January 2011

The Importance of Being Known: Relationship Banking and Credit Limits

Atreya Chakraborty
University of Massachusetts, Boston, atreya.chakraborty@umb.edu

The Importance of Being Known:

Relationship Banking and Credit Limits*

Cresenta Fernando
World Bank

Atreya Chakraborty
The Brattle Group

Rajiv Mallick
Harvard Business School

June 2002

Abstract

This paper measures the importance of bank-firm relationships in obtaining higher credit "limits." We use data from a relatively unused section of the National Survey of Small Business Finance (NSSBF, 1993) on credit limits, credit sources, and contract terms for firms with lines of credit from multiple banks. This lets us isolate the credit limit that each bank provides the same firm, eliminating the need to control for often immeasurable, unreliable, or firm-specific "soft" information. For a median Line of Credit (LOC) of $250,000, we find that a bank with a five-year information advantage provides a LOC limit that is $20,000 higher. We also find that purchase of loan and non-loan services by firm from the contracting bank affects the credit limit differently. Non-loan services increase the credit limit and loan services decrease the credit limit. Our findings confirm anecdotal claims from the small business community that relationships are vital to secure higher credit limits. We check for the robustness of our results to outliers, sample selection, and stratification across firm organization types.

Keywords: Lending Relationship, Small Business Finance, Credit limits

JEL Classification Numbers: G21, M21

* Mailing address: Atreya Chakraborty, The Brattle Group, Third Floor, 44 Brattle Street, Cambridge, MA 02138, chuck@brattle.com. The authors wish to thank Allen Berger, Paul Harrison, and other seminar participants at the Board of Governors of the Federal Reserve Bank, Washington DC for useful suggestions.

The Importance of Being Known:
Relationship Banking and Credit Limits

Abstract

This paper measures the importance of bank-firm relationships in obtaining higher credit "limits." We use data from a relatively unused section of the National Survey of Small Business Finance (NSSBF, 1993) on credit limits, credit sources, and contract terms for firms with lines of credit from multiple banks. This lets us isolate the credit limit that each bank provides the same firm, eliminating the need to control for often immeasurable, unreliable, or firm-specific "soft" information. For a median Line of Credit (LOC) of $250,000, we find that a bank with a five-year information advantage provides a LOC limit that is $20,000 higher. We also find that purchase of loan and non-loan services by firm from the contracting bank affects the credit limit differently. Non-loan services increase the credit limit and loan services decrease the credit limit. Our findings confirm anecdotal claims from the small business community that relationships are vital to secure higher credit limits. We check for the robustness of our results to outliers, sample selection, and stratification across firm organization types.

1. Introduction

How does a bank's ability to produce private information about a borrower affect its credit rationing practices? Do firms obtain higher credit limits from the banks with which they have transacted for longer durations vis-à-vis from banks with which they have transacted for shorter durations? If so, how much?

Economic theory predicts that a bank's ability to produce reliable private information lowers the information asymmetry between the firm and the bank, and facilitates higher credit limits (Leland and Pyle, 1977, Diamond, 1984).[1] The social embeddedness approach in sociological theory predicts that bank/firm interactions over time would lead to private networks of social relations between entrepreneurs and bank officials; again,

[1] See Bhattacharya and Thakor (1993) and Freixas and Rochet (1997) for recent surveys.

leading to higher credit limits (Uzzi, 1999).[2] While access to such private information and networks is particularly important in lending to legally opaque, personality-driven small businesses, direct empirical evidence of the effect of bank/borrower relationships on credit limits is sparse.

Previous work on relationship banking has examined the effect of relationship durations on the interest rate charged (Petersen and Rajan, 1994), on the probability of the loan being secured by collateral (Berger and Udell, 1995), and on the probability of the loan application being rejected (Cole, 1998). Yet there is little empirical evidence to suggest that relationships may affect the credit limit banks are willing to commit and supply to a firms' future financing needs.

Credit limits on lines of credits (LOCs) are an important source of financing for small business (Jayaratne and Wolken, 1999 and Mitusch, 1999). Since these funds are not asset or project specific, they also represent substantial credit risk for a lender. A lender can reduce some of these risks by producing reliable private information through repeated interaction over time. This paper examines the extent to which credit *limits* are affected by bank-borrowing relationships using data from the National Survey of Small Business Finance (NSSBF, 1993).

The credit limits that banks are willing to commit to firms are a function of owner, firm, contract, and bank characteristics plus the strength of the embedded relationship between the bank and the firm. For small businesses, owner characteristics may be the most important determinant of the banks' credit decisions. Unfortunately, most of these attributes are "soft" information, i.e., information that cannot be unambiguously documented by any dataset (Stein, 2000). For instance, the owner might be a skilled entrepreneur with specialized knowledge and experience in a field of enterprise. For the bank, the owner's expertise may become the most important determinant in making a credit decision—an example of what Stein calls a "character loan." Yet, in the absence

[2] This is a consequence of social networks leading to exchange protocols and a system of long-term reciprocity beyond the immediate credit transaction.

of such "soft" information in the data, the researcher is forced to relegate this factor to the error term, causing omitted variable bias.

The NSSBF data allows us to design an estimating procedure that circumvents this problem. By looking at the *difference* in the LOC limits that two banks have provided the same firm, our econometric specification eliminates the need to control for owner and firm characteristics. These characteristics are treated as *Fixed Effects* that both contracting banks observe, but the dataset cannot measure. Our differencing procedure also allows us to incorporate other relationship-related variables that may be important to credit limits. Number of financial services that firms obtain from banks is included as a proxy for differences in the intensity of bank/firm activity. Additionally, we allow for differences in the lending institution and contract features to affect the difference in credit limits.

Our procedure of looking at how the differences in relationships affect the differences in credit limits allows us to overcome some of the "traditional" econometric problems encountered in this area. For example, (1) it avoids multicolinearity problems caused by the strong correlation between firm characteristics and key relationship measures,[3] (2) It avoids the problems of omitted variable bias in a level specification, and (3) it avoids measurement and reporting errors of firm characteristics given by company accounts—which may be easily altered by the owner.[4]

Our results add to the previous findings on relationship banking. For a median credit limit of $250,000 a bank with a five-year information advantage provides a credit limit that is $20,000 higher. Berger and Udell (1995) find that a one-year information advantage is associated with a 33-basis point reduction on the LOC interest rate and a reduction in the probability of the lender requiring collateral. Cole (1998) finds that

[3] For instance, the correlation coefficient between firm age (a proxy for public information about the firm) and the duration of relationship between the firms and their most recent lender (the principal proxy for the strength of relationship) is 0.49 (NSSBF, 1993). Berger and Udell (1995) report a correlation coefficient of 0.476 for the 1987 dataset. Cole (1998) argues the importance of disentangling these effects.

[4] Bushong (1995) questions the usefulness of small business financial statements for loan officers and their credit decisions.

having at least a year of relationship increases the probability of a loan application approval. The evidence confirms what is intuitively and anecdotally clear: Relationships matter even for credit limits.

We also find that a borrower's access to and purchase of other loan and non-loan financial services impacts credit limits differently. We find that the number of loan services obtained is negatively associated with the LOC limit, while the number of non-loan services is positively associated. The former, while generating additional information about the firms, also increases the banks' risk exposure. The latter generates information without increasing the banks' risk exposure. By providing a menu of services, banks generate information that is fungible across these services. For example, banks' decisions about LOC commitments may be influenced by information gathered while providing brokerage services to firms.

The paper is organized as follows: Section 2 describes the institutional details of a LOC loan and surveys the literature. Section 3 describes the econometric framework. Section 4 presents the data and the derivation of variables used. Section 5 presents the results, the stratification of the sample, and robustness checks to outliers. Section 6 discusses policy implications and research direction.

2. Background

In an LOC contract, a bank promises to lend funds up to a limit, within a certain time period (usually a year), at preset price and non-price conditions.[5] The price conditions in a typical LOC contract include a borrower-specific markup over an economy-wide interest rate, and an up-front commitment fee. The non-price conditions include collateral requirements, compensating balances, and a Material Adverse Change (MAC) clause that gives the bank the option to escape its lending obligations if the borrower's condition deteriorates, in terms of balance sheet, litigation, etc. Commitments are usually

[5] This Section draws heavily from Melnik and Plaut (1986), Avery and Berger (1991), Shockley and Thakor (1999), and anecdotal evidence from Edward Bayone, Chief Credit Officer, BankBoston.

for one year, with provisions made for extensions and renegotiation.[6] After the expiration of each commitment period the terms of the agreement are renegotiated, incorporating the information gathered by both parties in the preceding period.

Avery and Berger (1991) condense the major motives behind the use of LOCs by firms. The liquidity-flexibility hypothesis holds that LOCs allow the loan paperwork and evaluation to be performed in advance, so that funds can be obtained quickly and cheaply at the appropriate time when expenditures are required. Moreover, in a 'credit crunch' LOCs provide protection against being rationed out. A second hypothesis suggests that LOCs provide firms with insurance against a potential decline in their credit worthiness by locking in loan parameters consistent with their current risk class. Thus, LOCs may be seen as put options on debt claims or call options on interest rate markups.

The importance of LOCs for business operations is highlighted in Figure A1 of the appendix showing the ratio of aggregate credit limits to total assets for firms in our sample. Forty percent of the firms have credit limits that constitute more than half the value of their total assets and twenty percent of the firms had credit limits that exceeded the value of their total assets. The credit limits have a median of $250,000 and a mean of $1.5 million.

Lines of Credit are an attractive vehicle for studying the bank-borrower relationship because they are not "transaction-driven" (Berger and Udell, 1995). Given the fungible nature of funds, it is difficult to track their final use. For this reason they are perceived to be riskier for the lender.[7] In "transaction-driven" loans, magnitude and other parameters reflect the specific transaction the loan is financing. An LOC, on the other hand, is used mainly for working capital needs. In this sense, LOC contracts to firms are akin to credit cards to consumers, where a credit limit and other price and non-price conditions are specified without being tied to a specific transaction. Like a credit card

[6] 74 percent of all LOCs in the Most Recent Loan (MRL) Section of the NSSBF data are contracts of one year or less.

[7] Credit officers say that they derive information about the firm's use of active LOCs by the pattern of usage (Edward Bayone, BankBoston).

limit, the LOC limit is the quantity of credit the bank is willing to supply to the firm. The firm's demand for credit may be more or less than this quantity.

Figure A2 of the Appendix shows the average usage rate of credit limits in our sample. Half the firms had usage rates below 50% of the total available limit and 17% had exhausted their total available limit.

Recent empirical work by Petersen and Rajan (1994), Berger and Udell (1995), and Cole (1998) bases the empirical findings of firms' Most Recent Loan (MRL) data in measuring the importance of relationship on small business credit. Since the quantity reported for the MRL is determined both by demand and supply phenomena, no analysis of quantity is possible using the MRL data.[8] Instead, we utilize a relatively unused segment of the NSSBF data on Line of Credit limits that the banks have committed to supply.

This limit is a function of a firm's risk category as perceived by the lender, according to theories on credit rationing by Jaffee and Russell (1976) and Stiglitz and Weiss (1981). Repeated interactions with firms, over time, allow banks to place firms in a lower risk class by mitigating information asymmetries between them (Boot and Thakor, 2000). Hence, the length of relationship and the breadth of financial services firms obtain from banks must have explanatory power on credit limits.

3. Methodology

Consider firm i that has two LOCs from two banks: j and k. Following Melnik and Plaut (1986), we write two equations, [1a] and [1b]. Here, $LIMIT_{ij}$ and $LIMIT_{ik}$ are the credit limits that the firm has secured from the two banks. Both limits depend on the firm, and owner characteristics F_i. We assume these characteristics to be fixed effects that both

[8] A subset of MRLs are LOCs, but the quantity reported is the amount utilized by the firm.

banks observe uniformly.[9] In addition, these limits depend on the corresponding loan contract features C_{ij} and C_{ik}, on the bank characteristics B_j and B_k, and on the strength of the relationships R_{ij} and R_{ik},

$$LIMIT_{ij} = b_0 + b_1 F_i + b_2 C_{ij} + b_3 R_{ij} + b_4 B_j + e_{ij} \quad [1a]$$
$$LIMIT_{ik} = b_0 + b_1 F_i + b_2 C_{ik} + b_3 R_{ik} + b_4 B_k + e_{ik} \quad [1b]$$

In writing equations [1a] and [1b], we treat the credit limit as the quantity of funds the banks are willing to supply—conditioned on contract features, borrower characteristics, lender characteristics, and strength of relationship. Again, it is best to think of the credit card analogy, where the credit limit is different from the credit the consumer had utilized—the latter indicative of the consumer's demand. Similarly, the demand for credit by the firm may be *more*, *less*, or *equal* to the credit limit. This is seen by examining the firms' usage rates of their credit limits: in our sample, 50% of the firms used less than 50% of their limit, 25% used their entire limit. If we think of usage as indicative of the firms' demands for credit, the under-utilizers are firms whose demands were less than the limit, while firms at the limit had demands greater than or equal to the limit. For empirical estimation, we proceed to subtract [1b] from [1a] to obtain [1c].

$$(LIMIT_{ij} - LIMIT_{ik}) = b_2 (C_{ij} - C_{ik}) + b_3 (R_{ij} - R_{ik}) + b_4 (B_j - B_k) + (e_{ij} - e_{ik}) \quad [1c]$$

This explains the difference in credit limit that the firm had obtained from two banks as a function of the difference in contract features, the difference in relationship strength, and the difference in bank characteristics. Note that this eliminates the need to control for often unreliable or immeasurable firm and owner characteristics F_i.[10]

[9] It is possible that the firm may have changed between the negotiations of the first and the second credit limits. Since credit lines are mostly short term and typically renegotiated annually; significant changes in firm or owner characteristics are unlikely.

[10] In the statistics literature this is called a static group experiment. For a theoretical discussion see Meyer (1994).

Other than eliminating the need to control for F_i, this approach has additional advantages. The empirical literature on relationship banking has used the length of relationship as a measure for the strength of relationship (private information), while using the firm age as a measure of public information (Petersen and Rajan, 1994, Berger and Udell, 1995, and Cole, 1998). Both factors are important for the banks' credit decisions. In the data, the length of relationship with the contracting bank for the Most Recent Loan (MRL) and the firm age are highly correlated, resulting in strong multicolinearity (Cole, 1998). Disentangling the private from the public information effects caused problems. In the present formulation, firm age is a fixed effect that is eliminated in the subtraction. The result is a direct estimate of the benefit of private relationship.

4. Data and Description of Variables

Sections F7-F153 of the National Survey of Small Business Finance (NSSBF, 1993) provides information on LOC limits. The information includes the credit limit, collateral requirements, usage, and information about contracting banks.[11] NSSBF also provides data on the length of the relationships that firms have had with banks, as well as information regarding the financial services firms obtained from the banks. We isolate the 226 firms that have two LOCs from two banks.[12]

Figure A3 of Appendix illustrates the relative credit limits. The histogram gives the frequency for the ratio of the higher limit to the lower limit: 16% of the firms have

[11] The NSSBF has no information on the timeline of credit line approvals. How does one credit line affect the other? It is routine for banks to inquire applying firms about its existing credit lines with other banks. TSeeing an already approved credit limit and its corresponding credit history may be a positive signal for them. On the other hand, already approved credit limits entail the possibility of the firm being highly leveraged and therefore in a higher risk category. Also note that it is the usage and not the limit of the credit line that appears as a balance sheet item.

[12] What firms have multiple lines of credit? Table I of Data Appendix presents results of two models: A binary Probit model that explains the presence or absence of multiple LOCs, and a Poisson model for count data for 0, 1, 2, or 3 LOCs. For a discussion on why firms might obtain credit from multiple sources see Chakraborty and Hu (working paper). It suffices to say here that larger firms, older firms, and corporations with a higher current ratio, serving multiple markets tend to have multiple LOCs. We will adjust for sample selection in checking for the robustness of our results.

identical credit limits from the two sources. The higher limit was more than 200% the lower limit for half the firms.

From the credit limit data we construct our dependent variable $\Delta LIMIT$, which is the log difference between the two credit limits.[13]

$$\Delta LIMIT = \ln\left(\frac{LIMIT_j}{LIMIT_k}\right)$$

The log-differenced formulation compresses outliers and makes interpretation convenient. Approximately 15% of the firms obtained the same credit limit from both banks, and 35% got from one bank a limit that is more than double the limit they got from the other.

Our main proxy to measure the strength of relationship is the number of years the firm has transacted with the banks. The longer the borrower has been transacting with the lender, the more viable the business, and more trustworthy its owner (Diamond, 1984). Loans to longtime customers will be seen as less risky, and banks might increase their willingness to provide funds (Petersen and Rajan, 1994). Moreover, social embededness increases with the duration of the relationship. Time permits personal opportunities for reciprocity to emerge between owners and loan officers outside the immediate realm of the loan transaction (Ongena and Smith, 2001 and Degryse and Ongena, 2001). The variable used in our estimation $\Delta LENGTH$ is the difference in the length of relationship the firm has had with the two banks.[14] We expect a positive coefficient on $\Delta LENGTH$. As Table I in illustrates, the average difference in length of relationship in the sample is 5 years, with a maximum of 20, and a skew to the right.[15]

[13] There are 8 firms with complete data for a third LOC. But including those firms in our differencing methodology would overweigh those firms in the sample and may cause possible estimation bias.
[14] The order of the subtraction in limit is preserved through all the differenced variables. We are precluded from taking the log of these differences due to the possibility of the differences being negative, and in terms of ratios the prevalence of zeros.
[15] This necessitates a check for sensitivity to outliers.

In addition to interactions over time, relationships can be built through interactions over multiple financial products, sometimes called the multiplexity of relationship (Uzzi, 1999). Deposit accounts, brokerage services, cash management services, etc. help reveal information about the firm and can mitigate information asymmetries between the borrower and the lender. We capture this dimension by counting the number of financial services firms obtain from banks. In looking at financial services, a distinction needs to be made between loan and non-loan services. The former, while providing information about the firm, also increases the bank's risk exposure vis-à-vis the firm. The latter provides information without increasing risks. Both provide the lender the opportunity to spread any fixed costs of information production and storage (Petersen and Rajan, 1994). We construct 3 variables: the difference in the total number of financial services $\Delta SERV$, the difference in the number of non-loan services $\Delta NLSERV$, and the difference in the number of loan services $\Delta LSERV$.[16] On average, there is a difference of 1.4 in the number of financial services firms obtain from banks, and this ratio is skewed to the right. We expect a positive coefficient on $\Delta NLSERV$. The coefficient signs of the other two service variables are ambiguous, due to the competing effects of risk and information.

For contract features, we obtain a count of various collateral types required to secure the line of credit. Collateral minimizes losses in case of default, enabling banks to commit more credit (Rajan and Winton, 1995, Bester, 1985 and Klapper 2001). We expect a positive coefficient on collateral requirements. The various types of collateral include inventory, equipment, real estate, security deposits, and compensating balances. The variable $\Delta COLLAT$ is the difference in the count of collateral types required to secure the LOCs. This is an improvement from previous work that uses a binary variable to indicate collateral or no-collateral requirements in the contract (Berger and Udell, 1995).

To examine whether differences in the lending institution changes the provision of credit, we divide the lending institution into Commercial Banks and Other Institutions. If bank *j*

[16] Non-loan services are checking accounts, savings accounts, brokerage services, cash management services, transaction services, credit-related advisory services, and 401K plans. Loan services are leasing

is a commercial bank, then $BANK_j = 1$ and zero otherwise. We construct the trinomial dummy variable,[17]

$$\Delta BANK = BANK_j - BANK_k = \begin{cases} 0 & \text{if institutions } i \text{ and } j \text{ are "similar"} \\ 1 & \text{if institution } j \text{ is a Commercial Bank and } k \text{ is not} \\ -1 & \text{if institution } k \text{ is a Commercial Bank and } j \text{ is not} \end{cases}$$

Commercial banks, which are usually larger, may enjoy economies of scale in information production and transaction costs (Boyd and Prescott, 1986, James and Weir, 1990 and Berger, Klapper and Udell, 2001). This implies that commercial banks can better manage credit risk and provide more credit. We expect a positive coefficient on $\Delta BANK$.

We also include a variable to capture the relative distance between the firm and the banks. We conjecture that the bank closer to the firm's area of operation is likely to have more information about the firm that it will use to facilitate credit. However, recent evidence from Petersen and Rajan (2000) show that advances in communication and information technology have facilitated long distance lending relationships between banks and small business. As a result, distance is less of an impediment to facilitate credit. We construct the following variable and leave the sign of its coefficient as an empirical question.

$$\Delta DIST = DIST_j - DIST_k$$

5. Results

facilities, mortgages, equipment, and vehicle loans.

[17] See Pindyck and Rubinfeld (1991), *Econometric Models*, pages 121-123 for a theoretical discussion on trinomial dummies.

Column (1) of Table II reports the OLS estimates for explaining the difference in credit limit using our main measure of relationship $\Delta LENGTH$ together with $\Delta COLLAT$ and $\Delta BANK$. The variable $\Delta LENGTH$ is significant in explaining the difference in credit limits. If a firm has an additional year of relationship with bank *i* relative to bank *j* then it will secure from bank *i* a Loan Commitment that is 1.6% higher. For a median LOC limit of $250,000 a bank with a 5-year relationship advantage provides $20,000 more in credit facilities. The significant coefficient on the collateral variable indicates that a bank will provide a credit limit that is 26% higher if the loan is secured by one additional type of collateral. There is no evidence to indicate that the bank type or distance matters for LOC limits.

Column (2) of Table II incorporates a second measure of relationship: $\Delta SERV$; the difference in the total number of financial services the firm obtains from the banks. This variable does not distinguish between loan and non-loan services. The insignificant coefficient indicates that, at least in its present form, the total number of services does not add any explanatory power to the regression. The other variables remain unaffected in magnitude and significance.

Column (3) of Table II decomposes services into loan and non-loan services, while dropping the aggregate services term. The significance of non-loan services in explaining the LOC limit confirms our expectations. If the firm obtains one additional non-loan service from a bank, it can secure a credit limit that is 17% higher. This justifies the decomposition of financial services. The coefficient on loan services is insignificant, indicating the competing risk and information effects of loan services.

Column (4) of Table II drops the commercial bank dummy. This makes the loan services variable significant and negative. Since commercial banks tend to provide a larger array of loan services, the commercial bank dummy and the loan-services variables are correlated. By having an additional loan service, the firms obtain a credit limit that is on average 0.6% lower.

5.1 Stratification

The first few years of relationship are likely to be more important in mitigating information asymmetries between firm and lender. The familiarity, thereon, must lead to an information-saturation, as in other relationships. Cole (1998) finds that completing a year of relationship is significant in explaining the probability of a loan application being accepted. Moreover, the information that the lender generated in the first few years of a 10-year relationship may have changed, and needs to be updated. Hence, the value of information from a 5-year relationship may not be different from the value of information generated from a 10-year relationship. In such a scenario, the purchase of services, which are current transactions, must be more important for the banks' credit decisions.

To test this, we divide our sample into firms that have had a 5-year relationship (called a 'mature' relationship) with both banks and the others that have either one or no 'mature' relationships. Column (1) of Table III reports the results for the sub-sample of firms with two mature relationships, and Column (2) of Table III reports the results for the other firms. As expected, when both relationships are mature, the length of relationship adds no marginal value to the LOC limit. The length of relationship is important for those with one or no 'mature' relationships. The service variables are important for firms with two mature relationships and insignificant for the others. There is also a statistically significant increase in the strength of the collateral variable for firms with one or no mature relationships. For banks, the collateral that a new customer can provide is more important than the services it purchases, in case the firm is a "fly-by-night."[18]

The relationship dimensions important for corporations are likely to be different than those for sole-proprietorships and partnerships. In particular, corporate management may change in the course of a relationship, and more current relations through financial services may be more important. Moreover, limited liability in corporations puts restrictions on assets that can be liquidated in case of default. To test these possible

[18] The stratification was also done using 3 and 4 years of relationship as cut-off for 'mature' relationship. The shift in the significance of the length variable occurs at 5 years.

differences in corporations, Column (3) of Table III isolates the sub-sample of corporations. Due to degrees of freedom restrictions we can only compare the results of Column (3) to the full sample in Column (4) of Table II. For corporations relative to the full sample, the effect of relationship length weakens statistically, the effect of non-loan services strengthens, and the effect of collateral strengthens.

5.2 Sample Selection

Column (4) of Table III checks the robustness of the result to sample selection. We follow Heckman's (1979) two-step estimation procedure. In the first stage, using all firms, we estimate a Probit equation explaining the probability, $\hat{p}$, of a firm having two lines of credit using firm characteristics F.[19] For each firm in the selected sample, i.e., the firms with two lines of credit, we compute the nonlinear adjustment term $f(\hat{p})/\Phi(\hat{p})$; where $f(\cdot)$ and $\Phi(\cdot)$ are the probability density and cumulative density functions of a standard normal distribution.[20] In the second stage, this term is used as a regressor in the least squares regression to adjust for sample selection.

The results are reported in Column (4) of Table III. The adjustment for sample selection does not alter our main result. The coefficients remain significant and stable. The only difference is that the intercept term is now statistically zero.[21]

---

[19] The results of the Probit selection equation is given in Column (2) of Table A1.

[20] This is the inverse Mills' ratio for a censored normal.

[21] This improves our regression in one noticeable way: if there is no relationship or contractual difference in the two credit sources, i.e., all regressors are equal to zero, our model suggests that there should be no difference in the credit limits that the two sources provide, or $\left(\frac{LIMIT_j}{LIMIT_k}\right)=1$. By taking the log of both sides $\ln\left(\frac{LIMIT_j}{LIMIT_k}\right)=0$. Since our dependendent variable is log form, the constant term is predicted to be zero, which is established in the regression reported in Column (4) of Table III.

5.3 Interest Rates

Column (5) of Table III includes a proxy for the relative interest rates. The NSSBF provides data on the unused proportion (typical balance) in LOC accounts. The proxy we suggest rests on the following argument: If a firm has two active lines of credit, it will first pay-off the LOC channel that charges the higher interest rate, i.e., given its availability of funds, it will keep a higher unused balance in the L/C that charges a higher interest rate. This is akin to a consumer with multiple credit cards paying off the card that charges a higher rate of interest first. Hence, we use the difference in balance $\Delta BALANCE$ as a proxy for relative interest rates.[22]

A higher value of $\Delta BALANCE$ proxies a higher relative interest rate on the LOC contract provided by bank *j* relative to bank *k*. As the Loan Commitment theory of Melnik and Plaut (1986) suggests, by charging a higher interest rate a bank can afford to offer a higher loan commitment; since the increase in risk due to lending more to an individual borrower has been compensated by the higher rate. Column (4) illustrates that the interest rate proxy returns the correct sign while keeping the other coefficients significant.

5.4 Sensitivity to outliers

Recall from Section 4 that the variables used were skewed and need to be checked for sensitivity to outliers. Columns (1) to (3) of Table IV use the DFBETA method to check the robustness of the estimates to outliers (Belsley, Kuh, and Welsch, 1980). The method focuses on one coefficient at a time, and measures the change in the coefficient as one data point is dropped (jack-knifed) at each running of the regression. We drop the five most influential data points and check for the robustness of the result. Column (1) of

[22] In calculating this we exclude 26 firms that have used up their entire limit on both LOCs. Clearly, these data points convey no information on the *relative* interest rate.

Table IV focuses on the length-of-relationship coefficient, Columns (2) and (3) focus on the service coefficients. Our results are robust to the exclusion of outliers.

6. Conclusion and Discussion

We investigated how bank-borrower relationships affect the credit limits of US small business. Our main finding is that the credit limit extended by the lender increases with the length of the borrower-lender relationship. In particular, for a median LOC limit of $250,000, a bank with a 5-year relationship advantage provides $20,000 more in credit facilities. Insofar as the length of relationship is a proxy for private information generated within a relationship, our results indicate that, after a certain threshold, added years of relationship may not be as useful. For example, for firms with two relationships that both exceed 5 years ("mature" relationships), an additional year of relationship adds no statistically significant benefit in terms of credit limit. Within 5 years of business, firms reveal their true type and banks incorporate the information fully into their loan decisions. It is for firms with either one or no "mature" relationships that an additional year of business brings statistically detectable credit benefits to firm.

We also find that the number of loan and non-loan services the firm purchases from banks affects credit limits differently. The credit limit increases with non-loan services and decreases with loan services. Loan services, while providing information about the firm's repayment patterns, punctuality, etc., also increase the lender's risk exposure vis-à-vis the borrowing firm. Non-loan services are primarily information generators, and have a strong positive effect on the credit limit.[23]

The methodology we used to obtain these results avoids a few important data problems that the empirical literature on relationship banking has struggled to overcome. We achieve this by looking at a single firm's interactions with two banks—eliminating the need to control for confounding firm and owner characteristics that we treat as *fixed effects.*

[23] When it comes to financial services, we are unable to distinguish between relationship effects and product "bundling" effects.

Our process subtracts out often immeasurable, unreliable, or "soft" information on balance sheets, owner characteristics, public information, etc. Also, among the fixed effects subtracted out is firm age—a proxy for the set of public information about firm, and a measure highly correlated with the length of bank-firm relationships. This allows a statistically clean derivation of the impact of private information from lender –borrower relationship.

Bank-borrower relationship captures an economic setting where formal arm's length ties seamlessly interact with personal bonds that borrowers form with loan officers and other bank agents. Legally opaque, personality driven small businesses benefit immensely from these interactions, in terms of credit availability, cheaper loans, less-restrictive terms, and higher limits. Given fairly specific loan pricing guidelines that banks require their officers to follow, the credit limit may be a loan variable that the loan officers find easier to influence. Furthermore, since credit lines are not directly tied to the size of a specific project, these credit limits are not strictly bound by the expected needs of the project. This gives the credit officer even more leeway in adjusting the credit limit in accordance with the set of private information acquired through the relationship. Our results are consistent with such behavior.

It is an important matter of public policy to realize the value of information that is generated through what we term a relationship—repeated interactions over a length of time. Banks act as repositories for this economically valuable information and use it to reduce uncertainties associated with lending to small businesses. As Stein (2000) argues, bank mergers and closures can lead to structures that limit bank-borrower relationships to arm's length ties, as well as a loss of valuable accrued information. Our results indicate that regulators overseeing bank consolidations must be wary of this concern.

References

Avery, Robert and Allen Berger, 1991. Loan Commitments and Bank Risk Exposure. *Journal of Banking and Finance* 15, 173-92

Belsley, D., E. Kuh, and R. Welsch. 1980. *Regression Diagnostics.* New York: John Wiley & Sons.

Berger, Allen and Gregory Udell, 1995. Relationship Lending and Lines of Credit in Small Firm Finance, *Journal of Business*, 68, 351-382.

Berger, Allen, Leora Klapper, and Gregory Udell, 2001. The Ability of Banks to Lend to Informationally Opaque Small Businesses, Finance and Economic Discussion Series # 2001-34, Board of Governors of the Federal Reserve System.

Bester, H., 1985. Screening vs. Rationing in Credit Markets with Imperfect Information. *American Economic Review*, 75, 850-55.

Bhattacharaya, S. and A. V. Thakor, 1993. Contemporary Banking Theory. *Journal of Financial Intermediation*, 3, 2-50.

Boot, Arnoud, 2000. Relationship Banking, *Journal of Financial Inter-mediation*.

Boot, Arnoud and A. V. Thakor, 2000. Can Relationship Banking Survive Competition?, *Journal of Finance*, 55, 679-713.

Boyd, J., and E. C. Prescott, 1986. Financial intermediary-coalition, *Journal of Economic Theory*, 38, 211-32.

Bushong, Joe Gregory, 1995. Accounting and Auditing of Small Businesses, Studies in Entrepreneurship. Garland, New York and London.

Chakraborty, Atreya and Charles Hu, Working Paper. Collateral Use and Lending Relationships: Evidence from Small Business Finance

Cole, Rebel, 1998. The Importance of Relationships to the Availability of Credit, *Journal of Banking & Finance*, 22, 959-977.

Degryse, H. and S. Ongena, 2001. Bank Relationships and firm Ferformance, *Financial Management*, 20, 9-34.

Diamond, Doug, 1984. Financial Intermediation and Delegated Monitoring, *Review of Economic Studies*, 51, 393-414.

Diamond, D. and P. Dybvig, 1983. Bank Runs, Deposit Insurance, and Liquidity, *Journal of Political Economy* 91, 401-19.

Freixas, Xavier and Jean-Charles Rochet, 1997. Microeconomics of Banking. Cambridge, MA: MIT Press.

Jaffee, D. and T. Russell, 1976. Imperfect Information, Uncertainty, and Credit Rationing. *American Economic Review* 59, 850-872.

James, C. and P. Wier, 1990. Borrowing Relationships, Intermediation, and the Cost of Issuing Public Securities, *Journal of Financial Economics*, 28, 149-71.

Jayaratne, Jith and John Wolken, 1999. How Important are Small Banks to Small Business Lending? New Evidence From a Survey of Small Firms, *Journal of Banking and Finance* 23, 427-58

Klapper, Leora, 2001. The Uniqueness of Short-term Collateralization, Working Papers – Domestic Finance, Saving, Financial Systems, Stock Markets # 2544, The World Bank.

Leland, Hayne and David Pyle, 1977. Information Asymmetries, Financial Structure, and Financial Intermediaries, *Journal of Finance* 28, 149-171

Melnik, Arie and Steven Plaut, 1986. Loan Commitment Contracts, Terms of Lending, and Credit Allocation, *Journal of Finance*, v XLI, 425-435

Mitusch, Kay, 1999. Aggregate Liquidity and Banking: The Role of Loan Commitments and Liquidity Constraints, *Journal of Institutional and Theoretical Economics* v 155, n3, 551-66.

Ongena, S., and D. C. Smith, 2001. The Duration of Bank Relationships, *Journal of Financial Economics*, 61, 449-475.

Petersen, Mitchell and Raghuram Rajan, 1994. The Benefits of Lending Relationships: Evidence from Small Business Data, *Journal of Finance*, v XLIX, No 1, 3-37.

Petersen, Mitchell and Raghuram Rajan, 2000. Does distance still matter? The information revolution in small business lending. Presented to the Eleventh Annual Utah Winter Conference.

Pindyck, Robert and Daniel Rubinfeld, 1976. Econometric Models & Economic Forecasts, 3rd Edition, New York, NY. McGraw Hill.

Rajan, R. and A. Winton, (1995). Covenants and Collateral as Incentives to Monitor, *Journal of Finance*, 50, 1113-1146.

Shockley, R and Anjan Thakor, 1999. Bank Loan Commitment Contracts: Data, Theory, and Tests, *Journal of Money & Banking* 29, 517-534

Stein, Jeremy, 2000. Information Production and Capital Allocation: Decentralized vs. Hierarchical Firms, *NBER Working Paper*, 7705

Stiglitz, Joseph and Andrew Weiss, 1981. Credit Rationing in Markets with Imperfect Information, *American Economic Review*, 71, 393-410.

Uzzi, Brian, 1999. Embeddedness in the Making of Financial Capital: How Social Relations and Networks Benefit Firms Seeking Financing, *American Sociological Review*, 64, 481-505.

Table I
Univariate Statistics of

The derivation of the variables are given in parentheses. The descriptive statistics reported for the independent variables are for the absolu value of each differenced series. For an example, the data shows an average 5-year relationship difference between a firm's two contractir banks. The dependent variable is in log differenced form. We decide not to use a log specification for the independent variables due to the prevalence of zeros which pushes the log values to infinity. Non-loan services are checking accounts, savings accounts, brokerage services management services, transaction services, credit-related advisory services, and 401K plans. Loan services are leasing facilities, mortgage equipment, and vehicle loans. Collateral include inventory, equipment, real estate, security deposits, and compensating balances in checki savings accounts.

Variable	Mean	Median	Max	Std
Independent				
Difference in the Length of *(?LENGTH= Length of relationship with bank 1 minus Length of with bank 2), in*	5	3	20	8.4
Difference in Number of Total *(?SERV=Number of Financial Services obtained from bank 1 minus Financial Services obtained from bank*	1.4	1	5	1.8
Difference in Number of Non-Loan *(?NLSERV=Number of Non-Loan Services obtained from bank 1 Number of NonLoan Services obtained from bank*	0.4	0	3	0.7
Difference in the Number of Loan *(?LSERV=Number of Loan Services obtained from bank 1 minus Loan Services obtained from bank*	1	1	5	1.6
Difference in the Number of Collateral Types Securing Credit *(?COLLAT=Number of Collateral types securing credit line from bank 1 Number of Collateral types securing credit line from*	0.6	0	5	1.2
Difference in Distance to *(?DIST=Distance to bank 1 minus Distance to bank*	85	6	989	193
Dependent				
Log Difference in the Credit *(?LIMIT=ln(Credit Limit from bank 1 divided by Credit Limit from*	1.1	0.8	4.9	0.9

Table II

Difference in the LOC Limits Explained by Differences in Relationships, Loan Contract, and Banking Institution

The results of the OLS regressions explaining the difference in Lines of Credit Limits using the differences in relationship variables, contract features, lending institution type. The dependent variable is the log difference between the two Lines of Credit Limits: ln(Limit 1/Limit 2). This reduces heteroscedasticity across firms. The Eicker-White standard errors are in parentheses. * & ** indicate significance at the 10 percent and 5 percent levels.

Independent Variables	(1)	(2)	(3)	(4)
Difference in the Years of Relationship *(?LENGTH)*	0.016** (0.006)	0.016** (0.006)	0.013** (0.006)	0.015** (0.006)
Difference in Number of Total Services *(?SERV)*	-	0.002 (0.06)	-	-
Difference in Number of Non-Loan Services *(?NLSERV)*	-	-	0.17** (0.07)	0.17** (0.07)
Difference in the Number of Loan Services *(?LSERV)*	-	-	-0.05 (0.04)	-0.06* (0.035)
Difference in the Number of Collateral Types *(?COLLAT)*	0.26** (0.06)	0.25** (0.05)	0.23** (0.06)	0.22** (0.06)
Difference in Bank Type *(?BANK)*	-0.16 (0.101)	-0.15 (-1.29)	-0.06 (-0.12)	-
Difference in Distance to Bank *(?DIST)*	0.00 (0.01)	-	-	-
Intercept	0.09** (0.006)	0.09** (0.006)	0.09** (0.006)	0.09** (0.006)
Adjusted R-squared	0.09	0.08	0.11	0.13
Observations	226	226	226	226

Table III

Robustness Check: Difference in the LOC Limits Explained by Differences in Relationships and Loan Contract

The results of the OLS regressions explaining the difference in Lines of Credit Limits using the differences in relationship variables and contract features. The dependent variable is the log difference between the two Lines of Credit Llimits. The Eicker-White standard errors are in parentheses. * & ** indicate significance at the 10% and 5% levels.

Independent Variables	(1)	(2)	(3)	(4)	(5)
	Stratification			Adjusted for sample selection	With Interest Rate Proxy
	with "Mature" relationships	Otherwise	Corporations		
Difference in the Years of Relationship *(?LENGTH)*	0.013	0.016**	0.012**	0.015**	0.012**
	(0.01)	(0.008)	(0.006)	(0.006)	(0.006)
Difference in Number of Non-Loan Services *(?NLSERV)*	0.38**	0.09	0.20**	0.18**	0.22**
	(0.14)	(0.09)	(0.08)	(0.07)	(0.07)
Difference in the Number of Loan Services *(?LSERV)*	-0.13**	-0.04	-0.06*	-0.06**	-0.08**
	(0.07)	(0.04)	(0.037)	(0.03)	(0.03)
Difference in the Number of Collateral Types *(?COLLAT)*	0.16**	0.24**	0.24**	0.23**	0.21**
	(0.10)	(0.07)	(0.06)	(0.05)	(0.06)
Heckman Adjustment term for sample selection	-	-	-	0.19	-
				(1.54)	
Difference in Unused Balance *(?BALANCE)*	-	-	-	-	0.11**
					(0.03)
Intercept	0.09**	0.09**	0.09**	0.03	0.09**
	(0.01)	(0.007)	(0.006)	(1.15)	(0.006)
Adjusted R-squared	0.14	0.11	0.12	0.12	0.2
Observations	67	159	181	226	200

Table IV
Robustness Checks

The dependent variable is the log difference between the two Lines of Credit "Limits." The Eicker-White standard errors are in parentheses. * & ** indicate significance at the 10% and 5% levels. The data points with most influence on respective coefficients obtained by a Jack knife process of excluding one data point at a time and observing the change in coefficients. The 5 highest influence points in absolute value are excluded from the regressions. For an example, the five data points with most influence on the ?LENGTH coefficient are excluded from the regression in Column (1)

Variable	(1) Excl. DFBETA ?LENGTH	(2) Excl. DFBETA ?NLSERV	(3) Excl. DFBETA ?LSERV
Difference in the Years of Relationship *(?LENGTH)*	0.012** (0.006)	0.015** (0.006)	0.014** (0.006)
Difference in Number of Non-Loan Services *(?NLSERV)*	0.15** (0.07)	0.15* (0.08)	0.18** (0.07)
Difference in the Number of Loan Services *(?LSERV)*	-0.06* (0.035)	-0.06* (0.035)	-0.07** (0.034)
Difference in the number of collateral types *(?COLLAT)*	0.23** (0.06)	0.21** (0.06)	0.21** (0.06)
Intercept	0.09** (0.006)	0.09** (0.006)	0.09** (0.006)
Adjusted R-squared	0.11	0.11	0.14
Observations	221	221	221

Table A.1
Firm Characteristics and Multiple Lines of Credit

Column (1) presents the results of a Poisson regression explaining the number of Credit Lines in terms of firm characteristics. The Dependent Variable is Count Data on the number of Credit Lines firms have from different banks: 0,1,2, or 3. T-statistics in parentheses. Column (2) is a Probit regression explaining the binary variable (firm with multiple LOCs=1 all others = 0). ** & * indicates significance at 5% & 10% respectively. Data is from the full sample of firms.

Variable	(1) Poisson Coefficients	(2) Probit Coefficients
Firm Characteristics and Governance		
Firm Age (Years)	0.01**	0.003*
	(3.05)	(1.72)
Assets ($ '000)	0.09**	9E-9**
	(4.71)	(2.96)
S or C Corporation? (Yes=1)	0.43**	0.15*
	(7.53)	(1.82)
Market		
Export Market? (Yes=1)	0.15**	0.05
	(2.18)	(0.46)
Sites of Operation (Multiple=1)	0.02**	0.013*
	(3.28)	(1.62)
Credit Issues and Risk Proxies		
Credit Serious Problem in Last 12 months? (Yes=1)	0.79**	0.15**
	(3.31)	(2.13)
Owner Bankrupt in Last 7 years? (Yes=1)	-0.36**	-0.13
	(-2.20)	(-0.62)
Business Delinquencies? (Yes=1)	-0.09	-0.12
	(-0.34)	(-0.10)
Judgment Rendered Against Owner? (Yes=1)	-0.15	-0.12
	(-1.40)	(-1.28)
Trade Credit used? (Yes=1)	0.18**	-0.02
	(3.31)	(-0.25)
Bank Variables		
	0.07	0.02
Herfindahl for Banks in Region (1=More Competition)	(1.48)	(0.39)
Industry (Relative to Retail)		
Mining	-0.31	-0.12
	(-1.01)	(-0.31)
Construction	0.12	-0.04
	(1.53)	(0.12)
Manufacturing	0.12	-0.29**
	(1.38)	(-2.26)
Utilities/Transport	0.05	-0.16
	(0.31)	(-0.99)
Wholesale	0.23**	-0.11
	(2.40)	(-0.92)
Insurance	-0.30**	0.22
	(-2.09)	(1.52)
Services	-0.16**	-0.38
	(-2.35)	(-3.90)
Constant	-0.55**	-0.49
	(-4.98)	(-3.16)
Regression Statistics		
Pseudo R-squared	0.09	0.06
Prob>Chi2	0	0
Observations	4514	4514

Figure A1

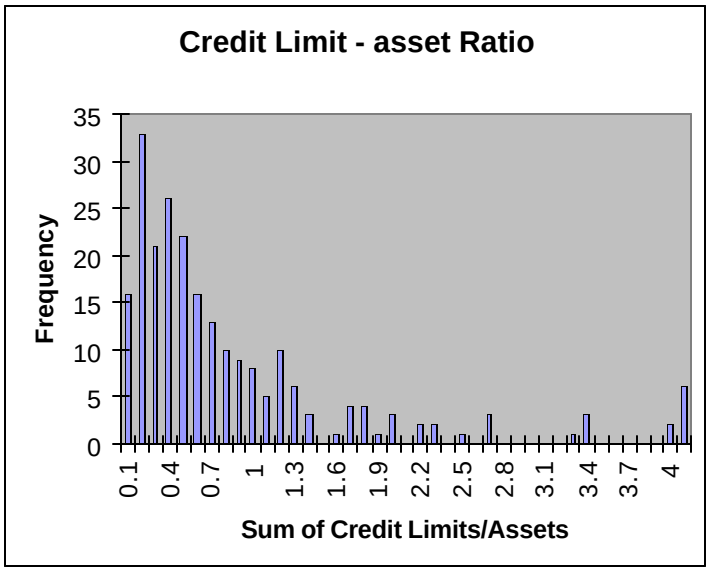

Figure A2

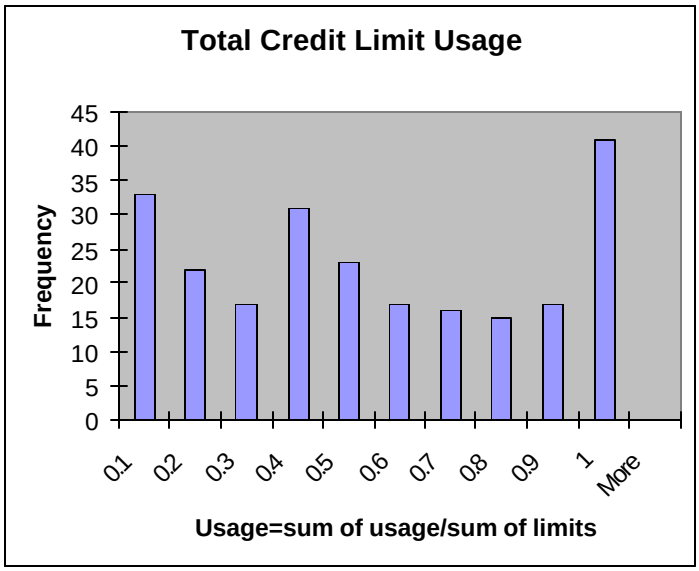

Figure A3

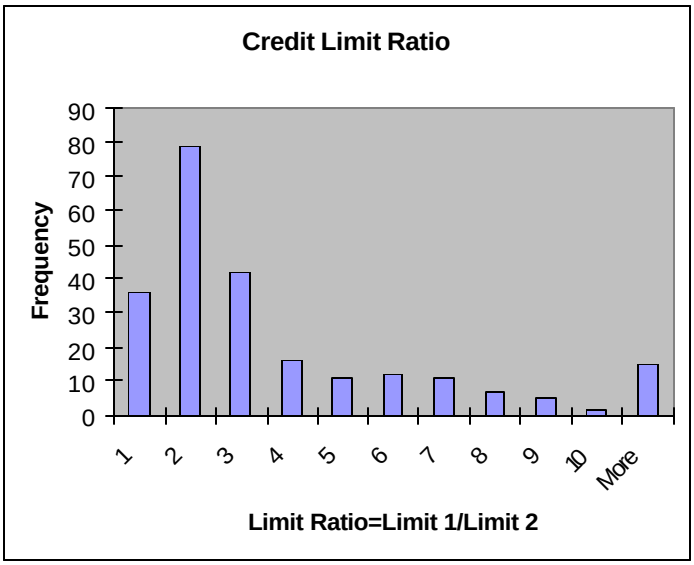

Table A4
Descriptive Statistics of Credit Limits and Usage

	mean	median	mode	std
Credit Limit Ratio	3.8	2.2	1	4.5
Credit Limit Usage	0.5	0.4	1	0.3
Credit Limit Asset ratio	0.8	0.4	-	1