Journal of Financial Intermediation **9**, 90–109 (2000)
doi:10.1006/jfin.1999.0278, available online at http://www.idealibrary.com on IDEAL®

Relationship Lending within a Bank-Based System: Evidence from European Small Business Data

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Received July 31, 1999

We investigate relationship lending using detailed contract information from nearly 18,000 bank loans to small Belgian firms operating within the continental European bank-based system. Specifically, we investigate the impact of different measures of relationship strength on price and nonprice terms of the loan contract. We test for the possibility of rent shifting by banks. The evidence shows two opposing effects. On the one hand, the loan rate increases with the duration of a bank–firm relationship. On the other hand, the scope of a relationship, defined as the purchase of other information-sensitive products from a bank, decreases the loan's interest rate substantially. Relationship duration and scope thus have opposite effects on loan rates, with the latter being more important. We also find that the collateral requirement is decreasing in the duration of the relationship and increasing in its scope. *Journal of Economic Literature* Classification Numbers: G21, G32.

[1] The authors have benefited from comments by Geert Bekaert, Xavier Freixas, Gary Gorton, Curtis Hunter, Rezaul Kabir, Joep Konings, Doris Neuberger, Theo Nijman, Steven Ongena, Frederic Palomino, Kristian Rydqvist, Elu von Thadden, Anjan Thakor (editor), Oved Yosha, two anonymous referees, and seminar participants at CentER, UFSIA, the Norwegian School of Management, the JFI 1998 Symposium on "The Design of Financial Systems: A Symposium on Financial Intermediation and Corporate Finance," the WFA 1998 meetings in Monterey, and the EFMA meetings in Lisbon. We thank the financial institution for providing the data. The first author acknowledges support from the Foundation for Scientific Research Flanders under contract G.0302.00.

1042-9573/00 $35.00

I. INTRODUCTION

Small firms are an engine of growth in many countries. A significant portion of the employment growth in the U.S. is credited to small firms. And small firms are apparently even more important in Europe. About 70% of the European workforce is employed in companies with fewer than 500 employees (Schwalbach (1994)), as opposed to about half of the workforce in the U.S. (Brown *et al.* (1990)).

Since small firms depend largely on banks for their external finance, the impact of various aspects of the bank–borrower relationship on the terms of the loan contract is a topic worth researching. Previous research has shown that larger banks tend to lend less to small firms, particularly to those most in need of bank relationships (see Berger and Udell (1996), Keeton (1995, 1996), and Peek and Rosengren (1996)).[2] However, theory tells us that this reluctance to lend may be diminished if the borrower has a longstanding relationship with the bank (e.g. Boot and Thakor (1994), Diamond (1991), and Stiglitz and Weiss (1983)).

This raises the following important question that we seek to empirically address in this paper: How does the strength of the bank–borrower relationship affect the price and nonprice terms of a loan contract in a bank-dominated economy?[3] We use two measures of relationship strength. The first is *duration*, which is the length of time the bank and the firm have maintained a financial relationship. The second is *scope*, which represents the breadth of the relationship and is measured by the number of different services the firm purchases from the bank. The data set used for our analysis is contract-specific credit file information from one large Belgian bank. The data consist of nearly 18,000 loan contracts for small firms.

The theoretical literature generates conflicting predictions about the evolution of interest rates over the duration of a relationship. All theories predict that the repeated provision of bank services through time reveals information about the firm's type. Boot and Thakor (1994) show that loan rates decline as a relationship matures. Savings from the bank's improved knowledge of the borrower are passed on to the borrower. Greenbaum *et al.* (1989), Sharpe (1990), and Wilson (1993) predict that loan rates increase with the duration of a bank–firm relationship. They argue that the bank's improved knowledge locks the borrower into the relationship, enabling the bank to charge above-cost interest rates as the relationship continues.

Using U.S. data, Petersen and Rajan (1994, 1995) find that the duration of a bank–firm relationship does not influence the contracted loan rate, but Berger and Udell (1995) document that rates on lines of credit decrease with the duration of the bank–firm relationship. Petersen and Rajan (1994) document a positive link between relationship duration and availability of credit. However, Cole (1998) shows that the duration of a relationship is unimportant for the availability of credit after the first year of the relationship. For German mid-sized companies,

[2] The *Journal of Banking and Finance* dedicated its August 1998 issue to the economics of "small business finance."

[3] Allen and Gale (1995) provide a comparison of "bank-based" systems and "market-based" systems.

Elsas and Krahnen (1998) find the price of credit unrelated to the duration of the bank–firm relationship. Using data from Norway, Ongena and Smith (1997) document that the likelihood of a firm ending a bank relationship increases with the length of that relationship, suggesting that the benefits from a bank relationship may decrease over time.

There are also theories that predict that large institutional investors produce information about firms and use it to make decisions on whether or not to grant credit (e.g., Diamond (1991) or Ramakrishnan and Thakor (1984)). One source of information concerns the *scope* of a bank–firm relationship. Scope relates to the breadth of a relationship, or the amount of services a firm buys from a bank. A bank may maintain the checking and saving accounts of a firm (Nakamura (1991)). Easy access to this checking account information gives a bank a unique advantage in monitoring borrowers. It also allows the bank to spread the cost of information production over several products. We would thus expect an increase in the scope of a relationship to both increase the availability and reduce the price of credit. Using U.S. data, Cole (1998) reports that a potential lender is more likely to extend credit to a firm when a relationship existed before. Petersen and Rajan (1994) find no relationship between the cost of credit and the use of the bank as a source of depository services. However, the scope of the bank–borrower relationship can obviously extend well beyond loans and deposits. This makes it important for the data to permit an identification of a variety of noncredit bank services, including cash management. Our data set does permit such an identification and thus allows us to conduct a sharper test of the relationship between relationship scope and lending terms than was possible in Petersen and Rajan (1994).

A distinguishing aspect of our paper is that we also examine collateral as a part of the loan contract terms. The existing literature (Petersen and Rajan (1994), Elsas and Krahnen (1998), Angelini *et al.* (1998), or Cole (1998)) is silent on this issue, however. The terms of the loan contract also include collateral. This allows us to conduct a more elaborate test of the Boot and Thakor (1994) prediction about the dependence of collateral requirements on both the duration and the scope of a bank–firm relationship.

We document that the loan interest rate is increasing in the duration of the bank–firm relationship. The impact of duration on loan rates is decreasing in the scope of the relationship. That is, the loan rate declines less as relationship duration increases when the firm does *not* buy other information-sensitive products from that bank. Moreover, the loan rate is decreasing in the scope of the relationship. Finally, a "main bank" relationship, one with a broad scope, is accompanied by more collateral than non-main-bank relationships.

The paper proceeds as follows. In the next section we review the theoretical and empirical literature on relationship lending. The data are described in the third section. Section IV presents the empirical results on the borrowing costs and the determinants of collateral. Finally, Section V concludes. All tables are relegated to the Appendix.

II. THEORY AND PREVIOUS EMPIRICAL RESULTS ON RELATIONSHIP LENDING

Banks learn about a firm's ability to meet future obligations through its past repayment history. Financial institutions obtain information through the provision of other services (e.g., deposit accounts and clearing and payment services). Banks may use this information in designing loan contracts to small businesses. Theoretical papers on banking relationships have focused on how the strength of a bank–firm relationship affects the design of these credit contracts (Greenbaum *et al.* (1989), Sharpe (1990), Boot and Thakor (1994), Nakamura (1991)), as well as the availability of supplemental financing in a liquidity crisis (Longhofer and Santos (forthcoming)).

At least two dimensions of a relationship can be distinguished (see also Petersen and Rajan (1994)). First, the *duration* of a financial relationship is important. The information generated over time by bank–borrower interaction should influence price and nonprice terms of the loans. As the relationship gets longer, information asymmetries are overcome more effectively, producing a gain in allocative efficiency. Some authors argue that these efficiency gains are passed along to the firm over the course of the relationship (Boot and Thakor (1994)). The resulting empirical prediction is that both the price of credit and the incidence of collateral decline in the duration of the relationship. Others argue that the ability of a bank to privately observe proprietary information about the borrower can generate a lock-in problem in that the borrower cannot costlessly transfer to another lender what the bank knows about it, which creates a switching cost for the borrower. The incumbent bank then gains monopoly power over the borrower through its informational advantage over competitors (Greenbaum *et al.* (1989), Sharpe (1990), Rajan (1992), and von Thadden (1998)). The empirical prediction of these papers is that the loan interest rate will rise as the duration of the bank–firm relationship lengthens.

Second, because bank–borrower interactions over multiple products also have information generation implications, we should expect the scope of the relationship to affect contract terms as well. For instance, a bank may maintain the checking and saving accounts of a firm (Nakamura (1991)), and this could generate information that would facilitate bank monitoring of the firm in its capacity as a borrower (Black (1975) and Fama (1985)). The broader the scope of the bank–borrower relationship, the greater should be the amount of such information that is generated. Since such spontaneously produced information lowers the overall cost the bank faces in learning about the borrower, we expect the loan rate and collateral requirements to be decreasing in the scope of the relationship.

The empirical papers concerning the strength of bank–firm relationships address whether these relationships are valuable to the economy. Various papers have analyzed small business financing in the U.S., using data from the Federal Reserve Board National Survey of Small Business Finances (NSSBF). Using all loans,

Petersen and Rajan (1994) found a positive, but insignificant, effect of the duration of the bank–firm relationship on the loan rate. The scope of a relationship, that is whether the creditor obtains deposits or informational services from the firm, did not impact the loan rate significantly. Berger and Udell (1995) focus on lines of credit. They find that the loan rate premium above the prime rate and the probability that the lender requires collateral to secure the loan both decrease with the duration of the relationship. Cole (1998) examines the effect of scope (i.e., pre-existing relationships) and duration on the potential lender's decision in granting credit. He finds that the duration of pre-existing relationships is unimportant, but the potential lender is more likely to extend credit whenever the scope of the pre-existing relationship is broad.

More recently, researchers have started examining the impact of relationship strength in Europe. Elsas and Krahnen (1998), and Harhoff and Körting (1998) investigate lending relationships in Germany. Based on survey data, Harhoff and Körting (1998) find for small German firms that relationship variables may have some bearing on the price of external funds, but more so on the availability of those funds. Elsas and Krahnen (1998) focus on German firms of moderate size using credit file data. Their results provide no evidence for intra- or intertemporal price differentiation related to housebanking. Angelini *et al*. (1998) find that, with banks other than cooperative banks, lending rates in Italy tend to increase in the duration of a relationship. Members of cooperative banks enjoy easier access to credit, unlike non-member customers. Ongena and Smith (1999) explore a data set concerning the number of bank relationships, covering 20 European countries. They find that firms, on average, maintain more bank relationships in countries with inefficient judicial systems and poor enforcement of creditor rights. A higher number of bank relationships inevitably reduces relationship scope.

III. THE DATA SET

An important Belgian bank provided our data. The bank operates all over Belgium. The data set consists of 17,776 loans given to independents (or single-person businesses) and small, medium-sized, and large firms.[4] The definitions of firm size applied by the bank are as follows; a small firm has less than 10 employees and turnover of less than 250 million Belgian francs (BEF) (∼7 million U.S. dollars), a medium-sized firm has at least 10 employees and/or turnover between 250 million BEF (∼7 million U.S. dollars) and 1 billion BEF (∼28 million U.S. dollars), and a large firm has turnover of more than 1 billion BEF (∼28 million U.S. dollars).[5] Approximately 81% of the firms are single-person businesses (sole proprietorships), 17% are small firms, and 1% are medium-sized firms. The rest (less than

[4] Independents or single-person businesses are natural persons who run a small business in which they are employed themselves. They have no limited liability and are comparable to sole proprietorships.

[5] The bank providing our data uses this definition.

1%) are large firms. Hence, our sample is dominated by small firms. Some borrowers took several loans from this bank; our data set covers loans granted to 13,104 borrowers—implying that the average borrower maintained 1.36 loans at that bank at that point in time. Our sample begins with all loans at the bank as of August 10, 1997 that were initiated after January 1, 1995.[6] For the results reported here, we drop large and medium-sized firms from the sample, leaving 17,429 loans. The (similar) results for the entire data set are presented in Degryse and Van Cayseele (1998).

Table I describes the variables used in this study, broken down into five sets of characteristics: loan contract characteristics, relationship characteristics, interest rate variables, firm characteristics, and governance characteristics and other variables. Table I shows the definition, mean, median, minimum, maximum, and standard deviation of our variables.

Consider *loan contract characteristics*. The first is the interest on a loan until the next revision (INTRATE). For fixed interest rate loans, this is the yield to maturity of the loan. For variable interest rate loans, this is the interest rate until the date at which the interest rate will be revised as stipulated in the contract. The average interest rate on a loan is 8.13%. The variable rate loans are, after an interest rate revision, treated in the sample as a new observation, with a revised interest rate. The variable COLLAT indicates whether the loan is collateralized or not. Approximately 26% of the loans are collateralized. Another loan contract characteristic is the repayment duration of the loan (DURATION).[7] We include the natural logarithm of this variable (ln(DURATION)) in order to proxy for the risk associated with the time until the loan is repaid. We also include dummies capturing the type of loan the firm is taking. We have five types of loans in our sample. For bank-strategic considerations, we cannot reveal the relative importance of the types of loans. Hence, the types of loans are not included in Table I but appear in our empirical work later on. A distinction is made between "business mortgages," "bridging finance loans," "credit to prepay taxes," "business-term loans (investment credit)," and "consumer credit (capturing installment loans)." Business mortgages and business-term loans have one contractual difference when they are compared with other types of loans in our data set. That is, they are made under a commitment contract such that a firm can always recall, under contractual conditions, the entire amount of the loan (see also Morgan (1998)). We will exploit this contractual difference in our empirical work. Together with the firm characteristics and the two-digit industry dummies, the loan types should proxy for the risk of the borrower. The SIZE of the loan is rather small, since a large part of our loans are of the consumer credit and prepay taxes types.

[6] The bank argues that loans starting earlier than 1995 have been prepaid. We have a dummy variable PREPAY, capturing whether the new loan served to prepay an old loan.

[7] For all loans to the firms, we know at what speed the loans are repaid. This allows us to exactly compute the repayment duration of a loan.

TABLE I
Data Description

	Definition	Mean	Median	Min	Max	Std. dev.
Loan contract characteristics						
INTRATE	% interest rate on loan until next revision	8.13	7.85	1.56	22.37	2.38
COLLAT	=1 if loan is secured via collateral	0.26	0.00	0.00	1.00	0.44
SIZE	size of loan in thousands of BEF[a]	870	300	50	62900	1639
DURATION	repayment duration of loan in years	2.41	0.55	0.08	20.00	3.32
Relationship characteristics						
MAIN	=1 if bank considers itself as main bank[b]	0.58	1.00	0.00	1.00	0.49
RELAT	length of relationship with current lender in years	7.87	7.37	0.00	26.46	5.49
Interest rate variables						
RATEEQDUR	% interest rate on a Belgian government security with same repayment duration as loan to firm	3.90	3.51	3.05	8.05	0.88
TERMSPREAD	yield on Belgian government bond of 5 years – yield on treasury bill with maturity of 3 months	1.79	1.77	1.00	2.68	0.31
Firm characteristics						
SMALL	=1 if size of firm is small	0.17	0.00	0.00	1.00	0.38
AGE	age of firm in years (only available for a subset of the firms)	16.19	6.02	0.00	96.27	24.51
Governance characteristics						
BVBA[c]	=1 if limited partnership	0.12	0.00	0.00	1.00	0.33
NV[d]	=1 if corporation	0.03	0.00	0.00	1.00	0.18
CV[e]	=1 if firm is limited partnership with equal sharing	0.01	0.00	0.00	1.00	0.11
Other characteristics						
PREPAY	=1 if goal of loan is prepaying other loan	0.10	0.00	0.00	1.00	0.30

[a] One dollar is approximately 35 BEF.

[b] The definition used by the bank to determine whether it is the main bank is: for single person businesses and small firms, have a ‘turnover’ on the current account of at least 100,000 BEF per month and buy at least two products from that bank.

[c] Besloten vennootschap met beperkte aansprakelijkheid.

[d] Naamloze vennootschap.

[e] Cooperatieve vennootschap.

The *relationship characteristics* are central in the analysis. The first characteristic in this category is RELAT, which measures the *duration* in years of the financial relationship with that particular bank at the time the loan rate is decided upon. A relationship starts when a firm buys a product from a bank for the first time. RELAT is a measure of the duration of the bank–firm relationship. RELAT proxies for (1) the increased time for a bank to gain private information about a firm, (2) added flexibility to maintain and fulfill implicit contracts (e.g., we will loan to you at a lower rate now because we believe we can make it up in the future), and (3) the possibility that a firm has become locked in and cannot leave a bank. The mean value of RELAT is 7.87 years; thus the average duration of the relationship in the sample is about 8 years. This value is lower than the one found by Ongena and Smith (1997) or Elsas and Krahnen (1998), for instance, and roughly half of the relationship duation found by Berger and Udell (1995). This can be explained by some of the previous authors working with listed or medium-sized firms, whereas our sample concerns small firms.

A second measure of the strength of the financial relationship is MAIN. MAIN indicates whether this bank considers itself as the main bank of a firm or not. The definition used by the bank to determine whether it is the main bank is "having a monthly turnover on the current account of at least 100,000 BEF (U.S. $3,000), and buying at least two products from the bank." Thus MAIN captures the *scope* of the relationship, that is, whether this firm also buys other products from the bank and executes most of its payments via the bank. If these sources of information improve the accuracy of the bank's information or reduce the monitoring costs, the measure MAIN should reduce the expected cost of such loans.[8] Unfortunately, we have no data to disentangle the composition of MAIN for each individual firm. Also, due to the small size of the borrowing firms, accounting data are not available; most of the firms are not obliged to make their annual reports public. Since so few public information sources exist for our sample, the importance of private sources through the bank relationship becomes apparent.

The *interest rate variables* are incorporated to control for the underlying cost of capital in the economy. We control for variations in the cost of capital by including three variables. The first is the interest rate on a Belgian government security with the same repayment duration as the loan granted to the small firm (RATEEQDUR). We calculate this using the exact date of granting the loan to the small firm. Secondly, we include a term premium (TERMSPREAD), defined as the difference between the yield on a government bond with repayment duration of five years and the yield on a 3-months Belgian Treasury bill. Finally, we incorporate year dummies to control for business cycle effects. The *firm characteristics* include a proxy for the size of the firm. The reduced data set consists of small firms (SMALL) and single person businesses (the base case). The age of the firm (AGE) is a proxy for its reputation. In examining the duration of a relationship, it is important to

[8] A possible effect of MAIN is that the bargaining power of a firm increases, as it also buys other products at that bank. In other words, cross-subsidization could negatively influence the loan rate.

account for the potential confounding effect of firm age. AGE captures public information whereas RELAT reflects private information gathered through the intermediation process (Diamond (1991)). The data set provides us with information on the age of the firm for those firms having a legal form. In our sample, such firms have been granted 3073 loans. The *corporate governance characteristics* relate to the legal form of the firm. We distinguish limited partnerships (besloten vennootschap met beperkte aansprakelijkheid (BVBA)), cooperative partnerships (cooperatieve vennootschap (CV)), and corporations (naamloze vennootschappen (NV)).[9] The inclusion of 49 two-digit NACE code dummies captures the industry characteristics.[10]

IV. ECONOMETRIC SPECIFICATION AND EMPIRICAL RESULTS

This section analyzes the empirical results of the determinants of the loan rate. We also focus on the empirical association between a loan requiring collateral and the strength of a bank–firm relationship. Interest rates and collateral requirements are determined in a complex bargaining procedure. As in Berger and Udell (1995) and Harhoff and Körting (1998), we assume that collateral and interest rate conditions are determined in a sequential procedure, with the collateral decision preceding the interest rate determination.

A. Determinants of the Loan Rate

We analyze the determinants of the loan rate by regressing the loan interest rate (INTRATE) on relationship characteristics and control variables. We first discuss some start-up specifications. Afterwards, we elaborate on these simple specifications, discuss our methodology and perform additional robustness tests.

(a) Start-up specifications. Using OLS, we ran variations of the following regression,

$$\begin{aligned}\text{Loan interest rate} &= \beta_0 + \beta_1\,\text{Economy-wide interest rate variables} + \beta_2\,\text{Firm characteristics} \\ &\quad + \beta_3\,\text{Relationship characteristics} + \beta_4\,\text{Loan contract characteristics} \\ &\quad + \beta_5\,\text{Governance characteristics} + \beta_6\,\text{Other characteristics} + \varepsilon.\end{aligned}$$

We refer to Table I and Section III for precise definitions of the variables used in the regression. To summarize, the loan interest rate is given by INTRATE. Economy wide interest rate variables are captured by the interest rate on a government bond

[9] BVBAs are partnerships with limited liability. Sole proprietorships can erect a BVBA in order to have limited liability. Cooperative partnerships imply equality among the partners. NVs are corporations having ease of ownership transfer and perpetual succession.

[10] The NACE code is the European industrial classification system subdividing industries.

with the same repayment duration (RATEEQDUR), and the difference between the interest rate on a 5-year government bond and a 3-month treasury bill rate (TERMSPREAD). Firm characteristics are given by a dummy variable indicating a "small" firm (SMALL) and the age of the firm (AGE). MAIN, capturing relationship scope, and RELAT, measuring relationship duration, are included as relationship characteristics. Loan contract characteristics are given by a dummy variable indicating whether the loan is collateralized (COLLAT), the repayment duration of the loan (DURATION), and dummy variables for loan type (consumer credit, business mortgage, business term loans, bridging finance). Governance characteristics relate to the legal type of the firm (BVBA, NV, CV). Other characteristics refer to 2-digit industry dummies and year dummies.

Table II presents the results. We first discuss the results concerning the control variables before turning to the relationship characteristics. A significant fraction of the variation in the loan rate is explained by economy-wide factors. As in Petersen and Rajan (1994) or Ausubel (1992), the change in the loan rate due to a change in the interest rate on a government security with the same repayment duration (RATEEQDUR) is less than one. This can be seen from the coefficient of RATEEQDUR in (1). A 1% parallel shift of the term structure implies a 0.7% shift in the loan rate. This is more than two times the size of the coefficient found by Petersen and Rajan (1994) (0.28), but it still is significantly less than one. The term structure measured by TERMSPREAD positively influences the loan rate. The firm size dummy SMALL allows for a separate intercept effect for small firms. Small firms tend to pay a slightly but insignificantly higher interest rate than do single-person businesses (the base case). Corporations (NV) pay a lower interest rate than single-person businesses with unlimited liability for business debts.

The loan contract characteristics include whether the loan is collateralized or not and the repayment duration of the loan.[11] The coefficient of COLLAT indicates that when a loan is collateralized, the loan rate decreases by approximately 0.5%. This result is in line with the sorting-by-private-information paradigm which predicts that safer borrowers pledge more collateral (see Bester (1985), Besanko and Thakor (1987), or Berger and Udell (1990)). The coefficient of ln(DURATION) is significantly negative: an increase of the duration from 5 to 6 years reduces the interest rate by 0.16%.

We now turn to the empirical results concerning the role of relationships. We capture the role of the bank–firm relationship in two complementary ways. The first one is through the *duration* of the financial relationship RELAT. We include the duration of a financial relationship as the logarithm of RELAT, (ln(RELAT)). The reason is that we expect the marginal impact on the loan rate to decrease in the duration of the relationship. The coefficient of ln(RELAT) is significantly positive. Thus, the loan rate is increasing in the duration of relationship. Regression (2) introduces our second indicator of relationship strength, MAIN, measuring the

[11] We have no further information on the type of collateral provided.

TABLE II
Borrowing Costs and the Role of Bank–Firm Relationships

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interest rate variables								
RATEEQDUR	0.702***	0.709***	0.708***	0.752***	0.698***	0.706***	0.584***	0.430***
	(0.062)	(0.062)	(0.062)	(0.147)	(0.062)	(0.062)	(0.049)	(0.045)
TERMSPREAD	0.343***	0.345***	0.339***	0.224	0.351***	0.346***	0.416***	0.442***
	(0.084)	(0.084)	(0.084)	(0.199)	(0.084)	(0.084)	(0.066)	(0.062)
Firm characteristics								
SMALL	0.263	0.294	0.267	0.462**	0.330*	−0.017	−0.043	−0.227
	(0.191)	(0.191)	(0.191)	(0.209)	(0.191)	(0.208)	(0.287)	(0.140)
ln(AGE)	—	—	—	−0.055*	—	—	—	—
				(0.030)				
Relationship characteristics								
MAIN	—	−0.390***	−0.014	0.258	−0.393***	−0.395***	0.047*	0.103**
		(0.035)	(0.089)	(0.172)	(0.035)	(0.035)	(0.028)	(0.026)
ln(RELAT)	0.086***	0.163***	0.233***	0.411***	0.235***	0.135***	0.017	0.039*
	(0.021)	(0.022)	(0.027)	(0.077)	(0.026)	(0.023)	(0.017)	(0.016)
MAIN*ln(RELAT)	—	—	−0.193***	−0.294***	—	—	—	—
			(0.042)	(0.107)				
ln(RELAT)*(TERM LOANS + MORTGAGES)	—	—	—	—	−0.223***	—	—	—
					(0.043)			
ln(RELAT)*SMALL	—	—	—	—	—	0.183***	—	—
						(0.055)		
Loan contract characteristics								
COLLAT	−0.525***	−0.461***	−0.467***	−0.181	−0.452***	−0.455***	−0.135**	−0.158***
	(0.078)	(0.078)	(0.078)	(0.142)	(0.078)	(0.078)	(0.061)	(0.057)
ln(DURATION)	−0.886***	−0.883***	−0.881***	−0.401***	−0.885***	−0.879***	0.175***	0.128***
	(0.057)	(0.057)	(0.057)	(0.106)	(0.057)	(0.057)	(0.046)	(0.043)
ln(SIZE)	—	—	—	—	—	—	−1.745***	−10.693***
							(0.017)	(0.177)

TABLE II—*Continued*

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(SIZE)^2	—	—	—	—	—	—	—	0.351***
								(0.007)
Consumer credit	−0.297***	−0.324***	−0.322***	−1.654***	−0.311***	−0.326***	−0.494***	−0.086
	(0.081)	(0.081)	(0.081)	(0.162)	(0.081)	(0.081)	(0.063)	(0.060)
Business mortgages	0.439**	0.356**	0.363**	−0.935	0.790***	0.388**	1.244***	0.799***
	(0.174)	(0.173)	(0.173)	(0.604)	(0.192)	(0.173)	(0.136)	(0.127)
Business term loans	−0.392**	−0.447***	−0.463***	−2.502***	−0.087	−0.449***	1.162***	0.409***
	(0.192)	(0.156)	(0.156)	(0.287)	(0.171)	(0.156)	(0.123)	(0.116)
Bridging finance	−0.444	−0.483	−0.434	—	−0.394	−0.528	−1.532	−1.140
	(1.509)	(1.504)	(1.180)		(1.503)	(1.504)	(1.180)	(1.101)
Governance characteristics								
BVBA	−0.359*	−0.319*	−0.324*	—	−0.323*	−0.315*	−0.048	0.099
	(0.187)	(0.187)	(0.186)		(0.186)	(0.187)	(0.146)	(0.137)
CV	−0.345	−0.348	−0.335	−0.023	−0.360	−0.397	−0.164	−0.003
	(0.242)	(0.242)	(0.241)	(0.159)	(0.241)	(0.242)	(0.190)	(0.177)
NV	−1.195***	−1.164***	−1.163***	−0.793***	−1.175***	−1.165***	−0.126	−0.190
	(0.210)	(0.210)	(0.210)	(0.105)	(0.210)	(0.210)	(0.165)	(0.154)
Other characteristics								
PREPAY	0.228***	0.249***	0.246***	0.503**	0.270***	0.250***	0.382***	0.309***
	(0.070)	(0.069)	(0.069)	(0.239)	(0.070)	(0.069)	(0.055)	(0.051)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs	17429	17429	17429	3073	17429	17429	17429	17429
Adjusted R^2	0.207	0.212	0.213	0.290	0.214	0.213	0.515	0.578

Note. The dependent variable is the interest rate until next revision on a firm's loan (yield until next revision) (INTRATE). Standard errors are reported in parentheses.

*,**,*** Significant at 10%, 5%, and 1% levels, two-tailed. The definition of the variables can be found in Table I. ln(RELAT) and ln(AGE) are the natural log of one plus the length of the financial relationship and one plus the age of the firm, respectively. All regressions also include four dummies capturing the effect of the revisability of a loan, as well as an intercept. Column (4) presents the regression results for those loans for which we have data about the age of the firm.

scope of the bank–firm relationship. The loan rate is decreasing in the scope of the relationship. The results show that a firm pays a 0.39% lower loan rate when the scope of a relationship is sufficiently broad.

We expect that our two measures of relationship strength, MAIN and ln(RELAT), are correlated. The previous regressions show that the introduction of MAIN increases the coefficient of ln(RELAT). We suspect that the impact of ln(RELAT) may differ, depending on whether MAIN equals one or zero. In other words, the impact of the duration of a financial relationship may depend on the scope of a relationship. In regression (3), we allow the slope coefficient of ln(RELAT) to depend on the value of MAIN by adding the interaction term MAIN*ln(RELAT). The coefficient of this interaction term is significantly negative. This implies that the increase in the loan rate due to a longer duration is larger for firms without a main bank relationship. The sum of the coefficients of ln(RELAT) and MAIN*ln(RELAT) is positive though jointly not significantly different from zero. The coefficient of MAIN approaches zero and becomes statistically insignificant in specification (3). The results of (3) suggest that it is the *combination of scope and duration* of the financial relationship that affects the interest rate. Whenever the bank acts as a dual source/new source in providing funds, it extends credit at a higher interest rate.

This empirical evidence supports the predictions of the mixed-strategy equilibrium in von Thadden (1998). In equilibrium, some firms occasionally switch to an outside bank (MAIN = 0), and the outside bank charges a higher interest rate, because it takes into account a winner's curse effect. The performance of the regressions, as shown by the adjusted R^2, improves by the introduction of this interaction term. We therefore take (3) as our preferred specification.

In examining the duration of a relationship, it is important to account for the potential confounding effect of firm age. In regression (4) of Table II we add the age of the firm (ln(AGE)) as an explanatory variable. The data set provides us with information on the age of the firm for those firms having a legal form. In our sample, such firms have been granted 3073 loans. We expect that the older a firm is, the lower will be the interest rate charged. Our results in (4) confirm this: an increase in age from 5 to 6 years reduces the interest rate by 0.009%. The results for the duration of the financial relationship gain economic significance, as ln(RELAT) might have picked up some of the effects of ln(AGE). An increase from 5 to 6 years increases the interest rate by 0.018% (0.063%) if the bank is (not) the main bank. Our conclusion thus is that the private information component, reflected in the duration of a relationship, dominates the public information component reflected in age, as the coefficient of the duration of the bank–firm relationship is higher than the coefficient of age.

(b) Further testing. The results of Berger and Udell (1995) and Petersen and Rajan (1994) are different. In particular, the first authors analyze L/C to small U.S. businesses and find that the spread declines in the duration of the relationship. The latter focus on all loans and find that the length of a financial relationship increases the interest rate (although the increase is not statistically significant). In our data

set, business mortgages and business-term loans are made under a commitment contract. These loans are thus akin to lines of credit, which were the focus of Berger and Udell (1995). We therefore interacted these types of loans with the duration of the financial relationship (ln(RELAT)*(BUSINESS-TERM LOANS + MORTGAGES) and focused again on our sample of 17,429 loans. The results, which are reported in Eq. (5) of Table II, indicate that the interest rates on the loans made under commitment increase significantly less with the duration of the relationship than the interest rates on other types of loans.

In regression (6) we include an interaction variable between the size of the firm and the duration of the relationship, ln(RELAT)*SMALL. The purpose is to check whether the effect of duration depends on the size of the firm. This coefficient turns out to be significantly positive, suggesting that the increase in the interest rate by the duration of the financial relationship is higher for small firms than for single-person businesses. Lock-in problems are higher for small firms.

(c) Discussion of methodology. Our OLS estimation technique assumes one-way causality from the independent variables to the dependent variable. Theory suggests that banks design the interest rate, loan size, and collateral to reflect borrower quality. We believe that the simultaneity problem between collateral and interest rate in our data set is minimal. For instance, deleting collateral in all reported equations does not affect the estimates of other variables. The same remark holds when the interest rate is introduced into our collateral equation (see next section).

To address potential simultaneity problems between the loan size and the interest rate, regressions (7) and (8) also include loan size. In Eq. (7) we introduce ln(SIZE). The coefficient is highly significant and negative. The coefficient on ln(RELAT) remains positive but becomes insignificant. MAIN becomes slightly positive and significant at the 10% level. When the second-order term of ln(SIZE) is included, the coefficient of ln(RELAT) becomes significantly positive (regression (8) of Table II). Adding the interaction variable MAIN*ln(RELAT) confirms our previous finding that the duration of a relationship results in an increase in the interest rate only when the scope of a relationship is narrow (not reported). Loan size could capture project size or firm size better than SMALL.[12] To test whether our earlier results are unchanged, we ran a separate regression using only the medium-sized and large firms that we had previously dropped from our sample. The results only including these firms confirm our earlier results: based on specification (2), relationship scope (MAIN) implies a 0.35% lower loan interest rate (standard error of 0.37%) whereas the coefficient of relationship duration ln(RELAT) increases to 0.62 (standard error of 0.21). Introducing loan size into that specification reduces the coefficient of MAIN to −0.07 and the coefficient of ln(RELAT) to 0.173 (standard error 0.165). These results suggest that the simultaneity problems between loan size and loan rate are affecting the change in sign of MAIN reported in specifications (7) and (8).

[12] Unfortunately, we have no other indicator of firm size.

(d) Robustness. Following Berger and Udell (1995) and Harhoff and Körting (1998), we first check the sensitivity of the results to using a different definition of the dependent variable, i.e., the spread over a government security with the same repayment duration. The results on the relationship variables are not affected. Second, we check whether our results are unchanged when we focus on firms having a bank–firm relationship of less than 3 years. It turns out that our results hold even in this case. Third, we aggregate loans for each firm and rerun the regressions. The results even strengthen our previous findings. For instance, the parameter estimate of ln(RELAT) in specification (1) of Table II equals 0.157 with a standard error of 0.041 compared to 0.086 without aggregation. Based on specification (2) of Table II, the coefficient of ln(RELAT) equals 0.248 (0.025) and the coefficient of MAIN equals −0.526 (0.040) (standard errors between brackets).

Overall, our analysis complements and further illuminates the findings of Petersen and Rajan (1994), Berger and Udell (1995), and Harhoff and Körting (1998). Petersen and Rajan (1994) and Harhoff and Körting (1998) found that the duration of the bank–borrower relationship has a small positive effect on the loan rate. Their regression coefficients, however, were insignificant. In contrast to the Petersen–Rajan and Harhoff–Körting findings as well as ours, Berger and Udell (1995) report that the loan rate is decreasing in the bank–borrower relationship. Our analysis suggests that the reconciliation between these apparently conflicting findings may lie in taking into account the type of the loan. What we find is that loans similar to the lines of credit examined by Berger and Udell (1995) have interest rates that increase less with the duration of the relationship than other types of loans.

B. Determinants of Collateral

This section empirically investigates whether the strength of a bank–firm relationship influences the probability of pledging collateral. We use logit regressions to examine the probability of a loan being secured. This section offers a more elaborate test of Boot and Thakor's (1994) model, which predicts that borrowers with longer and broader bank–firm relationships have a lower probability of pledging collateral. Berger and Udell (1995) report evidence that supports this prediction for relationship duration. Our empirical evidence adds to this by also discussing the impact of relationship scope on collateral requirements.

For all loans in our sample we know whether or not collateral was required (see also Table I). Table III shows the results of the logit regressions for the probability of any type of collateral being pledged. As for the loan-rate regressions, we control for firm, loan, governance, and other characteristics. We focus again on the relationship variables.

We report the results for various specifications. Specifications (1) and (2) differ in that (1) includes only the relationship duration ln(RELAT), whereas (2) also takes into account the relationship scope MAIN. We expect a negative sign for both. If a bank maintains the account of a firm, and thus does more than just lend

TABLE III
Pledging Collateral and the Role of Bank–Firm Relationships

Variable	(1)	(2)	(3)	(4)
Firm characteristics				
SMALL	1.363**	1.422***	1.419***	1.024*
	(0.566)	(0.576)	(0.576)	(0.537)
ln(AGE)	—	—	—	−0.115*
				(0.058)
Relationship characteristics				
MAIN	—	0.645***	0.729***	0.723**
		(0.091)	(0.193)	(0.314)
ln(RELAT)	0.033	−0.093*	−0.073	0.062
	(0.048)	(0.052)	(0.066)	(0.152)
MAIN*ln(RELAT)	—	—	−0.048	−0.144
			(0.097)	(0.209)
Loan contract characteristics				
ln(SIZE)	0.338***	0.300***	0.300***	0.081
	(0.073)	(0.073)	(0.074)	(0.134)
ln(DURATION)	0.675***	0.699***	0.699***	0.607***
	(0.105)	(0.105)	(0.105)	(0.192)
Consumer credit	9.736**	9.754**	9.752**	12.006
	(4.558)	(4.542)	(4.543)	(12.060)
Business mortgages	17.354***	17.333***	17.330***	15.909
	(4.584)	(4.567)	(4.568)	(12.123)
Business term loans	12.583***	12.636***	12.635***	14.928
	(4.566)	(4.549)	(4.550)	(12.070)
Bridging finance	22.251	22.299	22.312	—
	(305.865)	(302.842)	(302.547)	
Governance characteristics				
BVBA	−0.708	−0.845	−0.850	—
	(0.563)	(0.574)	(0.574)	
CV	−0.675	−0.741	−0.738	0.066
	(0.632)	(0.643)	(0.643)	(0.324)
NV	−0.829	−0.955*	−0.957	−0.013
	(0.592)	(0.602)	(0.603)	(0.216)
Other characteristics				
PREPAY	0.265*	0.276*	0.274	0.326
	(0.166)	(0.176)	(0.167)	(0.337)
# obs	17429	17429	17429	3073
$-2 \log L$	4100	4049	4048	1132
χ^2 covariates	15989	16041	16040	2002

Note. Dependent variable: Collateral was required to obtain loan or not (1/0) (COLLAT). Logit Regression Coefficients, Standard errors are reported in parentheses.

*,**,*** Significant at 10%, 5%, and 1% level, two-tailed. The definition of the variables can be found in Table I. ln(RELAT) and ln(AGE) are the natural log of one plus the length of the financial relationship and one plus the age of the firm respectively. Each regression also includes 49 two-digit NACE industry dummies, and 8 regional dummies, 2 year dummies, and 4 dummies capturing the effect of the revisability of a loan, as well as an intercept. We could have estimated this logit regression jointly with the loan rate regressions in a Seemingly Unrelated Regression model. As the exogenous variables are almost the same in both equations, there would be little gain in jointly estimating those equations (see also Berger and Udell (1995)). Column (4) presents the regression results for those loans for which we have data about the age of the firm.

to the firm, it should cost it less to monitor that firm and the lower should be the collateral required. Our findings on this are mixed. The coefficient of ln(RELAT) is slightly positive in (1) and slightly negative in (2). Both estimates are statistically not different from zero. Evaluated around the mean, and based on (2), an increase of 10 years in the duration of the bank–borrower relationship decreases the likelihood of requiring collateral by 2.6%. This number is substantially lower than the one found in Berger and Udell (1995), where an increase of 10 years in the relationship duration decreases the probability of pledging collateral by 16%.

Examining the variable MAIN, however, we see that an increase in the scope of the relationship increases the probability that a loan requires collateral. The reasons for this result are unclear, although the result has been encountered before. Machauer and Weber (1998) also report that more collateral is pledged at the German housebank compared to the non-housebanks. A possible explanation for this effect is that the bank uses the lock-in effect of its informational advantage via the scope of the relationship. That is, through the scope of the relationship the bank becomes better informed about the assets that are available as collateral. This could reduce the dissipative costs of deploying collateral as a part of the loan contract and make collateral use more efficient.

Deleting loan size or including the loan rate does not affect the results for either ln(RELAT) and MAIN, minimizing the relevance of the simultaneity problem for the collateral decision. Moreover, the results remain unchanged when one examines the medium-sized and large firms originally excluded from the sample.

As for the loan rate, we again include an interaction dummy between MAIN and ln(RELAT). The purpose is to detect whether the impact of relationship duration depends on the scope of the relationship, i.e., on whether the bank is the main bank. The results of (1) and (2) suggest that there may be a differential impact, as the sign of the relationship duration changes when MAIN is introduced. Our result for (3) does not, however, confirm this possibility. In other words, the interaction between relationship duration and main bank status does not generate a significant differential impact on the probability of pledging collateral. The duration of the relationship negatively affects the probability of pledging collateral. MAIN again increases the probability of pledging collateral.

Loans of the consumer credit type, business mortgages, and business-term loans are significantly more often collateralized than are loans to prepay taxes (the base case). Only three other control variables are systematically significant: the size of the loan (ln(SIZE)), the repayment duration of a loan (ln(DURATION)), and the indicator for small firms (SMALL). The sign for loan size (ln(SIZE)) is positive. That is, larger loans are collateralized more often. Loans with longer repayment duration need more collateral than shorter repayment duration loans. Small firms have to pledge collateral more often than single-person businesses (which could be due to their limited liability).

As for the loan-rate regressions, we included the age of the firm whenever that information was available to us. We expect that the older a firm becomes, the less

likely it is that it will have to pledge collateral. The results in logit regression (4) of Table III bear out this intuition. The age of a firm reduces the probability of pledging collateral and is statistically significant at the 10% level.

V. CONCLUDING REMARKS

Small businesses often complain that they are unable to borrow from banks at affordable loan rates. Theory suggests that borrowers can mitigate this problem by building a strong relationship with a bank. We empirically investigate how the strength of a bank–borrower relationship affects loan rates and collateral requirements. We measure relationship strength by examining both the duration of the relationship and its scope. Our data come from a credit-file data set of small firms in a European bank-dominated economy where relationship banking is of great importance, making our study among the first to focus on the impact of the relationship on contracting behavior within a bank-dominated economy.

Since our data set consists of small firms to whom the public debt market is unavailable, the information the bank learns about the borrower is likely to remain exclusively with the bank. We find that the loan rate is increasing in the duration of a bank–borrower relationship. Our results thus suggest that intertemporal shifting of rents is possible. Regarding the empirical direction of rent-shifting, our results indicate the following. A firm with a longer financial relationship pays a higher interest rate on its loans. However, the effect of the scope of a bank–firm relationship goes in the opposite direction. The interest rate on a loan significantly decreases when a firm also buys other products and conducts most of its payment transactions via that bank.

In order to determine what is driving the results, we examined the interaction of both dimensions of bank–borrower relationships. The results reveal that relationship scope ameliorates the impact of relationship duration on the loan interest rate. That is, the rate at which the loan rate increases in the duration of the relationship is lower when the scope of the relationship is broader. Our evidence provides empirical support for the limited "informational-capture" result of von Thadden (1998), where banks charge above-market interest rates and borrowers sometimes switch banks at equilibrium. We also find that greater availability of public information, measured by the age of the firm, results in a lower loan interest rate. This effect, however, is dominated by the lock-in effect of the bank–borrower relationship in that a longer relationship duration leads to a higher loan rate.

We have also studied the association between pledging collateral and the strength of the bank–borrower relationship. Theory predicts that collateral requirements should be inversely related to the strength of the bank–borrower relationship. Our empirical results provide mixed evidence on this. We find that the probability of pledging collateral is slightly decreasing in the duration of the bank–borrower relationship and significantly increasing in the scope of the bank–borrower relationship.

The findings here raise a number of issues for further exploration. Relationship strength can be examined more comprehensively. For instance, relationship scope here was measured as a binary variable. In practice, relationship scope is a continuous variable and evolves over time due to banking competition. This raises the following questions: How does relationship scope help in handling financial distress and monitoring firms? And, how do banking competition and relationship scope affect bank-borrower relationships? These issues are left for future research.

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