The importance of relationships to the availability of credit

Rebel A. Cole [*]

Employment Policies Institute, Washington, DC 20006-4605, USA

Abstract

In this article, I examine the effect of pre-existing relationships between a firm and its potential lender on the potential lender's decision whether or not to extend credit to the firm. I find that a potential lender is more likely to extend credit to a firm with which it has a pre-existing relationship as a source of financial services, but that the length of this relationship is unimportant. These findings provide empirical support for theories of financial intermediation positing that banking relationships generate valuable private information about the financial prospects of the financial institution's customer. The results also provide evidence that potential lenders are less likely to extend credit to firms with multiple sources of financial services, in support of the theory that the private information a financial institution generates about a firm is less valuable when the firm deals with multiple sources of financial services. © 1998 Published by Elsevier Science B.V. All rights reserved.

1. Introduction

The problem of asymmetric information between a borrower and potential creditor can impede the flow of credit to profitable firms (Stiglitz and Weiss,

[*] Corresponding author. Tel.: 1 202 463 7650; fax: 1 202 463 7107.

PII S 0 3 7 8 - 4 2 6 6 (9 8) 0 0 0 0 7 - 7

1981). Financial institutions have an important advantage in mitigating this problem. Through interactions with a firm that obtains financial services it provides, a financial institution develops private information about the firm's financial prospects that are useful in deciding whether to extend credit to the firm (Diamond, 1984).

Recent empirical work on firm–lender relationships has focused on how relationships between a firm and its potential lenders affect the firm's value. One group of studies has focused on demonstrating that the existence of a firm–lender relationship increases the value of the firm (Billett et al., 1995; Slovin et al., 1993; Hoshi et al., 1990; James and Wier, 1990; Lummer and McConnell, 1989; James, 1987), whereas a second group has sought to measure the strength of that relationship (Berger and Udell, 1995; Petersen and Rajan, 1994). This study extends the work of the second group.

Both Petersen and Rajan (1994) and Berger and Udell (1995) use data from the Federal Reserve Board's 1987 National Survey of Small Business Finances (NSSBF) to examine the effect of relationships on the availability of credit. Petersen and Rajan examine how firm–lender relationships affect the interest rate quoted on a firm's most recent loan. While they do not find that the loan rate varies with the length of the firm's relationship with its lender or with whether the firm obtains deposit accounts or informational services from its lender, they do find that the loan rate increases with the number of banks from which the firm borrows and decreases with firm age. Petersen and Rajan also examine how firm–lender relationships affect the availability of credit as proxied by the percentage of a firm's trade credits paid late. They find that their proxy is negatively related to both the length of the firm's longest relationship and firm age, and positively related to the number of banks from which the firm borrows.

Berger and Udell (1995) focus their analysis on floating-rate lines of credit obtained by small businesses, arguing that relationships are less important when obtaining what they characterize as "transaction-driven" loans, such as mortgages and motor-vehicle loans. They find that the loan-rate premium over the lending bank's prime rate is negatively related to length of the firm's relationship with the lending bank. They also provide evidence that the age of the firm and the length of the firm's relationship with its lender decrease the probability that the lender will require collateral to secure the loan.

This study is similar to the work of Petersen and Rajan (1994) and Berger and Udell (1995). As in those papers, the effect of firm–lender relationships on the availability of credit is analyzed using a sample of small firms without access to public debt and equity markets – firms for which informational asymmetries are likely to be most severe.

This study differs from earlier work, however, in three important ways. First, it directly analyzes the effect of relationships on credit availability by examining whether relationships affect the likelihood that the firm's potential

lender denied or extended credit. [1] Previous studies have focused on the cost rather than the availability of credit. As Berger and Udell (p. 362) note, a test of whether relationships affect loan rates is in fact a joint test of whether (i) prospective lenders gather valuable information from relationships; (ii) they use this information in pricing loans; and (iii) this information is reflected in the observed loan rates. If, as anecdotal evidence suggests, lenders are more likely to use their private information in deciding whether or not to extend the loan rather than in deciding how to price the loan, one might expect to find that relationships affect the availability but not necessarily the price of credit. Also, whether or not a firm was extended credit is a more direct and intuitive measure of credit availability than the percentage of trade credits paid late by the firm, which was analyzed by Petersen and Rajan. [2] (Berger and Udell do not analyze credit availability.) Second, this study uses data from the Federal Reserve Board's 1993 NSSBF. The 1993 NSSBF provides a larger, richer, and more timely dataset than that available from the 1987 survey, which was the data source of both Petersen and Rajan (1994) and Berger and Udell (1995). [3] Third, this study analyzes some different dimensions of the firm–creditor relationship not appearing in the previous literature – whether the firm obtained checking accounts, savings accounts, loans, or financial services from its prospective lender.

I find that a potential lender is more likely to extend credit to a firm with which it has a pre-existing relationship as a source of financial services, but that the length of this relationship is unimportant. These results are quite different from those of Berger and Udell (1995), who found that the price of credit is a negative function of the length of a firm's relationship with its creditor, and those of Petersen and Rajan (1994), who found the price of credit unrelated to the length of the firm's relationship with its creditor. This suggests that role of relationships in the availability of credit is different from its role in the pricing of credit.

---

[1] As Stiglitz and Weiss (1981) demonstrate, banks may choose to ration the amount of credit they grant because altering the loan rate influences the riskiness of the average borrower as well as the demand for funds. Higher rates attract riskier borrowers, an adverse selection problem, and also induce borrowers to increase the riskiness of their projects, a moral hazard problem. For these reasons, the bank's expected return can reach a maximum at an interest rate lower than is necessary for the market to clear.

[2] Moreover, less than one-third (1119 of 3404) of the firms in the Petersen–Rajan sample were included in their analysis of trade credit paid late. This reduction in sample size is attributable to the fact that not all firms reported using trade credit and, of those that did report trade credit usage, many did not make any payments after the due date. Presumably, such firms were omitted from the analysis. In the 1993 NSSBF sample, only about half of the firms that applied for credit during the past three years reported that some portion of their trade credit was paid after the due date.

[3] The 1993 survey gathered data from a sample that was 50% larger than the 1987 survey sample, and included many useful questions not asked by the 1987 survey, such as firm's delinquency rates.

In analyzing different dimensions of the firm creditor relationship, I find that the pre-existing use of a potential lender as a source for savings accounts and financial management services increases the likelihood that the lender will extend credit. This is in contrast with Petersen and Rajan (1994), who found no relationship between the cost of credit and the use of the creditor as a source of depository services.

I also find that firms with multiple sources of financial services are less likely to receive credit, in support of the theory that the private information about a firm generated by a financial institution is less valuable when the firm deals with multiple sources of financial services. And finally, I find that commercial banks are less likely to extend credit than other types of lenders, a finding consistent with the anecdotal evidence that these lenders tightened their underwriting standards in the early 1990s in response to pressure for regulators. In general, my results provide empirical support for theories of financial intermediation positing that banking relationships generate valuable private information about the financial prospects of the financial institution's customer.

The remainder of the paper is organized as follows. Section 2 reviews factors likely to influence the credit allocation decision, while Section 3 describes the data and methodology used in the empirical analysis. Section 4 presents the results while a summary and conclusions appear in Section 5.

2. Factors affecting the credit allocation decision

The types of pre-existing relationships between a firm and its potential lender should influence whether or not the potential lender extends credit to the firm. Specifically, pre-existing relationships that generate information useful in ascertaining the firm's creditworthiness should increase the probability that the potential lender will extend credit. To investigate whether these types of pre-existing relationships affect credit availability, I analyze four variables that indicate whether the firm obtained financial services from the source where it applied for credit. These variables are *checking accounts*, *savings accounts*, *loans* (credit lines, equipment loans, motor vehicle loans, mortgage loans, miscellaneous other loans, and capital leases), and *financial management services* (transaction services, cash management services, credit-related services, brokerage services, and trust and pension services). [4] Each variable is equal to one if

---

[4] Transaction services encompass the provision of paper money and coins, the processing of credit card receipts, the collection of night deposits, and wire transfers. Cash management services include the provision of sweep accounts, zero-balance accounts, lockbox services, and other services designed to invest liquid funds in liquid, interest-bearing assets automatically. Credit-related services include the provision of bankers' acceptances, letters of credit, and factoring. Trust services include the provision of 401(k) plans, pension funds, business trusts, and securities safekeeping.

the firm obtained that financial service from the potential lender and zero otherwise. In contrast to Petersen and Rajan (1994), who use a single variable indicating whether a firm obtained checking or savings accounts from its credit source, I use independent variables for each type of account. This is important because 70% of the firms applying for credit obtained checking accounts from their prospective lender, but only 22% obtained savings accounts. Also, the type of information that a lender obtains from monitoring a firm's checking account is likely to be different from the information obtained by monitoring a firm's savings accounts.

For three of these relationship variables (checking accounts, savings accounts, and financial management services), the expected influence on the probability that the lender will extend credit is positive. When a firm obtains any of these services, the prospective lender can monitor the firm's use of the services to generate valuable private information about the firm's financial condition. For the remaining variable (loans), the expected relationship is ambiguous because, in addition to providing information about the firm, a pre-existing loan unambiguously increases the leverage of the firm ceteris paribus.

The length of the relationship between a borrower and a potential lender also should be an important determinant of whether the lender extends credit to the firm. A longer relationship provides more time for a potential lender to monitor and develop private information about a firm by monitoring that relationship, thus mitigating the problem of asymmetric information between borrower and lender.

In examining the length of the firm–lender relationship, it is important to account for the potentially confounding effect of firm age, which previous studies have shown to be highly correlated with the length-of-relationship variable. As Berger and Udell (1995, p. 360), point out, age reflects public information whereas the length of relationship reflects private information available only to the potential lender, and corresponds to the difference between information obtained as a result of reputation versus information obtained from monitoring. The age of the firm should influence whether a firm receives credit because firms in business for longer periods of time have established that they can survive the critical start-up period and have generated reputational effects (Diamond, 1991). Thus, lenders should be more likely to extend credit to older firms.

The degree of a firm's dependence on its potential lender as a source of financial services should influence whether the firm receives credit. Theory suggests that the private information generated by potential lenders about firms with multiple sources of financial services is less valuable to that potential lender. As Bulow and Shoven (1978) point out, free-rider problems reduce the incentive for lenders to extend credit because the individual lender incurs all of the costs but shares the benefits. In addition, the number of sources of financial services may proxy for firm credit quality. Lower quality firms are forced to

shop around in order to find a lender that will extend credit. For both of these reasons, potential lenders should be less likely to extend credit to firms with multiple sources of financial services, after controlling for other relevant factors such as firm size, profitability, and riskiness.

In analyzing whether a potential lender extends credit to a firm, it is important to control for differences in firm riskiness. I accomplish this by including in my model a number of control variables. First, I follow Petersen and Rajan (1994) in using dummy variables indicating a firm's one-digit standard industrial classification to control for industry-wide differences. Anecdotal evidence suggests that bankers often use industry classification in assessing borrower credit quality, and may not lend to firms in certain industries when those industries are under financial stress. Second, I include dummy variables indicating the firm's organizational form – proprietorship, partnership, *S*-corporation, or (regular) *C*-corporation. The degree of informational asymmetry may vary with organizational form, as the agency conflicts between owners, managers, and creditors differ markedly by organizational form, as do the degrees of liability. Third, I include several traditional firm-specific measures of riskiness including size, leverage, profitability, and creditworthiness. I measure size by the natural logarithm of total assets, leverage by the ratio of equity to assets, profitability by return on assets and the natural logarithm of total sales (which is also a measure of size), and creditworthiness by the number of business delinquencies and the number of personal delinquencies by the primary owner. [5] To the best of my knowledge, this is the first study to use such delinquency data to measure firm riskiness in the credit allocation decision, even though these data are commonly used by lenders in assessing creditworthiness.

Larger firms and firms with higher earnings are less risky than other firms so that total assets, total sales, and return on assets should be positively correlated with the likelihood a potential lender extends credit to the firm. Firms with higher leverage and firms with more delinquent payments are riskier than other firms so that the equity-to-assets ratio should be positively correlated and the business and personal delinquency variables should be negatively correlated with the likelihood a potential lender extends credit to the firm.

---

[5] More specifically, survey respondents were asked the following two questions: (1) Within the past three years, on how many different *personal* obligations has the *principal owner* been 60 or more days delinquent? (2) Within the past three years, on how many different *business* obligations has the *firm* been 60 or more days delinquent?

3. Data and methodology

3.1. Data

The data analyzed in this study are taken from the 1993 NSSBF, which was co-sponsored and co-funded by the Federal Reserve Board and the US Small Business Administration. [6] The firms surveyed constitute a nationally representative sample of 5356 small businesses operating in the United States as of year-end 1992, where a small business is defined as a non-financial, non-farm business employing fewer than 500 full-time equivalent employees. These data are broadly representative of approximately 5 million firms operating in the US as of year-end 1992.

The NSSBF provides detailed information about each firm's most recent borrowing experience during 1991–94, including the identity and characteristics of the potential lender to which the firm applied, what other financial services (if any) the firm obtained from that potential lender, whether the potential lender denied or extended credit to the firm, and, if the lender extended credit, what were the terms of the loan. Survey data also provide information on each firm's balance sheet; income statement; credit history; firm characteristics, including standard industrial classification, organizational form, and age; and demographic characteristics of each firm's primary owner, including age, education, experience, and credit history.

3.2. Methodology

Because my dependent variable is binary (extend or deny credit), the use of ordinary-least-squares regression is inappropriate (see Maddala, 1983, pp. 15–16). Instead, I utilize the multivariate logistic regression model. In this model, I assume $Extend_i^*$ is an unobservable index of the probability that lender i extends credit to the firm and is a function of firm-specific characteristics x_i, so that

$$Extend_i^* = \beta' x_i + \mu_i, \tag{1}$$

where x_i is a vector of relationship and control variables, β is a vector of parameter estimates for the independent variables, μ_i is a random disturbance term, $i = 1, 2, \ldots, N$, where N is the number of firms applying for credit.

Let $Extend_i$ be an observable variable that equal to one if $Extend_i^* > 0$ and zero if $Extend_i^* \leqslant 0$. In this particular application, $Extend_i$ is equal to one if a

---

[6] For a detailed description of the 1993 NSSBF, see Cole and Wolken (1995). For a description of the 1987 NSSBF, which was used by Petersen and Rajan (1994, 1995) and Berger and Udell (1995), see Elliehausen and Wolken (1989).

firm is extended credit and zero if the firm is denied credit. Since $Extend_i^*$ is equal to $\beta'x_i + \mu_i$, the probability that $Extend_i > 0$ is equal to the probability that $\beta'x_i > 0$, or, equivalently, the probability that $(\mu_i > -\beta'x_i)$. Therefore, one can write the probability that $Extend_i$ is equal to one as the probability that $(\mu_i > -\beta'x_i)$, or, equivalently, that $\text{Prob}(Extend_i = 1) = 1 - \Phi(-\beta'x_i)$, where Φ is the cumulative distribution function of ϵ, here assumed to be logistic. The probability that $Extend_i$ is equal to zero is then simply $\Phi(-\beta'x_i)$. The likelihood function L for this model is:

$$L = \prod_{Extend_i=0} [\Phi(-\beta'x_i)] \prod_{Extend_i=1} [1 - \Phi(-\beta'x_i)],$$

where:

$$\Phi(-\beta'x_i) = \exp(-\beta'x_i)/[1 - \exp(-\beta'x_i)] = 1/[1 + \exp(-\beta'x_i)],$$

$$1 - \Phi(-\beta'x_i) = \exp(-\beta'x_i)/[1 + (-\beta'x_i)].$$

4. Results

4.1. Univariate statistics

Table 1 presents univariate statistics (means and standard errors) for the variables introduced in Section 2. Statistics are presented separately for all firms that applied for credit (column 2) and for firms applying for credit whose potential lenders denied or extended credit (columns 3 and 4). In column 5 of Table 1 are the results of t-tests to determine whether the mean values for the groups of firms that were denied or extended credit are statistically different.

Of the 2007 firms that applied for credit, 1695 or 84.5% were extended credit. There are sharp differences in the characteristics of firms extended credit and the characteristics of firms denied credit. For five of the six relationship variables analyzed, the difference in means of the extended and denied groups of firms are statistically significant at the 0.01. The incidence of each of the four pre-existing financial services variables – checking accounts, savings accounts, loans, and financial management services – is significantly higher for firms extended credit than for firms denied credit. Among firms extended credit, 72% have checking accounts with their prospective lender, 24% have savings accounts, 44% have other loans, and 40% obtain financial management services. Among firms denied credit, 61% have checking accounts, 10% have savings accounts, 34% have other loans, and 22% obtain financial management services. And, as hypothesized, firms extended credit have significantly longer pre-existing relationships with their potential lenders (8.1 years vs. 5.5 years). However, the number of sources for financial services is somewhat larger for firms extended credit (3.0 vs. 2.9), but this univariate result may be attributable to

Table 1
Univariate statistics: For each variable identified in column 1, the mean appears in the first row and the standard error appears in parentheses in the second row. Results for all firms that applied for credit appear in column 2 while results for firms denied credit and extended credit appear in columns 3 and 4, respectively. Column 5 presents the results of t-tests for differences in the means of the firms denied credit and extended credit

(1) Variable	(2) Firm applied for credit	(3) Firm denied credit	(4) Firm extended credit	(5) t-test
Number of firms	2007	1695	312	
Pre-existing relationships				
Checking account	0.70	0.61	0.72	−3.60 [b]
obtained from credit source	(0.01)	(0.03)	(0.01)	
Savings account	0.22	0.10	0.24	−7.37 [b]
obtained from credit source	(0.01)	(0.02)	(0.01)	
Loan	0.42	0.34	0.44	−3.35 [b]
obtained from credit source	(0.01)	(0.03)	(0.01)	
Financial management service	0.37	0.22	0.40	−6.61 [b]
obtained from credit source	(0.01)	(0.02)	(0.01)	
Length of relationship	7.69	5.51	8.09	−6.37 [b]
with credit source	(0.18)	(0.35)	(0.20)	
Number of sources for	2.96	2.86	2.98	−1.10
financial services	(0.05)	(0.10)	(0.04)	
Firm characteristics				
Firm age	15.50	11.29	16.27	−7.66 [b]
	(0.31)	(0.55)	(0.35)	
Total assets (millions)	2.84	0.80	3.22	−8.93 [b]
	(0.20)	(0.13)	(0.24)	
Equity to assets	0.31	0.21	0.33	−3.34 [b]
	(0.01)	(0.03)	(0.01)	
Total sales (millions)	6.19	1.53	7.04	−10.58 [b]
	(0.34)	(0.34)	(0.40)	
Return on assets	0.19	0.13	0.20	−1.98 [a]
	(0.01)	(0.03)	(0.01)	
Business delinquencies	0.64	1.18	0.54	7.74 [b]
	(0.03)	(0.08)	(0.03)	
Primary owner's delinquencies	0.31	0.85	0.22	8.41 [b]
	(0.02)	(0.07)	(0.02)	
Regular corporation	0.44	0.34	0.46	−4.07 [b]
	(0.01)	(0.03)	(0.01)	
S-Corporation	0.29	0.29	0.28	0.28
	(0.01)	(0.03)	(0.01)	
Partnership	0.07	0.06	0.07	−1.13
	(0.01)	(0.01)	(0.01)	
Proprietorship	0.20	0.31	0.18	4.64 [b]
	(0.01)	(0.03)	(0.01)	

Table 1 (Continued)

(1) Variable	(2) Firm applied for credit	(3) Firm denied credit	(4) Firm extended credit	(5) t-test
Standard industrial classification				
Construction and mining	0.12	0.12	0.13	−0.38
	(0.01)	(0.02)	(0.01)	
Primary manufacturing	0.07	0.05	0.07	−1.34
	(0.01)	(0.01)	(0.01)	
Other manufacturing	0.09	0.07	0.09	−1.74
	(0.01)	(0.01)	(0.01)	
Transportation	0.05	0.05	0.05	0.20
	(0.01)	(0.01)	(0.01)	
Wholesale trade	0.11	0.11	0.11	0.28
	(0.01)	(0.02)	(0.01)	
Retail trade	0.20	0.20	0.20	−0.02
	(0.01)	(0.02)	(0.01)	
Insurance and real estate	0.06	0.04	0.06	−1.12
	(0.00)	(0.01)	(0.01)	
Business services	0.16	0.25	0.15	3.78 [b]
	(0.01)	(0.02)	(0.01)	
Professional services	0.14	0.11	0.14	−1.88
	(0.01)	(0.02)	(0.01)	

[a] Indicates that the difference in the means of the two groups of firms is significant at the 0.05 level.
[b] Indicates that the difference in the means of the two groups of firms is significant at the 0.01 level.

factors such as firm size. Cole and Wolken (1995), for example, document that larger firms tend to use more sources for financial services.

Indeed, my two primary control measures for firm size, total assets and annual sales, are much larger (by a factor of about four) for firms extended credit than for firms denied credit. Firms extended credit averaged $3.2 million in assets and $7.0 million in annual sales, whereas firms denied credit averaged $0.8 million in assets and $1.5 million in sales. Other significant differences in these two groups of firms are firm age, leverage, profitability, creditworthiness, and organizational form. Firms extended credit were significantly older (16 vs. 11 years), were less highly levered (33% vs. 21% capital to assets) and more profitable (20% vs. 13% return on assets), had fewer delinquent obligations of the business (0.54 vs. 1.18) and primary owner (0.22 vs. 0.85), were more likely to be organized as regular corporations (46% vs. 34%) and less likely to be organized as proprietorships (18% vs. 31%), and were less likely to be classified as business-services firms (15% vs. 25%).

4.2. Do firm–lender relationships generate valuable private information?

Table 2 presents the multivariate logistic regression results from estimating the probability of credit extension as a function of the six relationship variables

Table 2
Logistic regression results for variables used to explain the importance of relationships to the availability of credit. Results are for a sample of 2007 firms that applied for credit during 1991–94. The dependent variable is whether a firm applying for credit was extended credit. Credit source refers to the lender to which the firm applied for credit. *t*-statistics appear in parentheses

(1) Variable	(2)	(3)	(4)
Intercept	1.25 [b]	0.93 [b]	−3.31 [b]
	(11.76)	(6.28)	(−7.38)
Pre-existing relationships			
Checking account	−0.01	−0.08	−0.22
obtained from credit source	(−0.05)	(−0.52)	(−1.40)
Savings account	0.94 [b]	0.91 [b]	0.78 [b]
obtained from credit source	(4.51)	(4.36)	(3.64)
Loan	0.22 [b]	0.14 [b]	−0.10
obtained from credit source	(1.62)	(1.03)	(−0.71)
Financial management services	0.68 [b]	0.63 [b]	0.31
obtained from credit source	(4.36)	(3.96)	(1.88)
Length of relationship		0.05 [b]	0.04 [b]
with credit source		(4.06)	(3.40)
Number of sources for		0.06	−0.12 [b]
financial services		(1.62)	(−2.88)
Firm size			
Log of annual sales			0.22 [b]
			(4.53)
Log of total assets			0.16 [b]
			(3.30)
Pseudo-R^2	0.039	0.051	0.115

[a] Indicates statistical significance at the 0.05 level.
[b] Indicates statistical significance at the 0.01 level.

but without any of the twenty control variables. In column 2, I include only the four pre-existing financial service variables – checking accounts, savings accounts, loans, and financial management services. I find that three of the four – savings accounts, loans, and financial management services – are positive; and two – savings accounts and financial management services – are statistically significant at the 0.01 level. The *checking account* variable is marginally negative, but lacks statistical significance.

In column 3 of Table 2, I augment the four pre-existing financial service variables with two variables that measure the length of the firm's relationship with the potential lender and the number of sources for financial services. I find that firms with longer relationships and more sources of financial services are more likely to be extended credit. The effects of the four pre-existing financial service variables on the likelihood of credit extension are qualitatively

unchanged by inclusion of these two variables. These results are consistent with the theory that firm–lender relationships generate valuable private information over time, but inconsistent with the theory that the value of this information to a potential lender is negatively related to the number of sources from which the firm obtains financial services. However, as with the univariate results, I have yet to control for firm size.

In column 4 of Table 2, I augment the specification in column 3 with two measures of firm size – the natural logs of annual sales and total assets. Both are positive and highly significant, indicating that lenders are more likely to extend credit to larger firms. More importantly, the *number of sources* variable switches signs to negative and becomes statistically significant at the 0.01 level after controlling for firm size, consistent with the theory that private information is less valuable when shared among potential lenders. Not surprisingly, the significance of the financial management services variable drops considerably after controlling for size (to a *p*-value of 0.06), consistent with Cole and Wolken (1995), who report that larger firms are more likely to use such financial services. Overall, the results in Table 2 strongly support the theories that firm–lender relationships generate valuable private information useful in assessing the creditworthiness of the firm, and that the value of this information diminishes as the number of potential lenders increases.

4.3. Disentangling the effects of private and public information

In Table 3, I seek to disentangle the potentially confounding effects of private and public information on credit availability. Following Berger and Udell (1995), I use the length of the relationship with the potential lender as my proxy for private information and the age of the firm as my proxy for public information. In Tables 1 and 2, I documented that potential lenders are more likely to extend credit to firms with which they have had longer pre-existing relationships.

In Table 3, I explore this link more closely. First, I control for firm age, which is highly correlated with the length of firm's relationship with its potential lender (correlation coefficient 0.49). If all information about the firm is publicly available, then the significance of the length of relationship documented in Table 2 may be the result of a spurious correlation. I test and reject this hypothesis on the basis of the results in column 2 of Table 3, where I find that inclusion of firm age attenuates, but does not eliminate, the significance of the length of relationship variable. These results demonstrate that the potential lender does, indeed, generate valuable private information from the pre-existing relationship that is independent of the publicly available information reflected in the age of the firm.

The linear specification in column 2 implies that the marginal effect of an additional year of firm age or length of relationship is constant. However, it seems

Table 3
Logistic regression results for variables used to explain the importance of firm age and the length of firm-lender relationship to the availability of credit. Results are for a sample of 2007 firms that applied for a loan or line of credit during 1991–94. The dependent variable is whether or not a firm applying for credit was extended credit. Credit source refers to the lender to which the firm applied for credit. t-statistics appear in parentheses

(1) Variable	(2)	(3)	(4)	(5)	(6)
Intercept	1.06 [b]	−0.01	0.43	0.29	0.52
	(9.99)	(−0.06)	(1.85)	(1.10)	(1.80)
Firm age	0.03 [b]	–	–	–	–
	(4.00)				
Length of relationship with credit source	0.03 [b] (2.60)	–	–	–	–
Log of firm age		0.45 [b]	0.69 [b]	0.70 [b]	0.70 [b]
		(4.64)	(6.20)	(6.05)	(6.05)
Log of length of relationship with credit source		0.37 [b] (4.46)	−0.14 (1.24)	−0.17 (−1.45)	−0.18 (−1.51)
Zero length of relationship with credit source			−1.94 [b] (−6.73)	−1.90 [b] (−6.46)	−1.90 [b] (−6.46)
Pre-existing relationships					
Checking account obtained from credit source				−0.33 (−1.95)	−0.15 (−0.80)
Savings account obtained from credit source				0.96 [b] (4.56)	0.96 [b] (4.55)
Loan obtained from credit source				0.05 (0.33)	0.03 (0.22)
Financial management services obtained from credit source				0.61 [b] (3.79)	0.62 [b] (3.84)
Number of sources for financial services				0.02 (0.62)	0.02 (0.63)
Credit source is a commercial bank					−0.41 [a] (−2.07)
Pseudo-R^2	0.031	0.043	0.071	0.097	0.099

[a] Indicates statistical significance at the 0.05 level.
[b] Indicates statistical significance at the 0.01 level.

likely that the information generated in the earliest years is more valuable than the information generated in later years, i.e., that the marginal effect declines over time. To test this hypothesis, I replace the firm age and length of relationship variables with their natural logarithms. These results appear in column 3 of Table 3. A comparison of column 2 with column 3 reveals that the explanatory power of the model rises from a pseudo-R^2 of 0.031 to 0.043 and the significance level of each variable increases when the variables are replaced by their natural logs. These results favor the log specification over the level

specification, and support the hypothesis that the value of information, both public and private, declines over time.

Construction of the log of length of relationship variable revealed that 120 firms reported a zero length of relationship. It seems likely that lenders would view applications from such firms with an especially jaundiced eye, as the lenders would have had no opportunity to develop any private information about such firms. Indeed, closer examination of these zero length-of-relationship firms reveals that 47.5% were denied credit as compared to 14.5% for the entire sample. No other length-of-relationship cohort experienced a denial rate of even 20%. Consequently, I augment the log specification in column 3 of Table 3 with a dummy variable indicating a zero length of relationship with the potential lender. The results from estimating this augmented specification, which appear in column 4, show that the dummy variable for a zero length of relationship is negative and highly significant, while the log of the length of relationship variable is no longer significant. This implies that a pre-existing relationship with a potential lender improves the likelihood that the lender will extend credit, but that the length of that relationship is unimportant. The sign and significance of the log of firm age variable are not qualitatively affected by inclusion of the zero length of relationship variable, although the significance level increases. Indeed, the explanatory power of this three-variable specification rises to 0.071 versus 0.043 for the two-variable log specification in column 3. In contrast to Berger and Udell (1995), who found that longer relationships were associated with lower loan rates, these results suggest that the potential lender generates the valuable private information about its customers very quickly. [7] This finding has important policy implications, in that the valuable private information about a firm lost when its source of financial services disappears as the result of merger, regulatory seizure, or other reason can be quickly replaced if the firm develops a relationship with another source of financial services. Moreover, it is at odds with theories of financial intermediation such as Diamond (1991) and Petersen and Rajan (1995) that model lenders as slowly developing information about the firm over multiple time periods. I attribute this discrepancy to the focus of those theories on the price of credit rather than the availability of credit.

---

[7] I also tested a number of alternative spline specifications that allowed the slope coefficients for firm age and length of relationship to vary for firms in different intervals, such as five years. Only the variables for firm age of five year or less and for zero length of relationship are significant in these alternative specifications. As compared with the sample average denial rate of 14.5%, firms age five years or less were denied credit at a 28.8% rate while firms with zero length of relationship were denied at a 47.5% rate. Angelini et al. (1998) report a similar result for a sample of small Italian firms. Specifically, they find that only firms with banking relationships of less than three years are likely to be liquidity constrained.

In column 5 of Table 3, I augment the specification analyzed in column 4 with the four pre-existing financial services variables and the number of sources for financial services variable to see if the relationships documented thus far hold up after controlling for the additional information in this specification. I find that my earlier results are qualitatively unchanged, with the notable exception that the checking account variable is now counter intuitively negative and marginally significant (p-value 0.05). This indicates that, after controlling for the additional relationship variables, firms with checking accounts are less likely to be extended credit. One potential explanation for this finding is a spurious correlation attributable to the omission of an indicator for type of lender. [8] The checking account variable may be proxying for commercial banks, which during the early 1990s were under heavy regulatory pressure to improve their loan underwriting standards. If this regulatory pressure translated into tighter lending standards at commercial banks, then commercial banks would be less likely to extend credit than other types of lenders. To test this hypothesis, I add to the specification in column 5 a dummy variable indicating loan applications at commercial banks. As shown in column 6 of Table 3, there is strong support for this hypothesis. The commercial bank variable is negative and significant, indicating that commercial banks were less likely to extend credit than other types of lenders. Moreover, inclusion of the commercial bank variable renders the checking account variable insignificant.

4.4. The effect of firm riskiness on the probability of credit extension

Column 2 of Table 4 shows the results from estimating the probability of credit extension as a function of the relationship variables and an extensive set of variables included to control for differences in firm riskiness (see Section 2). The most important result in Table 4 is that the relationship variables remain significant determinants of credit availability even after including the control variables. Pre-existing savings accounts and financial management services increase the likelihood while multiple sources of financial services and pre-existing relationships of less than a year reduce the likelihood that a potential lender will extend credit to the firm. Hence, my results continue to provide support for the theory that firm–lender relationships generate private information valuable in assessing credit quality, and demonstrate that this information is independent of the effects of firm age, size, and riskiness.

Of my control variables, the logs of both total assets and annual sales are positive and significant, indicating that a potential lender is more likely to extend credit to a larger firm. Both the business- and personal-delinquencies vari-

---

[8] I am grateful to John Duca for suggesting this potential explanation for the counter intuitively negative sign on the checking relationship variable.

Table 4
Logistic regression results for variables used to explain the importance of relationships to the availability of credit. Column 2 presents the results from estimating the probability that a firm applying for credit was extended credit based upon a sample of 2007 firms. Column 3 presents the results from estimating the probability that a firm applied for a working capital loan based upon the subsample of 1090 firms that applied for this particular type of credit. Credit source refers to the lender to which the firm applied for credit. Each model also includes eight industry dummies based upon two-digit SIC codes and three dummies for organizational type (regular corporation, S-corporation, and partnership). *t*-statistics appear in parentheses

(1) Variable	(2) All types of credit	(3) Working capital loans only
Intercept	−2.34 [b]	−2.31 [b]
	(−3.72)	(−2.56)
Pre-existing relationships		
Checking account	−0.08	−0.01
obtained from credit source	(−0.37)	(−0.03)
Savings account	0.64 [b]	0.86 [b]
obtained from credit source	(2.85)	(2.82)
Loan	−0.21	−0.50 [a]
obtained from credit source	(−1.32)	(−2.22)
Financial management services	0.38 [a]	0.69 [b]
obtained from credit source	(2.10)	(2.79)
Log of length of relationship	−0.20	−0.16
with credit source	(1.89)	(−1.10)
Zero length of relationship	−2.04 [b]	−2.69 [b]
with credit source	(−7.06)	(−5.86)
Number of sources for	−0.11 [a]	−0.21 [b]
financial services	(−2.29)	(−3.07)
Firm characteristics		
Log of firm age	0.51 [b]	0.49 [b]
	(4.00)	(2.73)
Log of total assets	0.14 [a]	0.09
	(2.53)	(1.02)
Equity to assets	0.09	0.24
	(0.65)	(1.26)
Return on assets	0.16	−0.26
	(1.25)	(−1.38)
Log of total sales	0.21 [b]	0.26 [b]
	(3.64)	(2.81)
Number of business delinquencies	−0.34 [b]	−0.34 [b]
	(−5.18)	(−3.72)
Number of primary owner's delinquencies	−0.25 [b]	−0.17
	(−3.33)	(−1.61)
1991 loan application	−0.65	−1.08 [b]
	(−1.70)	(−7.62)
1992 loan application	−1.11 [b]	−1.83 [b]
	(−5.29)	(−5.95)
1993 loan application	−0.45 [b]	−0.57 [a]
	(−2.80)	(−2.55)

Table 4 (Continued)

(1) Variable	(2) All types of credit	(3) Working capital loans only
Credit source is a commercial bank	−0.80 [b] (−3.15)	−0.98 [a] (−2.22)
Pseudo-R^2	0.224	0.290

[a] Indicates statistical significance at the 0.05 level.
[b] Indicates statistical significance at the 0.01 level.

ables are negative and significant, indicating that a prospective lender is less likely to extend credit to a firm with demonstrated payment problems or whose primary owner has exhibited payment problems. Moreover, by controlling for the creditworthiness of the firm, I can with much greater confidence interpret the negative and significant sign on the number of sources variable as evidence that multiple sources of financial services reduce the value of private information the potential lender develops about the firm. None of the organizational form or SIC group control variables (not shown in Table 4) are statistically significant in explaining whether a potential lender extends credit to the firm.

Berger and Udell (1995) demonstrate that the effect of firm-creditor relationships on the price of credit is very different for floating rate lines of credit than for other types of loans. Whereas Petersen and Rajan (1994) found a positive and insignificant effect for the length of the firm–creditor relationship on the price of credit, Berger and Udell document a negative and significant effect. They attribute this to the fact that they limit their analysis to "relationship-driven" loans while Petersen and Rajan include many different loan types in their sample, including "transaction-driven" loans such as equipment and motor vehicle loans. Hence, a logical question is whether my results hold true when I limit the analysis to "relationship-driven" loans.

Because the 1993 NSSBF did not identify the loan type for credit applications that were denied, I cannot directly examine lines of credit. However, the 1993 survey does identify the proposed use of the prospective loan. I use this information to limit my analysis to prospective loans whose proposed use was working capital – the typical use fund obtained under a line of credit. This reduced the sample of firms by roughly half from 2007 to 1090.

The results of this analysis, which appear in column 3 of Table 4, demonstrate that the results for the full sample do, indeed, hold true for the subsample of working-capital loans. Each of the four relationship variables statistically significant in the analysis of the full sample has the same sign and remains significant in the working-capital subsample. The only substantive difference is that a pre-existing loan reduces the likelihood that the prospective lender will extend credit to the firm. This may be attributable to the greater loss exposure to which a line of credit would expose the prospective lender.

5. Summary and conclusions

This study draws upon theories of financial intermediation to develop testable hypotheses about the benefits of relationships between a firm and its prospective lender. I test these hypotheses using a model that estimates the probability that a potential lender extends credit to the firm. This is a more comprehensive and intuitive test that previous studies that have focused on the role of firm–lender relationships in the pricing of credit. Moreover, it enables us to make inferences about firms denied credit as well as those extended credit.

My results indicate that pre-existing relationships are important determinants of the likelihood that a potential lender will extend credit to the firm – strong evidence that such relationships generate valuable private information about the firm's financial prospects. I also provide new evidence on how the use of different financial services affects the availability of credit, finding that a prospective lender is more likely to extend credit to a firm that has pre-existing savings accounts and financial management services at the lender. Moreover, the evidence suggest that the prospective lender generates the valuable private information from these relationships quickly. This latter finding has important policy implications, in that it indicates the private information lost when a lender disappears as a result of merger, regulatory seizure, or some other reason, can be regenerated rather quickly.

I also show that the likelihood that a potential lender will extend credit to the firm decreases with the number of sources of financial services used by the firm, supportive of the theory that multiple relationships diminish the value of the private information generated by the potential lender. Finally, my results confirm that the importance of firm–lender relationships is independent of reputational effects of the firm as proxied by age and of firm riskiness as proxied by size, leverage, return, and creditworthiness.

Unanswered by this analysis is how firm–lender relationships affect the terms of the credit, such as the loan rate and the types and amount of collateral required by the lender. With this new source of data, there is the opportunity to further extend the work of Petersen and Rajan (1994) in examining the determinants of the loan rate and the work of Berger and Udell (1995) in examining the importance of collateral. I leave these as fruitful areas for future research.

References

Angelini, P., Di Salvo, R., Ferri, G., 1998. Availability and cost of credit for small businesses: Customer relationships and credit cooperatives. Journal of Banking and Finance 22, 925–954, this issue.

Berger, A., Udell, G., 1995. Relationship lending and lines of credit in small firm finance. Journal of Business 68, 351–382.

Billett, M., Flannery, M., Garfinkel, J., 1995. The effect of lender identify on a borrowing firm's equity return. Journal of Finance 50, 699–718.

Bulow, J., Shoven, J., 1978. The bankruptcy decision. Bell Journal of Economics 9, 437–456.

Cole, R.A., Wolken, J.D., 1995. Sources and uses of financial services by small businesses: Evidence from the 1993 National Survey of Small-Business Finances. Federal Reserve Bulletin 81, 629–670.

Diamond, D., 1984. Financial intermediation and delegated monitoring. Review of Economic Studies 51, 393–414.

Diamond, D., 1989. Reputation acquisition in debt markets. Journal of Political Economy 97, 828–861.

Diamond, D., 1991. Monitoring and reputation: The choice between bank loans and directly placed debt. Journal of Political Economy 99, 688–721.

Duca, J., Rosenthal, S., 1993. Borrowing constraints household debt and racial discrimination in loan markets. Journal of Financial Intermediation 3, 77–103.

Elliehausen, G.E., Wolken, J.D., 1990. Banking markets and the use of financial services by small and medium-sized businesses. Federal Reserve Bulletin 76, 801–817.

Fama, E., 1985. What's different about banks? Journal of Monetary Economics 15, 29–36.

Greene, W., 1991. LIMDEP Version 6.0: User's Manual and Reference Guide. Econometric Software, Bellport, New York.

Hoshi, T., Kashyap, A., Scharfstein, D., 1990. The role of banks in reducing the costs of financial distress in Japan. Journal of Financial Economics 27, 67–88.

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

James, C., Wier, P., 1990. Borrowing relationships, intermediation, and the cost of issuing public securities. Journal of Financial Economics 28, 149–171.

Leland, H., Pyle, D., 1977. Informational asymmetries, financial structure, and financial intermediaries. Journal of Finance 32, 371–387.

Lummer, S., McConnell, J., 1989. Further evidence on the bank lending process and the capital market response to bank loan agreements. Journal of Financial Economics 25, 99–122.

Maddala, G.S., 1983. Limited Dependent and Qualitative Variables in Econometrics, Cambridge University Press, Cambridge.

Petersen, M.A., Rajan, R.G., 1994. The benefits of lending relationships: Evidence from small businesses. Journal of Finance 49, 3–37.

Petersen, M.A., Rajan, R.G., 1995. The effect of credit market competition on lending relationships. Quarterly Review of Economics 110, 407–442.

Rajan, R.G., 1992. Insiders and outsiders: The choice between informed and arms length debt. Journal of Finance 47, 1367–1400.

Slovin, M.B., Sushka, M.E., Poloncheck, J.A., 1993. The value of bank durability: Borrowers as bank stakeholders. Journal of Finance 48, 247–266.

Stiglitz, J., Weiss, A., 1981. Credit rationing in markets with imperfect information. American Economic Review 71, 393–410.