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Relationship Lending and Lines of Credit in Small Firm Finance*

This article examines the role of relationship lending in small firm finance It examines price and nonprice terms of bank lines of credit (L/Cs) extended to small firms The focus on L/Cs allows the examination of a type of loan contract in which the bank-borrower relationship is likely to be an important mechanism for solving the asymmetric information problems associated with financing small enterprises We find that borrowers with longer banking relationships pay lower interest rates and are less likely to pledge collateral These results are consistent with theoretical arguments that relationship lending generates valuable information about borrower quality

I. Introduction

Large corporations typically obtain credit in the public debt markets, while small firms usually must depend on financial intermediaries, particularly commercial banks Given that asymmetric information problems tend to be much more acute in small firms than in large firms, it is not surprising that the ways in which these respective groups obtain credit financing differ significantly Bank financing often involves a long-term relationship that may help attenuate these information problems, whereas public debt financing generally does not have this feature

Banks solve these asymmetric information problems by producing and analyzing information and by setting loan contract terms, such as the interest rate charged or the collateral required, to improve borrower incentives The

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bank-borrower relationship may play a significant role in this process of gathering information and setting the terms of the loan contract. Banks may acquire private information over the course of a relationship and use this information to refine the contract terms offered to the borrower. Our empirical analysis uses data on loan rates and collateral requirements on lines of credit (L/Cs) issued to small businesses; this allows us to test the joint hypothesis that banks gain information as the bank-borrower relationship progresses and use this information to adjust the contract terms.

This analysis is motivated by theories of financial intermediation that emphasize the information advantages of banks (e.g., Diamond 1984, 1991; Ramakrishnan and Thakor 1984; Boyd and Prescott 1986). Recently, a theoretical literature on relationship lending has appeared that provides predictions about how loan interest rates evolve over the course of a bank-borrower relationship. The models of Petersen and Rajan (1993) and Boot and Thakor (1994) predict that loan interest rates should decline as a relationship matures, while the models of Greenbaum, Kanatas, and Venezia (1989), Sharpe (1990), and Wilson (1993) predict increases in rates over time. Boot and Thakor's model also predicts that collateral requirements on loans will be lower the longer a borrower has had a relationship with a particular lender. The main purpose of this article is to provide empirical tests of these theoretical predictions using an extensive data set on small firm finance.

Two strands of the literature have provided some empirical evidence on the value of bank-borrower relationships. In the first strand, studies of "bank uniqueness" addressed the question of whether banks produce valuable private information about borrowers (e.g., James 1987; Lummer and McConnell 1989; Hoshi, Kashyap, and Scharfstein 1990*a*, 1990*b*; James and Weir 1990; Wansley, Elayan, and Collins 1992; Shockley and Thakor 1993; Kwan 1994; Billett, Flannery, and Garfinkel 1995). Among other things, these studies provided evidence that the *existence* of a bank-borrower relationship increases firm value. Some of these studies also indirectly provided evidence about the value of the *strength* of a bank-borrower relationship. They found that announcements of renewals of existing bank L/Cs often generate greater abnormal market returns than do announcements of newly issued L/Cs.

The second strand of the empirical relationship lending literature provided more direct tests of the strength of the bank-borrower relationship (Petersen and Rajan 1993, 1994). These studies used a continuous measure of the strength of the bank-borrower relationship—its duration—as opposed to the simple new-versus-renewal L/C distinction. These studies did *not* find that the rate charged on a loan depended on the strength of the bank-borrower relationship, although

other evidence of relationship lending was found in the firm's trade credit arrangements

Our analysis is similar to this second strand of the empirical literature in that we focus on the duration of the bank-borrower relationship as a measure of its strength We also share with these studies a focus on small, mostly untraded firms for which the bank-borrower relationship is likely to be important This differs from the bank-uniqueness studies, which generally concentrated on large, publicly traded firms that may be less dependent on banking relationships Our study and the Petersen and Rajan (1993, 1994) studies also share a third advantage over the bank-uniqueness studies We are able to test directly the predictions of the recent theoretical models of relationship lending about the path of loan interest rates over the course of the bank-borrower relationship

Our approach, however, differs from the Petersen and Rajan (1993, 1994) studies in two important ways First, we focus exclusively on lending under L/Cs The L/C is an attractive vehicle for studying the bank-borrower relationship because the L/C itself represents a formalization of this relationship By limiting our study to L/Cs, we exclude from our data set most loans that are "transaction-driven" rather than "relationship-driven" and may thus avoid diluting our relationship lending results

Second, we analyze the empirical association between relationship lending and the collateral decision, providing the first test of Boot and Thakor's (1994) theoretical predictions about collateral and the first analysis of the pattern of collateral requirements over time We also test some propositions from the collateral literature about the associations among collateral, borrower risk, and loan risk

Our data are drawn from the National Survey of Small Business Finances (NSSBF), which contains extensive information on both borrowers and loan contracts, as well as information on the relationship between the bank and the borrower By way of preview, we find that borrowers with longer banking relationships pay lower interest rates and are less likely to pledge collateral These findings are both statistically and economically significant despite relatively low R^2s and generally insignificant coefficients of the control variables

Our relationship lending findings are consistent with the theoretical predictions of Petersen and Rajan (1993) and Boot and Thakor (1994) and support the more general theoretical literature on the role of banks as information producers Our results are also consistent with much of the bank-uniqueness literature However, our findings conflict with the loan pricing results in the second strand of the empirical bank-borrower relationship literature, which draws its data from the same source We attribute this difference to our exclusive use of L/C loans,

which are more likely to reflect relationship effects than are other loans. Additional evidence to support this attribution is presented below.

The article is organized as follows. Section II discusses the extant literature on relationship lending. Section III describes the data set and motivates the variables used in the analysis. Section IV presents our econometric tests of the determination of the loan rate and whether collateral is pledged, both as functions of the strength of the bank-borrower relationship and other variables. Section V concludes the discussion.

II The Relationship Lending Literature

The information-based literature on financial intermediation (e.g., Diamond 1984, 1991, Ramakrishnan and Thakor 1984, Boyd and Prescott 1986) suggests that financial intermediaries exist because they enjoy economies of scale and/or comparative advantages in the production of information about borrowers. Banks in particular specialize in lending to a highly information-problematic class of borrowers. Because of this specialization, contracting in the bank loan market appears to differ substantially from contracting in other major debt markets (see Carey, Prowse, Rea, and Udell 1993). One feature often ascribed to commercial bank lending is its emphasis on relationship lending.[1] Banks may acquire information through the relationship by monitoring borrower performance over time under credit arrangements and/or through the provision of other services such as deposit accounts (see Allen, Saunders, and Udell 1991; Nakamura 1993), banks may then use this information in designing future credit contracts.

Some studies have specifically modeled the association between the length of the bank-borrower relationship and the pricing of loans. In an extension of Diamond (1989), Petersen and Rajan (1993) developed a theoretical model with both adverse selection and moral hazard in which banks offer higher rates in the first period, when borrower types are unknown, and then reduce rates in later periods after borrower types have been revealed. Boot and Thakor (1994) demonstrated that the duration of the bank-borrower relationship may be important in determining loan prices even in a model without a learning component. They also found that collateral requirements are related to the length of the relationship. Borrowers pay a high rate and pledge collateral early in the relationship, they then pay a lower rate and do not pledge collateral later in the relationship after they have demonstrated some project success.

1 Some theoretical papers have formally examined the choice between bank debt and public debt (e.g., Diamond 1991; Rajan 1992).

The Petersen and Rajan (1993) and Boot and Thakor (1994) models stand in contrast to other theories. Greenbaum, Kanatas, and Venezia (1989), Sharpe (1990), and Wilson (1993) all demonstrated conditions under which lenders subsidize borrowers in early periods and are reimbursed for this subsidy in later periods. Thus, the issue of the association between loan pricing and the length of the bank-borrower relationship is ultimately an empirical one. In addition, as noted above, no one has previously tested the empirical association between collateral and the length of the bank-borrower relationship.

The bank L/C is a particularly important part of relationship lending because it represents a forward commitment to provide working capital financing under prespecified terms.[2] It is not surprising, therefore, that much of the empirical literature on bank uniqueness has focused on bank L/Cs. James (1987) found positive abnormal returns associated with announcements of firms who were granted bank L/Cs. Lummer and McConnell (1989) and Wansley, Elayan, and Collins (1992) found evidence that James's results were driven by L/C renewals as opposed to newly initiated L/Cs. This result is consistent with the notion that information about the borrower is acquired over time through the bank-borrower relationship and is reflected in the continuation of credit arrangements, as opposed to initial credit assessments. Billett et al. (1995), however, found no difference in the announcement effects between new and renewal L/Cs.[3] One explanation for these disparate results may be that the new-renewal binomial categorization of L/Cs is at best a weak measure of the strength of the relationship. As in Petersen and Rajan (1993, 1994), we avoid this measurement problem by using the continuous duration of the bank-borrower relationship as a measure of its strength. Also, unlike the uniqueness event studies that focus primarily on large, publicly traded firms, we use data on small, mostly untraded firms, which tend to be much more bank dependent.

Petersen and Rajan (1993, 1994) also used the NSSBF data source to analyze relationship lending and found somewhat conflicting results. As in this article, they used the length of the bank-borrower relationship as a measure of its strength. They found no statistical association

2 Most L/Cs contain material adverse change (MAC) clauses that permit the bank to abrogate the commitment if the borrower's financial condition has changed substantially. However, these clauses can only be contingent on verifiable characteristics of the borrower. In addition, because of reputation effects and lender liability laws, banks may be reluctant to invoke these clauses except under extreme conditions (see Avery and Berger 1991).

3 Billett, Flannery, and Garfinkel (1995) also found higher abnormal returns for higher-rated lenders. Other papers have found that the loan-announcement-related abnormal returns may be associated with firm characteristics. Slovin, Johnson, and Glascock (1992) found a negative association with firm size and Best and Zhang (1993) found a positive association with forecasts of declining or uncertain earnings.

between the strength of the bank-borrower relationship and business loan pricing in their 1994 paper (they did not include the length of the bank-borrower relationship in the loan pricing equation in their 1993 paper). However, they did find evidence of a lesser dependence on trade credit by firms with longer banking relationships, which supports the value of relationship lending.

Petersen and Rajan's failure to find evidence of relationship lending in bank loan pricing, which runs counter to our findings below, may be attributable to their inclusion of all types of external loans in their data set rather than focusing on bank L/Cs.[4] That is, they included a number of different types of loans for which reputation and relationship effects may be substantially less important than those associated with the forward commitment embodied in an L/C. These non-L/C loans include mortgages, equipment loans, motor vehicle loans, and other spot loans, many of which may be one-time loans or loans for nonrecurring credit needs. In the parlance of Wall Street, these loans tend to be "transaction-driven" rather than "relationship-driven." Thus, the loan pricing effect of relationships may have been diluted by the inclusion of these loans in their samples. In contrast, we limit our analysis to only loans drawn under L/Cs.[5]

III. The Data Set

The NSSBF provides more extensive information on individual small businesses than does any other publicly available source. The survey was conducted in 1988–89 by the Federal Reserve Board and the Small Business Administration (SBA). The data were obtained by telephone interviews with executives of about 3,400 businesses. Each interview consisted of about 200 questions covering firm description, governance, history, use of credit, relationships with financial institutions, and balance sheet and income information. The respondents represent a stratified random sample, by size and geography, of for-profit, nonagricultural, nonfinancial firms. Approximately 80% of the sample had less than 50 employees, 10% had 51–100 employees, and 10% had 101–500 employees. Nearly all of the firms were privately owned—only about 5% were publicly traded. Asset size ranged up to $219 million. The geographical representation was also relatively uniform, with about 25% each from the northeastern, north central, southern, and western states.

4 Petersen and Rajan excluded loans from the owner or the owner's family. By focusing on just bank L/Cs, we also exclude these loans from our data set.

5 Petersen and Rajan (1993, 1994) also examined the association between loan rates and the age of the firm and found that older firms had lower borrowing costs, as we find below. Petersen and Rajan (1993) found that this association was stronger in less concentrated markets.

Table 1 describes the variables used in this study, broken down into five main categories L/C contract characteristics, firm financial characteristics, firm governance characteristics, industry characteristics, and information/relationship characteristics Looking first at the *contract characteristics* of commercial L/Cs, PREM is the premium over the prime rate at which loans drawn under the L/C are priced,[6] COLLAT indicates whether the L/C is secured, which is further decomposed by type of security—ARINV for accounts receivable and/or inventory, and OTHERSEC for all other security, including equipment, real estate, and personal assets of the owners

The distinction between ARINV and OTHERSEC is important to the analysis Practitioners tend to view L/Cs secured by accounts receivable and inventory as the riskiest type of working capital financing, and so PREM may be expected to be higher for these loans to compensate the bank for this risk Perhaps more important for analyzing relationship lending, ARINV financing or "asset-based lending" generally involves a form of intense monitoring not associated with other types of loans This type of monitoring, which includes observation of sales invoicing and inventory management, may produce valuable information about overall firm performance as well as information about the value of the collateral (Swary and Udell 1988) Such information may be particularly valuable for young firms early in their bank-borrower relationships when there is substantial uncertainty about their abilities to repay loans If so, ARINV financing may involve the bank acquiring more information per year through the relationship than is customary with other types of loans and using this information to design future loan contracts The inclusion of different types of collateral distinguishes our article from previous studies of business lending [7]

6 One element of the price vector about which we do not have data is the L/C fee Presumably, PREM is less than it otherwise would be because the bank receives some compensation from fee income This could create a bias if the fees vary systematically with the characteristics of the individual borrowers used as exogenous variables We do not expect this omission to create substantial bias, however, since most of any systematic variation in fees would likely be related to the policies of the bank rather than to the characteristics of the individual borrowers

7 A further distinction can be made between "inside ' collateral (assets of the borrowing firm) and "outside ' collateral (assets outside the firm belonging to either the owner of the firm or another interested party, such as a major customer of the firm) Inside collateral reorders the claims of creditors, whereas outside collateral provides additional assets for the secured creditors to claim The theoretical models in the literature generally focus on outside collateral, with the exception of Swary and Udell (1988) Unfortunately, data limitations prevent a clean distinction between inside and outside collateral since the NSSBF survey focused on the type of asset pledged rather than its ownership Nonetheless, we may conclude that ARINV is almost surely all inside collateral, although OTHERSEC likely includes many cases of both inside and outside collateral It is also interesting to note that the SBA recently announced a new loan program that, for the first time will provide a government guarantee for L/Cs secured by ARINV This is a significant departure for the SBA which previously had substantially limited the scope of its guarantees to amortizing term loans Some lenders have expressed

TABLE 1 Variable Description

Variable Name	Description
Contract characteristics	
PREM	Premium over the prime rate
COLLAT	= 1 if loan is secured
ARINV	= 1 if loan is secured by accounts receivable and/or inventory
OTHERSEC	= 1 if loan is secured by other than accounts receivable and/or inventory
GUAR	= 1 if loan is guaranteed
COMPBAL	= 1 if loan requires compensating balances
Financial characteristics	
LEV	Leverage [total debt/assets]
PROFMARG	Pretax profit margin (% of sales)
CURRAT	Current ratio [(current assets)/(current liabilities)]
QUICKRAT	Quick ratio [(current assets − inventory)/(current liabilities)]
ARTURN	Accounts receivable turnover in days [(accounts receivable)/(sales /day)]
INVTURN	Inventory turnover in days [inventory/(cost of goods sold)/day]
APTURN	Accounts payable turnover in days [(accounts payable)/(cost of goods sold)/day]*
TA	Total firm assets (in thousands of dollars)
Governance characteristics	
CORP	= 1 if firm is a non-Subchapter S corporation
SUBS	= 1 if firm is a Subchapter S corporation
PART	= 1 if firm is a partnership
PROP	= 1 if firm is a proprietorship (excluded from regressions as the base case)
OWNMG	= 1 if firm is owner managed
CONC50	= 1 if at least 50% ownership is in one family
Industry characteristics	
CONSTR	= 1 if in construction industry
SERVICES	= 1 if in services industry
RETAIL	= 1 if in retail industry
OTHERIND	= 1 if in other industries (excluded from the regressions as the base case)
Information/relationship characteristics †	
AGE	Number of years current owners have owned the firm‡
RELATE	Length of relationship with current lender in years

* Because of data availability, cost of goods sold per day was used in place of purchases per day.

† A maximum limit of 30 years was imposed on AGE and RELATE.

‡ If the firm was diffusely held, then AGE equals the number of years that the firm has been in existence.

The dummy variable GUAR indicates whether the L/C is guaranteed. Guarantees are generally provided by the firm's owners and give the lender recourse against the owners for any deficiency in payment

concern about the new program because of the intense monitoring associated with ARINV and because of the perceived riskiness of this type of secured lending (Sel/ 1994)

by the borrowing firm Guarantees are similar to the pledging of personal collateral, although they do not involve specific liens The dummy COMPBAL indicates whether the L/C has a compensating balance requirement

The *financial characteristics* of the firm consist of key financial ratios, including the leverage ratio (LEV), the current ratio (CURRAT), the quick ratio (QUICKRAT) accounts receivable turnover (ARTURN), inventory turnover (INVTURN), accounts payable turnover (APTURN), and total assets (TA) The purpose of the financial variables is to control for the observable risk of the borrower in our regressions that determine the loan rate and whether collateral is pledged It is expected that all else equal, riskier borrowers would pay higher loan rates and pledge collateral more frequently, and prior empirical analysis is consistent with these expectations (e g , Berger and Udell 1990, 1992) Most of the financial ratios are among the ratios conventionally used in credit risk analysis and so should correspond reasonably well to the data used by banks in making their loan rate and collateral decisions

The *governance characteristics* include the legal form of the firm CORP for (non-Subchapter *S*) corporation, SUBS for Subchapter *S* corporation, PART for partnership, and PROP for sole proprietorship, OWNMG indicates whether the firm was owner managed, and CONC50 signifies whether 50% or more was owned by a single family The governance characteristics are included because different ownership structures may be related to the amount of private information that borrowers have, the risks that borrowers take, and the ability of borrowers to shift risk to the bank and other fixed-claim holders All of these factors should figure in the determination of loan rates and collateral requirements

Industry characteristics are reflected in dummy variables for whether the firm is in the construction (CONSTR), services (SERVICES), or retail (RETAIL) industries The bulk of the remaining respondents (OTHERIND) were in the manufacturing sector Again, these variables are included because they may help proxy for risk in our equations that determine the loan rate and the probability of collateral being pledged

The *information/relationship characteristics* consist of AGE and RELATE The variable AGE refers to the number of years that current ownership has been in place If the firm is currently owned by its founders, then AGE represents the actual age of the firm The variable RELATE is the number of years that the firm has conducted business with its current lender and represents our measure of the strength of the bank-borrower relationship [8] The purpose of RELATE is to cap-

8 An upper limit of 30 years was imposed on AGE and RELATE This imposes the restriction that no additional relevant information is revealed after 30 years For the few publicly traded firms AGE was also set equal to 30

ture the ability of the bank to learn more about the borrowing firm through the bank-borrower relationship There is an important distinction between AGE and RELATE AGE reflects information that becomes revealed to the market as a whole—that is, a firm's public reputation—while RELATE reflects private information revealed through the intermediation process only to the lender through the bank-borrower relationship Thus, the difference between AGE and RELATE essentially corresponds to the distinction between reputation and monitoring in Diamond (1991)

The use of both AGE and RELATE also may help distinguish the role of bank loans versus public debt offerings It would be expected that AGE would have an effect in public markets but that RELATE would not since the investors who buy public issues do not gain access to exclusive information from monitoring in the same way that banks do Thus, our main relationship tests of whether RELATE has effects on PREM and on the probability of COLLAT may also be viewed as tests of the specialness or uniqueness of banks As noted earlier, RELATE is also likely to be a better measure of the strength of the bank-borrower relationship than the distinction between new and renewal L/Cs used in Lummer and McConnell (1989), Wansley, Elayan, and Collins (1992), and Billett, Flannery, and Garfinkel (1995) Although we are primarily interested in the effects of RELATE, it is important to include AGE in the analysis as a control variable to avoid bias, since AGE and RELATE are so highly correlated ($\rho = .476$)

In the empirical tables below, we report the results of regressions in which we specify the natural logs of AGE and RELATE—LNAGE and LNRELATE, respectively This allows for the possibility of diminishing marginal effects of additional years in business or in a relationship on the value of information gained That is we expect that the marginal effect of the fifth year of AGE or RELATE to be more important in revealing information about the firm than the twenty-fifth year, by which time virtually all of the information that is going to be revealed has been revealed As discussed below, we also run robustness checks with AGE and RELATE measured in levels rather than logs, and with second-order terms in both the logs and the levels

The means of the variables for the entire sample of 863 firms who reported L/Cs are shown in the first column of table 2 These means reveal several interesting characteristics of small firms using L/Cs The vast majority are owner managed (89%) with a single family owning more than half of the stock (80%) Most are also organized as non-Subchapter *S* corporations (55%) Consistent with other data sources the majority of the L/Cs are secured (53%) usually with accounts receivable and inventory (36%) Only 7% of all L/Cs in the sample have compensating balance requirements suggesting that this pricing element no longer plays a prominent role for small firms The

TABLE 2 Variable Means—Lines of Credit

Variable	All Firms	Total Assets above $500,000	Total Assets below $500,000
PREM*	1 49	1 32	1 73
COLLAT	53	59	47
ARINV	36	46	25
OTHERSEC	18	14	22
GUAR	41	46	35
COMPBAL	07	09	05
LEV	60	60	59
PROFMARG	12	08	16
CURRAT	3 51	2 90	4 13
QUICKRAT	2 52	1 85	3 20
ARTURN	34 11	42 14	25 87
INVTURN	103 30	103 98	102 62
APTURN	91 90	95 53	88 18
TA	2,331 66	4 442 95	165 84
CORP	55	70	38
SUBS	16	20	13
PART	07	05	08
PROP	22	04	41
OWNMG	89	85	92
CONC50	80	73	86
CONSTR	14	13	15
SERVICES	16	10	22
RETAIL	23	19	27
OTHERIND	47	57	36
AGE	14 10	16 49	11 66
RELATE	11 39	12 67	10 08
Number of observations	863	437	426

* PREM available for 371 219, and 152 observations only See text

data also indicate that the small firms with L/Cs have been in business under current management about 14 years on average (AGE) and have a constant banking relationship for the last 11 of those years (RELATE)

We also split the sample roughly in half between firms with assets above and below $500,000 As shown in columns 2 and 3 of table 2, the data suggest that firms with assets greater than $500,000 may be quite different from smaller firms in that they are much more likely to be corporations, they are much more likely to pledge collateral, they generally have lower liquidity ratios and lower profit margins, and they tend to pay a lower PREM The data also show that firms with assets above $500,000 are about 5 years older on average than firms with assets below $500,000, and have bank-borrower relationships that are about 2 5 years longer on average We emphasize that $500,000 in assets is quite small, and that our subsamples above and below this threshold should *both* be considered small firms

IV. Econometric Specification and Test Results

In our empirical analysis, we test the joint hypothesis that (i) banks gather valuable information about a borrower over the course of a bank-borrower relationship, (ii) that they use this information to refine the loan contract terms, and (iii) that this is reflected in the loan rate and the collateral requirements. This may be viewed as a rather stringent test of whether bank-borrower relationships generate value since we will not be able to detect if banks gather information but do not use it to change contract terms significantly over time or if they change contract terms other than the loan rate or collateral.[9]

Note that the refinement of contract terms to borrowers with longer relationships (i.e., higher values of RELATE) can come about in at least two distinct ways. First, for a given borrower the loan rate or collateral requirements may be changed as the length of the relationship increases. Second, there may be a survivorship effect in which borrowers with longer relationships pay different rates or have different collateral requirements on average than borrowers with shorter relationships. This is similar to the selection-over-time mechanism in Diamond (1991). For example, banks might gain information during their relationships with borrowers in a high-risk pool that helps them distinguish creditworthy customers from uncreditworthy ones. If they offer prohibitively expensive terms or simply refuse to relend to the uncreditworthy borrowers after gaining some experience with them, the average observed loan interest rate may decline with RELATE, assuming that this high-risk pool was paying a relatively high rate on its loans. In practice, it is probable that both of these effects are in operation. If loan rates or collateral requirements decline with the length of the relationship, it is likely due in part to some continuing borrowers receiving more favorable loan terms, and in part to some borrowers with relatively unfavorable terms having their relationships terminated. Both of these phenomena are valid representations of the theory that banks acquire information through relationship lending and use this information to refine loan contract terms. In fact, nonprice credit rationing or the setting of an infinite price for credit renewal might be viewed as the ultimate loan contract refinement.

A. *Loan Rate Tests*

We perform empirical tests first on loan rates and then on collateral. Our loan rate tests analyze the determinants of PREM, the loan rate premium over the bank's prime rate. PREM is regressed on the loan contract, financial, governance, industry, and information/relationship characteristics of the firm. These tests offer the opportunity to examine

9 Empirical support for this hypothesis is also consistent with Boot and Thakor's (1994) model of loan contracting which does not involve information production.

the role of relationship lending in commercial loan contracting by measuring the effect of RELATE on the interest rate of an L/C

The NSSBF data set includes data on the interest rate paid on the firm's most recent loan, which is often drawn under an L/C The survey also gives information on whether the loan was indexed to the prime and, if so, the premium over prime (PREM) and whether it was floating or fixed rate For purposes of this analysis, the cleanest data for loan-by-loan comparison comes from using only floating rate L/C loans that were indexed to the bank's prime rate [10]

The PREM results for the entire sample are shown in table 3 The regression in the first column of the table excludes the potentially endogenous loan contract variables for collateral, guarantees, and compensating balances, and should be viewed as the reduced form for PREM The coefficients of the included variables may be interpreted as the effects of these variables on the rate, inclusive of any predicted rate-reducing effect of collateral, guarantees and compensating balances that they may imply For example, the coefficient of LEV represents the association between leverage and the rate on the loan after taking into account the expected values of collateral, guarantees, and compensating balances that a marginal increase in leverage implies Thus, the coefficients of the firm characteristics in column 1 can also be interpreted as reflecting the association between these characteristics and the risk of the loan, as reflected in its price

Column 2 of table 3 includes all of the variables in the first column plus the collateral, guarantee, and compensating balance contract variables The interpretation of the borrower and relationship characteristics now reflect their effects on the premium excluding their effects through the contract terms [11] Thus, the coefficients of the firm charac-

10 Fixed-rate L/Cs were excluded because it was not possible to construct a PREM variable that would be accurate and comparable to the PREM for floating-rate L/Cs First, the loan rate itself appears to have substantially different properties for fixed-rate and floating-rate loans For example prior research showed that fixed loan rates were stickier than floating rates (Berger and Udell 1990 1992) Second it is difficult to find a comparable market rate to subtract from the loan rate to measure PREM A logical choice might be the rate on a Treasury security with approximately the same repayment duration However this still may create problems of accuracy and noncomparability with the fixed-rate PREM because (i) only the month of the loan takedown is known and Treasury rates often varied considerably within the months covered by our data set, (ii) the repayment duration of the loan is not known because the payment schedule is not reported and because the callability of commercial loans makes the prepayment option difficult to evaluate and (iii) the prime rate which is subtracted from our floating loan rates, is known to be sticky relative to Treasury rates

11 A bias could occur in estimating this equation because the collateral, guarantee, and compensating balance variables are endogenous to the firm and relationship characteristics We assume a recursive model structure here in which the firm and relationship characteristics explain the contract terms up to random errors that are not significantly correlated with the PREM error term Our findings given just below— that (i) the coefficients of the contract terms in column 2 are not significantly different from zero and that (ii) their inclusion has no material effect on the coefficients of the other variables— suggest that no substantial bias is present

TABLE 3 **Premium over Prime Rate (Floating Rate Only) for Loans Issued under Lines of Credit—All Firm Sizes**
OLS Regressions for PREM

	Excluding Loan Contract Terms (1)		Including All Variables (2)		Loan Contract Terms Only (3)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INTERCEPT	2 3642**	2 704	2 5928**	2 886	1 3883**	9 632
ARINV			1330	703	2141	1 227
OTHERSEC			− 2440	− 982	0424	173
GUAR			0449	271	0091	056
COMPBAL			− 0979	− 285	− 0319	− 093
LEV	2262	783	1766	592		
PROFMARG	3232	933	3220	926		
CURRAT	0058	093	0057	090		
QUICKRAT	− 0473	− 718	− 0504	− 760		
ARTURN	0029	1 591	0029	1 594		
INVTURN	0006	731	0005	634		
APTURN	− 0004	− 508	− 0003	− 419		
LNTA	− 0286	− 506	− 0457	− 778		
CORP	− 5930**	−2 261	− 6496**	−2 429		
SUBS	− 5202*	−1 741	− 5389*	−1 783		
PART	− 1709	− 403	− 2051	− 481		
OWNMG	3227	1 339	3218	1 317		
CONC50	1740	876	1972	986		
CONSTR	2366	813	2799	949		
SERVICES	2538	1 001	2629	1 021		
RETAIL	1281	584	1014	460		
LNAGE	− 1376	−1 253	− 1280	−1 155		
UNRELATE	− 2004**	−2 217	− 1981*	−2 164		
R^2	089		095		004	

NOTE.—Number of observations = 571. OLS = ordinary least squares.
** Statistically significant at the 10% level, two-tailed.
* Statistically significant at the 5% level, two-tailed.

teristics in column 2 can also be interpreted as reflecting the association between these characteristics and the risk of the borrower, as reflected in the loan price The regressions in columns 1 and 2 may also be viewed as robustness checks on each other—we expect that if relationship effects are strong, they should be present in both equations The regression in column 3 includes only the loan contract terms on the right-hand side and will be discussed further below

The most interesting results in column 1 of table 3 are the importance of the information/relationship variables, LNAGE and LNRELATE Both coefficients are negative, although the LNAGE coefficient is not statistically significant at standard confidence levels When this regression was rerun using levels in place of logs to measure the effects of AGE and RELATE (not shown), both coefficients were negative and statistically significant The negative coefficients suggest that the older the firm is in terms of current ownership and the longer the banking relationship, the lower the rate on the loan (inclusive of any collateral and guarantee effects associated with these variables) The RELATE results contrast sharply with those of Petersen and Rajan (1993, 1994), who found a positive but insignificant effect of RELATE on PREM instead of our negative, significant effect

We also investigate whether the magnitudes of the measured AGE or RELATE effects on PREM are economically significant The LNAGE coefficient of about − 14 suggests that, all else held equal, a small firm with an additional 10 years of business experience, 11 years versus 1 year, pays an expected 33 basis points less on its L/C loans (i e , − 14 × (ln 11 − ln 1)) Similarly, the LNRELATE coefficient of about − 20 suggests that a firm with an 11-year banking relationship can expect to pay an L/C loan premium 48 basis points less than a firm that is the same in every way except that it has only a 1-year relationship Note that these figures are additive, rather than mutually exclusive, so that an 11-year-old firm with an 11-year bank-borrower relationship can expect to pay about 81 basis points less than a 1-year-old firm with a 1-year relationship

In order to determine whether these changes in PREM are economically important, we evaluate them in terms of our sample distribution of the PREM variable [12] The sample density of PREM (not shown) is concentrated almost entirely on values of PREM that are divisible by 25 basis points (i e , 1 00%, 1 25%, 1 50%, etc) This suggests that banks group their borrowers into pricing pools on the basis of risk, relationship, and other factors at 25-basis-point intervals Therefore the 33 basis point estimated AGE effect moves a firm more than a full pricing pool, and the 48 basis point estimated RELATE effect moves a firm about two full pricing pools Moreover, 59 6% of the PREM

12 We thank the anonymous referee for this very helpful suggestion

observations are concentrated in the closed interval between 100 and 150 basis points, suggesting that our relationship effect—which lowers PREM by about the breadth of this interval when RELATE increases by 10 years—can by itself move a firm's rate below that paid by most other small firms with L/Cs

To check robustness, we also examined the magnitudes of the estimated effects using three other specifications—second order in the logs of AGE and RELATE, linear in their levels, and second order in the levels. The second-order equation in logs adds the terms 1/2 LNAGE^2, 1/2 LNRELATE^2, and LNAGE × LNRELATE, and similarly for the second-order equation in levels. The second-order equations allow the data more freedom to choose the shapes of the curves giving the marginal effects of AGE and RELATE at different numbers of years. Increasing AGE from 1 to 11 years, while holding RELATE at its sample mean value, gives expected declines in PREM of 66, 19, and 39 basis points for the three alternative specifications, respectively, as opposed to the 33 basis points for the model shown in the text. Similarly, increasing RELATE from 1 to 11 years, while holding AGE at its mean value, lowers PREM by predicted values of 60, 21, and 29 basis points, respectively (as opposed to 48 basis points for the log model). These additional results suggest that our conclusion that the measured AGE and RELATE effects are economically meaningful is robust, although the least preferred linear specification (which forces all years to have the same marginal effect), yields notably smaller results.

The coefficients of most of the control variables in column 1 of table 3 are not statistically significant. The exceptions are CORP and SUBS, which are negative and statistically significant, suggesting that loans to either type of corporation tend to be safer than other loans. Most of the variables do have the predicted signs, and the magnitudes of the eight financial variables taken together suggest that if all of these variables moved one standard deviation in the direction of greater risk, PREM would increase by 19 basis points. This movement in the predicted direction provides some verification of the model, despite the lack of statistical insignificance. The insignificance of most of the control variables could be a consequence of low statistical test power, given the large number of parameters of the model relative to the limited number of observations. Another potential reason for the insignificance could be multicollinearity. Many of the 16 control variables, particularly the eight financial variables, are intended to proxy for borrower risk. Each variable could individually be insignificant, but the variables as a whole might be significant. However, tests of the joint significance of both the eight financial variables together and the 16 total control variables together could not reject the null hypothesis that they jointly have zero effect. Perhaps the most likely reason that most of the control variables are insignificant and that the R^2 of the

equation is relatively low is that the pricing of loans to small businesses is idiosyncratic and often depends on the reputation and credit of the business owners as much as or more than the reputation and characteristics of the firm This is discussed further below Whatever the reason for the low R^2 and the general lack of statistical significance of the control variable coefficients, it does not detract from our central result the relationship variable is both statistically and economically significant over a number of different specifications

The second column in table 3 includes the contract variables as well as all the firm and relationship variables from column 1 The AGE and RELATE effects are virtually unchanged from the prior equation The coefficients and t-statistics on LNAGE and LNRELATE are almost the same as earlier, so that only RELATE is statistically significant Once again, however, both coefficients were negative and statistically significant when this regression was rerun using levels in place of logs The RELATE results in columns 1 and 2 of table 3—plus the various checks of statistical significance economic significance, and robustness—strongly suggest a role for private information acquired through relationship lending where information becomes available only to the specific lender through monitoring over time The AGE results are somewhat weaker, given that the coefficients are not always statistically significant, but they generally still support a role for reputation, or publicly available information, which becomes available over time to the lending community as a whole [13]

The RELATE results in columns 1 and 2 are consistent with the theoretical models of Petersen and Rajan (1993) and Boot and Thakor (1994) They may also shed some light on the ambiguous results found in the uniqueness event studies that have examined the difference in announcement effects between new L/Cs and renewal L/Cs These studies relied on what may be a relatively weak binomial proxy for the strength of the bank-borrower relationship—whether the L/C was new or a renewal Our methodology permits a more revealing continuous measure of the relationship its length Using this measure (RELATE), we find that the strength of the relationship is an important determinant of loan pricing

13 It is also possible that the RELATE results represent public information to some degree If alternative lenders observe the length of the relationship and are able to infer that a longer customer is a better one, they may make more competitive offers to borrowers with larger values of RELATE The lower PREM associated with longer relationships could in part reflect the higher degree of competition among lenders for these borrowers This would be similar to the competitive process described in Greenbaum et al (1989) (although they reached the opposite conclusion regarding the association between PREM and RELATE) We do not however expect this public-revelation-of-private-information effect to be particularly strong in our sample of small firms since there is little in the way of public pronouncements and outside monitoring for firms of this size

We next deal with an unresolved issue in the collateral literature—the associations among collateral, borrower risk, and loan risk. Most theoretical models of collateral demonstrate that collateral will be associated with safer borrowers and loans (Bester 1985, Besanko and Thakor 1987*a*, 1987*b*, Chan and Kanatas 1987), while others predict that riskier borrowers will more often pledge collateral (Swary and Udell 1988, Boot, Thakor, and Udell 1991, Black and de Meza 1992). Most of the empirical collateral literature supports the view that collateral is associated with riskier borrowers and loans (Orgler 1970, Hester 1979, Scott and Smith 1986, Berger and Udell 1990, 1992, Booth 1992, 1993). These empirical studies have been hampered by a dearth of data sources on the risk characteristics of individual borrowers and the lack of detailed information on the type of collateral pledged—problems that we can resolve with our detailed borrower information and two types of collateral.

The regression in column 3 of table 3, which includes only the loan contract terms on the right-hand side, tests the association between collateral and loan risk. The collateral tests presented later provide some evidence that secured L/Cs are associated with observably riskier borrowers. But this does not necessarily mean that secured loans are relatively risky because recourse against collateral reduces the risk of these loans, possibly to levels below those of unsecured loans. The results in column 3 of table 3 show positive coefficients on both types of collateral, indicating higher loan rates for secured loans, although none of the slope coefficients in this equation are statistically significant either individually or jointly, and the explanatory power of the regressors is very low. These results suggest that secured loans may be riskier than unsecured loans as found in prior studies, but the association is not very strong and there is not sufficient test power to reject the null hypothesis of no statistical association.

Tables 4 and 5 show the same regressions as in table 3, except that they are for firms with assets above and below $500,000, respectively. For firms with assets above $500,000 in table 4, the findings are somewhat stronger than the findings for all firms in table 3. The LNAGE and LNRELATE coefficients and *t*-statistics are larger, and the R^2s are all higher. In addition, in column 3 of table 4, the coefficient of ARINV is .35 and is marginally statistically significant. This suggests that for firms with assets above $500,000, being secured by accounts receivable and inventory may be an important indicator of higher loan risk, for which the bank charges an additional risk premium of about 35 basis points.[14] The R^2 for this equation is still very low, however,

14 Some caution should be exercised in interpreting this result because ARINV financing typically requires that banks closely monitor the collateral. Thus the higher PREM for ARINV loans may be partly explained by the costs of this monitoring to the extent that these costs are not paid for by fees.

TABLE 4 **Premium Over Prime Rate (Floating Rate Only) for Loans Issued under Lines of Credit to Firms with Total Assets above $500,000**
OLS Regressions for PREM

	Excluding Loan Contract Terms (1)		Including All Variables (2)		Loan Contract Terms Only (3)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INTERCEPT	3 2273*	1 864	3 5784**	2 004	1 0645**	5 667
ARINV			0329	145	3502*	1 656
OTHERSEC			− 4210	−1 169	0907	257
GUAR			− 0073	− 036	1625	819
COMPBAL			− 2836	− 702	− 1601	− 393
LEV	5077	1 162	5614	1 229		
PROFMARG	1852	391	2057	430		
CURRAT	0636	742	0705	816		
QUICKRAT	− 2130**	−2 113	− 2226**	−2 188		
ARTURN	0021	1 053	0021	1 002		
INVTURN	0000	043	0002	141		
APTURN	0001	141	0002	227		
LNTA	− 0591	− 554	− 0810	− 741		
CORP	− 8768	−1 533	− 9501	−1 637		
SUBS	− 8700	−1 458	− 9439	−1 561		
PART	− 3607	− 436	− 4337	− 520		
OWNMG	3931	1 505	4141	1 561		
CONC50	2579	1 105	2768	1 176		
CONSTR	3885	1 086	4348	1 204		
SERVICES	5679	1 600	5827	1 613		
RETAIL	− 2966	−1 080	− 3291	−1 183		
LNAGE	− 1870	−1 397	− 1729	−1 276		
LNRELATE	− 2363**	−2 320	− 2491**	−2 406		
R^2	155		165		018	

NOTE —Number of observations = 219 OLS = ordinary least squares
* Statistically significant at the 10% level two-tailed
** Statistically significant at the 5% level, two-tailed

and a test of joint significance of all the coefficients could not reject the null hypothesis of all zeros

In contrast to these stronger results for firms with assets above $500,000, the regressions for firms with assets below $500 000 in table 5 show much greater weakness Only one of the independent variables is statistically significant and the R^2s are about half of those for firms with assets above $500,000 in table 4 This suggests that the pricing of bank loans to very small firms is relatively idiosyncratic This may be the case because the reputation and financial accounts of the business and of its owners are often not economically separable for small family-owned and -operated businesses Unfortunately, we lack the personal data on the owners that might be used by the bank, such as their credit history and how long they may have had personal relationships with the bank This problem likely affects many of the firms with assets over $500,000 in our sample as well, and may help explain why, even in tables 3 and 4, the R^2s are fairly low and most of the control variables are statistically insignificant [15] Another reason why the AGE and RELATE effects may be more difficult to estimate for firms with assets below $500,000 is that these variables have smaller standard deviations and are more highly correlated with each other for these firms than for the subset with assets over $500,000

Overall the results of the loan rate tests suggest that the bank-borrower relationship plays an important role in the pricing of loans to small businesses, with the possible exception of the very smallest borrowers Our results are generally consistent with the theoretical models of Petersen and Rajan (1993) and Boot and Thakor (1994), both of which generate a negative association between loan rates and the length of the bank-borrower relationship

As noted above, it is our conjecture that our loan rate test results differ from those of Petersen and Rajan (1993 1994) who use the same NSSBF data source, primarily because of our focus on lines of credit We include only L/C loans and exclude "transaction-driven" loans, such as mortgages, equipment loans, motor vehicle loans and other spot loans To investigate this issue more thoroughly, we calculated "loyalty ratios," which indicate how often borrowers reuse the same bank for the same type of loan If what we call transaction-driven loans are actually relationship driven then we would expect that firms with more than one of these loans would almost always have them at the same bank In contrast, if these loans are generic bank products without strong bank-borrower ties, then firms with multiple loans might often have them at multiple institutions In the full NSSBF sample (including borrowers with and without L/Cs), we found that of

15 For a more complete discussion of the integration of personal and business activities associated with small business, see Ang (1992)

TABLE 5 **Premium over Prime Rate (Floating Rate Only) for Loans Issued under Lines of Credit to Firms with Total Assets below $500,000**
OLS Regressions for PREM

	Excluding Loan Contract Terms (1)		Including All Variables (2)		Loan Contract Terms Only (3)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INTERCEPT	1 9547	961	2 0661	977	1 7136**	7 673
ARINV			1688	474	2020	653
OTHERSEC			− 2014	− 517	− 0930	− 266
GUAR			1636	523	− 1116	− 406
COMPBAL			− 0120	− 017	2502	416
LEV	0904	212	− 0378	− 083		
PROFMARG	5753	1 044	5895	1 056		
CURRAT	0145	146	0073	072		
QUICKRAT	− 0051	− 052	− 0074	− 074		
ARTURN	0056	1 398	0061	1 481		
INVTURN	0010	813	0009	665		
APTURN	− 0006	− 473	− 0006	− 451		
LNTA	− 0574	− 359	− 0678	− 407		
CORP	− 4234	−1 189	− 5295	−1 398		
SUBS	− 3263	− 731	− 3417	− 749		
PART	0816	139	0429	071		
OWNMG	1645	308	1914	348		
CONC50	1682	439	1872	474		
CONSTR	3154	620	3695	694		
SERVICES	2533	609	2882	673		
RETAIL	6691*	1 723	6677*	1 674		
LNAGE	− 1404	− 660	− 1303	− 601		
LNRELATE	− 0013	− 007	0091	048		
R^2	084		091		007	

NOTE —Number of observations = 152 OLS = ordinary least squares
* Statistically significant at the 10% level, two-tailed
** Statistically significant at the 5% level, two-tailed

borrowers with two or more mortgages, only 45 7% had these loans consolidated at a single bank Similarly, equipment loans motor vehicle loans, and other spot loans had loyalty ratios of 50 8%, 52 3%, and 41 9%, respectively Thus, only about half or less of the time did borrowers with more than one loan of a given type have all of the same type at the same bank, suggesting a lack of loyalty that would be expected if these were relationship-driven loans Moreover, when we group these four types of loans together, only 26 0% of borrowers with two or more of any of these types of loans had them concentrated at a single institution By contrast, borrowers with L/Cs demonstrated a high degree of loyalty, supporting our interpretation of the L/C contract as a formalization of a lending relationship Of all borrowers with L/Cs, 88 8% had them with only one bank, thus these borrowers almost always have their multiple loans under L/Cs consolidated at a single institution These figures provide support for the conjecture that our finding of a significant effect of relationship lending on loan prices differs from that of Petersen and Rajan (1993, 1994) primarily because of their inclusion of transaction-driven loans that dilute the relationship effect

A recent working paper by Blackwell and Winters (1994) also focused on L/Cs, but their loan pricing results are unclear They used a sample of L/Cs drawn from two bank holding companies When they included LNAGE and LNRELATE in their PREM regressions, the coefficients of both variables were negative (as expected), but the coefficient of LNRELATE was not statistically significant The LNRELATE coefficient became significant when LNAGE was either dropped or replaced by ln(AGE - RELATE), but it is unclear what these regressions imply The dropping of LNAGE obviously creates a bias because LNAGE and LNRELATE are highly correlated The inclusion of ln(AGE − RELATE) along with LNRELATE without also including LNAGE may create a similar bias because it does not allow AGE to have an effect independent of RELATE, despite the fact that its independent effect was shown in other regressions Moreover, the marginal effect of RELATE on PREM depends on a combination of two coefficients in this equation but the significance of this combination was not investigated Thus, no other study to our knowledge has established a link between the length of the relationship and the loan rate

B Collateral Tests

In order to determine whether collateral requirements are greater or lesser for borrowers with longer banking relationships, we use logit models to examine the probability of an L/C being secured Recall that Boot and Thakor's (1994) model predicts that collateral will less

often be pledged for borrowers with longer relationships This prediction is also consistent with conventional wisdom among bankers

Unlike the loan interest rate data analyzed above, data on collateral are available for all firms with L/Cs, not just those whose last loan was a floating-rate, prime-based draw under an L/C Therefore, our sample size is more than twice as large for the collateral regressions than the PREM regressions above, that is, 863 observations instead of 371 The explanatory variables again include the firm's financial, governance, and industry characteristics, as well as the information/relationship variables The other contract variables, GUAR and COMPBAL, are excluded from the right-hand side of these regressions because of the possibility that the collateral, guarantee, and compensating balance decisions are codetermined [16]

Logit regressions for the probability of any type of collateral being pledged (i e , prob(COLLAT) are shown in table 6 Column 1 shows the results using the entire data sample [17] The coefficients of the information/relationship variables, LNAGE and LNRELATE, are both significant and negative in this regression Both were also negative and significant when AGE and RELATE were included as levels in place of logs [18] As above for the loan rates, the magnitudes of these coefficients suggest that they are economically significant in determining whether collateral is pledged The LNAGE coefficient of about − 19 suggests that, all else held equal, a small firm with 11 years experience versus 1 year would have a probability of pledging collateral of about 12 percentage points lower, from a mean probability of 53% to 41%, (i e , ln[53/(1 − 53)] − 19 × (ln 11 − ln 1) = ln[41/(1 − 41)]) Similarly, the LNRELATE coefficient of about − 26 suggests that an additional 10 years of bank-borrower relationship could lower the probability of

16 We examine this codetermination problem by also running separate collateral regressions on two subsets of the data—L/Cs with personal liability (corporations with a guarantee, sole proprietorships, partnerships) versus those without personal liability (corporations without a guarantee) These additional logit regressions (not shown) suggest that our results reported below generally hold for both of these groups and are robust

17 In principle, the prob(COLLAT) logit regression could be estimated jointly with the PREM OLS regression in a Seemingly Unrelated Regression (SUR) model Under the assumed recursive model structure, however, the error terms of these equations are not correlated and so there would be no gain from joint estimation The fact that we found virtually no change in the PREM results when the COLLAT variables were added to those regressions suggests that this assumption is justified Moreover, even if the error terms were substantially correlated there would likely be little gain from joint estimation because the exogenous variables in both equations are the same In a linear model, there is no gain from joint estimation with a common X matrix and experiments with nonlinear forms suggest little or no improvement when nonlinearities, such as the logit form are used

18 The negative effect of AGE is consistent with the results of Scott and Smith (1986) They did not however, have data on our RELATE variable

TABLE 6 **Probability Tests on Collateral (All Types) Lines of Credit**
Logit Regressions for the Probability of COLLAT

	All Firms (1)		Total Assets above $500,000 (2)		Total Assets below $500,000 (3)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INTERCEPT	−2 6619**	3 4548	− 8259	4635	−5 2428**	3 3701
LEV	1 0487**	4 1222	2 7432**	5 2775	5373**	2 0026
PROFMARG	− 0437	1510	3182	6387	0631	1658
CURRAT	0840	1 4998	1146	1 2018	0499	6768
QUICKRAT	− 0826	1 3837	− 0534	4707	− 0761	1 0066
ARTURN	0032*	1 6697	0022	8941	0057*	1 8037
INVTURN	− 0000	0141	− 0005	3926	0006	7449
APTURN	− 0009	1 3639	− 0016	1 3922	− 0008	9585
LNTA	2065**	3 9953	0755	6745	4043**	3 2936
CORP	0648	2963	− 5081	9407	1003	3712
SUBS	0292	1109	− 7419	1 2860	4021	1 1394
PART	3661	1 0662	− 9854	1 3097	7528*	1 7761
OWNMG	3426	1 4543	5200*	1 6620	0357	0906
CONC50	0015	0100	− 2020	7735	2556	7867
CONSTR	− 2213	9767	− 7832**	2 2868	3732	1 1462
SERVICES	1954	8500	2092	4890	5043*	1 6840
RETAIL	− 0295	1439	− 5794*	1 8985	4229	1 4359
LNAGE	− 1942*	1 8814	− 1321	8575	− 2124	1 3836
LNRELATE	− 2635**	3 1076	− 3880**	3 1959	− 1147	8936
Number of observations	863		437		426	
Diagnostics						
$-2\log L$	1 099 024		509 316		550 387	
df	18		18		18	
χ^2 covariates	93 311		81 394		39 037	

NOTE — The *t*-statistics in this table refer to the square roots of the Wald χ^2's and are compared to the critical values for Student's *t* distribution
* Statistically significant at the 10% level, two-tailed
** Statistically significant at the 5% level, two-tailed

collateral being pledged by about 16 percentage points from the mean of 53% to 37% Thus, firms with greater experience and stronger bank-borrower relationships appear to pledge collateral much less often than other firms, which is consistent with Boot and Thakor (1994) and conventional wisdom

As above for the PREM regressions, the coefficients of the control variables are generally statistically insignificant, although most of the coefficients have the predicted signs The simulation of an increase in risk by moving all the financial variables one standard deviation in the direction of greater risk increases the predicted probability of collateral being pledged as expected, providing some verification of the specification

Columns 2 and 3 of table 6 show logit regressions for prob(COLLAT) using the subsamples of firms above and below $500,000 in assets, respectively The coefficients of the information/relationship variables are again negative and of economically meaningful magnitudes However, the AGE coefficient in the assets-above-$500,000 regression and both the AGE and RELATE coefficients in the assets-below-$500,000 regression are not statistically significant This may at least partly reflect a loss of statistical test power in the smaller subsamples As well, the explanatory power of the assets-below-$500,000 regression is considerably lower, presumably reflecting a finding that the terms of bank lending to very small firms are quite idiosyncratic to the owner-manager and are not well explained by our firm-level economic variables Similar results obtained for the specification in the levels of AGE and RELATE (not shown)

In table 7 the same logit regressions were run except that the dependent variable is the probability that the loan is secured by accounts receivable and/or inventory (ARINV) The decision to pledge this type of collateral, which requires intensive monitoring by the bank, may have different motivations than pledging other collateral [19] The results for the information/relationship variables in table 7 all have the same negative signs as were observed in table 6, and the coefficients are generally of economically significant magnitudes, although LNAGE loses its statistical significance in the full sample In the specification with levels of AGE and RELATE (not shown), the results are similar, except that AGE is statistically significant for the full sample and for the assets-over-$500,000 subsample

Thus, the collateral findings generally imply that the older a firm is and the longer its banking relationship, the less often it will pledge collateral (although the AGE effect is not always statistically signifi-

19 An alternative specification would be to use a trichotomous logit with the choices being ARINV OTHERSEC, and no collateral Regressions run under this alternative were not materially different from those reported

TABLE 7 **Probability Tests on Collateral (Accounts Receivable and Inventory) Lines of Credit**
Logit Regressions for the Probability of ARINV

	All Firms (1)		Total Assets above $500 000 (2)		Total Assets below $500 000 (3)	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INTERCEPT	−5 0383**	5 9557	−4 1130**	2 2371	−8 4317**	4 0608
LEV	5680**	2 4784	2 1056**	4 2758	2563	1 1283
PROFMARG	− 4051	1 2208	3110	6106	− 7795	1 5456
CURRAT	1229**	2 1315	0690	7622	1673**	2 1305
QUICKRAT	− 1374**	2 1312	− 0747	6701	− 1489*	1 8086
ARTURN	0042**	2 1659	0043*	1 7725	0053	1 5068
INVTURN	0002	2437	− 0003	2973	0010	9306
APTURN	− 0009	1 2565	− 0029**	2 5628	0005	4925
LNTA	2909**	5 2200	1988*	1 7817	4697**	2 8612
CORP	6923**	2 6526	1 0707	1 5555	5532*	1 6839
SUBS	2845	9248	5495	7635	4290	1 0267
PART	1 0166*	2 7201	0220	0245	1 6301	3 4767
OWNMG	5838**	2 2669	4039	1 2527	1 0326*	1 9159
CONC50	− 0392	1985	− 2107	8223	0912	2565
CONSTR	− 9110**	3 3097	−1 3344**	3 5423	− 4014	9138
SERVICES	0545	2140	4567	1 1357	1312	3538
RETAIL	1678	7827	− 3770	1 2431	6768**	2 0292
LNAGE	− 1544	1 4455	− 1378	9042	− 1077	5962
LNRELATE	− 2570**	2 8852	− 3584*	2 9931	− 1062	6952
Number of observations	863		437		426	
Diagnostics						
$-2\log L$	974 127		508 366		419 591	
df	18		18		18	
χ^2 covariates	149 376		94 308		60 615	

NOTE.—The *t* statistics in this table refer to the square roots of the Wald χs and are compared to the critical values for Student's *t* distribution.
* Statistically significant at the 10% level two-tailed
** Statistically significant at the 5% level two-tailed

cant) These results are consistent with Boot and Thakor (1994), who demonstrate that requiring collateral early in a relationship may be useful in solving a moral hazard problem The findings are also consistent with conventional wisdom in banking As above for the PREM regression results the collateral findings suggest that information about the firm is revealed over time Young firms with new banking relationships may be willing to incur the costs associated with collateral because they know that pledging collateral attenuates the problems associated with asymmetric information Over time, the firms are able to demonstrate some project success to the lender, who then reduces the collateral requirements The prob(COLLAT) findings are also consistent with the PREM findings in that, in both cases, borrowers with longer relationships receive easier terms from their banks—lower rates and collateral is less often required

The data shown in tables 6 and 7 may also be used to investigate the association between collateral and borrower risk Borrower risk should be distinguished from loan risk, which was investigated above with the loan rate data Borrower risk does not include the risk-reducing effects of the pledged collateral itself In table 6, the leverage coefficient (LEV) is positive and statistically significant in all three regressions, suggesting that more leverage is associated with a higher probability of pledging collateral Similarly, in table 7, the LEV coefficient is positive in all three regressions and statistically significant in all but the assets-below-$500,000 subsample This evidence of a positive association between borrower risk and the likelihood of collateral being pledged is consistent with earlier studies (Hester 1979, Berger and Udell 1990, 1992) [20]

V. Conclusion

Our analysis highlights the role of relationship lending in commercial bank loan contracting The evidence indicates that small firms with longer banking relationships borrow at lower rates and are less likely to pledge collateral than are other small firms These effects appear to be both economically and statistically significant The results are consistent with the financial intermediation literature, which emphasizes that banks produce private information about borrower quality (e g , Diamond 1984, 1991, Ramakrishnan and Thakor 1984, Boyd and Prescott 1986) Our empirical results also suggest that banks accumulate increasing amounts of this private information over the duration of the bank-borrower relationship and use this information to refine

20 Note, however, that the coefficients of the financial ratios other than LEV in tables 6 and 7 are generally statistically insignificant or fail to have signs that consistently associate collateral with either greater or lesser borrower risk

their loan contract terms In addition, our findings are consistent with recent theoretical models of bank-borrower relationships (Petersen and Rajan 1993, Boot and Thakor 1994) although our results run counter to the predictions of other theoretical models (Greenbaum et al 1989, Sharpe 1990, Wilson 1993) This does not suggest that one set of theories is true and the other is false—rather that, on net the Petersen and Rajan and Boot and Thakor models appear to have stronger effects on loan contract terms than do the other models

Our analysis attempts to extend two strands of the empirical literature that bear on relationship lending questions Studies of bank uniqueness found that the existence of a bank-borrower relationship increases firm value, and that the strength of the relationship—as measured by the distinction between the announcements of L/C renewals versus newly issued L/Cs—often generates market value as well The uniqueness literature results are often consistent with the notion that banks acquire valuable private information over the course of their relationships with mostly large, publicly traded firms

Our study differs from these uniqueness studies in three important ways First, we focus on small, mostly untraded firms rather than on large publicly traded firms Small firms are generally more dependent on banks and are more likely to have the type of asymmetric information problems that a bank-borrower relationship may resolve Second, we use a continuous measure of the strength of the bank-borrower relationship, that is, the length of time that the borrower has conducted business with its current bank We believe that this measure dominates the simple binomial proxy of whether the L/C was a renewal versus a new issue as a measure of the relationship's strength Third, we are able to test directly the predictions of the recent theoretical literature about the path of loan interest rates over the course of the relationship

Similar to our analysis, the second strand of the empirical literature on relationship lending focused on small firms, used the continuous length of the bank-borrower relationship as a measure of its strength, and tested the path of loan interest rates over the course of the relationship (Petersen and Rajan 1993, 1994) However an important difference from our study is that this second strand of studies did not confine themselves to L/C loans We focus on bank lines of credit only, excluding from our data set loans that are primarily transaction-driven, rather than relationship-driven Our exclusion of transaction-driven loans—such as mortgages, equipment loans, motor vehicle loans, and other spot loans that small firms often obtain from multiple banks—may avoid diluting our relationship lending results and may explain why our results concerning the pricing of bank loans differ from this second strand of empirical literature

Our study also differs from both strands of the empirical literature in that it analyzes the association between the pledging of collateral

and the bank-borrower relationship The relationship lending model of Boot and Thakor (1994), as well as conventional wisdom in banking, emphasize the role of collateral in the evolution of the bank-borrower relationship Our empirical result that collateral is less often pledged in a mature relationship is consistent with the predictions of Boot and Thakor and conventional wisdom Our findings may also help clarify some of the issues in the collateral literature by controlling for more types of collateral and more firm characteristics than were previously available The collateral findings are also consistent with the loan rate findings—in both cases, borrowers with longer relationships receive easier loan terms from their banks (lower rates, fewer collateral requirements)

Finally, our finding that bank-borrower relationships have value may have some policy implications about the future of the banking industry First, relationship lending may help limit the so-called "decline of banking," in which securitization and nonbank competition are reducing the share of loans held by banks Our results suggest that the impact of these trends on small business lending may be limited because of the value of relationships associated with bank lending Second, our results suggest that bank failures may create a loss of value in excess of the book value of the bank—the additional loss of the relationships Research on both the Great Depression (Bernanke 1983) and a recent bank failure (Slovin, Sushka, and Polonchek 1993) verify these losses Lastly, bank failures may create "credit crunches," or reductions in the supply of credit for small borrowers, who may face higher loan rates and more collateral requirements if a bank with which they had an established relationship fails

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