ABSTRACT

GONG,JIE. Relationship Lending and Lines of Credit for Small Business—Empirical Analysis of Relationship Lending under Lines of Credit for Small Business. (Under the direction of Douglas K. Pearce).

This thesis examines the influences of bank-borrower relationships on the terms for bank lines of credit for small business. I use the Surveys of Small Business Finances data to estimate two models: an OLS Regression explaining the premium over the prime rate and a Logistic Regression for the probability of collateral requirements. I focus on those firms with lines of credit with floating rates from commercial banks and use contract, financial, governance, industry and relationship characteristics as explanatory variables. Dun and Bradstreet (D&B) credit scores, minority status and gender are also added to previous models reported in the literature. My results are: (1) Small firms with longer market experiences will pay lower premium rates over the prime rate and firms with higher risk D&B credit scores will pay higher premiums. These results are both statistically and economically significant. However, the length of bank-borrower relationships does not have a statistically significant effect on the loan rate. Although lines of credit may provide more 'soft-information' on borrowers during bank-borrower relationships, banks still put more weight on credit scores and the firms' age. (2) There is no statistically significant relationship between *Relationship Characteristics* and the probability of collateral requirements. Banks pay more attention to *Financial Characteristics* and type of ownership. D&B credit scoring system plays a more important role than bank-borrower relationship status. (3) Minority status and gender do not have impacts on loan rates or the probability of pledging collateral.

Relationship Lending and Lines of Credit for Small Business

by
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A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Master of Arts

Economics

Raleigh, North Carolina

2010

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DEDICATION

To my parents - I love them more than life.

BIOGRAPHY

Jie Gong was born in Hangzhou, Zhejiang Province, P.R.CHINA in 1986. She studied in Zhejiang University, major in Finance and Banking, from 2005 to 2009 for bachelor degree in Economics. From 2008 to 2010, she joined ZJU-NCSU 3+1 program and started her Graduate level studies of Economics in North Carolina State University.

ACKNOWLEDGMENTS

To my parents, thank you for the patience and support you provided over these years. I would like to express special acknowledgments to Dr. Doug. K. Pearce who gave me professional, clear and heuristic guide on the construction of models and dissertation. I also thank for Dr. Howard Bondell for his suggestions on statistical problems and knowledge which are provided during his courses. Be grateful to Dr. Karlyn Mitchell for her patience and help. I would also thank all those professors, Dr. Thayor Morrill, Dr. Asli Leblebicioğlu, Dr. Michael Wohlgenant, Dr. Tom Gerig, Dr. Jason Osborn and Dr. Subhashis Ghoshal, who gave me theoretical and applied knowledge in Economics and Statistics. I also acknowledge information and suggestions support provided by Direct of Graduate Program, Dr. Tamah Morant.

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I. INTRODUCTION

Small business is an essential part of the US economy. In 2008 there were 29.6 million small businesses in the United States[1]. These businesses largely depend on commercial banks and other depository institutions for credit. Banks need to obtain hard and / or soft information on small firms to support their credit services. But this information may not be complete enough to eliminate the asymmetric information problems that face financial institutions. Banks solve these asymmetric information problems by collecting and analyzing data for setting loan contract elements such as interest rate premium, collateral or guarantees. It is reasonable that banks will get much information on the firms while providing financial services. However, in recent research (i.e. Berger and Udell 1989; Best and Zhang 1993; Frame, Srinivasan and Woosley 2001; Berger, Frame and Miller 2005), most financial institutions obtain 'hard-information', such as financial, owner, and governance characteristics of small businesses and construct credit scoring or rationing models. Most small businesses have less convincing 'hard-information' than big corporations. So small businesses face a difficult financial environment in which financial institutions, especially commercial banks, are reluctant to issue loans or lines of credit because of risk. On the other hand, banks may want to provide loans to those firms which have good credit records or long business relationships with one or more banks. This 'soft-information', such as the length of business relationships with banks may play an important role especially for those small firms seeking lines of credit.

[1] The Office of Advocacy defines a small business for research purposes as an independent business having fewer than 500 employees. And the 1987 and 2003 Survey of Small Business Finances use the same definition.

As a result, the bank-borrower relationships should be included in our analysis to test whether bank-borrower relationships influence loan rates.

Banking has become a more concentrated industry over the last twenty years. At the end of 1987, the number of commercial banks in United States was 13,531, but by the end of Quarter 3 of 2009 this number had dropped to 6,815. The financial environment changed rapidly during these twenty years not only for financial institutions but also for small businesses. Nevertheless, many small businesses still have characteristics such as short market experience and questionable credit record worthiness. An important question is whether relationships with banks can overcome these handicaps to obtain credit.

Several theoretical and empirical papers focus on the bank-borrower relationship and loan interest rate, such as Diamond(1984, 1991), Sharp(1990), Berger and Udell(1992, 1995, 2002), Petersen and Rajan(1993, 1994, 1995), Boot and Thakor(1994) and Degryse and Cayseele(2000). However, results differ across studies. Diamond(1989), Petersen and Rajan(1993), Boot and Thakor(1994) and Berger and Udell(1995), conclude that the longer the relationship, the lower the interest rate firms pay, and the less likely are collateral requirements. Petersen and Rajan(1994) find no significant association between bank-borrower relationship and loan interest rate. On the other hand, Greenbaum, Kanatas and Venezia(1989), Sharp(1990), and Wilson(1993) conclude that interest rates rise with length of relationship. Degryse and Cayseele (2000) reported similar results using European data.

This paper re-examines the role of relationships to see if the changed financial environment affects the results and whether more recent data support the assumption that small firms benefit from bank relationships.

My analysis uses data from the 2003 Survey of Small Business Finances (SSBF) on loan interest rates and collateral requirements under lines of credits (L/Cs) issued or renewed by commercial banks to small businesses, and tests whether banks use information obtained from bank-borrower relationships to adjust the loan rate and the loan contract. The basic model comes from Berger and Udell (1995) which used the 1987 SSBF data to analyze the relationship impact on small businesses loan rates and collateral requirements.

The paper is organized as follows. Part II discusses the previous theoretical and empirical analyses on relationship lending. Part III describes the database and variables used in the models. Part IV presents the econometric analysis of loan rate premiums and collateral requirements. Part V provides the conclusion.

II. THE RELATIONSHIP LENDING LITERATURE

A. Theoretical Analysis of Relationship Lending

Diamond (1984, 1991), Ramakrishnan and Thakor (1984) and Boyd and Prescott (1986) all suggest that financial intermediaries exist because they enjoy economics of scale and/or comparative advantages in the production of information about borrowers.[2] More specifically, Diamond (1989) emphasizes reputation acquisition, which is an element of soft-information, and concludes that as a borrower achieves a good reputation, the interest rate falls, and the present value of rents in the future from a good reputation rises. Ramakrishnan and Thakor (1984) indicate that intermediation is shown to improve welfare if informational asymmetries are present and the information generated to rectify these asymmetries is potentially unreliable build up a theoretical model to analyze whether banks become more like capital market underwriters and offer passive transaction loans or return to their roots as relationship-lending experts. Their results indicate that as interbank competition increases, banks make more relationship loans but each has lower added value for borrowers. And capital market competition reduces relationship lending while each relationship loan has greater added value for borrowers.

From the above theoretical studies, asymmetric information does affect interest rates on loans or welfare of financial intermediates. There are several ways that banks acquire

[2]Berger, Allen N. and Gregory F. Udell. "Relationship Lending and Lines of Credit in Small Firm Finance." The Journal of Business, Vol. 68, No. 3 (Jul., 1995): pp. 351-381.

information on borrowers from business relationships such as operation data and deposit accounts (Berlin and Mester 1999).

Some theoretical research has examined relationship lending and loan interest rates. Boot and Thakor (1994) demonstrated that even without learning or risk aversion the bank-borrower relationships are welfare enhancing. Another important result they found was that durable relationships made banks subsidize borrowers and, over time, collateral requirements were reduced in long-term contracting. Petersen and Rajan (1995) study the effect of credit market competition on lending relationships and conclude that young firms in concentrated markets receive more institutional finance than do similar firms in competitive markets. And financial institutions seem to smooth interest rates over the life cycle of firm in a concentrated market, charging a lower-than-competitive rate when the firm is young and higher-than-competitive rate when the firm is old.[3] Boot (1999) reviewed the literature on relationship lending and discussed the concept, the way of adding value, the cost and the empirical evidence on relationship lending. This literature provided a brief picture of the essence and importance of relationship lending. And it also shows controversial effects of relationships on loan rates.

Boot and Thakor (1994), Petersen and Rajan (1995) and some others, mentioned in Boot (1999), all got positive results for bank-borrower relationships and the loan interest rate (lower loan rates). However, other research found that the relationships between banks and borrowers have zero effects (loan rates do not change) or even negative influences on loan interest rates (higher loan rates). Theoretically, Sharp (1990) demonstrated that lenders

[3] Berger, Allen N. and Gregory F. Udell. "Relationship Lending and Lines of Credit in Small Firm Finance." The Journal of Business, Vol. 68, No. 3 (Jul., 1995): pp. 351-381.

subsidize borrowers in early periods and are reimbursed for this subsidy in later periods.[4] More evidences for negative effects of bank-borrower relationship on loan rates are provided in empirical analyse. (i.e. Petersen and Rajan 1994; Hernández-Cánovas and Martínez-Solano 2006; Ono and Uesugi 2009)

B. Empirical Analysis of Credit Scoring and Relationship Lending

a. Credit Scoring

Since the analysis of bank-borrower relationship and loan interest rate focuses on evaluating the credit worthiness of small businesses, credit analysis is another important resource and basis for establishing our models. According to the credit scoring research, finance, industry, governance characteristics etc. are used to compute a credit score. In our models we use those 'hard-information' variables to evaluate credit worthiness.

Orgler (1970) produced a credit scoring model for commercial loans using four financial measures: liquidity, profitability, leverage and activity[5]. Time series data on these variables and past loan performance in financial institutions allowed estimation of the model. This is the earliest credit scoring model for commercial loans and provides a good model for further research.

Based on Orgler's (1970) general credit scoring model for commercial loans, Frame, Srinivasan, and Woosley (2001) used the data from a phone survey by the Federal Reserve

[4] Berger, Allen N. and Gregory F. Udell. "Relationship Lending and Lines of Credit in Small Firm Finance." The Journal of Business, Vol. 68, No. 3 (Jul., 1995): pp. 351-381.

[5] Activities includes as sales / fixed assets; sales / net worth; sales / total assets; sales /inventory; sales / receivables.

Bank of Atlanta and tested whether the use of credit scoring by large banking organizations influences the level of small-business lending and whether there are particular characteristics of the credit-scoring programs that predict their effectiveness in enhancing credit availability. Using an instrumental variables approach, they concluded that credit scoring lowers information costs between borrowers and lenders, thereby reducing the value of traditional, local bank of relationships. Further, Berger, Frame, and Miller (2005) examined the small business credit scoring model and concluded that Small Business Credit Scoring (SBCS) system significantly changed lending behavior, especially on loans for firms with total assets lower than $100,000. They found that SBCS have important effects on the small business lending behavior of banks that adopt the technology and is also associated with higher loan risk.

b. Empirical Analysis of Relationship Lending

Some studies have specifically modeled the association among the bank-borrower relationship, loan interest rate and collateral. However, the empirical results yield no consensus.

Petersen and Rajan (1994) used 1987 SSBF data to analyze relationship lending for all types of loans for small business. They set the length of bank-borrower relationship as the measure of strength of relationship but found no statistically significant impact on loan rates. However, Berger and Udell (1995) had totally different results. They also used SSBF data but limited the analysis to firms with lines of credit from commercial banks. They also added length of bank-borrower relationship as the relationship measure and they found that the length of bank-borrower relationship does have a significantly and robustly negative

influence on the loan rate. They also tested the association between length of relationship and collateral and found that the length of relationship has significant effects on contract characteristics. That is, longer bank-borrower relationships reduce collateral requirements.

Lines of credit (L/C) are particularly important in relationship lending because they represent a forward commitment to provide working capital financing under prespecified terms.[6] James (1987), Lummer and McConnel (1989), Wansley, Elayan and Collins (1992) all built models for L/Cs and found positive abnormal returns accompanying announcements of firms who got L/Cs from banks.

Empirical analysis of relationship lending has also been done using different countries' data with different results. Elsas and Krahnen (1998) used credit-file data in Germany to test whether 'house banks' (have relationship with firms) have the same credit policy as 'normal banks' and found that, with respect to loan rates, there was no intra- or intertemporal difference. Hernández-Cánovas and Martínez-Solano (2006) estimated a regression model in which duration was the measure of bank-borrower relationships using Spanish data and they concluded that businesses with longer relationships with banks paid higher loan rates. Ono and Uesugi (2009) analyzed the collateral and personal guarantees in relationship lending for small businesses in Japan. They found that borrowers who have a long-term relationship with their main banks are more likely to pledge collateral but this result is not robust with respect to personal guarantees. Niskanen and Niskanen (2010) focused on the effect of managerial ownership on relationship lending for small businesses. They founded that agency costs involved with managerial ownership are taken into account by banks when issuing loans with

[6] Berger, Allen N. and Gregory F. Udell. "Relationship Lending and Lines of Credit in Small Firm Finance." The Journal of Business, Vol. 68, No. 3 (Jul., 1995): pp. 351-381.

increases in managerial ownership initially increasing interest rates and collateral requirements. All of them use the same basic framework as Berger and Udell (1995).

Some studies focused on other 'soft-information', such as the distance between firms and institutions and owner characteristics. Degryse and Ongena (2005) found that loan rates decrease with the distance between the firm and the lending bank and increase with the distance between the firm and competing banks. Jimenez and Saurine (2008) analyzed the relationship between the distance and collateral. They concluded that collateral is higher for loans issued by local financial institutions and that the influence of distance is much greater for big corporations. Moreover, banks use different technologies for different distance.

Some papers add dummy variables for minority status and gender of owners. Cavalluzzo, Cavalluzzo and Wolken (1998) and Blanchflower, Levine and Zimmerman (2003) all found that racial minorities and females face higher loan rates and more collateral requirements in small business loans. Blanchard, Zhao, and Yinger (2008) reported that black-owned and Hispanic-owned firms face discrimination in interest rates when they apply for loans from financial institutions. However, none of them combine these owner characteristic with length of relationships.

C. Replication of Berger and Udell (1995)

This paper is mainly based on Berger and Udell (1995). Before estimating the models on the 2003 data I present my attempt to replicate the Berger and Udell (1995) results for 1987 and discuss problems in replication.

a. Data Selection. [7]

The model uses those small firms which have lines of credit from commercial banks and I get 874 observations where 434 of the firms have total assets over $500,000 and 440 less than $500,000. For the firms with floating rates that report the premium over the prime rate for their most recent loan, we finally have 370 observations, 214 and 156 firms with total assets above / below $500,000 respectively. The number of observations is not exactly the same as Berger and Udell (1995) who reported using 371 observations.

b. Variable Means.

The descriptive statistics for my sample are similar to those of Berger and Udell (1995). The definitions of variables are provided in Table 3. Two kinds of problems occurred, however. One is the method to calculate the current ratio, quick ratio, accounts receivable turnover in days, inventory turnover in days and accounts payable turnover in days. Another problem is the treatment of missing values for calculating those variables. I calculate those financial characteristic variables using the definitions from Ross (2009) which is the most common approach. For missing values the problem becomes complicated. When calculating the current ratio and quick ratio, we use current liabilities as the denominator and current assets as the numerator. There are firms where current assets are zero or missing which makes the current ratio or quick ratio zero or where current liabilities are zero or missing, which leads to more missing values for the current ratio and quick ratio. I can set the ratios to zero if the numerator is zero but cannot correct the problem of missing current assets or missing or zero on current liabilities. The basic problem seems to be that Berger and Udell (1995) keep

[7] See Table 3 for definitions of variables.

observations with zero or missing current liabilities. Table 1 shows my replication of variable means. The differences appear on CURRAT, QUICKRAT, ARTURN, INVTURN and APTURN.

Table 1. Variable Means (Replication)

Variables	All Firms		Total Assets above $500,000		Total Assets below $500,000	
	Berger & Udell (1995)	Replication	Berger & Udell (1995)	Replication	Berger & Udell (1995)	Replication
PREM*	1.49	1.4653	1.32	1.3436	1.73	1.6322
COLLAT	0.53	0.6007	0.59	0.6429	0.47	0.5591
ARINV	0.36	0.4680	0.46	0.5530	0.25	0.3841
OTHERSEC	0.18	0.1327	0.14	0.1129	0.22	0.1750
GUAR	0.41	0.2494	0.46	0.2995	0.35	0.2000
COMPBAL	0.07	0.0584	0.09	0.0668	0.05	0.0500
LEV	0.60	0.5895	0.60	0.5948	0.59	0.5843
PROFMARG	0.12	0.0799	0.08	0.0548	0.16	0.1051
CURRAT	3.51	5.0798	2.90	3.5209	4.13	6.6126
QUICKRAT	2.52	2.8712	1.85	1.9760	3.20	3.7513
ARTURN	34.11	38.5877	42.14	49.4994	25.87	27.8249
INVTURN	103.30	83.3676	103.98	87.3327	102.62	78. 2372
APTURN	91.90	57.9694	95.53	83.3707	88.18	25.0060
TA	2331.66	2217.0900	4442.95	4292.0600	165.84	170.4259
CORP	0.55	0.5458	0.7	0.6935	0.38	0.4000
SUBS	0.16	0.1613	0.2	0.2120	0.13	0.1114
PART	0.07	0.0698	0.05	0.0553	0.08	0.0841
PROP	0.22	0.2231	0.04	0.0392	0.41	0.4045
OWNMG	0.89	0.8844	0.85	0.8548	0.92	0.9136
CONC50	0.80	0.7895	0.73	0.7304	0.86	0.8477
CONSTR	0.14	0.1418	0.13	0.1382	0.15	0.1455
SERVICES	0.16	0.2117	0.10	0.1336	0.22	0.2886
RETAIL	0.23	0.2265	0.19	0.1843	0.27	0.2682
OTHERIND	0.47	0.4199	0.57	0.5437	0.36	0.2977
AGE	14.10	13.6007	16.49	16.0806	11.66	11.1545
RELATE	11.39	11.5432	12.67	12.9437	10.08	10.2519
Number of observations	863	874	437	434	426	440
Number of PREM available	371	370	219	214	152	156

* I set CURRAT and QUICKRAT as zero when missing or zero current assets or liabilities occur.

c. Regression Results.

Table 2 shows the replication of the OLS and Logistic regression models for the premium over the prime rate and collateral respectively. The 2003 SSBF data is also used to refit the model for comparison.

Column 1 indicates the results of my replication of the OLS regression for the premium over the prime rate. There are several differences compared with Berger and Udell (1995). Both LNAGE and LNRELATE are not statistically significant although they have the same signs as Berger and Udell (1995) reports. OTHERSEC, GUAR, PTOFMARG, INVTURN and RETAIL have opposite signs compared with Berger and Udell (1995). Column 2 shows my replication of the Logistic model for the probability of collateral requirements. LNAGE and LNRELATE have negative signs and LNRELATE is significant. But PROFMARG, QUICKRAT, APTURN, CORP, SUBS, PART and CONSTR have different signs compared with Berger and Udell (1995).

Columns 3 and 4 indicate the estimations of both models using the 2003 SSBF data. In the OLS regression, neither LNAGE nor LNRELATE have significant results though they have negative signs given everything else in the model. In the Logistic regression, LNRELATE appears significantly negative as for the 1987 data, which means that longer bank-borrower relationships will lower the probability of collateral. But LNAGE changes to positive. And more variables (i.e. ARINV, COMPBAL, LEV, CURRAT, QUICKRAT, APTURN, SERVICES, RETAIL and etc.) have different signs compared with Berger and Udell (1995).

Table 2. OLS and Logistic Regression (Replication and Comparison)

	OLS Regression for PREM 1987 Coefficients		Logistic Regression for COLLAT 1987 Coefficients		OLS Regression for PREM 2003		Logistic Regression for COLLAT 2003	
Variables	**Berger and Udell (1995)**	**Replication**	**Berger and Udell (1995)**	**Replication**	**Coefficient**	**t-statistic**	**Coefficient**	**χ^2-statistic**
INTERCEPT	2.5928*	2.0064*	-2.6619*	-0.8669	2.9320	5.73*	-1.5887	3.8615
ARINV	0.1330	0.1399			-0.0936	-0.64		
OTHERSEC	-0.2440	0.2468			-0.2808	-1.44		
GUAR	0.0449	-0.0236			0.0051	0.04		
COMPBAL	-0.0979	-0.0867			0.1439	0.65		
LEV	0.1766	0.2682	1.0487*	1.9993*	-0.0006	-0.45	-0.0044	2.8958
PROFMARG	0.3220	-0.4654	-0.0437	1.9348*	-0.2534	-0.78	0.3421	0.4148
CURRAT	0.0057	0.0185	0.0840	0.0001	-0.0255	-5.17*	-0.0301	2.5809
QUICKRAT	-0.0504	-0.0339	-0.0826	0.0212	0.0379	5.35	0.0242	1.4968
ARTURN	0.0029	-0.0005	0.0032	0.0008	0.0012	0.73	-0.0035	1.6705
INVTURN	0.0005	0.0002	-0.0000	-0.0009	0.0024	2.49	0.0009	0.2760
APTURN	-0.0003	-0.0003	-0.0009	0.0039	0.00003	0.03	0.0010	0.3916
LNTA	-0.0457	-0.0943	0.2065*	0.1851*	-0.2146	-5.30*	0.3480	27.4795*
CORP	-0.6496*	-0.4650	0.0648	-0.0684	0.1363	0.44	-0.2717	0.2963
SUBS	-0.5389	-0.3732	0.0292	-0.3335	-0.1063	-0.36	-0.7520	2.3924
PART	-0.2051	-0.4265	0.3661	0.3829	-0.0184	-0.05	-0.4791	0.6389
OWNMG	0.3218	0.4394	0.3426	0.5340	0.1848	0.40	0.4172	2.0093
CONC50	0.1972	0.0021	0.0015	0.0290	0.3086	2.07	-0.2159	0.8163
CONSTR	0.2799	0.2472	-0.2213	-0.2788	-0.0211	-0.10	0.1801	0.3000
SERVICES	0.2629	0.1774	0.1954	-1.1602	-0.1131	-0.68	0.0459	0.0296
RETAIL	0.1014	-0.2338	-0.0295	-0.4236	-0.0143	-0.07	-0.2171	0.4936
LNAGE	-0.1280	-0.0121	-0.1942	-0.1733	-0.0912	-0.90	0.1091	0.4556
LNRELATE	-0.1981*	-0.0797	-0.2635*	-0.3924*	-0.1095	-1.49	-0.3047	6.5248*
R^2	0.089	0.1059			0.1892			
Number of Observation	371	370	863	874	597		896	
Diagnostics:-2logL			1099.024	563.292			568.351	
DF			18	18			18	

*Statistically significant at 5% level, two tailed.

My replication results indicate that LNAGE and LNRELATE do not have significant effects on the premium over the prime rate and LNRELATE has significantly negatively effects on the probability of collateral requirements when other variables are in the model.

The differences of replications of 1987 models may be caused by the method of implicating missing values. Although the 2003 data have the same results for RELATE, there are more differences that need to be considered. The reasons for these differences may come from the concentration of banks, the increased use of credit scoring systems and discrimination. So in my model, I would like to add some variables, such as Dun and Bradstreet (D&B) credit scores, minority status and gender, to test whether bank-borrower relationships affect loan rates and collateral requirements.

III. DATA AND VARIABLES DESCRIPTIONS

In this part, my analysis uses data from the 2003 Survey of Small Business Finances (SSBF) sponsored by the Board of Governors of the Federal Reserve System. The 2003 SSBF contains information on 4,240 small businesses that had fewer than 500 employees and were in operation during the interview period. The data are collected by interviewing and are divided into several sections: Firm and Owner Characteristics, Financial Services Inventory, Most Recent Loans Characteristics, Institution Characteristics, Trade Credits, Capital Injections and Financial Statements. In part II I discussed several problems in replicating the Berger and Udell (1995) results. As I mentioned, the problems may come from the imputation method for missing values. The 2003 SSBF data have five implicates for missing values and I use the first type for simplification[8]. I restricted the model to firms where the most recent loan is a floating rate, line of credit (L/C) loan from a commercial bank[9], following Berger and Udell (1995). The respondents represent a stratified random sample but the firms are not selected randomly in the survey. So we will provide both weighted and unweighted results.

Included firms satisfy these requirements: has L/C, most recent loan is a new L/C or L/C renewal, lender is a commercial bank and interest rate floats. After selection there are 896

[8] The survey actually uses one method to construct the regression estimates for missing values by randomly choosing other observations. And this regression is run five times. So the missing values, which are a small part of observations, are slightly different each time. We also run the regression for other four imputations. And the results do not have significant differences.

[9] We include both new and L/Cs renewal. Renewal L/Cs should also reflect the bank-borrower relationship influences. If L/C renewals are excluded, we only have 229 observations which is too small for our statistical analysis.

firms. Our analysis also splits the sample by total assets since the firms with total assets over $500,000 may have significant differences compared with smaller firms. There are 584 firms with total assets exceeding $500,000.

Table 3 gives the definitions of the variables I use. The variables are classified into five categories: *Contract Characteristics* for the most recent loan under L/C, *Financial Characteristics, Governance Characteristics, Industry Characteristics* and *Relationship Characteristics.*

Table 3. Variable Description

Variable names are from the 2003 SSBF

Variable Names	**Description**
Contract characteristics	
PREM	Premium over the prime rate { PREM= MRL19}
COLLAT	= 1 if loan is secured; = 0 otherwise { COLLAT=1 if MRL13=1; COLLAT = 0 otherwise }
ARINV	= 1 if loan is secured by accounts receivable or inventory; = 0 otherwise { ARINV = 1 if MRL13_1T1 = 1; ARINV = 0 otherwise }
OTHERSEC	= 1 if loan is secured by other than accounts receivable or inventory; = 0 otherwise { OTHERSEC = COLLAT - ARINV}
GUAR	= 1 if the loan is guaranteed; = 0 otherwise { GUAR = 1 if MRL12 = 1; GUAR = 0 if MRL12 = 2}
COMPBAL	= 1 if loan requires compensating balance; = 0 otherwise { COMPBAL = 1 if MRL11 = 1; COMPBAL = 0 if MRL11 = 2}
Financial Characteristics	
LEV	Leverage = Total debt / Total assets { LEV = S8 / R12}
PROFMARG	Profit Margin = Profit / Sales { PROFMARG = PROFIT / P2}
CURRAT	Current ratio = Current assets / Current liabilities { CURRAT = (R1+R2+R3+R4) / (S2+S3) }
QUICKRAT	Quick Ratio = (Current assets – Inventory) / Current liabilities { QUICKRAT = (R1+R2+R4) / (S2+S3) }
ARTURN	Accounts receivable turnover in days = Accounts receivable / (sales / 365) { ARTURN = R2 / (P2 / 365) }
INVTURN	Inventory receivable turnover in days = Inventory / (cost of goods sold / 365) { INVTURN = R3 / (P5 / 365) }
APTURN	Accounts payable turnover in days = Accounts payable / (cost of goods sold / 365) { APTURN = S2 / (P5 / 365) }[#]
TA	Total assets in thousands of dollars { TA = R12 / 1000 }
DBHIGH	=1 if D&B credit score is in high risk level; =0 otherwise { DBHIGH=1 if A0_DB_CREDRK=1,2; =0 otherwise}
DBMED	=1 if D&B credit score is in medium risk level; =0 otherwise { DBHIGH=1 if A0_DB_CREDRK=3,4; =0 otherwise}
DBLOW	=1 if D&B credit score is in low risk level; =0 otherwise { DBHIGH=1 if A0_DB_CREDRK=5,6; =0 otherwise}

Table 3. Variable Description (continued)

Variable Names	Description
Governance characteristics	
CORP	= 1 if firm is a non-Subchapter S corporation; = 0 otherwise { CORP = 1 if B3 = 6,7,8,9; CORP = 0 otherwise }
SUBS	= 1 if firm is a Subchapter S corporation; = 0 otherwise { SUBS = 1 if B3 = 5; SUBS = 0 otherwise }
PART	= 1 if firm is a partnership; = 0 otherwise { PART = 1 if B3 = 2,3,4; PART = 0 otherwise }
PROP	= 1 if firm in a proprietorship; = 0 otherwise { PROP = 1 if B3 = 1; = 0 otherwise }
OWNMG	= 1 if firm is owner managed; = 0 otherwise { OWNMG = 1 if CF_MANAGE = 1; OWNMG = 1 otherwise }
CONC50	= 1 if at least 50% ownership is in one family; = 0 otherwise { CONC50 = 1 if CF_FAMILY = 1; CONC50 = 0 otherwise }
MINOR	= 1 if at least 50% owners are in minority; = 0 otherwise { MINOR = 1 if CF_MINOR $>$ 50; MINOR = 0 otherwise }
FEMALE	= 1 if at least 50% owners are female; = 0 otherwise { MINOR = 1 if CF_FEMALE $>$ 50; MINOR = 0 otherwise }
Industry Characteristics	
CONSTR	= 1 if firm is in construction industry; = 0 otherwise { CONSTR = 1 if 15 $\leq$ A0_SIC2_FIN $\leq$ 19; CONSTR = 0 otherwise }
SERVICES	= 1 if firm is in services industry; = 0 otherwise { SERVICES=1 if 70$\leq$A0_SIC2_FIN$\leq$89; SERVICES=0 otherwise }
RETAIL	= 1 if firm is in retail industry; = 0 otherwise { RETAIL = 1 if 52 $\leq$ A0_SIC2_FIN $\leq$ 59; RETAIL = 0 otherwise }
OTHERIND	= 1 if firm is in other industry; = 0 otherwise { OTHERING = 1 if CONSTR = 0 AND SERVICES = 0 AND RETAIL = 0; OTHERING = 0 otherwise }
Relationship characteristics	
AGE*	Number of years current owners have owned the firm { AGE = CF_FAGE }
RELATE*	Length of relationship with current lender in years { RELATE = MRL8 / 12 }

Purchase per day is replaced by cost of goods sold per day because of data availability. Same definition as Berger and Udell (1995) and Chakravarty and Yilmazer (2009)

* A maximum limit of 30 years was applied on AGE and RELATE.

First, look at the *Contract Characteristics*. PREM is the premium over or under the prime rate on the most recent loans drawn under L/Cs. PREM is the dependent variable for our first regression model. COLLAT describes whether the loan is secured by collateral or not. Further, ARINV expresses if the loan is secured by accounts receivable and/or inventory and OTHERSEC indicates other types of collateral, which are business equipment or vehicles, securities or deposits, real estate or personal assets. Accounts receivable and/or inventory is viewed as the most risky collateral. Banks can obtain information from accounts receivable

and/or inventory during financing services. So COLLAT and ARINV will be the dependent variables in our Logistic models. Our expectation is that longer bank-borrower relationships will reduce the loan rate and lessen the need of collateral.

GUAR indicates whether the loan requires a personal guarantee, cosigner or other guarantor and COMPBAL indicates a required compensating balance in a checking or saving account.

Secondly *Financial Characteristics* are financial 'hard-information', including the leverage ratio (LEV), current ratio (CURRAT), quick ratio (QUICKRAT), accounts receivable turnover in days (ARTURN), inventory turnover in days (INVTURN), accounts payable turnover in days (APTURN) and total assets (TA). Financial ratios are measures of the overall financial condition of a firm. These measures are observable and can be used to evaluate debt paying ability. Therefore, in my models, these variables will be helpful to determine the loan rate and whether collateral is pledged.

Since those financial variables do not contain all the credit information relevant to small business, D&B credit scores are added to the model in three levels. DBHIGH stands for the firms which have highest risk level while DBLOW represents the firms which have lowest risk level. And DBMED reports the rest firms which have medium level of credit risk. These variables may capture firms' credit status in a more complete way. Moreover, since more banks use credit scoring systems to evaluate a firm's credit abilities, I want to test whether bank-borrower relationship matters when these scores are included.

The *Governance Characteristics* contains the legal form of the firms, CORP, SUBS, PART and PROP, and owner characteristics, OWNMG, CONC50, MINOR AND FEMALE.

CORP stands for non-Subchapter S corporation, SUBS stands for Subchapter Corporation, PART stands for partnership and PROP stands for sole proprietorship. For owner characteristics, OWNMG indicates whether the firm is managed by the owner. CONC50 describes whether a single family owns at least 50% of the firm. MINOR indicates whether the owner belongs to a racial minority and FEMALE tells whether the owner is a female. These variables are included since different ownership characteristics may contain information about risk worthiness level, credit ability and debt paying ability. For MINOR and FEMALE, the discriminatory elements, as Cavalluzzo, Cavalluzzo and Wolken (1998) and Blanchflower, Levine and Zimmerman (2003) reported, these owner characteristics may influence loan rates and collateral requirements.

The *Industry Characteristics* are included as category variables which describe whether the firm is in construction (CONSTR), services (SERVICES), retail (RETAIL) or other (OTHERIND) industries. The OTHERIND includes mining, manufacturing, transportation/public utilities, wholesale trade, FIRE (finance, insurance and real estate), public administration and other unclassified industries. Different industries may have different credit cycles and debt paying abilities.

Relationship Characteristics include two important variables: AGE and RELATE. AGE indicates the number of years that the current owners have owned the business. If the current owner is the founder, then AGE is the actual age of the firm. If the firm was purchased or acquired, then AGE is the number of years under the current owner. RELATE, is the number of years that the firm conducted business with the bank that granted the most recent loan and describes the length of the bank-borrower relationship. Both AGE and RELATE are included

because AGE represents the public prestige in the finance market or even in the debt market but RELATE represents the private bank-borrower relationship. And this 'soft-information' may contain personal reputation and social relationships. So our test of the bank-borrower relationship will focus on AGE and RELATE. Further, we want to know whether the bank-borrower relationship still affects loans when the D&B credit scores have been included. Including only RELATE is not enough. The correlation between AGE and RELATE is high as expected. As Berger and Udell (1995) mentioned, both of them need to be in the model since AGE is a control variable to avoid bias. Instead of using AGE and RELATE directly, I follow Berger and Udell (1995) and use natural logarithms of 1 + AGE (LNAGE) and 1 + RELATE (LNRELATE) because the marginal effect of the fifth year of AGE or RELATE is likely to be more important than the fifteenth or twenty-fifth. For robustness tests, we will run the regression with AGE and RELATE in levels and squared.

Table 4 provides the mean of each variable for the entire sample which has the most recent loan under lines of credit from commercial banks. (Column 1) And we also split the observations by TA above or below $500,000. (Column 2 and 3)

These means reveal some important information. For the entire sample, the premium over the prime rate is positive which means that usually the loan rate is higher than the prime. Almost half of the loans are secured (47.50%) and half of these are secured by accounts receivable and/or inventory (21.34%). Only 6.57% of all L/Cs require compensating balances. Over half of the loans are guaranteed (60.88%). For the D&B credit scoring, more firms are evaluated as medium level (44.84%). For the ownership, 91.20% of the firms are owner managed with a single family owning most of the firms (82.88%). And only 5% of owners

are minorities. Female owners are only 13.88%. The model firm is a Subchapter S corporation (42.98%).

Table 4. Variable Means[#] (Weighted)

Variables	All Firms	Total Assets above $500,000	Total Assets below $500,000
PREM[*]	1.5029	1.2366	1.6666
COLLAT	0.4750	0.5412	0.4329
ARINV	0.2134	0.3116	0.1507
OTHERSEC	0.2617	0.2296	0.2821
GUAR	0.6088	0.6772	0.5651
COMPBAL	0.0657	0.0681	0.0642
LEV	9.9269	18.5894	3.4554
PROFMARG	0.1178	0.1352	0.1066
CURRAT	28.5419	27.2498	29.5830
QUICKRAT	24.0509	20.8654	26.6179
ARTURN	32.2906	47.9678	22.2903
INVTURN	44.7815	66.9105	30.6773
APTURN	25.4127	41.4033	15.2208
TA	1643.3600	3969.4700	160.7730
DBHIGH	0.2053	0.1847	0.2185
DBMED	0.4484	0.4421	0.4525
DMLOW	0.3385	0.3666	0.3206
CORP	0.2422	0.3569	0.1691
SUBS	0.4298	0.4230	0.4341
PART	0.0799	0.0612	0.0919
PROP	0.2480	0.1589	0.3049
OWNMG	0.9120	0.8424	0.9564
CONC50	0.8288	0.7869	0.8555
MINOR	0.0443	0.0353	0.0501
FEMALE	0.1262	0.1064	0.1388
CONSTR	0.1322	0.1699	0.1082
SERVICES	0.3532	0.2146	0.4415
RETAIL	0.1728	0.1714	0.1737
OTHERIND	0.3418	0.4442	0.2765
AGE	15.4300	16.7624	14.5807
RELATE	9.5367	11.0675	8.5610
Number of observations	896	584	312

[#] Unweighted means will be provided in appendix.

We use two-sample proportion T-test to check whether variable means in from groups in column 2 and column 3 have statistically significant differences. PREM, LEV, APTURN, TA, AGE and RELATE do have significant differences in means.

[*] PREM (needs additional requirements as floating rate and under prime rate index) is available for 597, 383 and 214 observations.

Looking at the firms with total assets above or below $500,000, we find that smaller firms tend to have a higher PREM and are more likely required to have collateral. In *Financial Characteristics*, smaller firms have smaller leverage ratios, smaller pre-tax profit margins and lower liquidity ratios. In *Governance Characteristics*, 95.64% of the firms which have total assets below $500,000 are owner managed with a single family (85.55%) and more owners are female (13.88%). Moreover, firms with assets over $500,000 are approximately two years older and the length of bank-borrower relationship is three years longer. Since these means differs, as we mentioned before, model results may be different. So the regressions will be separated into such two groups.

IV. MODELS AND RESULTS

I estimate two types of models: OLS regressions for PREM and logistic regressions for the probability of COLLAT and ARINV. I then test:

i. Whether banks obtain information on a borrower during the bank-borrower relationship that affects the loan rate and collateral requirements when a credit scoring system is used.

ii. Whether banks discriminate with respect to the loan rate and collateral requirements against the firms whose owners are females or minorities.

The refinement of *Contract Characteristics* to length of relationship and discrimination terms is as follows. For a given firm, the premium over the prime rate and the collateral requirements may be changed as the bank-borrower relationship lengthens. But the direction is unclear. Banks gain more information from 'hard-information' such as the D&B credit scoring system and during the relationships, and may find out that the firms are less creditworthy borrowers. Then PREM and COLLAT will rise or the loan may be denied. Alternatively, banks may learn that firms are low risk borrowers during the bank-borrower relationship and then PREM and COLLAT will decline. Banks may charge different loan rates and collateral requirements for those firms whose owners are females or minorities. In order to test these hypotheses two sets of models are estimated below. One is an OLS regression model for estimating PREM and the other is a Logistic Regression for estimating the probability of COLLAT.

A. Loan Rate Regression Model

My empirical analysis will first examine PREM. In this model PREM, the premium over the prime rate, is regressed on contract, finance, governance, industry and relationship characteristics. This model will provide an opportunity to test whether the length of bank-borrower relationships influence the PREM for commercial bank L/Cs.

My sample comes from the 2003 SSBF data which have both borrowers' and lenders' information on the most recent loan. I choose those firms that have the most recent loans under L/Cs at a floating rate tied to banks' prime rate. All of these loans are approved by commercial banks.

Table 5 gives the regression results of PREM for the entire sample. Column 1 indicates the whole model with all variables. Column 2 includes all the variables in column 1 except for *Contract Characteristics* while Column 3 only includes *Contract Characteristics.* Several variables are statistically significant at the two-tailed 5% level. The interpretation of the borrower and relationship characteristics reflect their effects on PREM except for their effects on the *Contract Characteristics*.[10] I also check whether the regression results have significant differences between two kinds of firms. An additional OLS regression is designed on PREM with original 26 variables (X), a dummy variable for firm size categories (D) and

[10] As Berger and Udell (1995), *Contract Characteristics* are endogenous from borrower and relationship characteristics. So a bias estimation would occur. So, as in Berger and Udell (1995), we assume a recursive model structure. We assume that firm and relationship characteristics explain *Contract Characteristics* up to random errors that are not significantly correlated with errors coming from PREM. Our results show that (1) coefficients of contract terms in column 1 are not significantly different from zero and (2) their inclusion has no effects on other coefficients. Therefore, no bias occurs.

interactions of original variables and the dummy (XD). My test shows that the results for two kinds of firms are significantly different.[11]

Table 5. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—All Firms Sizes[#]

OLS Regression for PREM--Weighted

	Including All Variables		Excluding Contract Terms		Contract Terms only	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	3.5630	7.39*	3.3562	7.12	1.7543	12.81*
ARINV	-0.0682	-0.43			-0.2560	-1.72
OTHERSEC	-0.0175	-0.10			-0.0544	-0.31
GUAR	-0.2790	-1.93			-0.2277	-1.54
COMPBAL	-0.2438	-1.07			-0.0604	-0.25
LEV	0.0003	0.19	0.0003	0.23		
PROFMARG	-0.4053	-1.37	-0.3586	-1.23		
CURRAT	-0.0100	-1.95	-0.0099	-1.93		
QUICKRAT	0.0148	2.00*	0.0148	2.00*		
ARTURN	0.0011	0.68	0.0015	0.95		
INVTURN	0.0019	2.08*	0.0019	2.14*		
APTURN	0.0002	0.28	0.00005	0.07		
DBHIGH	0.5505	3.31*	0.5403	3.27*		
DBLOW	0.0375	0.25	0.0828	0.56		
LNTA	-0.2355	-5.82*	-0.2399	-6.28*		
CORP	0.3597	1.58	0.3226	1.43		
SUBS	0.0590	0.28	0.0384	0.19		
PART	-0.3410	-1.21	-0.3614	-1.29		
OWNMG	0.1189	0.52	0.0897	0.40		
CONC50	0.0188	0.11	0.0338	0.21		
MINOR	0.4707	1.68	0.4558	1.62		
FEMALE	-0.3390	-1.51	-0.3503	-1.56		
CONSTR	-0.1903	-0.93	-0.2313	-1.14		
SERVICES	-0.2332	-1.44	-0.2387	-1.48		
RETAIL	-0.2990	-1.70	-0.3035	-1.74		
LNAGE	-0.1968	-2.04*	-0.1974	-2.05*		
LNRELATE	-0.0871	-1.19	-0.0853	-1.16		
R^2_{adj}	0.1392		0.1356		0.0042	

[#] Number of observations=597. Unweighted results will be provided in appendix.

* Statistically significant at the 5% level two-tailed.

I estimated the three models in table 3 because I want to compare my results to those of Berger and Udell (1995) who report these three regressions for the 1987 data. The other

[11] In matrix form, I run the model as $Y= \alpha_0+\alpha_1X+\alpha_2D+\alpha_3XD$. Then I do the Global F-test with hypothesis: $\alpha_2=0$ and $\alpha_3=0$. The P-value is less than 0.0001 which means that the regression results are significantly different.

reason is that variable means of firms that have total assets above or below $500,000 have statistically significant differences. Then the effects of relationships may differ.

The primary variables of interest are DBHIGH, MINOR, FEMALE, LNAGE and LNRELATE. From column 1 of table 3, DBHIGH, the D&B credit category for high risk firms, has a positive and significant coefficient. But DBLOW does not. This means that banks use the D&B credit scoring system, at least for high risk levels, as important information to decide loan rates. The most important results are for LNAGE and LNRELATE. LNAGE is statistically significant in columns 1 and 2 with negative signs but LNRELATE is not significant given other variables in the model. Combined with D&B credit scores, this result means that banks not only used credit scores but also a firm's age while setting loan rates. But the bank-borrower relationship does not affect PREM. As mentioned before, AGE can be considered as a representative of public market reputation. These results are different with Berger and Udell (1995) who found that AGE and RELATE significantly lowered PREM.

Now let's go back to column 3 of table 2 which shows the model without D&B credit scores categories, MINOR and FEMALE. I note that without DBHIGH and DBLOW, LNAGE and LNRELATE still have no significant effects on loan rates. And the same results come out from weighted estimations. I also remove MINOR and FEMALE respectively and refit the models for PREM. LNAGE and LNRELATE both have insignificant effects. This means that banks put more weight on D&B credit score categories when deciding loan rates, results similar to those of Frame, Srinivasan, and Woosley (2001).

We also want to know whether the magnitude of DBHIGH, AGE and RELATE have economically significant influences on PREM. The coefficient of DBHIGH is 0.5505 which means that PREM will be higher by 55 basis points for firms in the high risk category compared to firms in the medium risk category. The coefficient of LNAGE is -0.1968 so that, all else equal, a small firm with additional 10 years of experience, that is 11 years versus 1 year, pays 47 basis points[12] less on its L/C loan. If a firm has a high risk D&B credit scoring and has 11 years public market experience, it can expect to pay 8 basis points less for its L/C loan. Since RELATE is not statistically significant, we cannot add it into our analysis.

In order to determine whether these changes in PREM are economically important, we draw lessons from Berger and Udell (1995). The sample distribution of PREM shows that it is divisible by 25 basis points (i.e. 1.00%, 1.25%, 1.5%, etc.) and 25.46% of loan rates are on 100 basis points (2.00%). This indicates that banks group their borrowers into pricing pools on the basis of 'hard' and 'soft' information by 25-basis-point intervals. So either DBHIGH or AGE will cause big and important changes in PREM economically.

To check robustness, we use quadratic functional forms for AGE and RELATE and their natural logarithm. In second order we use AGE^2, $RELATE^2$ and AGE × RELAGE[13] for levels and 1/2 $(LNAGE)^2$, 1/2 $(LNRELATE)^2$ and LNAGE × LNRELATE for logs. However, we do not find any statistically significant results for AGE and RELATE. In summary, there are only a few robust results on AGE and banks appear to put more weight on the credit information. The change of financial environment and concentration of banks

[12] 47 basis points≈100×0.1968×(ln11-ln1)

[13] When this interaction is added into the model, the coefficient of RELATE will be influenced by AGE. In this situation we can capture the change of PREM caused by RELATE. For example, when a firm has a long age, then we can test whether the increase of RELATE matters for the loan rate.

appears to have pushed borrowers towards credit scoring systems, which has lower costs than gaining information from bank-borrower relationships, and length of public market experience.

Both MINOR and FEMALE are not significant in the weighted model. However, in the unweighted estimates[14], MINOR is statistically significant with a positive sign. Unlike prior research, our result is not robust since our sample is selected non-randomly and we cannot reject the hypothesis of no association when accounting for sample weights.

There is a puzzle with respect to CURRAT and QUICKRAT. It is obvious that they are highly correlated but they have opposite signs when both of them are in the model and are statistically significant. If I remove either of them the remaining variable has a positive sign but is not significant. This problem needs to be studied further. [15]

Now, let's talk about column 3 of table 5. In this column, we test the relationship between collateral and loan risk. The results in column 3 show negative coefficients on both types of collateral which illustrate lower loan rates for secured loans. However, none of the coefficients are statistically significant either individually or jointly. So the regression results suggest that secured loans may be less risky than unsecured loans but the relationship is not that robust and strong and we do not have enough statistical power to reject the hypothesis of no association. This conclusion is opposite to that of Berger and Udell (1995) although they also had non-significant tests. On the other hand, banks may ask for collateral for riskier loans. Because of asymmetric information, banks cannot obtain complete information from

[14] See table 11 in appendix.

[15] Since the coefficients of CURRAT and QUICKRAT are close and we may think that they cancel each other's effects on PREM. When I remove one of them, the left variable has expected sign though it is not significant. This may mean that CURRAT or QUICKRAT do not have statistically influences on PREM given other variables in the model.

financial services, credit scoring systems and bank-borrower relationships. In this situation, collateral may be a representation of a high risk borrower. That is the higher risk the borrower is the more collateral requirements maybe asked for.

The low R^2s and the insignificance of many of them dependent variables indicate that the Berger and Udell (1995) model captures little of the variation in loan rates. One possible reason is that the firm characteristics are mainly used to decide whether the firm gets the loan and that only a fewer factors influence the loan rate.

Table 6 and table 7 report OLS regressions for firms with total assets above and below $500,000 respectively. Table 6 shows the results of OLS regression on PREM for the firms with total assets above $500,000. Other than the models in table 5, AGE does not have significant results in these models. But the DBHIGH is still as significant as before. Another important result is that for the firms with total assets over $500,000, MINOR is important in setting the loan rate and minority owners pay higher loan rates by about 94 basis points. As we mentioned about the distribution of PREM before, this magnitude is economically significant. *Contract Characteristics* have similar coefficients as for the entire sample (in table 5), with secured loans have lower loan rates for the full model.

Table 7 illustrates the regression results for firms with total assets below $500,000. In contrast to the results for firms that have total assets above $500,000, results for smaller firms are similar to those for the whole sample. DBHIGH and AGE are statistically significant. Since the coefficients are 0.7505 and -0.537, PREM will be changed by about 75 basis points and 129 basis points (a 10 year difference in AGE). Combined DBHIGH and AGE, PREM will decline by about 54 basis points. This will also be economically significant.

In addition to this, CORP is significant for the smaller firms for the full model indicates that a firm with total assets below $500,000 as a non-Subchapter S corporation will pay a higher PREM by about 116 basis points. For small firms, the limited liability may make them riskier.

Table 6. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—Total Assets over $500,000[#]

OLS Regression for PREM—Weighted

	Including All Variables		Excluding Contract Terms		Contract Terms only	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	2.5510	4.46*	2.3704	4.36*	1.1735	8.19*
ARINV	-0.3358	-2. 45*			-0.0738	-0.57
OTHERSEC	-0.0314	-0.15			-0.0273	-0.14
GUAR	-0.0259	-0.18			-0.0786	-0.55
COMPBAL	-0.0741	-0.30			-0.1317	-0.58
LEV	-0.00002	-0.02	0.0002	0.24		
PROFMARG	-0.2467	-0.80	-0.2961	-0.97		
CURRAT	-0.0204	-3.35*	-0.0186	-3.08*		
QUICKRAT	0.0299	3.33*	0.0273	3.07*		
ARTURN	-0.0033	-1.86	-0.0031	-1.81		
INVTURN	0.0021	3.13*	0.0021	3.10*		
APTURN	0.0019	2.48*	0.0019	2.56*		
DBHIGH	0.5397	2.92*	0.4785	2.65*		
DBLOW	-0.0861	-0.58	-0.0080	-0.06		
LNTA	-0.1644	-2.83*	-0.1769	-3.10*		
CORP	0.0580	0.22	0.1680	0.69		
SUBS	-0.1970	-0.74	-0.0566	-0.23		
PART	-0.1229	-0.33	0.0029	0.01		
OWNMG	0.0840	0.46	0.0070	0.04		
CONC50	-0.2423	-1.46	-0.1737	-1.08		
MINOR	0.9375	2.92*	0.9291	2.94*		
FEMALE	0.1810	0.66	0.1316	0.49		
CONSTR	0.5399	2.97*	0.4946	2.77*		
SERVICES	0.0566	0.30	0.0996	0.54		
RETAIL	-0.1761	-1.02	-0.1505	-0.88		
LNAGE	0.0413	0.45	0.0445	0.48		
LNRELATE	-0.0897	-1.18	-0.1034	-1.36		
R^2_{adj}	0.1245		0.1160		-0.0090	

[#] Number of observations = 383. Unweighted results will be provided in appendix.

* Statistically significant at 5% level, two-tailed.

The PREM regressions indicate that the bank-borrower relationship has no significant effect on loan rates. DBHIGH has a robust and positive effect on PREM while AGE and RELATE do not, so we conclude that banks put more weight on firms' credit information than relationship when deciding loan rates. Our empirical results differ from Berger and

Udell's (1995) results for the 1987 SSBF data. More banks appear to use credit scoring systems to evaluate firms and make loan decisions. As the concentration of banking and increases credit scoring systems, more banks will move to these lower cost methods. As we mentioned, we only include L/C loans in our model since L/C may depend much more on 'soft-information' than 'transaction-driven' loans. But according to our results, L/C loan rates are still based much more on credit scoring systems than on the length of relationship with the lending bank.

Table 7. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—Total Assets Below $500,00[#]

OLS Regression for PREM--Weighted

	Including All Variables		**Excluding Contract Terms**		**Contract Terms only**	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	2.6767	2.16*	2.47073	2.15*	2.0506	7.87*
ARINV	0.3926	0.97			0.0086	0.02
OTHERSEC	-0.2710	-0.69			-0.1325	-0.40
GUAR	-0.4763	-1.52			-0.2610	-0.89
COMPBAL	-0.2036	-0.42			-0.0308	-0.06
LEV	0.0076	0.34	0.0120	0.55		
PROFMARG	-0.1048	-0.15	-0.2645	-0.42		
CURRAT	-0.0129	-0.67	-0.0222	-1.19		
QUICKRAT	0.0183	0.88	0.0282	1.40		
ARTURN	0.0040	1.22	0.0049	1.53		
INVTURN	0.0087	1.46	0.0112	1.96		
APTURN	-0.0008	-0.18	-0.0032	-0.75		
DBHIGH	0.7505	2.22*	0.6458	1.95		
DBLOW	0.1618	0.49	0.1592	0.49		
LNTA	-0.2158	-1.56	-0.2029	-1.55		
CORP	1.1567	2.15*	0.8381	1.66		
SUBS	0.5694	1.27	0.4004	0.91		
PART	-0.1984	-0.34	-0.1504	-0.27		
OWNMG	0.8610	1.25	0.8419	1.33		
CONC50	0.5230	1.42	0.4087	1.16		
MINOR	0.7032	1.20	0.5584	0.96		
FEMALE	-0.7717	-1.65	-0.8817	-1.90		
CONSTR	-0.8051	-1.62	-0.8177	-1.65		
SERVICES	-0.4731	-1.36	-0.4566	-1.33		
RETAIL	-0.6964	-1.46	-0.7050	-1.48		
LNAGE	-0.5370	-2.32*	-0.5101	-2.26*		
LNRELATE	0.0248	0.15	0.0393	0.24		
R^2_{adj}	0.098		0.0964		-0.0232	

[#] Number of observation = 214. Unweighted results will be provided in appendix.

* Statistically significant at 5% level, two tailed.

B. Estimates of Model of Collateral Requirements

In this section I test whether collateral requirements will be lower for borrowers with longer banking relationships. I use Logistic Regression to estimate the probability of a L/C being secured. Berger and Udell (1995) concluded that *Relationship Characteristics* have significant and negative associations with the probability of collateral being required.

There are 896 observations with L/Cs from commercial banks. COLLAT will be used as the dependent variable with financial, governance, industry and relationship characteristics as explanatory variables. I also estimate the probability of ARINV using the same procedure.

Table 8 summarizes the Logistic Regression results for all firms (column 1), firms with total assets above $500,000 (column 2) and firms with total assets below $500,000 (column 3). In column 1, the coefficients on DBHIGH and DBLOW are statistically significant. And DBHIGH is also significantly positive in the other two models. However LNAGE and LNRELATE are never significant, even when AGE and RELATE are in levels and second-order forms. These results clearly illustrate that the D&B credit scores play a more important role than age and bank-borrower relationship when banks decide whether the loans need to be secured or not. Thus, according to the Logistic models in Berger and Udell (1995) and my replications, we find different results on the probability of collateral requirements.

The coefficient of DBHIGH is 0.6029 implying that, all else equal, a small firm with a D&B credit score in the high risk category would have a probability of pledging collateral,

about 71.85%[16], that is about 19.57% higher, from a mean probability of 58.28%[17] to 71.85%. As we expected DBLOW has a negative sign to be significant. That is, for firms with credit scores indicating lower risk have a lower probability of pledging collaterals by 12.67%[18].

Table 8. Probability Tests on Collateral (All Types) for Loans Issued under Lines of Credit from Commercial Banks[#]

Logistic Regression for the Probability of COLLAT—Weighted

	All Firms		Total Assets above $500,000		Total Assets below $500,000	
Variables	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**
INTERCEPT	-2.9557	18.9147*	-2.2393	2.9291	-8.2876	20.3660*
LEV	-0.0152	8.3143*	-0.0141	7.7751*	-0.0561	2.3891
PROFMARG	-0.2662	0.6605	-0.3936	0.6024	0.5345	0.8422
CURRAT	-0.00779	1.1737	-0.00393	0.3347	-0.0201	0.8122
QUICKRAT	0.00800	1.2300	0.00380	0.2885	0.0308	1.8147
ARTURN	-0.00166	0.7661	0.000724	0.0551	-0.0106	4.3589*
INVTURN	0.00205	2.9074	0.00191	2.4952	-0.00103	0.0886
APTURN	-0.00081	0.4468	-0.00226	1.6702	0.00567	1.8104
DBHIGH	0.6029	6.5212*	0.7136	3.1433*	0.8144	5.8328*
DBLOW	-0.5105	5.9126*	-0.7800	5.8439*	-0.1526	0.2228
LNTA	0.3847	38.3476*	0.3940	7.9512*	0.7053	23.1896*
CORP	-0.5371	3.1059	-1.2421	5.4952*	-0.2313	0.2447
SUBS	-0.9840	13.4526*	-1.7791	11.9281*	-0.5489	2.0833
PART	-0.1707	0.1950	-1.6588	3.9877	0.5706	1.0594
OWNMG	1.4665	20.9883*	1.0082	6.5112*	4.5282	9.9275*
CONC50	-0.3574	1.9777	-0.3500	0.8528	-0.0432	0.0122
MINOR	0.2560	0.3490	-0.00439	0.0000	0.5194	0.6714
FEMALE	0.2328	0.7246	0.3753	0.7079	-0.2010	0.2314
CONSTR	0.4739	2.8641	0.4698	1.3980	0.4391	1.0215
SERVICES	-0.1874	0.6712	-0.1710	0.1936	-0.00378	0.0001
RETAIL	-0.3789	2.0493	-0.2054	0.2502	-0.0713	0.0284
LNAGE	0.1058	0.5369	0.1607	0.5270	0.1103	0.2576
LNRELATE	0.0697	0.4618	0.0797	0.2094	0.1231	0.7308
Number of Observation	896		584		312	
Diagnostics:-2logL	768.956		337.808		385.602	
DF	22		22		22	

[#] Unweighted results will be provided in appendix.

[*] Statistically significant at 5% level, tow tailed.

[16] The model can be transferred into a simple way that $Y = \alpha 0 + \alpha 1 * DBHIGH + \alpha 2 * DBLOW + X\beta$. I plug in sample means for numerical variables and use majority type of dummy variables. That is CORP=1, CONC50=1, OWNMG=1, MINOR=0, FEMALE=0 and SERVICES=1. Then prob (COLLAT|DBHIGH) = $\exp(-2.96+Y_{DBHIGH}) / [1+\exp(-2.96+Y_{DBHIGH})] = 0.7185$

[17] prob (COLLAT|DBMED) = $\exp(-2.96 +Y_{DBMED})/[1+\exp(-2.96+Y_{DBMED})] = 0.5828$

[18] prob (COLLAT|DBLOW)=$\exp(-2.96 +Y_{DBLOW}) / [1+\exp(-2.96+Y_{DBLOW})] = 0.4561$

Neither AGE nor RELATE are statistically significant. Leverage has significantly negative effects in both columns 1 and 2 which means that higher leverage would have lower probability of collateral requirements.[19] Total assets (TA) have consistent and significant results. The coefficient of TA is positive which means larger firms will have a higher probability of pledging collateral. In *Governance Characteristics*, SUBS and OWNMG have consistently significant effects. This means that a Subchapter S corporation with owner managed would have a higher probability of pledging collateral. But MINOR and FEMALE do not have statistically significant coefficients.

Recall the results in column 4 of table 2. The results show that LNRELATE has significant negative effects of the probability of COLLATE when D&B credit scores categories, MINOR, FEMALES are not included. The same results come out from the weighted model (not shown). If I only drop MINOR or FEMALE, other variables do not change significantly.

Columns 2 and 3 provide the regression results for firms with total assets above or below $500,000 respectively. The outcomes are not as strong as column 1 but almost the same variables are significant as in column 1. LNAGE and LNRELATE still have positive signs and DBHIGH and DBLOW still have the expected signs. For very small businesses, collateral requirements depend mostly on credit scores, ownership and total assets.

Table 9 provides the same Logistic Regression results except that the dependent variable is the probability that the loan is secured by accounts receivable and/or inventory (ARINV). LNAGE and LNRELATE still have insignificant coefficients and the signs are not consistent.

[19] This result puzzled me. Because I successfully replicate the 1987 data with positive signs but the 2003 data does not show the same results (columns 3 and 4 of table 2). Perhaps more firms in 2003 with high leverage are having lower risk projects. So banks ask for lower collateral requirements.

Lower risk firms, as measured by DBLOW, face a lower probability of pledging collateral but the coefficient is only significant for the entire sample and this effect is not as strong as in previous models. MINOR and FEMALE also do not have significant and consistent results. OWNMG remains significant, raising the probability of collateral requirements.

Table 9. Probability Tests on Collateral (Accounts Receivables and/or Inventory) for Loans Issued under Lines of Credit from Commercial Banks[#]

Logistic Regression for the Probability of ARINV—Weighted

	All Firms		Total Assets above $500,000		Total Assets below $500,000	
Variables	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**
INTERCEPT	-3.0276	10.4002*	-1.0666	0.4371	-11.1953	14.7302*
LEV	-0.0008	0.0837	-0.0012	0.1970	-0.0895	2.5325
PROFMARG	0.5151	1.6596	0.5023	0.6824	1.8619	4.8360*
CURRAT	-0.0227	1.3007	-0.0244	0.6217	-0.0008	0.0004
QUICKRAT	0.0220	1.1700	-0.0150	0.0937	0.0003	0.0000
ARTURN	-0.0127	6.9337*	-0.0098	2.4645	-0.0232	5.4160*
INVTURN	0.0014	0.6042	0.0021	1.1550	-0.0073	1.4496
APTURN	0.0025	1.0356	-0.0002	0.0030	0.0101	2.3711
DBHIGH	0.1245	0.1728	-1.0802	3.7170	1.3184	7.2969*
DBLOW	-0.6086	4.1106*	-0.3716	0.8385	-0.7908	2.1103
LNTA	0.1288	2.6493	0.1092	0.3883	0.8358	11.0799*
CORP	0.1844	0.2327	0.0552	0.0089	-0.3699	0.2915
SUBS	-0.7244	3.9768*	-0.7347	1.4245	-0.9614	2.9462
PART	0.6048	1.5330	-0.6959	0.3007	0.7155	1.0073
OWNMG	0.9808	4.2242*	0.7026	1.6523	5.1211	5.4756*
CONC50	-0.4659	2.0265	-0.1431	0.0820	-0.8958	2.7041
MINOR	-0.9870	1.2909	0.3271	0.1104	-16.1989	0.0001
FEMALE	0.4461	1.5589	0.9121	3.3436	-0.5273	0.5053
CONSTR	0.6934	4.4334*	0.9657	4.4450*	0.5591	0.9021
SERVICES	-0.8014	5.3261*	-0.6260	0.9393	-0.4540	0.6506
RETAIL	-0.7217	3.4653	-0.0934	0.0266	-1.2592	3.1680
LNAGE	0.2315	1.4381	-0.1512	0.2706	0.3648	1.0945
LNRELATE	0.0664	0.2097	-0.2948	1.7643	0.4812	3.8084
Number of Observation	896		584		312	
Diagnostics:-2logL	483.170		231.172		200.779	
DF	22		22		22	

[#] Unweighted results will be provided in appendix.

* Statistically significant at 5% level, tow tailed.

Relationship Characteristics do not have statistically significant influences on collateral pledging requirements. In contrast, D&B credit scores have more effect on banks' behavior. For *Governance Characteristics*, banks pay more attention to whether the firm is managed by the owner and whether the firm is a Subchapter S corporation. MINOR and FEMALE are not significant. These results differ from Berger and Udell (1995) who concluded that *Relationship Characteristics* have significant negative impacts on the probability of collateral.

V. CONCLUSION

In our empirical analysis, we examine the influences of *Relationship Characteristics*: firms' age (AGE) and length of bank-borrower relationship (RELATE) on commercial loans under lines of credit. We use the 2003 SSBF data and focus on those firms with approved L/Cs at floating rates from commercial banks. The models include contract, financial, governance, industry and relationship characteristics. We also add D&B credit scores to enhance the description of borrower risk. MINOR and FEMALE are also added to describe owners.

Our results are as follows. (1) Small firms with longer market experiences will have lower premium rates over the prime rate and firms with high risk D&B credit scores will pay a higher premium. These results are both statistically and economically significant. However, length of bank-borrower relationship does not have a statistically significant association with the premium. Although L/Cs may contain more 'soft-information' of borrowers during bank-borrower relationships, banks still put more weight on credit scoring systems and firms' age. (2) We do not find statistically significant relationships between *Relationship Characteristics* and the probability of collateral requirements. Banks pay more attention to *Financial Characteristics* and ownership status. D&B credit scores play a more important role than bank-borrower relationships. (3) Minority status and gender do not have impacts on either loan rates or the probability of pledging collateral.

Based on the Berger and Udell (1995) model I use the 2003 SSBF survey data and estimate two models: the OLS regression for the premium over the prime rate for loans

issued under L/Cs and the Logistic model for collateral and collateral of accounts receivable or inventories. However, my approach differs from that of the Berger and Udell (1995) in three important ways.

First, I use the 2003 SSBF data to estimate the model. The financial environment has changed rapidly over the past twenty years: more small firms entered into the market[20], more financial instruments appeared and bank concentration increased. Using new data to analyze relationship lending is necessary. For the 2003 data, missing values are imputed. Different imputed values, done by regressions, result in five samples but these differ only slightly so I use the first sample.

Second, I add the variables of minority status and gender to test the impact on loan rate and collateral. As the above literature suggests, minority status and gender of owners may have significant influences on loan rates.

Third, I add Dun and Bradstreet (D&B) credit scores to *Financial Characteristics*. Based on the results of Frame, Srinivasan, and Woosley (2001), credit scoring could reduce the cost of information and may decrease the effects of traditional bank-borrower relationships. And more banks use credit scoring systems as their main tool, which is less costly and more convenient, to evaluate firms' risk levels. This may be the reason that D&B credit score categories are statistically significant in both OLS and Logistic models, especially for high risk firms, but relationship length is not. These results are the same as those of Frame, Srinivasan, and Woosley (2001). Moreover, when I add variables, to the model to see whether minority status and gender affect loan rates and collateral requirements under L/Cs, I

[20] The Office of Advocacy reported that the number of small business increased from around 19.4 million to 23.4 million during the period of 1992 to 2003.

find that neither have significant influences. These results are different from Cavalluzzo, Cavalluzzo and Wolken (1998), Blanchflower, Levine and Zimmerman (2003) and Blanchard, Zhao, and Yinger (2008).

Some problems and puzzles exist in my models. The sample size is small especially for the firms with total assets below $500,000. The results for CURRAT and QUICKRAT are unexplained. Although our variables are all defined reasonably and traditionally, I had trouble replicating the models of Berger and Udell (1995).

Finally my research results may have some suggestions for small business. Since small firms still have trouble in obtaining loans, they had better try their best to meet banks' conditions. Small firms need to pay attention to their credit scores and expect to put up collateral for lines of credit.

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APPENDIX

Table 10. Variable Means (Unweighted)

Variables	All Firms	Total Assets above $500,000	Total Assets below $500,000
PREM*	1.3200	1.1273	1.7202
COLLAT	0.5056	0.5616	0.4006
ARINV	0.3393	0.4349	0.1603
OTHERSEC	0.1663	0.1267	0.2404
GUAR	0.6362	0.6404	0.6282
COMPBAL	0.0893	0.0993	0.0705
LEV	12.3774	16.6959	3.5194
PROFMARG	0.0934	0.2892	0.0819
CURRAT	29.1729	30.6165	25.7218
QUICKRAT	25.7847	26.8218	23.3056
ARTURN	41.1217	51.8063	21.0277
INVTURN	38.4438	43.0486	29.8244
APTURN	26.5634	32.5886	15.2855
TA	5644.18	8568.92	169.6662
DBHIGH	0.1473	0.1182	0.2019
DBMED	0.4498	0.4538	0.4423
DMLOW	0.3996	0.4247	0.3526
CORP	0.3661	0.4469	0.2147
SUBS	0.4498	0.4418	0.4647
PART	0.0759	0.0702	0.0865
PROP	0.1083	0.0411	0.2340
OWNMG	0.8415	0.7825	0.9519
CONC50	0.7277	0.6815	0.8141
MINOR	0.0513	0.0514	0.0513
FEMALE	0.1105	0.0856	0.1571
CONSTR	0.1328	0.1507	0.0994
SERVICES	0.3147	0.2466	0.4423
RETAIL	0.1573	0.1473	0.1763
OTHERIND	0.3951	0.4555	0.2821
AGE	17.4196	19.0873	14.2981
RELATE	9.9977	10.8908	8.7033
Number of observations	896	584	312

*PREM (needs additional requirements as floating rate and under prime rate index) is available for 597, 383 and 214 observations.

Table 11. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—All Firms Sizes

OLS Regression for PREM--Unweighted

	Including All Variables		Excluding Contract Terms		Contract Terms only	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	2.80116	5. 46*	2.73823	5.47*	1.24463	8.54*
ARINV	-0.10632	-0.72			-0.32830	-2.26*
OTHERSEC	-0.35485	-1.82			-0.2934	-1.42
GUAR	-0.01281	-0.09			0.20504	1.37
COMPBAL	0.08466	0.38			0.12530	0.53
LEV	-0.00034	-0.27	-0.00033	-0.27		
PROFMARG	-0.26642	-0.82	-0.30402	-0.94		
CURRAT	-0.02457	-4.97*	-0.02441	-4.95*		
QUICKRAT	0.03654	5.13*	0.03638	5.12*		
ARTURN	0.00100	0.62	0.00130	0.81		
INVTURN	0.00233	2.40*	0.00241	2.49*		
APTURN	0.00007	0.08	-0.00004	-0.04		
DBHIGH	0.38027	2.04	0.34537	1.87		
DBLOW	0.14321	1.01	0.14130	1.00		
LNTA	-0.21672	-5.30*	-0.22286	-5.80*		
CORP	0.18010	0.59	0.19209	0.63		
SUBS	-0.05436	-0.18	-0.02715	-0.09		
PART	0.03329	0.09	0.07173	0.20		
OWNMG	0.04326	0.23	0.04195	0.23		
CONC50	0.28744	1.91	0.28339	1.90		
MINOR	0.67227	2.36*	0.63810	2.27*		
FEMALE	0.00188	0.01	0.00401	0.02		
CONSTR	-0.02753	-0.14	-0.02858	-0.14		
SERVICES	-0.12298	-0.75	-0.12806	-0.78		
RETAIL	-0.06132	0.32	-0.05438	-0.28		
LNAGE	-0.09077	-0.89	-0.08959	-0.89		
LNRELATE	-0.08558	-1.16	-0.08713	-1.20		
R^2_{adj}	0.1585		0.1596		0.0083	

Note: Number of observations = 597.

*Statistically significant at 5% level, two-tailed.

Table 12. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—Total Assets over $500,000[#]

OLS Regression for PREM--Unweighted

	Including All Variables		Excluding Contract Terms		Contract Terms only	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	2.3284	2.92[*]	2.36783	3.04[*]	0.8766	5.70[*]
ARINV	-0.1077	-0.67			-0.1144	-0.77
OTHERSEC	-0.2496	-1.01			-0.1868	-0.78
GUAR	0.0757	0.47			0.2442	1.60
COMPBAL	0.1979	0.80			0.2416	1.01
LEV	-0.0005	-0.41	-0.0005	-0.44		
PROFMARG	0.0201	0.05	0.0695	0.18		
CURRAT	-0.0098	-1.20	-0.0091	-1.12		
QUICKRAT	0.0144	1.20	0.0133	1.12		
ARTURN	0.00007	0.04	0.0003	0.16		
INVTURN	0.0009	0.90	0.0008	0.78		
APTURN	0.0003	0.32	0.0002	0.23		
DBHIGH	0.3565	1.55	0.3396	1.49		
DBLOW	0.1164	0.74	0.1167	0.75		
LNTA	-0.1849	-2.71[*]	-0.1989	-3.06[*]		
CORP	0.1877	0.40	0.2454	0.53		
SUBS	-0.0258	-0.05	0.0298	0.06		
PART	0.1939	0.36	0.2623	0.49		
OWNMG	-0.0299	-0.16	-0.0191	-0.10		
CONC50	0.2151	1.27	0.2186	1.31		
MINOR	0.6095	1.75	0.6070	1.79		
FEMALE	-0.0220	-0.08	-0.0317	-0.12		
CONSTR	0.1351	0.61	0.1288	0.59		
SERVICES	0.0541	0.27	0.0565	0.29		
RETAIL	-0.0269	-0.12	-0.0107	-0.05		
LNAGE	-0.0229	-0.20	-0.0268	-0.23		
LNRELATE	-0.0734	-0.88	-0.0693	-0.85		
R^2_{adj}	0.0087		0.0152		0.0018	

[#]Number of observations = 383.

[*]Statistically significant at 5% level, two-tailed.

Table 13. Premium over Prime Rate (Floating rate only) for loans issued under Lines of Credit from Commercial Banks—Total Assets Below $500,00[#]

OLS Regression for PREM--Unweighted

	Including All Variables		Excluding Contract Terms		Contract Terms only	
Variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
INTERCEPT	2.7724	2.29*	2.7975	2.48*	2.0602	6.47*
ARINV	0.1656	0.44			-0.1719	-0.45
OTHERSEC	-0.3089	-0.81			-0.5590	-1.49
GUAR	-0.1528	-0.47			-0.1142	-0.33
COMPBAL	-0.3859	-0.77			-0.0544	-0.10
LEV	0.0008	0.04	0.0042	0.22		
PROFMARG	-0.3300	-0.46	-0.5782	-0.90		
CURRAT	-0.0290	-1.44	-0.0324	-1.64		
QUICKRAT	0.0483	2.31*	0.0520	2.55*		
ARTURN	0.0034	0.96	0.0037	1.09		
INVTURN	0.0146	2.54*	0.0155	2.78*		
APTURN	-0.0016	-0.34	-0.0031	-0.69		
DBHIGH	0.4541	1.34	0.3732	1.14		
DBLOW	0.1980	0.60	0.1562	0.49		
LNTA	-0.3711	-2.72*	-0.3747	-2.89*		
CORP	0.8330	1.47	0.6096	1.14		
SUBS	0.4010	0.81	0.2611	0.55		
PART	0.3187	0.50	0.2963	0.48		
OWNMG	0.9377	1.48	0.9526	1.56		
CONC50	0.7453	2.13*	0.7181	2.14*		
MINOR	0.6407	1.11	0.5504	0.97		
FEMALE	-0.2337	-0.56	-0.2660	-0.65		
CONSTR	-0.7440	-1.43	-0.7825	-1.55		
SERVICES	-0.5470	-1.60	-0.5624	-1.67		
RETAIL	-0.7477	-1.73	-0.7640	-1.80		
LNAGE	-0.4054	-1.73	-0.3925	-1.72		
LNRELATE	-0.0383	-0.22	-0.0336	-0.20		
R^2_{adj}	0.2653		0.2781		-0.0122	

[#]Number of observation = 214.

*Statistically significant at 5% level, two tailed.

Table 14. Probability Tests on Collateral (All Types) for Loans Issued under Lines of Credit from Commercial Banks

Logistic Regression for the Probability of COLLAT--Unweighted

	All Firms		Total Assets above $500,000		Total Assets below $500,000	
Variables	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**
INTERCEPT	-1.6236	6.3218*	-1.1842	1.2483	-4.8489	10.2588*
LEV	-0.0073	7.1019*	-0.0071	6.6247*	-0.0084	0.0865
PROFMARG	-0.4171	1.1797	-0.7564	2.2922	0.5325	0.5248
CURRAT	-0.0130	1.6217	-0.0098	0.7619	-0.0085	0.0984
QUICKRAT	0.0108	1.0218	-0.0045	0.0806	0.0091	0.1113
ARTURN	0.0001	0.0092	0.0012	0.3036	-0.0068	1.5949
INVTURN	0.0018	1.8261	0.0021	2.0310	-0.0029	0.4128
APTURN	-0.0003	0.0597	-0.0010	0.5311	0.0055	1.5195
DBHIGH	0.4773	3.8394*	0.4909	2.2967	0.4833	1.3858
DBLOW	-0.2675	2.1744	-0.3668	2.9675	0.1325	0.1231
LNTA	0.3083	35.0295*	0.3449	14.7078*	0.6138	12.1228*
CORP	-0.4386	1.4019	-0.9362	2.1650	-0.1856	0.0953
SUBS	-0.7434	4.2820*	-1.2603	3.9503*	-0.4834	0.8373
PART	-0.6049	1.7421	-1.1794	2.5242	-0.3793	0.2806
OWNMG	0.4006	3.0965	0.2348	0.8758	1.5656	3.4976
CONC50	-0.2795	1.9823	-0.2311	0.9809	-0.3321	0.6113
MINOR	0.4293	1.1830	0.4634	0.7775	0.2389	0.1136
FEMALE	0.4118	2.2838	0.6784	3.0766	0.1072	0.0559
CONSTR	0.0292	0.0122	-0.0766	0.0637	0.6743	1.2685
SERVICES	-0.0807	0.1422	-0.1163	0.1853	0.3630	0.7603
RETAIL	-0.2256	0.8598	-0.1719	0.3295	0.1512	0.0921
LNAGE	0.1391	1.0626	0.1283	0.6006	0.1243	0.2028
LNRELATE	-0.1256	1.8446	-0.1655	2.1972	-0.0170	0.0081
Number of Observation	896		584		312	
Diagnostics:-2logL	874.436		607.840		244.269	
DF	22		22		22	

*Statistically significant at 5% level, tow tailed.

Table 15. Probability Tests on Collateral (Accounts Receivable and Inventory) for Loans Issued under Lines of Credit from Commercial Banks

Logistic Regression for the Probability of ARINV--Unweighted

	All Firms		Total Assets above $500,000		Total Assets below $500,000	
Variables	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**	**Coefficient**	**χ^2-statistic**
INTERCEPT	-3.2520	15.416*	-2.4190	3.9757*	-5.1437	4.4266*
LEV	-0.0015	0.5030	-0.00138	0.4563	-0.0454	0.5186
PROFMARG	0.6995	2.2530	0.6785	1.5223	1.4877	1.9745
CURRAT	-0.0217	1.3018	-0.0117	0.2464	-0.0286	0.2571
QUICKRAT	0.0171	0.6682	-0.0527	1.2255	0.0302	0.2814
ARTURN	-0.0043	2.0354	-0.0022	0.4615	-0.0159	1.6973
INVTURN	0.0008	0.2978	0.0007	0.1673	0.0004	0.0032
APTURN	0.0014	0.6630	0.0009	0.2371	0.0059	0.4267
DBHIGH	0.2907	1.0671	0.2644	0.6267	0.2747	0.2145
DBLOW	-0.1120	0.2488	-0.0309	0.0157	-0.4244	0.4570
LNTA	0.2007	9.8352*	0.1641	2.8860	0.4165	2.0886
CORP	-0.2054	0.1996	-0.2714	0.1363	0.1876	0.0519
SUBS	-0.4440	0.9764	-0.3238	0.1954	-1.0123	1.7441
PART	-0.1633	0.0810	-0.1327	0.0234	-0.1090	0.0123
OWNMG	0.3278	1.3961	0.2678	0.8584	0.5265	0.1700
CONC50	-0.2104	0.7996	-0.1878	0.5124	-0.2695	0.1793
MINOR	-0.0918	0.0357	0.3658	0.4892	-13.6053	0.0009
FEMALE	-0.1253	0.1284	0.1357	0.1138	-0.6612	0.6001
CONSTR	0.0493	0.0256	-0.0747	0.0485	0.6471	0.6087
SERVICES	-0.5962	4.3367*	-0.6055	3.0555	-0.3304	0.2526
RETAIL	-0.0658	0.0504	-0.0151	0.0020	-0.2423	0.1040
LNAGE	0.2939	2.8628	0.1558	0.6288	0.5211	1.4335
LNRELATE	-0.0133	0.0149	-0.0499	0.1682	0.1632	0.3298
Number of Observation	896		584		312	
Diagnostics:-2logL	649.218		501.282		126.249	
DF	22		22		22	

*Statistically significant at 5% level, tow tailed.