	6.6	33.6	28	296	185
11	78	7.5	6.7	37.1	30	269	202
12	39	7.2	6.5	34.2	30	459	219
13	31	8.3	7.2	38.6	30	506	395
14	13	8.7	8.0	31.5	26	743	577
15	11	8.6	9.1	48.4	55	983	828
Total	16 804	8.1		20.5		71	

Sources: Banco de Portugal and authors' calculations.
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 that 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 BANK RELATIONSHIPS AND INTEREST RATES BY FIRM SIZE

	Number of observations	Number of bank relationships		Implicit bank interest rate		Mean comparison tests				
						Average interest rate for firms with few relationships[a]	Average interest rate for firms with many relationships[a]	Mean comparison test $Ho: diff = 0$		
		Mean	Median	Mean	Median			$diff$	$t\text{-}ratio$	$Pr(\|T\| > \|t\|)$
Micro	3 780	2.0	2.0	9.1	8.2	9.2	8.8	0.42	2.59	0.01
Small	7 836	3.1	3.0	8.2	7.2	8.4	8.0	0.36	3.59	0.00
Medium	4 204	4.7	4.0	7.2	6.3	7.3	7.2	0.08	0.59	0.55
Large	984	6.7	6.0	6.8	6.0	6.6	7.5	-0.90	-3.16	0.00
Total	16 804	3.5	3.0	8.1	7.1	8.7	7.5	1.26	16.11	0.00

Sources: Banco de Portugal and authors' calculations.
Notes: (a) Firms with few relationships were defined as those included in the first quartile of the distribution of the number of relationships. In turn, firms with many relationships were considered to be those in the fourth quartile of the same distribution.

5. BANK RELATIONSHIPS AND BORROWING COSTS

The descriptive analysis performed in the previous section 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. 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. Firms with higher 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.[5] 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. Moreover, this choice mitigates potential concerns of endogeneity biases due to simultaneity issues. Table 3 reports summary statistics for the dependent and independent variables.

The sample period corresponds to a time of structural changes in the Portuguese banking sector as well as to the period of convergence that led to the European Monetary Union participation. 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 and GDP growth.

We estimate the following fixed-effects model:

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

where r_{it} is the interest rate, n^r_{it} is the number of bank relationships, X_{it} and X_{it-1} are vectors of contemporaneous and lagged firm-specific variables,[6] and Z_t is a vector of time-varying variables.

In Table 4 we present our main 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 the *Number of bank relationships* is -0.142 with a *t-statistic*

Table 3

SUMMARY STATISTICS FOR EXPLANATORY VARIABLES

	N	Mean	Std dev	Min	p5	p25	p50	p75	p95	Max	Skewness	Kurtosis
Implicit bank interest rate	16 804	8.1	3.9	2.1	3.5	5.2	7.1	10.1	16.4	21.2	1.1	3.8
Number of bank relationships	16 804	3.5	2.3	1.0	1.0	2.0	3.0	5.0	8.0	25.0	1.6	8.1
Turnover	16 804	126.5	79.2	0.7	30.5	74.7	111.6	158.9	276.2	603	1.7	7.5
Tangible assets as a % of debt	16 804	49.5	42.9	0.2	2.8	16.4	39.6	70.7	132.8	286	1.5	5.9
Leverage	16 804	74.5	21.4	9.0	43.2	62.7	74.3	84.9	101.6	454	2.4	25.0
Credit risk	16 774	0.04	0.198	0.000	0.000	0.000	0.000	0.000	0.000	1.000	4.6	22.5
Debt coverage	16 804	8.0	43.5	-257	-44.4	0.2	3.7	14.5	70.8	322	0.9	15.9
Firm age	16 804	20.5	16.7	0.0	4.0	10.0	16.0	25.0	55.0	248.0	2.3	10.9

Sources: Banco de Portugal and authors' calculations.
Notes: The implicit 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 that 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 that takes the value one when the firm is in default; and debt coverage is defined as net profits over debt to credit institutions.

(5) Age defined as log(1+age).

(6) The only contemporaneous firm-specific variable considered is firm age.

Table 4

REGRESSION RESULTS
Dependent variable: Implicit bank interest rate

	Fixed-effect regressions									
	All firms				Micro firms	Small firms	Medium firms	Large firms	Young firms	Mature firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Number of bank relationships$_t$	-0.142	-0.196	-0.172	-	-0.259	-0.185	-0.120	-0.230	-0.236	-0.192
	-5.51	*-4.96*	*-4.34*	-	*-1.31*	*-2.51*	*-1.80*	*-2.27*	*-2.88*	*-4.04*
Ln(number of bank relationships+1)$_t$	-	-	-	-0.857	-	-	-	-	-	-
	-	-	-	*-4.16*	-	-	-	-	-	-
Turnover$_{t-1}$	-	-0.003	-0.003	-0.003	-0.009	-0.001	0.003	-0.002	-0.005	-0.003
	-	*-2.28*	*-2.21*	*-2.30*	*-2.30*	*-0.52*	*0.88*	*-0.27*	*-2.25*	*-1.64*
Tangible assets as % of debt$_{t-1}$	-	-0.007	-0.008	-0.008	0.000	-0.009	-0.008	-0.001	-0.007	-0.006
	-	*-2.84*	*-3.05*	*-2.87*	*0.04*	*-2.13*	*-1.95*	*-0.07*	*-1.45*	*-1.89*
Leverage$_{t-1}$	-	0.003	0.004	0.003	-0.007	0.013	0.006	-0.004	0.003	0.009
	-	*0.68*	*0.86*	*0.63*	*-0.77*	*1.53*	*0.60*	*-0.14*	*0.37*	*1.24*
Credit risk$_{t-1}$	-	0.492	0.520	0.496	0.432	0.905	0.042	0.075	0.384	0.576
	-	*2.23*	*2.32*	*2.25*	*0.70*	*2.32*	*0.11*	*0.14*	*0.95*	*2.05*
Debt coverage$_{t-1}$	-	-0.004	-0.004	-0.004	-0.003	-0.003	-0.007	-0.004	-0.001	-0.007
	-	*-2.73*	*-2.45*	*-2.73*	*-0.72*	*-1.41*	*-2.01*	*-0.92*	*-0.31*	*-3.57*
Firm age$_t$	-	-0.076	-2.887	-0.136	0.735	-0.569	1.076	2.652	-	-
	-	*-0.17*	*-7.69*	*-0.31*	*0.54*	*-0.83*	*1.09*	*1.23*	-	-
Assets$_{t-1}$	-	-0.521	0.933	-0.459	-6.762	4.026	-9.423	5.792	-0.196	-2.593
	-	*-0.36*	*0.63*	*-0.32*	*-1.31*	*1.12*	*-1.61*	*0.64*	*-0.08*	*-1.09*
Assets$^2_{t-1}$	-	0.035	-0.030	0.032	0.275	-0.109	0.318	-0.141	0.032	0.095
	-	*0.70*	*-0.60*	*0.65*	*1.37*	*-0.86*	*1.73*	*-0.54*	*0.36*	*1.22*
3-month Euribor$_t$	-	-	0.543	-	-	-	-	-	-	-
	-	-	*9.16*	-	-	-	-	-	-	-
Number of banks$_t$	-	-	-0.035	-	-	-	-	-	-	-
	-	-	*-9.04*	-	-	-	-	-	-	-
GDP growth$_t$	-	-	0.014	-	-	-	-	-	-	-
	-	-	*0.51*	-	-	-	-	-	-	-
Constant	13.764	13.453	15.123	13.789	54.291	-21.218	77.407	-53.848	9.993	29.665
	116.22	*1.26*	*1.40*	*1.30*	*1.60*	*-0.83*	*1.65*	*-0.69*	*0.57*	*1.64*
Year dummies	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Number of observations	38 764	16 804	16 804	16 804	3 780	7 836	4 204	984	7 584	9 220
Number of firms	16 014	7700	7 700	7 700	2 174	3 822	1875	435	4 043	4 115
R^2 within	0.268	0.186	0.160	0.186	0.122	0.198	0.234	0.174	0.159	0.197
R^2 between	0.265	0.094	0.073	0.098	0.037	0.084	0.132	0.037	0.037	0.171
R^2 overall	0.259	0.102	0.077	0.105	0.042	0.093	0.134	0.026	0.044	0.163

Sources: Banco de Portugal and authors' calculations.
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 that 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 that 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).

of -5.51. On average one additional bank relationship decreases the interest rate by 14 bps[7]. This result is consistent with the predictions of Sharpe (1990) and Rajan (1992), for instance.

In column 2 we control for the firm characteristics, including T*urnover, Tangible assets as % of debt, Leverage, Credit risk, Debt coverage, Firm age, Assets* and (*Assets*^{2}). The number of observations drops by approximately half in this specification 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 Debt coverage* reduce interest rates, while *Credit risk* has the opposite effect. The coefficients on *Leverage, Assets, (Assets)*^{2} and *Age* are not statistically significant at a 5% level. 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 20 bps. The time dummies are highly significant, suggesting that it is important to control for macroeconomic and financial developments.

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 17 bps.

However, it is likely that the negative effect of number of bank relationships on interest rates is not linear. In other words, we would expect that the marginal benefit of holding bank relationships is decreasing. In order to test this, we consider the variable *ln(Number of bank relationships + 1)* instead of using simply the *Number of bank relationships*. As shown in column 4, this variable is significant and has a negative coefficient, 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, as illustrated in Chart 5.

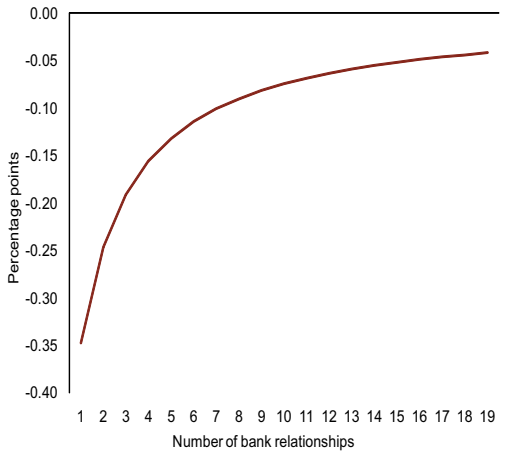
In order to better explore differences across firm size, we repeat the regression in column 2 for each size category. We find that the *Number of bank relationships* decreases the cost of debt for all firm sizes, with the exception of micro firms, for which the coefficient is not significantly different from zero.[8] The largest statistically significant slope coefficient is obtained for large firms: an additional bank relationship reduces the interest rate on average by 23 bps for large firms and by 19 and 12 bps for small and medium firms, respectively. The differences in economic and statistical significance across firm sizes may reflect asymmetric information issues, as informationally opaque (small and young) firms may benefit more from having concentrated lending relationships. Moreover, this result should also derive from larger firms having more bargaining power in their relationships with banks.

(7) In this specification we consider all the observations in the sample after application of the filters mentioned in Section 3 and not only those with two consecutive years of data

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

Chart 5

NON-LINEAR EFFECT OF THE NUMBER OF BANK RELATIONSHIPS ON INTEREST RATES



Sources: Banco de Portugal and authors' calculations.

Firm age fails to be significant in most of 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. 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. 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 19 bps, whereas younger firms benefit from a larger decrease (24 bps). Nevertheless, firm age does not seem to be a main driver of the impact of the choice of the number of bank relationships on interest rates.

For robustness purposes, we consider a different measure of the number of bank relationships. In fact, loan pricing may be influenced not only by the number of banks the firm borrows from, but also by the way loan amounts are distributed across these relationships. For instance, a firm with three different bank relationships may obtain almost all its funding from one of these banks or may choose to divide its total bank debt in three equal parts. The importance of considering the concentration of lending relationships is discussed, for instance, by Ongena, Tumer-Alkan and Westernhagen (2007).

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 the *Number of Bank Relationships*. This measure is similar, to some extent, to the weighted number of bank relationships.

Table 5 shows regression results with this alternative measure of the number of bank relationships.

Table 5

CONCENTRATION IN LENDING
Dependent variable: Implicit bank interest rate

	Fixed-effect regressions						
	All firms	**Micro firms**	**Small firms**	**Medium firms**	**Large firms**	**Young firms**	**Mature firms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Concentration in lending $(HHI)_t$	0.871	1.059	0.663	0.347	4.689	1.138	0.844
	2.94	*1.28*	*1.53*	*0.59*	*3.22*	*2.29*	*2.12*
$Turnover_{t-1}$	-0.003	-0.009	-0.001	0.002	-0.001	-0.005	-0.003
	-2.30	*-2.30*	*-0.56*	*0.84*	*-0.22*	*-2.29*	*-1.63*
Tangible assets as % of $debt_{t-1}$	-0.008	0.000	-0.009	-0.008	-0.005	-0.008	-0.006
	-2.91	*0.04*	*-2.13*	*-1.96*	*-0.46*	*-1.46*	*-1.98*
$Leverage_{t-1}$	0.003	-0.008	0.012	0.005	-0.017	0.002	0.008
	0.53	*-0.79*	*1.49*	*0.52*	*-0.63*	*0.24*	*1.12*
Credit $risk_{t-1}$	0.485	0.379	0.909	0.047	-0.006	0.369	0.567
	2.20	*0.61*	*2.33*	*0.12*	*-0.01*	*0.92*	*2.01*
Debt $coverage_{t-1}$	-0.004	-0.003	-0.003	-0.007	-0.006	-0.001	-0.007
	-2.66	*-0.71*	*-1.34*	*-1.98*	*-1.29*	*-0.26*	*-3.49*
Firm age_t	-0.209	0.689	-0.607	1.018	2.407	-	-
	-0.47	*0.51*	*-0.88*	*1.04*	*1.13*	-	-
$Assets_{t-1}$	-0.623	-6.528	4.058	-10.188	4.770	0.070	-2.993
	-0.43	*-1.28*	*1.12*	*-1.75*	*0.51*	*0.03*	*-1.25*
$Assets^2_{t-1}$	0.035	0.265	-0.113	0.340	-0.112	0.020	0.105
	0.71	*1.33*	*-0.89*	*1.86*	*-0.42*	*0.23*	*1.33*
Constant	13.981	51.899	-21.710	83.433	-46.339	7.382	32.085
	1.31	*1.55*	*-0.84*	*1.79*	*-0.58*	*0.42*	*1.75*
Number of observations	16 804	3 780	7 836	4 204	984	7 584	9 220
Number of firms	7 700	2 174	3 822	1 875	435	4 043	4 115
R^2 within	0.185	0.122	0.197	0.233	0.191	0.158	0.194
R^2 between	0.102	0.040	0.088	0.138	0.037	0.040	0.181
R^2 overall	0.107	0.045	0.096	0.137	0.034	0.046	0.167

Sources: Banco de Portugal and authors' calculations.
Notes: *t*-statistics in italics (using robust standard errors). Concentration in lending is a Herfindahl index using bank shares at the firm level. All other variables are defined in Table 4. All regressions were estimated using year dummies.

Our earlier results are confirmed by these regressions. When *Concentration in Lending (HHI)* increases, the cost of borrowing also increases. However, when we estimate the regressions for different firm size groups 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.

In sum, 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.

6. CONCLUDING REMARKS

In this article we empirically study the impact of the choice of the number of bank relationships on firms' borrowing costs. We observe that, on average, Portuguese firms usually borrow from three different banks. Moreover, we find that, other things controlled for, when a firm initiates one additional relationship with a bank, its interest rate decreases significantly, on average. This result is consistent with the theoretical predictions of Sharpe (1990) and Rajan (1992), as well as with empirical results found for other European countries (Degryse, Kim and Ongena, 2009). Furthermore, we find that this result holds for all firm sizes, with the exception of micro firms, for which the result obtained is not statistically significant. Larger firms are those that benefit more from holding multiple bank relationships. These differences across firm size may reflect asymmetric information issues, as informationally opaque firms may benefit more from having concentrated bank relationships. In addition, larger firms should also have more bargaining power in their relationships with banks, what may also contribute to explain these results. In turn, we do not find significant evidence of differences between young and mature firms. Furthermore, we find that the decrease in interest rates obtained with additional bank relationships is more significant for firms with a small number of relationships.

To complement our analysis, we consider another measure of relationships: instead of using the number of bank relationships held by each firm, we consider how are loan amounts distributed across these relationships, using a Herfindahl Index. We find that when firms' borrowing is more concentrated, their borrowing costs increase. However, this result is significant only for large firms.

REFERENCES

Antão, P. and D. Bonfim (2008), "Capital structure decisions in the Portuguese corporate sector", Banco de Portugal, *Financial Stability Report*.

Antão, P., M. Boucinha, L. Farinha, A. Lacerda, A.C. Leal and N. Ribeiro (2009), "Financial integration, financial structures and the decisions of households and firms", *in* Economics and Research Department, Banco de Portugal, *The Portuguese Economy in the Context of Economic, Financial and Monetary Integration.*

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.

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

Bonfim, D., Q. Dai and F. Franco (2008), "The number of bank relationships and the cost of borrowing. An empirical study", in Soares, O, J. Pina and M. Catalão-Lopes (eds), *New Developments in Financial Modelling*, Cambridge Scholars Publishing.

Boucinha, M. and N. Ribeiro (2009), "An assessment of competition in the Portuguese banking system in the 1991-2004 period", Banco de Portugal, *Working Paper* 1/2009.

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

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

Cerqueiro, G., H. Degryse and S. Ongena (2007), "Rules versus discretion in loan rate setting", CEPR *Discussion Paper* No. DP6450.

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.

Degryse, H, M. Kim and S. Ongena (2009), *Microeconometrics of Banking: Methods, Applications and Results*, Oxford University Press.

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

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

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

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.

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

Ioannidou, V. and S. Ongena (20010), "Time for a change: Loan conditions and bank behavior when firms switch banks", *Journal of Finance*, forthcoming.

Kim, M., E.G. Kristiansen and B. Vale (2007), "Life-cycle patterns of interest rate markups in small firm finance", Norges Bank *Working Paper* 2007/4.

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

Ongena, S., G. Tumer-Alkan and N. Westernhagen (2007), "Creditor concentration: An empirical investigation", Deutsche Bundesbank *Discussion Paper* Series 2 15/2007.

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

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

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