FEDERAL RESERVE BANK of ATLANTA

Bank Relationships and Small Firms' Financial Performance

Annalisa Castelli, Gerald P. Dwyer Jr., and Iftekhar Hasan

Working Paper 2006-5
May 2006

WORKING PAPER SERIES

FEDERAL RESERVE BANK *of* ATLANTA WORKING PAPER SERIES

Bank Relationships and Small Firms' Financial Performance

Annalisa Castelli, Gerald P. Dwyer Jr., and Iftekhar Hasan

Working Paper 2006-5
May 2006

Abstract: We examine the relationship between the number of bank relationships and firms' performance, evaluating possible differential effects related to firms' size. Our sample of firms from Italy includes many small firms, 99 percent of which are not listed and for which bank debt is a major source of financing. In the sample, 4 percent of the firms have a single bank relationship, and 66 percent of them have five or fewer relationships. We find that return on equity and return on assets decrease as the number of bank relationships increases, with a stronger relationship for small firms than for large firms. We also find that interest expense over assets increases as the number of relationships increases. Particularly for small firms, our results are consistent with analyses indicating that fewer bank relationships reduce information asymmetries and agency problems, which outweigh negative effects connected to holdup problems.

JEL classification: D21, G21, G32

Key words: bank relationships, small business lending, firms' performance

---

Annalisa Castelli and Iftekhar Hasan thank the Federal Reserve Bank of Atlanta for research support. Linda Mundy provided editorial assistance. The views expressed here are the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Annalisa Castelli, Research Associate, Department of Economics, University of Rome Tor Vergata, Via Columbia, 2, 00133 Rome, Italy; 39 06 72595714, 39 06 2020500 (fax), annalisa.castelli@uniroma2.it; Gerald P. Dwyer Jr., Vice President, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, GA 30309, 404-498-7095, 404-498-8810 (fax), gerald.p.dwyer@atl.frb.org; or Iftekhar Hasan, Cary L. Wellington Professor, Director of the Center for Financial Technology, and Area Coordinator, Rensselaer Polytechnic Institute, 110 8th Street, Pittsburgh Building, Troy, NY 12180, 518-276-2525, 518-276-8661 (fax), hasan@rpi.edu.

Bank Relationships and Small Firms' Financial Performance

INTRODUCTION

The contemporary literature on relationship banking has developed along two main branches corresponding to the lender's and the borrower's side of the issue. In his review of this topic, Boot (2000) characterises relationship banking and evaluates its associated costs and benefits from the lender's point of view. Ongena and Smith (2000) review the other side of the coin, focusing their analytical review mainly on the effects of bank relationship on customers. This paper shares this latter point of view and focuses on the effect of bank relationships on firms' performance.

Recent theoretical models imply that firms with multiple bank relationships are less profitable than firms with fewer relationships. On the other side, empirical results on the effect of bank relationships on firms' performance are mixed. Using Norwegian data, Degryse and Ongena (2001) find a negative relationship between the number of bank relationships and firms' performance; using Japanese data, Weinstein and Yafeh (1998) find the opposite result, a positive relationship between the number of bank relationships and firm profitability.

In their review of the evidence on bank relationships, Ongena and Smith (2000) summarize various estimates of the average number of bank relationships per firm across countries and data sets. The main features they highlight are 1. multiple bank relationships are a common feature in nearly all the data sets; 2. small firms tend to have fewer bank relationship than large firms; and 3. country effects exist, e.g. firms in the United Kingdom, Norway and Sweden have fewer relationships than firms in Italy, Spain, Belgium and Portugal.

In this paper, we try to resolve the following set of questions: How do bank relationships affect firm performance? Is a single bank relationship associated with better performance than relationships with multiple banks? Does the duration of relationships affect performance? Does size affect such relationships and familiarity with their banks?

We empirically test these hypotheses using a rich data set, the Capitalia Survey which provides information on banking relationships for a sample of about 4500 Italian manufacturing firms[1]. We think that this analysis can contribute to the debate because of some characteristics of the Italian economy. First, the predominance of smaller firms makes it possible to test the effect of the number of banks on small firms' performance. Second, over 95 percent of the firms report multiple lending relationship, similar to many other continental EU countries but in contrast with the Norwegian data studied by Degryse and Ongena (2001) in which only 30 percent of the firms have more than one bank. Third, most of the firms are not listed on a stock exchange.

We construct five different proxies for firms' performance and find that performance generally declines with the number of relationships, a relationship that is clear for small firms but is not as strong for medium and large firms.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature. Section 3 describes the data, the empirical specification and presents the estimates. Section 4 concludes.

BACKGROUND LITERATURE

A. Theory

Part of the literature on the value of a close relationship between a firm and a bank is premised on observations by Fama (1985) and James (1987) that bank loans to firms are based on information that is not widely available compared to other forms of financing. The relationship between a firm and a bank can help to overcome information asymmetries and agency problems that create liquidity constraints and can reduce firms' investment (Fazzari et al., 1988; Bernanke and Gertler, 1995).

These theories suggest that screening and monitoring by banks can overcome information and incentive problems and reduce liquidity constraints for borrowers (Leland and Pyle, 1977;

[1] The Survey has been previously known as Mediocredito Centrale Survey

Diamond, 1984; Bhattacharya and Thakor, 1993). A bank relationship – a continuing contact between the financial institution and the firm for the provision of financial services beyond simple, anonymous transactions – is associated with the collection of information that can be used to make decisions about the evolution of the contract terms (Berger and Udell, 1998). On the other hand, banks could disseminate, intentionally or incidentally, confidential information to firms' competitors and borrowing firms may need to consider negative effects of dissemination of confidential information[2].

Given these preliminary considerations, the main issue that arises is the potential benefit of this relationship for the borrower and the bank. This benefit has to be evaluated taking into account the influence of external factors such has the competitiveness of the environment, the degree of technological diffusion, and the level of financial market development.

Theoretical analyses suggest that a close relationship between banks and firms which reduces information asymmetries and improves firms' access to credit can lead to an overall improvement in their performance. Stiglitz and Weiss (1983) show that the threat of future credit rationing can reduce moral hazard. Diamond (1991) shows that reputation building through bank borrowing can provide certification, which can allow a firm to eventually raise funds on public markets. This benefit of a successful bank relationship raises the cost of default on a bank loan and lowers the equilibrium probability of default. A bank relationship also can reduce agency problems because the risk of a reduction in the amount of bank loans is an incentive for managers to pursue less risky projects (Rajan, 1992)[3]. On the same line, von Thadden (1995) shows that the efficiency of investment is improved by a debt contract with periodic monitoring. Moreover, borrowing from

[2] Rheinbaben and Ruckers (2004) theoretically show that the number of bank relationships increase in firm age and size.
[3] Boot and Thakor (1994) examine optimal contract design in a model in which banks provide firms with contracts that require initial high collateral and interest payments that fall when the bank has verified the successful completion of financed projects.

banks allows firms to keep information confidential, not requiring the widespread disclosure typical of others sources of financing[4].

This line of argument suggests that a closer bank relationship will be associated with better firm performance and that a small firm's optimal strategy is to establish a long term relationship and to borrow from one or perhaps a limited number of banks. The empirical observation of multiple, time-varying relationships, however, led economists to consider other factors.

If a bank and a firm have a long-term relationship, the bank can acquire a great deal of unique information about a firm and the bank may be able to exploit this, a problem which is called a hold-up problem in game theory. Various theoretical contributions emphasise the information-capture problems and the presence of fixed costs associated with the search for a new bank. On the one side, Sharpe (1990) suggests that long lasting bank and firm relationships arise because high quality firms are "informationally captured", meaning that the firms are unable to convey information about their quality to other banks. On the other side, Blackwell and Santomero (1982) highlight the inertia linked to search costs borne by a firm looking for a new source of funds. In a repeated game with moral hazard and adverse selection, Petersen and Rajan (1995) show that the reduction of the interest rate due to information acquired about the borrower is limited in more concentrated credit markets, and motivate this result arguing that these markets are characterised by more severe hold-up problems. Von Thadden (1998) shows that a single bank with better information about a firm can impose hold-up costs that can adversely affect the borrowers' value. These additional costs can be lessened or eliminated by multiple banking relationships.

The duration of relationships between firms and banks also plays a role. Greenbaum *et al*. (1989) present a model that includes search costs for firms looking for new banks and show that the borrowing rate is a non-decreasing function of the duration of the credit relationship and that the probability that a firm will terminate a relationship is positively associated with its duration.

[4] This is particularly important for innovating and R&D investing firms, as highlighted by Yosha (1995) and Bhattacharya and Chiesa (1995).

Longhofer and Santos (2000) demonstrate how during a recession firms that have ongoing relationships with a bank are better able to obtain additional financing, allowing them to weather the recession with minimal loss.

These effects of relationship between banks and firms are likely to be more important for relatively small firms, because these firm have a higher cost -- often prohibitively higher -- of obtaining investment funds from financial markets and rely heavily on banks as primary credit sources. Small firms tend to borrow from banks and to concentrate their borrowing with a few banks with which they have a long-term relationship. These relationships are an important feature of small business lending. As noted by Berger and Udell (1998), perhaps the most important characteristic defining small business finance is informational opacity: small firms usually do not enter into contracts that are publicly visible, do not have audited financial statements and consequently can have difficulty building reputations to signal high quality. Since there may be little public information available on small firms, relationship lending enables banks to collect private information on the credit-worthiness of these firms (Strahan and Weston, 1998). These factors suggest that relationship lending may be particularly beneficial for small firms, including lower cost or greater availability of credit, protection against credit crunches, and the provision of implicit interest rate or credit risk insurance.

On the other side, for a small firm with a single relationship, an interruption of the credit line from the bank can be interpreted as a bad signal about the firm even if the withdrawal of the credit is not linked to financial distress of the small business but others are uncertain about the reason for the credit withdrawal. As a result, small firms may have multiple banking relationships, which have higher transactions costs but also greater benefits than a single relationship (Berger and Udell, 1998).

B. Empirical Literature

Although the empirical implication of recent theoretical models seems to be in favour of single versus multiple relationships lending, we have shown in the previous section how the value of a single and close bank firm relationship remains unclear. A brief review of the empirical literature adds complexity to the issue by highlighting contrasting results.

Studies of financial markets' responses to announcements of bank loans usually indicate a positive effect of bank loans on firms' value (Best and Zhang 1993; Shockley and Thakor 1998.) Analysis of bank lending behaviour focused on banks' liabilities suggest that, thanks to their access to core deposits, banks can protect themselves from exogenous shocks and consequently insulate long-term borrowers from exogenous credit shocks (Berlin and Mester, 1999).

There are exceptions. For example, Kang and Stulz's (2000) results for a sample of Japanese firms indicate better performance for firms not financed by banks compared to firms with high shares of bank debt.

Empirical evidence on the effects of single versus multiple banking relationships on firms' performances is mixed. Angelini, Di Salvo and Ferri (1998) find evidence that liquidity constraints are relatively less frequent among firms borrowing from a limited number of banks, with a resulting positive impact on firms' performance. Petersen and Rajan (1994) find that multiple bank relationships are associated with higher interest payments and more credit constraints. Using a data set on Norwegian publicly listed firms, Degryse and Ongena (2001) find a negative two way correspondence between the number of relationships and sales profitability and also find that firms deciding to switch from single to multiple relationships are on average smaller and younger than firms choosing not to switch. Fok, Chang and Lee (2004) apply the Degryse and Ongena methodology for a sample of Taiwanese firms and find a negative link between firms' performance and the number of bank relationships, consistent with Degryse and Ongena's results.

Harhoff and Korting (1998) and Cole (1998) report increasing limits to credit access for firms borrowing from more than one bank. In sharp contrast with these findings, Houston and James

(1996) find a negative correlation between firm's reliance on single banks and growth potential and evidence that firms with one banking relationship also face more credit constraints than those with multiple relationships.

Detragiache, Garella and Guiso (2000) suggest that multiple banking relationships can diversify liquidity risk. By empirically testing a model of the optimal number of bank relationships, they find that multiple bank relationships decreases the probability of an interruption of funding due to a lender's internal problems.

Turning to the empirical literature that investigates the impact of bank relationship on small firms' performance, data for the United States, Japan and almost all European Union (EU) countries indicate that small firms tend to borrow from fewer banks than large firms (Ongena and Smith, 2000). This is in line with theoretical models which suggest that relationship lending can have a number of benefits for small firms including lower cost or greater availability of credit due to efficient gathering of information, protection against credit crunches and provision of implicit interest rate or credit risk insurance (Berger and Udell, 1998).

Berger, Klapper and Udell (2001) empirically show how Argentinean firms tend to borrow from more than one bank when their primary bank is financially distressed and that smaller firms prefer exclusive lending relationships.

Based on U.S. data, Petersen and Rajan (1995) find that small and young firms tend to be less credit constrained and to receive better lending rates when they borrow from one bank. This result is stronger in more concentrated credit markets, suggesting that small borrowers may be worse off with competition among banks. Cole's (1998) evidence indicates that the existence of a single bank relationship increases the probability of extension of credit for small businesses in the U.S.

Ongena and Smith (2001) in their study of publicly traded Norwegian firms find that the probability of ending a bank relationship increases over time, suggesting a corresponding decrease in the value of the relationship. Surprisingly, the shortest relationships are those of young, small and highly leveraged borrowers that usually are considered to be highly dependent on bank financing.

These effects altogether lead to a conclusion that firms do not seem to become locked into bank relationships, which could be interpreted as raising some doubt about the value of bank relationships.

Some more general results suggest that long term relationships improve the conditions for credit access by reducing both funding costs (Berger and Udell, 1995; Elsas and Krahnen, 1998) and collateral requirements (Berger and Udell, 1995; Harhoff and Korting, 1998; Degryse and Van Cayseele, 2000). Berlin and Mester (1997) show how loan rate smoothing in response to interest rate shocks is part of an optimal long term contract between a bank and a firm.

EMPIRICAL ANALYSIS

A. Sample

The data in this paper are from the Capitalia Survey, which is one of the most important qualitative and quantitative information sources on Italian firms. This survey contains yearly data and has been repeated every three years since 1989 for a sample of about 4500 firms.

In this study, we focus on the most recent wave of these annual surveys conducted in 1998, 1999 and 2000 of a sample of 4680 Italian manufacturer firms with more than nine employees. This wave contains information on bank relationships that were not included in the previous ones. After checking for inconsistencies, we obtain an unbalanced sample including 3566 firms for 1998, 3601 firms for 1999 and 3597 firms for 2000, with a total of 10764 firm-year observations[5].

In order to investigate the relationship between the number of bank relationships and firm performance focusing on the differential effects linked to firm size, we divide the full sample into size classes based on the number of employees. Small firms (10 to 50 employees) are 76.5 percent

[5] From the total sample, we select firms for which complete balance sheet and income statement data are available. We select firms with positive values of total assets, net worth and net sales. In order to eliminate the influence of extreme values, we discard observations according to the following rules: 1. return on equity (ROE) greater than 100 percent or lower than -20 percent; 2. return on assets (ROA) greater than 30 percent or lower than -20 percent; 3. ratio of total sales to total assets greater than 300 percent or lower than 20 percent; and 4. the number of bank relationships greater than 50.

of the total sample; medium firms (51 to 250 employees) are 17.2 percent of the total; and large firms (greater than 250 employees) are 6.3 percent of the total.

Information on the number and duration of bank relationships is based on the firms' answers to questions on the number of banks with which they had commercial relationships at the end of 2000 and the number of years for which a bank has been their main lender. During the period considered, 4 percent of the firms have a single bank relationship, 63 percent have two to five bank relationships, and the remaining 33 percent have six or more bank relationships. Looking at the same variables taking into account size classes, we find a higher percentage of single bank relationships for small firms (4.7 percent) and lower percentages for medium firms (1.0 percent) and large firms (1.3 percent). Descriptive statistics on these variables are reported in Table 1. Small firms have on average fewer bank relationships and, not surprisingly, are younger than medium and large firms. All three age classes of firms report quite long average durations of main relationships -- 17 years for small firms and almost 19 for medium and large firms. Nine out of ten firms have relationships that last more than five years.

As proxies for firms' performance, we use five different ratios: return on assets (ROA), return on equity (ROE), Interest Expense over Assets, Non-interest Expense over Assets, and Sales over Assets[6]. Table 2 reports summary statistics on these performance measures broken down by firm size. Table 2 suggests that small firms have relatively better performance than the average as measured by all performance variables considered except ROA.

Table 3 presents summary statistics on the performance measures broken down by size and number of bank relationships. Table 3 shows lower values of all performance indicators as the number of bank relationships increase both for the total sample and for small firms. This relation fades when considering medium and large firms. For medium firms, we find lower interest expense

[6] ROA= (net earnings/ total assets)*100; ROE = (net earnings/ net worth)*100; Interest over Assets = (interest expenses/ total assets)*100; Non Interest over Assets = ((non interest expenses) /Total Assets)*100. Non interest expenses is complementary to interest expenses meaning that the two sum up to total expenses. Sales over Assets = (net sales/ total assets)*100.

over assets always is associated with a single relationship, while evidence on other variables is mixed. The same happens for large firms.

B. Estimated Relationships

Because we have a relatively large number of observations, we initially estimate an unrestricted relationship between the number of banks and the performance variables. We then focus on a simple relationship that captures the features of the unrestricted relationship.

The first step is the specification of regressions with each of the performance measures as a left-hand-side variable,

$$DepVar = \alpha + \sum_{h=1}^{20} \beta_h bank_h + \beta_{21} \ln\_dur + \beta_{22} \ln\_dur2 + \beta_{23} \ln\_size + \\ + \beta_{24} \ln\_age + \beta_{25} \ln\_age2 + \sum_{i=1}^{19} \gamma_i ind_i + \sum_{j=1}^{2} \delta_j year_j + \varepsilon \quad (1)$$

In equation (1) we model the number of banks using dummy variables, $bank_h$, equal to 1 if the firm has respectively 1, 2, 3, …., 20 bank relationships and 0 otherwise. The intercept reflects the constant term for firms with 21 to 50 relationships; ln_*dur* is the logarithm of the duration of the main relationship, ln_*dur*2 is the square of ln_*dur*, ln_*size* is the logarithm of the size of the firm in terms of net sales, ln_*age* is the logarithm of the age of the firm, ln_*age*2 is the square of ln_*age*, ind_i is a set of dummy variables for the industries and $year_i$ is a set of dummy variables for the years[7]. The left-hand-side variable *DepVar* is in turn ROA, ROE, interest expense over assets, noninterest expense over assets and sales relative to assets. Duration is included because a bank relationship can be more specifically defined along two dimensions: time and scope (Ongena and Smith, 2000). Duration is an observable measure of the strength of a bank relationship. The longer the relationship between a firm and a bank, the more valuable this relationship is and the lower is the firm's incentive to initiate an additional relationship (Farinha and Santos, 2002). Age is included because it is likely to affect loan rates, with older firms receiving more favourable terms (Petersen and Rajan, 1994; Ongena and Smith, 2000). Moreover, if building relationships takes

[7] Industries have been grouped using the Ateco 1998 classification corresponding to NACE rev. 1.1.

time, multiple banking relationships can be positively correlated with the number of relationships (Detragiache, Garella and Guiso, 2000). This regression is estimated on the total sample and on the subsamples of small, medium and large firms[8]. While ordinary least squares would not be appropriate for estimating the effects of arbitrary changes in the number of bank relationships, this estimation strategy is fine for estimating the projection of the performance variables on the number of banks and for inferring the linear relationship between the performance variables and the number of relationships[9].

We then estimate a restricted equation (2) in which the number of bank relationships is represented by a second-order polynomial.[10] The equation with a second-order polynomial is

$$DepVar = \alpha + \beta_1 \ln\_bank + \beta_2 \ln\_bank2 + \beta_3 \ln\_dur + \beta_4 \ln\_dur2 + \beta_5 \ln\_size + \\ + \beta_6 \ln\_age + \beta_7 \ln\_age2 + \sum_{i=1}^{19} \gamma_i ind_i + \sum_{j=1}^{2} \delta_j year_j + \varepsilon \quad (2)$$

where ln_*bank* is the logarithm of the number of banks and ln_*bank*2 is the square of the logarithm of the number of banks.

Table 4 reports the results of F-tests to test restricting the general regression with dummies (1) to the regression with a second-order polynomial (2) for each of the performance variables. The p-values provide mixed evidence, with the number of banks in some instances seeming not to be well summarised by a second-order polynomial function of the number of banks. On the other hand, given the large number of observations, it is possible that these differences are statistically but not economically significant.

We plot the values of the implied coefficients for the performance variables by number of banks in Figures 1 to 4 for all banks and for the three size classes. The graphs in these figures, each of which includes the coefficients of the dummy variables and the values of implied coefficient of the

[8] Results are available from the authors upon request.

[9] For example, the variation in the number of relationships in our data seldom if ever is due to liquidity problems at banks. Ordinary least squares would provide a consistent estimator of the effect of such liquidity problems only if the effect of such problems on the number of relationships and performance were the same as the estimated relationship due to other factors.

[10] Estimation with the number of banks and with the natural logarithm of number of banks indicated that the natural logarithm fits better.

second-order polynomial, make it possible to examine the differences between the two estimated relationships and decide on the economic significance of deviations from the restricted equation. The polynomial is a reasonably close approximation for about ten or fewer bank relationships. The dummy variables estimate a more erratic relationship between the performance variables and the number of relationships as the number of relationships increases. This is not surprising, given that most of the banks have five or fewer relationships and as few as three firms underlie the estimated coefficients of the dummy variables at higher numbers of relationships. For example, there are only three small firms with 20 bank relationships, which makes it hard to know what to make of the substantially different coefficients shown in Figure 2 for 20 relationships than for fewer relationships.

Overall, we conclude that the simple function well approximates the more general estimated relationship and focus on those results. The p-values are mixed, but the estimated effects for the numbers of relationships are quite similar for numbers of relationships with many observations.

The figures show generally consistent results for the small firms, which are the largest part of the sample of all firms. ROA and ROE generally decline with the number of relationships, interest expense over assets generally increases, non interest expense over assets shows some evidence of decreasing as the number of relationships increases, and sales over assets decrease.

Table 5 reports the regressions including the logarithm of the number of banks linearly and squared[11]. F-statistics indicate that the estimated coefficients of the number of banks are statistically significant for all regressions for small and medium firms at any usual significance level. The F-statistics indicate that, for the largest firms, the number of banks is statistically significant at the five percent significance level for ROA and interest expense over assets and at the 5.2 percent level for ROE. Figures 1 through 4 show that these relationships generally are economically significant as well, with the relationships most marked for small firms and hardly apparent for the large firms. These figures also show that a larger number of bank relationships is associated with lower ROA,

[11] Results of the unrestricted regressions with dummy variables are available upon request.

ROE, higher interest expense over assets, lower non-interest expense over assets and lower sales over assets. These results support the hypothesis that better performing firms are more likely to have a smaller number of bank relationships than worse performing firms. This indicates that the benefits in terms of reduction of information asymmetries and agency problems of fewer relationships seems to outweigh the negative effects connected to hold-up problems. The clear negative relationship between firms' performance and the number of bank relationships for small firms also suggests how multiple bank relationships are associated with worse performance by small firms. Due to the heavy reliance of this group of firms on bank credit, the lower cost or the greater availability of credit due to efficient gathering of information deriving from a close relationship acquires a great importance.

F-statistics also indicate that the duration of the main relationship is important for these performance variables, as is the age of the firm. Although our results do not draw a clear path of the interaction between duration, age and firms' performance, the values of the F-statistics clearly suggest how these measures add important elements in explaining the relationship between the number of bank relationships and firms' performances, which is the main task of this paper. The duration of the lending relationship and the age of the firm become measures of the information generated over time that represent the possibility for the bank to gain private information about the borrower and the risk for the latter to be locked in that relationship.

CONCLUSIONS

In this paper we empirically study the consequences of firms' financing strategy in terms of the relationship between the number of lenders and a firms' performance, including an analysis of possible differential effects related to firms' sizes. We assess the issue using regression analysis for data on Italian manufacturers. This sample of firms has three distinctive features compared to prior data used: 1. almost 75 percent of the firms are small, with fewer than 50 workers, 2. almost 99

percent of the firms are not listed on a stock exchange, and 3. four percent of the firms have a single bank relationship and 66 percent have five or fewer relationships.

We find that firms' performance based on return on assets and equity decreases as the number of bank relationships increases, and this negative association between firms' performance and the number of relationships is strongest for small firms. We also find that interest expense over assets increases with the number of relationships, which may indicate a higher interest rate or simply more borrowing. The estimated negative association between multiple bank relationships and firms' performance is consistent with some previous results (Angelini, Di Salvo and Ferri, 1998; Degryse and Ongena, 2001; Fok, Chang and Lee, 2004; Petersen and Rajan, 1994).

Our results are consistent with the positive value of fewer bank relationships in reducing information asymmetries and agency problems, with these positive effects outweighing hold-up problems. This is particularly so for small firms.

Figure 1

Plot of dummy (1) and second order polynomial (2) equations. All firms

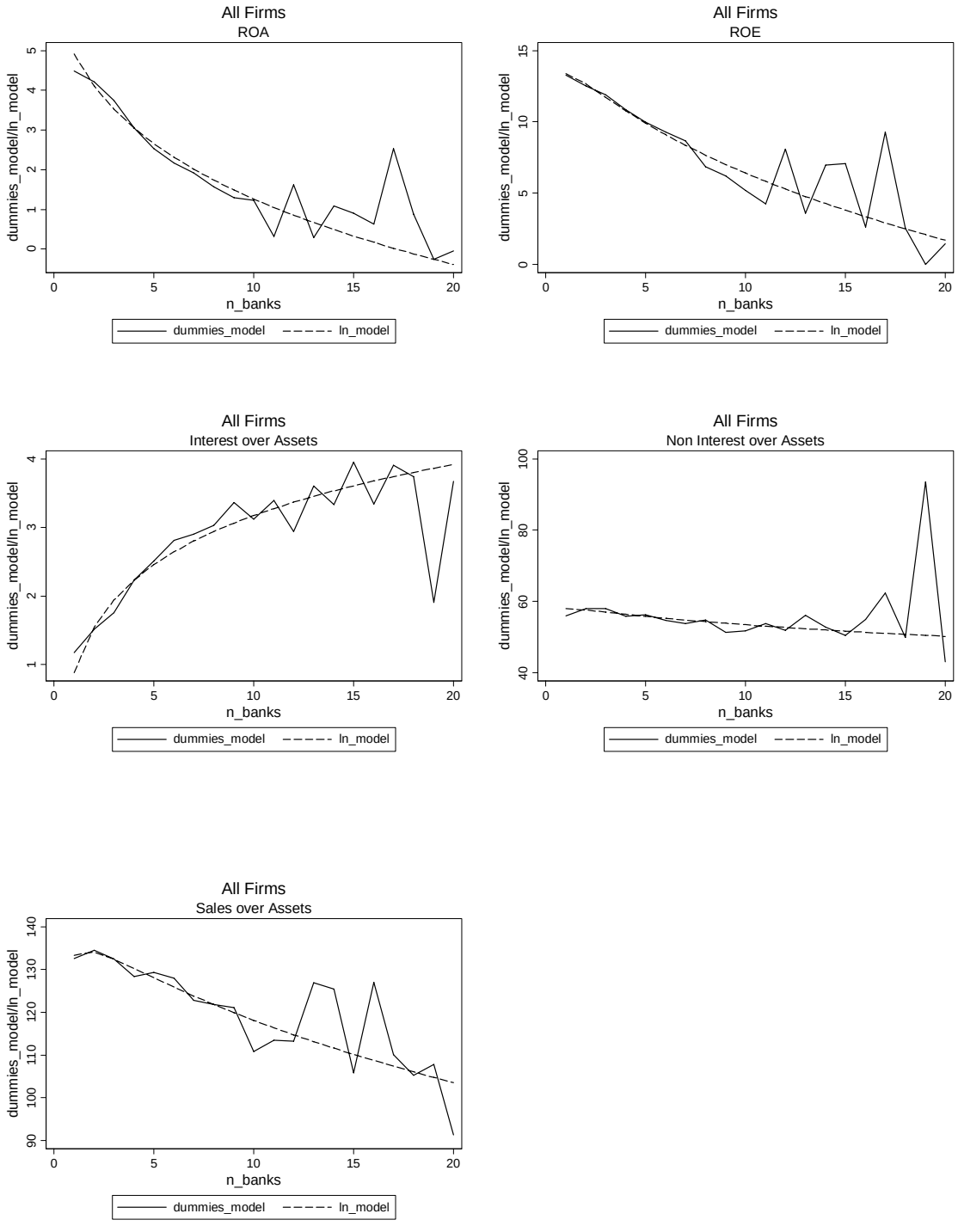

Figure 2
Plot of dummy (1) and second order polynomial (2) equations. Small firms

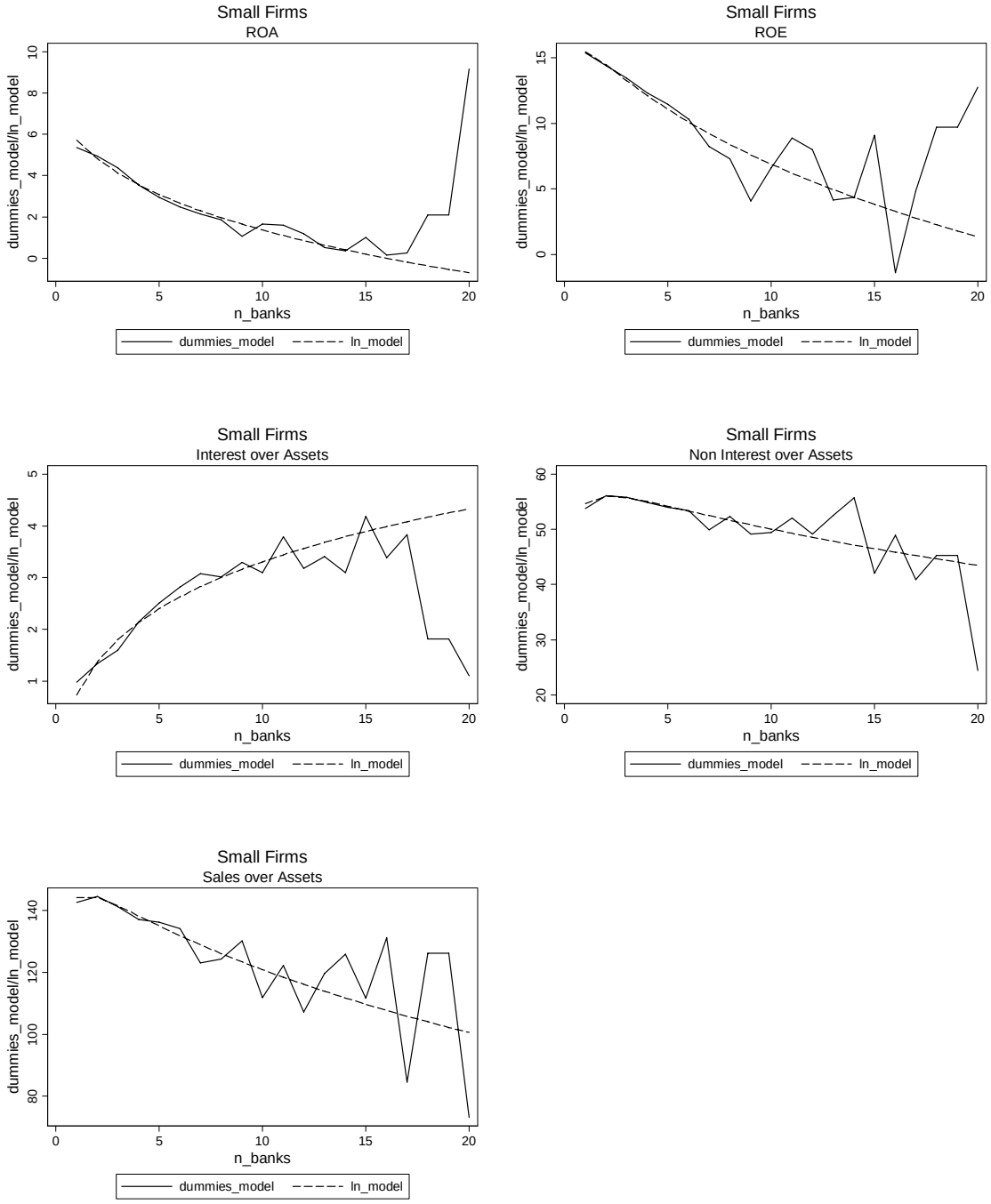

Figure 3
Plot of dummy (1) and second order polynomial (2) equations. Medium firms

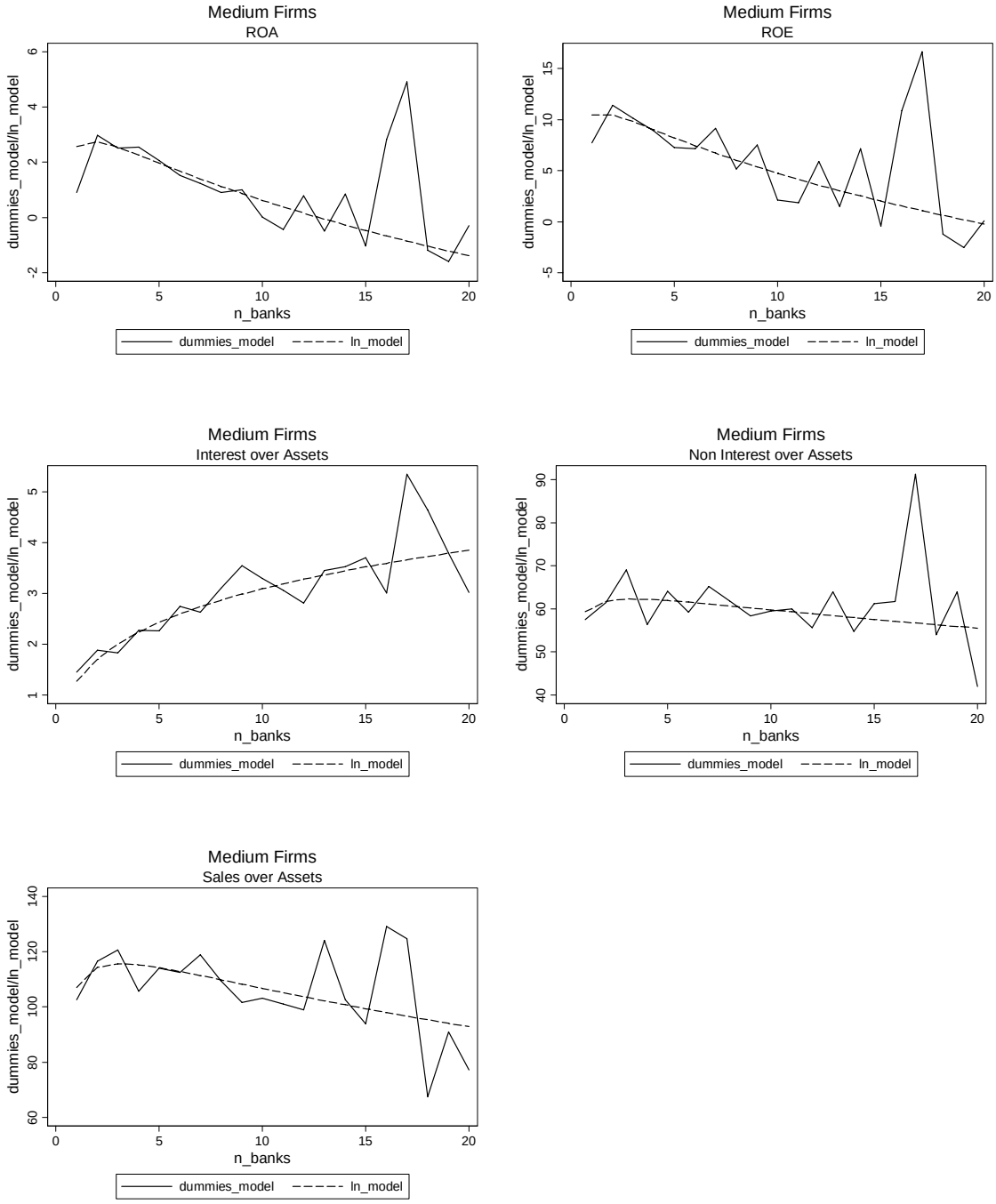

Figure 4
Plot of dummy (1) and second order polynomial (2) equations. Large firms

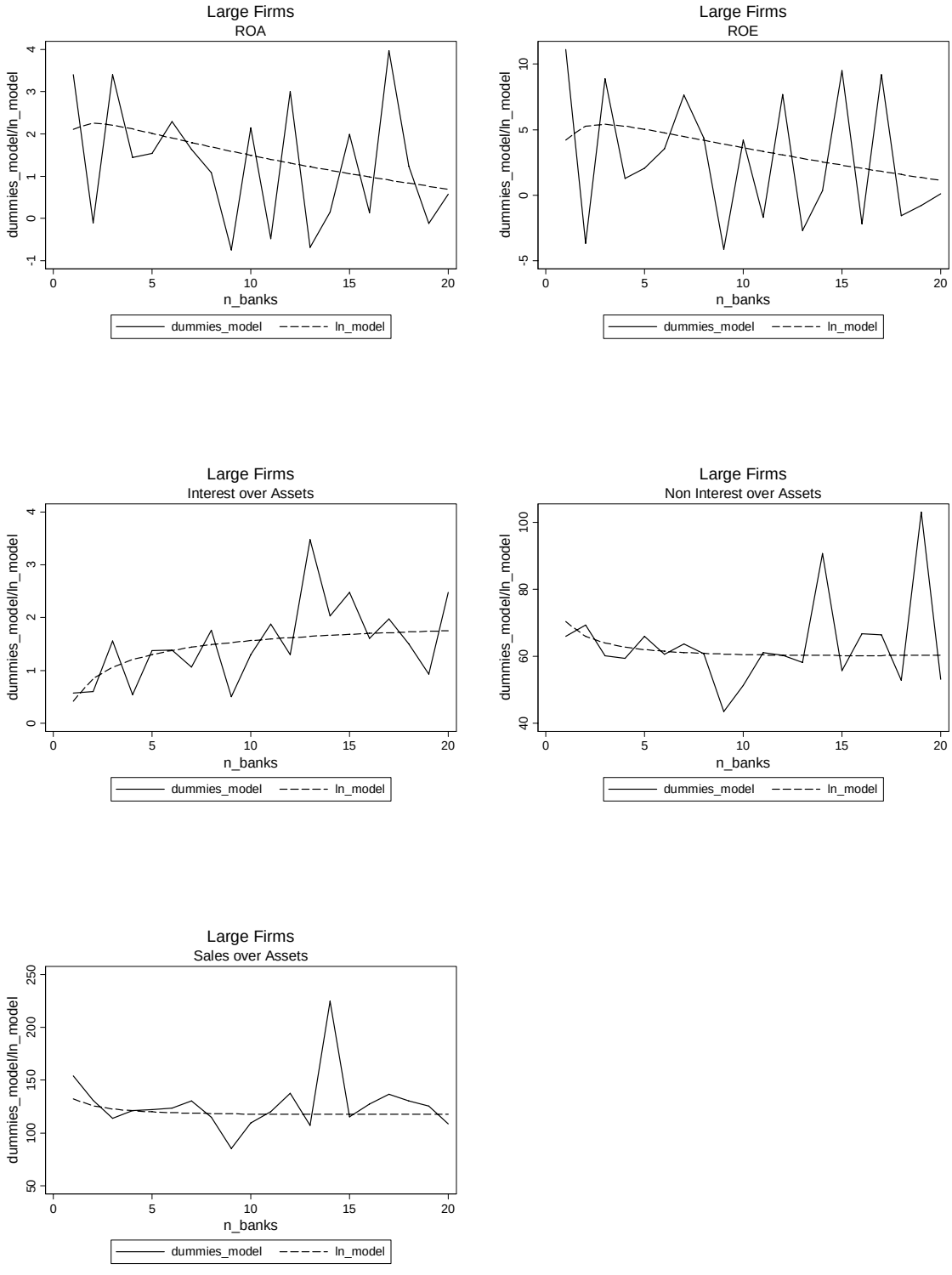

Table 1

Descriptive statistics of the Capitalia sample

	Small			Medium			Large			All		
	banks	duration	age	banks	duration	age	banks	duration	age	banks	duration	age
mean	4.4	17.0	22.2	7.2	19.8	29.7	10.5	19.3	37.9	5.2	17.6	24.5
median	4	15	19	6	20	26	10	15	32	4	15	20
sd	2.5	12.0	16.6	4.0	13.2	19.8	7.1	16.2	28.0	3.6	12.5	18.6
min	1	1	1	1	1	1	1	1	1	1	1	1
max	33	191	312	35	100	182	50	100	171	50	191	312
obs.	8200	7790	8236	1837	1712	1850	599	509	678	10636	10011	10764

banks = n. of bank relationships; duration = duration of main relationship expressed in years; age = 2001 - year of birth; obs. = n.firms*year

Table 2

Summary statistics of firms performance indicators broken down by size

	All (obs. 10764)					Small (obs. 8236)				
	mean	median	sd	min	max	mean	median	sd	min	max
ROA	2.57	0.95	4.33	-11.35	29.80	2.54	0.85	4.41	-11.35	29.80
ROE	9.90	5.51	15.60	-20.00	99.05	10.14	5.45	16.14	-20.00	99.05
Interest over Assets	2.34	2.03	1.91	0	62.06	2.41	2.08	1.87	0	26.34
Non interest over Assets	55.94	50.69	28.63	1.33	267.90	57.94	53.23	29.74	1.33	267.90
Sales over Assets	125.51	119.71	47.10	20.04	299.39	129.34	124.66	48.73	20.04	299.39
	Medium (obs. 1850)					Large (obs. 678)				
	mean	median	sd	min	max	mean	median	sd	min	max
ROA	2.51	1.09	4.01	-7.02	26.03	3.11	2.11	4.13	-11.03	25.10
ROE	8.87	5.05	13.94	-19.97	98.26	9.71	7.58	12.87	-19.59	85.77
Interest over Assets	2.16	1.90	2.20	0	62.06	2.09	1.85	1.44	0	13.87
Non interest over Assets	51.20	46.56	24.93	5.23	219.10	44.59	41.72	18.42	6.01	164.74
Sales over Assets	115.87	110.65	39.82	24.28	298.13	105.20	103.63	34.83	21.96	289.25

Sample period is 1998-2000. Firm-year obs. 10764. Size is based on number of employees (small: < 50 employees, medium: 51 - 250, Large: > 250). ROA: % ratio of Net earnings to Total assets.ROE: % ratio of Net earnings to Net worth. Interest over assets: % ratio of Interest expenses to Total assets. Non Interest over assets: % ratio of Non interest expenses to Total assets. Sales over assets: % ratio of Net sales to Total assets.

Table 3

Summary statistics of firms performance indicators broken down by size and number of bank relationships

		Single bank relationship						2-5 bank relationships						more than 5 bank relationships					
		mean	median	sd	min	max	n.	mean	median	sd	min	max	n.	mean	median	sd	min	max	n.
All	ROA	3.79	1.85	5.51	-8.98	28.66	408	2.82	1.08	4.62	-11.35	29.80	6738	1.97	0.71	3.46	-10.84	27.78	3618
	ROE	12.74	8.65	17.44	-19.55	96.23	408	10.45	5.88	16.14	-19.92	95.65	6738	8.54	4.59	14.18	-20.00	99.05	3618
	Interest over Assets	1.45	0.88	1.55	0	10.28	408	2.17	1.82	1.84	0	26.34	6738	2.77	2.48	1.99	0	62.06	3618
	Non interest over Assets	59.87	53.61	31.79	7.46	206.08	408	58.73	54.10	29.94	1.33	244.91	6738	50.29	46.10	24.66	3.20	267.90	3618
	Sales over Assets	132.60	130.97	54.65	24.03	291.47	408	128.31	122.80	48.67	20.04	299.39	6738	119.49	113.95	42.38	21.96	296.37	3618
Small	ROA	3.91	1.85	5.62	-8.98	28.66	381	2.75	0.98	4.61	-11.35	29.80	5831	1.65	0.50	3.31	-6.17	27.78	2024
	ROE	12.93	8.47	17.66	-19.55	96.23	381	10.53	5.83	16.40	-19.92	95.65	5831	8.51	3.94	14.90	-20.00	99.05	2024
	Interest over Assets	1.45	0.86	1.58	0	10.28	381	2.24	1.88	1.87	0	26.34	5831	3.06	2.82	1.72	0	12.18	2024
	Non interest over Assets	60.72	54.64	31.75	7.46	206.08	381	59.47	55.35	30.24	1.33	244.91	5831	53.00	48.24	27.26	3.20	267.90	2024
	Sales over Assets	133.22	130.82	55.78	24.03	291.47	381	130.23	125.57	49.35	20.04	299.39	5831	126.06	121.24	45.23	22.41	295.24	2024
Medium	ROA	0.78	0.00	2.81	-3.86	6.84	19	3.28	1.61	4.82	-7.02	26.03	747	2.01	0.86	3.26	-6.42	22.65	1084
	ROE	6.64	0.00	14.81	-11.76	41.38	19	10.20	5.91	14.81	-19.27	88.10	747	7.99	4.55	13.21	-19.97	98.26	1084
	Interest over Assets	1.29	1.08	1.02	0	3.57	19	1.70	1.42	1.58	0	23.52	747	2.49	2.27	2.50	0	62.06	1084
	Non interest over Assets	49.84	43.23	33.82	11.05	147.57	19	55.10	48.84	28.10	5.23	219.10	747	48.54	45.01	21.92	8.02	199.32	1084
	Sales over Assets	111.94	112.18	33.35	37.41	164.40	19	117.76	110.61	42.48	26.22	298.13	747	114.64	110.68	37.96	24.28	296.37	1084
Large	ROA	5.28	4.30	1.98	3.53	8.52	8	2.89	1.96	4.19	-11.03	22.63	160	3.15	2.13	4.14	-10.84	25.10	510
	ROE	18.35	19.44	7.00	10.07	27.43	8	8.85	6.82	12.21	-18.98	66.75	160	9.85	7.61	13.10	-19.59	85.77	510
	Interest over Assets	1.75	1.20	1.46	0.45	4.16	8	1.82	1.59	1.34	0	6.28	160	2.18	1.92	1.46	0	13.87	510
	Non interest over Assets	42.74	33.64	21.37	25.95	78.66	8	48.83	46.30	23.84	14.56	164.74	160	43.29	40.37	16.13	6.01	102.61	510
	Sales over Assets	151.91	146.72	15.66	132.72	176.21	8	107.48	105.06	38.97	25.25	289.25	160	103.75	101.74	33.13	21.96	247.83	510

Sample period is 1998-2000. Firm-year obs. 10764. Size is based on number of employees (small: < 50 employees, medium: 51 - 250, Large: > 250). Bank relationship: firms have been asked which was the number of banks with which they had commercial relationships at the end of 2000. ROA: % ratio of Net earnings to Total assets.ROE: % ratio of Net earnings to Net worth. Interest over assets: % ratio of Interest expenses to Total assets. Non Interest over assets: % ratio of Non interest expenses to Total assets. Sales over assets: % ratio of Net sales to Total assets.

Table 4

P-values of the F statistics on the significance of restrictions from (1) to (2).

	ROA	ROE	Interest over Assets	Non Interest over Assets	Sales over Assets	num. DF	den. DF
All	0.018	0.316	<0.001	0.024	0.005	18	9949
Small	0.02	0.243	<0.001	0.969	0.015	18	7733
Medium	0.077	0.034	0.321	<0.001	<0.01	18	1663
Large	0.009	<0.001	<0.001	<0.001	<0.001	18	463

Table 5
Estimated Regressions

Dependent variables are % – Standard errors in parenthesis. In addition to variables reported, each regression also includes 19 industries dummies (see note 5) and two year dummies accounting for 1998 and 1999 since we are working with firm-years observations.
The second part of the table reports p-values of F-tests performed comparing equation (2) with in turn: (a) same specification without banks variables, (b) same specification without duration variables; (c) same specification without age variables.

All Firms

	ROA	ROE	Interest over Assets	Non Interest over Assets	Sales over Assets
ln_bank	-0.983	-0.141	0.940	0.146	4.463
	(0.232)**	(0.841)	(0.101)**	(1.463)	(2.518)
ln_bank2	-0.263	-1.254	0.025	-0.911	-4.810
	(0.079)**	(0.286)**	(0.034)	(0.498)	(0.857)**
ln_dur	0.209	-0.890	-0.197	9.275	18.591
	(0.297)	(1.079)	(0.130)	(1.877)**	(3.230)**
ln_dur2	-0.015	0.246	0.027	-1.578	-2.960
	(0.060)	(0.217)	(0.026)	(0.378)**	(0.650)**
ln_size	0.858	2.077	-0.362	-3.931	3.145
	(0.048)**	(0.173)**	(0.021)**	(0.302)**	(0.519)**
ln_age	0.766	-6.881	0.112	-4.648	-4.647
	(0.320)*	(1.161)**	(0.140)	(2.019)*	(3.474)
ln_age2	-0.169	0.678	-0.058	0.419	-0.847
	(0.056)**	(0.204)**	(0.025)*	(0.354)	(0.610)
constant	-3.509	10.313	4.480	88.564	101.255
	(0.686)**	(2.492)**	(0.300)**	(4.335)**	(7.459)**
observations	9996	9996	9996	9996	9996
r-squared	0.075	0.056	0.105	0.159	0.077
F-test degrees of freedom (2,9967)					
(1) no bank	<0.001	<0.001	<0.001	<0.001	<0.001
(2) no duration	<0.001	<0.001	<0.001	<0.001	<0.001
(3) no age	<0.001	<0.001	<0.001	<0.001	<0.001

* significant at 5 percent level; ** significant at 1 percent level

Small Firms

	ROA	ROE	Interest over Assets	Non Interest over Assets	Sales over Assets
ln_bank	-1.047	-0.443	0.845	3.723	4.667
	(0.290)**	(1.065)	(0.119)**	(1.884)*	(3.168)
ln_bank2	-0.365	-1.426	0.119	-2.484	-6.405
	(0.109)**	(0.402)**	(0.045)**	(0.712)**	(1.197)**
ln_dur	0.048	-0.647	0.061	12.368	23.275
	(0.355)	(1.304)	(0.146)	(2.307)**	(3.880)**
ln_dur2	0.006	0.237	-0.025	-2.093	-3.912
	(0.072)	(0.264)	(0.030)	(0.468)**	(0.787)**
ln_size	1.601	4.465	-0.517	-4.514	15.959
	(0.083)**	(0.304)**	(0.034)**	(0.538)**	(0.905)**
ln_age	0.623	-8.678	0.094	-6.144	-9.511
	(0.373)	(1.372)**	(0.154)	(2.428)*	(4.083)*
ln_age2	-0.134	0.948	-0.048	0.593	-0.055
	(0.067)*	(0.245)**	(0.027)	(0.434)	(0.729)
constant	-8.675	-5.668	5.323	88.702	4.814
	(0.907)**	(3.335)	(0.374)**	(5.901)**	(9.924)
observations	7778	7778	7778	7778	7778
r-squared	0.089	0.069	0.132	0.158	0.106
F-test numerator and denominator DF (2,7749)					
(a) no bank	<0.001	<0.001	<0.001	<0.001	<0.001
(b) no duration	<0.001	<0.001	<0.001	<0.001	<0.001
(c) no age	0.063	<0.001	<0.001	<0.001	<0.001

*significant at 5 percent level; ** significant at 1 percent level

Table 5 (continued)
Estimated Regressions

Dependent variables are % – Standard errors in parenthesis. In addition to variables reported, each regression also includes 19 industries dummies (see note 5) and two year dummies accounting for 1998 and 1999 since we are working with firm-years observations.
The second part of the table reports p-values of F-tests performed comparing equation (2) with in turn: (a) same specification without banks variables, (b) same specification without duration variables; (c) same specification without age variables.

Medium Firms

	ROA	ROE	Interest over Assets	Non Interest over Assets	Sales over Assets
ln_bank	0.727	1.112	0.559	5.017	15.201
	(0.701)	(2.457)	(0.410)	(4.100)	(7.073)*
ln_bank2	-0.682	-1.561	0.101	-2.093	-6.649
	(0.204)**	(0.715)*	(0.119)	(1.193)	(2.057)**
ln_dur	0.637	-0.608	-0.743	5.668	18.376
	(0.684)	(2.400)	(0.400)	(4.004)	(6.908)**
ln_dur2	-0.070	0.145	0.148	-1.121	-2.765
	(0.134)	(0.468)	(0.078)	(0.782)	(1.348)*
ln_size	1.199	3.098	-0.243	-7.229	7.268
	(0.136)**	(0.476)**	(0.079)**	(0.794)**	(1.370)**
ln_age	-0.128	-5.133	0.084	-8.556	-3.862
	(0.781)	(2.739)	(0.457)	(4.570)	(7.883)
ln_age2	-0.059	0.472	-0.056	1.181	-0.057
	(0.131)	(0.458)	(0.076)	(0.765)	(1.319)
constant	-7.864	-4.552	4.460	128.577	29.284
	(1.899)**	(6.660)	(1.111)**	(11.112)**	(19.169)
observations	1709	1709	1709	1709	1709
r-squared	0.156	0.115	0.066	0.191	0.103
F-test numerator and denominator DF (2,1680)					
(a) no bank	<0.001	<0.001	<0.001	<0.001	<0.001
(b) no duration	<0.001	<0.001	<0.001	<0.001	<0.001
(c) no age	0.012	<0.001	0.025	0.064	0.034

*significant at 5 percent level; ** significant at 1 percent level

Large Firms

	ROA	ROE	Interest over Assets	Non Interest over Assets	Sales over Assets
ln_bank	0.412	2.296	0.673	-7.349	-10.896
	(1.092)	(3.651)	(0.421)	(4.634)	(9.046)
ln_bank2	-0.296	-1.110	-0.076	1.327	2.036
	(0.268)	(0.896)	(0.103)	(1.137)	(2.219)
ln_dur	0.712	-2.711	-0.885	-0.266	-9.507
	(0.796)	(2.661)	(0.307)**	(3.377)	(6.592)
ln_dur2	-0.167	0.383	0.165	0.341	2.224
	(0.161)	(0.540)	(0.062)**	(0.685)	(1.337)
ln_size	0.658	2.286	0.148	-4.192	2.142
	(0.222)**	(0.742)**	(0.085)	(0.941)**	(1.837)
ln_age	2.385	2.355	-0.179	14.060	13.828
	(1.054)*	(3.524)	(0.406)	(4.473)**	(8.731)
ln_age2	-0.366	-0.372	-0.025	-2.176	-2.311
	(0.177)*	(0.592)	(0.068)	(0.751)**	(1.466)
constant	-7.775	-14.453	1.015	82.766	102.971
	(3.295)*	(11.011)	(1.269)	(13.977)**	(27.281)**
observations	509	509	509	509	509
r-squared	0.123	0.101	0.153	0.187	0.166
F-test numerator and denominator DF (2,481)					
(a) no bank	0.022	0.052	0.003	0.117	0.324
(b) no duration	<0.001	<0.001	<0.001	<0.001	<0.001
(c) no age	0.067	0.796	0.003	0.005	0.282

*significant at 5 percent level; ** significant at 1 percent level

References

Agarwal, R. and J.A. Elston (2001) – Bank firm relationships, financing and firm performance in Germany, *Economics Letters,* 72, pp. 225 – 232.

Angelini, P., Di Salvo, R. and G. Ferri (1998) - Availability and cost of credit for small businesses: Customer relationships and credit co-operatives, *Journal of Banking Finance* **22**, pp. 925–954.

Berger, A.N., Klapper, L.F. and G. F. Udell (2001) – The ability of banks to lend to informationally opaque small businesses, *Journal of Banking and Finance,* 25, pp. 2127–2167.

Berger, A.N., and G. F. Udell (1995) - Relationship lending and lines of credit in small firm finance, *Journal of Business* 68, pp. 351–381.

Berger, A.N. and G.F. Udell (1998) – The Economics of small business finance: the roles of private equity and debt market in the financial growth cycle, *Journal of Banking and Finance*, 22, pp. 613-673.

Berlin, M. and L. Mester (1997) – On the profitability and costs of relationship lending. *Journal of Banking and Finance*, 22, pp. 873-897.

Berlin, M. and L. Mester (1999) – Deposits and relationship lending. *The review of Financial Studies,* 12, pp. 579-607.

Bernanke, B.S. and M. Gertler (1995) - Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives,* 9, pp. 27-48.

Best, R. and H. Zhang (1993) - Alternative information sources and the information content of bank loans, *Journal of Finance,* 48, pp. 1507-1522.

Bhattacharya, S. and G. Chiesa (1995) – Proprietary information, financial intermediation and research incentives, *Journal of Financial Intermediation,* 4, pp. 328 – 357.

Bhattacharya, S. and A.V. Thakor (1993) – Contemporary banking theory, *Journal of Financial Intermediation,* 3, pp. 2-50.

Blackwell, N. R. and A. M. Santomero (1982) – Bank credit rationing and the customer relation, Journal of Monetary Economics, 9, pp. 121 – 129.

Boot, A.W.A. (2000) – Relationship banking: what do we know?, *Journal of Financial Intermediation*, 9, pp. 7 - 25.

Boot, A.W.A. and A.V. Thakor (1994) – Moral hazard and secured lending in an infinitely repeated credit market game, *International Economic Review,* 35, pp. 899-920.

Cole, R. (1998) - The importance of relationships to the availability of credit, *Journal of Banking and Finance* 22, pp. 959–977.

Degryse, H. and S. Ongena (2001) – Bank relationship and firm profitability, *Financial Management,* Spring 2001, pp. 9 – 34.

Degryse, H. and P. van Cayseele (2000). Relationship lending within a bank-based system: Evidence from European small business data, *Journal of Finanancial Intermediation,* **9**, pp. 90–109.

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

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

Diamond, D. (1991) – Monitoring and reputation: the choice between bank loans and privately placed debt, *Journal of Political Economy*, 99, pp. 689-721.

Elsas, R., and J. P. Krahnen (1998) - Is relationship lending Special? Evidence from Credit-File data in Germany, *Journal of Banking and Finance* 22, pp. 1283–1316.

Fama, E.F. (1985) – What's different about banks?, *Journal of Monetary Economics*, 15, pp. 5-29.

Farinha, L. and J. A. C. Santos (2002) Switching from Single to Multiple Bank Lending Relationships: Determinants and Implications, *Journal of Financial Intermediation*, 11, pp. 124–151.

Fazzari, S.M., Hubbard, R.G. and B.C. Petersen (1988) - Financing constraints and corporate investment, *Brookings Papers on Economic Activity*, 1, pp. 141-206.

Fok, C. W., Chang, YC and WT Lee (2004) – Bank relationships and their effects on firms performance around the asian financial crises: evidence from Taiwan, *Financial Management*, Summer 2004, pp. 89-112.

Greenbaum, S. I., Kanatas, G., and I. Venezia (1989) - Equilibrium loan pricing under the bank-client relationship, *Journal of Banking Finance* 13, pp. 221–235.

James, C. (1987) – Some evidence on the uniqueness of bank loans, *Journal of Financial Economics*, 19, pp. 217-235.

Harhoff, D. and T. Korting (1998) - Lending relationships in Germany—Empirical evidence from survey data, *Journal of Banking and Finance*, 22, 1317–1353.

Houston, J., and C. M. James (1996) - Bank information monopolies and the mix of private and public debt choices, *Journal of Finance* 51, pp. 1863–1889.

Kang, J. and R.M. Stulz (2000) - Do banking shocks affect borrowing firm performance? An analysis of the Japanese Experience, *Journal of Business*, 73, pp. 1-23.

Leland, H.E. and D.H. Pyle (1977) – Informational asymmetries, financial structure and financial intermediation, *Journal of Finance*, 32, pp. 371-387.

Longhofer, S.D. and J.A.C. Santos (2000) – The importance of bank seniority for relationship lending, *Journal of Financial Intermediation*, 9, pp. 57 – 89.

Ongena, S. and C. Smith (2000) – Bank relationship: a Survey, in Harker and Zenios eds. *The Performance of Financial Institutions*, Cambridge University Press.

Ongena, S. and C. Smith (2001) – The duration of bank relationships, *Journal of Financial Economics*, 61, pp. 449-475.

Petersen, M. and R. Rajan (1994) - The benefits of lending relationships: Evidence from small business data, *Journal of Finance* **49**, pp. 1367–1400.

Petersen, M.A. and R.G. Rajan (1995) – The effect of credit market competition on lending relationship, *Quarterly Journal of Economics*, 110, pp. 406-443.

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

Refait, C. (2003) – Multiple banking relationship: choice of the number of main banks and choice of the number of banks, *Revue Economic*, 3, 54, pp. 649 – 661.

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

Shockley, R. and A.V. Thakor (1998) Bank loan commitment contracts: data, theory, and tests, *Journal of Money, Credit, and Banking*, 29, pp. 517–534.

Stiglitz, J. and A. Weiss (1983) – Credit rationing in markets with incomplete information, *American Economic Review*, 73, pp. 912-927.

Strahan, P.E. and J.P. Weston (1998) – Small business lending and the changing structure of the banking industry, *Journal of Banking and Finance*, 22, pp. 821-845.

von Rheinbaben, J. and M. Ruckes (2004) – The number and the closeness of bank relationships, *Journal of Banking and Finance*, 28, pp. 1597 – 1615.

von Thadden, E.L. (1995) – Long term contracts, short term investment, and monitoring, *Review of Economic Studies*, 62, pp. 557-575.

von Thadden, E.L. (1998) - Asymmetric information, bank lending, and implicit contracts: the winner's curse. Unpublished working paper. University of Lausanne (DEEP).

Weinstein, D. and Y. Yafeh (1998) - On the Costs of a Bank-Centered Financial System: Evidence from the Changing Main Bank Relations in Japan, *Journal of Finance*, 53, pp. 635-672.

Yosha, O. (1995) - Information disclosure costs and the choice of financing source, *Journal of Financial Intermediation*, 4, pp. 3-20.