Credit Gap in Small Businesses: Some New Evidence

Rajiv Mallick
Harvard Business School & Brandeis University

&

Atreya Chakraborty[1]
Charles River Associates Inc.

APRIL 2002

Abstract: What is the magnitude of credit constraint or credit gap affecting small businesses? This paper provides estimates of credit gap, defined as the difference between the desired and actual levels of debt for credit-constrained small businesses using the data from the National Survey of Small Business Finances. The estimated credit gap is approximately 20 percent – credit constrained small business on the average would desire 20 percent more debt. This credit gap varies considerably across industries, with service, manufacturing, and wholesale industries facing a significantly larger gap than firms in other industries. Evidence also indicates that relationship banking helps to narrow the credit gap. From a policy perspective, our results indicate that credit policies will be more effective if they are customized to industry needs.

JEL classification: G21; C31

Keywords: Credit gap, small business, multiple selections

1 Mailing Address: John Hancock Tower, 200 Clarendon Street, T-33, Boston, MA 02116-5092

Credit Gap in Small Businesses: Some New Evidence

19 April 2002

Abstract: What is the magnitude of credit constraint or credit gap affecting small businesses? This paper provides estimates of credit gap, defined as the difference between the desired and actual levels of debt for credit-constrained small businesses using the data from the National Survey of Small Business Finances. The estimated credit gap is approximately 20 percent – credit constrained small business on the average would desire 20 percent more debt. This credit gap varies considerably across industries, with service, manufacturing, and wholesale industries facing a significantly larger gap than firms in other industries. Evidence also indicates that relationship banking helps to narrow the credit gap. From a policy perspective, our results indicate that credit policies will be more effective if they are customized to industry needs.

1. Introduction

A growing body of empirical literature on small business lending suggests that credit constraint affects a significant proportion of small businesses; yet there is little evidence on the magnitude of this constraint.[2] A measure of credit constraint (i.e., the difference between the observed amount of debt and the desired level of debt by a firm) is particularly important for designing targeted relief policies for small businesses.

The primary purpose of this paper is to estimate the magnitude of credit gap -- the difference between desired and observed levels of debt for credit-constrained small businesses. It is essential to identify all credit-constrained firms in such a study. However, empirical evidence about credit-constrained firms from loan application data is inherently flawed, since some credit-constrained firms may not apply for a loan, fearing denial. Fortunately, data from the National Surveys of Small Business Finances (NSSBF, 1988–1989 and 1993) provide direct evidence on credit-constrained firms, i.e., firms that

did not apply for a loan fearing denial, and firms that were unable to acquire the amount for which they applied.[3]

In theory, a significant credit gap is expected for small businesses due to acute information asymmetry between borrowers and lenders. Under information asymmetries, excess demand for credit is due to the fact that increases in rates of interest will attract borrowers with higher risk when a lender is unable to distinguish among various borrowers' creditworthiness (Stiglitz and Weiss, 1981). In equilibrium, lenders will resort to rationing credit to their borrowers rather than use the interest rate as a market-clearing device (i.e., charge the less creditworthy borrowers higher rates of interest to compensate for the credit risk).[4] Hence, information asymmetry could cause credit markets not to clear, and some firms to be credit rationed.

Our study extends previous work (for example, see Petersen and Rajan (1994), Berger and Udell (1995, 2001), Cole (1998)) on small business lending in several ways. First, we estimate the gap between desired and observed debt for credit-constrained small firms with a positive demand for debt. We find that a credit-constrained small firm desires an average 20 percent more debt. To the best of our knowledge, evidence on the magnitude of credit gap at the firm level does not exist. However, there is extensive empirical work that estimates a similar gap for households.[5] Our study extends the liquidity constraint literature from households to small business finances.

---

[2] See, for example, Jaffee and Modigliani (1966), Jaffee (1971), Slovin and Sushka (1983), King (1986), Sofianos et al. (1990), Berger and Udell (1992, 1998) and Stein (2000).

[3] See questions J53 and J12 of the NSSBF (1993) codebook.

[4] Petersen and Rajan (1995) describe that initial asymmetric information creates adverse selection and moral hazard problems in which banks charge high rates initially and reduce rates in later periods after borrower types have been revealed.

[5] See Hayashi (1985), Jappelli (1990), Duca and Rosenthal (1993), and Cox and Jappelli (1993).

Second, we provide the first estimates of the selection biases inherent in quantifying desired debt. Any attempt to estimate the desired debt requires identifying a subsample of firms that have positive debt and are unconstrained in the credit market. Extending the econometric findings to all small businesses, however, requires that we control for differences between firms that are credit constrained and those that are unconstrained, and firms that have debt and have no debt.[6] Our estimates of sample selection term coefficients confirm that the sub-sample is indeed non-random, and that unobserved factors that increase the probability of holding debt also increase the demand for desired debt, and unobserved factors that increase the probability of being credit constrained reduce the demand for desired debt.

Finally, we provide evidence on how credit gap varies by firm characteristics. For example, manufacturing, wholesale, and service firms experience the largest credit gap, and utilities, insurance, and mining firms appear to be unconstrained. We find that the more people a firm employs, the greater the extent of the firm's credit gap. Similarly, C-corporations and S-corporations experience a greater credit gap than proprietary and partnership businesses. Also, unlike franchised firms, independent credit-constrained firms would have 21 percent more debt if credit constraints were removed.

Establishing the existence of the credit gap has some important policy implications.[7] First, a better understanding of the credit gap facing small businesses is required for targeting businesses that are more vulnerable to changing credit conditions. Since the magnitude of credit gap differs across firms, policy intervention will be more effective when targeted toward population groups that are more likely to face binding

[6] See Tunali (1985), Catsiapis and Robinson (1982), and Ham (1982).

credit constraints. Empirical evidence on the magnitude at firm level will help in drawing appropriate tax and transfer policy to aid such small business operators. Second, information on the magnitude of credit-constrained small businesses can also affect the outcome of a monetary policy (Gertler and Gilchrist, 1994). For example, the "credit" or "lending" view stresses the ability of monetary policy to regulate the pool of funds available to bank-dependent borrowers.[8] Our findings can be used to design monetary policies that may have a disproportionate impact on borrowers with limited access to capital markets.

This paper is organized as follows. Section II presents the background literature on credit rationing and summarizes empirical work on small business finances. Section III presents the empirical model. Sections IV and V describe the data and empirical results. Section VI presents the credit gap estimates, and section VII presents our conclusions.

2. Background

Why are small businesses more likely to be credit constrained? In this section, we examine this question with an emphasis on how banks have developed mechanisms to address this issue. We also provide a survey of current empirical work on small business lending.

Small businesses are generally characterized by opacity of their operations. Owners know more about their business prospects and often have no credible

[7] See Kashyap and Stein (2000) for a survey.
[8] Romer and Romer (1990); Kashyap, Stein, and Wilcox (1993); and Bernanke and Blinder (1992) provide discussions of the credit view.

mechanisms to convey such private information to lenders (Leland and Pyle, 1977). The resulting information asymmetry is fundamental to understanding why small businesses are credit rationed. Mitigating such information asymmetry is beneficial both to banks and small firms, and over time, sophisticated screening and monitoring mechanisms have been developed to address this issue.

Collateral and guarantees can be viewed as powerful tools that allow banks to offer credit on favorable terms to small businesses (Stiglitz and Weiss, 1981; Bester, 1985; Boot et al., 1991; Diamond, 1984). These contract features may reduce the cost of intermediation, and banks are in position to assess the value of pledged or guaranteed assets at lower cost than it can assess the value of the business as an ongoing concern. Loan commitments and lines of credit provided by banks protect borrowers against credit rationing, and are based on general market conditions (Melnik and Plaut 1986 and Sofianos et al., 1990). Loan commitments provide protection for the borrower against credit rationing (Melnik and Plaut, 1986; Sofianos at el., 1990). Lines of credit are pure revolving credits that allow the firm to borrow as much of the line as needed at any given time over a specified time period. Banks can induce borrowers to reveal their types by offering them sets of contract terms on commitment -- up-front fees, usage fees, interest rates etc. (Thakor and Udell, 1987; Boot et al., 1987). At times, loan commitments may exacerbate information problems as contracts are signed when limited information is available. By the time the funds are drawn down, it is possible that lenders have enough information to refuse a spot loan on similar terms or that borrowers can risk-shift to take advantage of the financial contract (Avery and Berger, 1991).

Banks may also use restrictive loan covenants and loan maturity to solve information problems. Such contracts force borrowers to renegotiate the covenants when a strategic opportunity to enhance the value of a loan arises or the financial condition of the firm changes (Berlin and Loeys 1988). Restrictive loan covenants prevent borrowers from engaging in risk-shifting behavior. Banks have a comparative advantage over financial institutions that issue private equity placement or public bonds in renegotiating and selectively relaxing debt contract covenants (Berlin and Mester 1993).

Loan maturity can also be used to complement covenants. A sequence of short maturity credits forces firms to renegotiate all covenants frequently, while covenant renegotiations can only be triggered by those covenants enumerated in the loan agreement. Small firms have less access to long maturity debt because they tend to be informationally opaque. In addition, unlike large firms, effective implementation of ratio-related financial covenants is difficult to monitor because of unreliable accounting procedures.

A more dynamic and comprehensive tool that banks use to ease the informational asymmetry is relationship lending. Relationship lending is a process in which banks, through continuous contact, gather private information over several years from a borrowing business. This information is derived from repayment histories, periodic submissions of financial statements, renegotiations, visits to banks, and other data associated with on-going monitoring.[9, 10] For example, banks providing a host of financial services to a borrowing business may be able to complement the usual

[9] For example, see Petersen and Rajan (1994), Berger and Udell (1995), Cole (1998), Allen et al. (1991) and Nakamura (1993).
[10] See Elsas and Krahnen (1998) for a similar study using German data.

information on credit balance and transaction activity with payroll data and get a unique picture of the financial health of the firm. Information specific to owners can be garnered from the provision of personal loans, credit cards, deposit accounts, trust accounts, and investment services.

Empirical evidence on the efficacy of relationship lending has been has been slow to accumulate, largely due to unavailability of reliable data on small business lending. Petersen and Rajan (1994) use the NSSBF (1988–1989) to examine benefits of the bank-firm relationship on credit availability among small businesses. They find that length of relationship has little impact on loan rates, but it enhances the availability of funds. In a similar spirit, Berger and Udell (1995) find that the length of relationship lowers both loan rate premiums above the prime rate and the probability of collateral use. Cole (1998) also examines the importance of bank-firm relationships to the availability of credit and, in several ways, extends the works of Petersen and Rajan (1994) and Berger and Udell (1995). He finds that the previous use of a lender as a source of savings accounts and financial management service increases the likelihood of credit availability. Elsas and Krahnen (1998) examine the notion of house-bank, which is closely related to relationship lending using German data. Harhoff and Korting (1998) use survey of small- and medium-size German firms to examine the role of lending relationship in determining the collateral requirements, costs and availability of funds. Our study extends this literature in that we not only estimate the credit gap, but also how the duration of lending relationship affects the credit gap for small firms.

3. Empirical Model

Our primary goal is to estimate the gap between desired and actual debt for credit-constrained small businesses. We consider a firm as having its desired level of debt if it is not credit-constrained and holds a positive level of debt (Cox and Jappelli 1993). We use the estimates of desired debt equation for these firms to forecast the desirable level of debt for credit-constrained firms with positive demand for debt. The estimates are likely to be biased, however, if a variable that affects a firm being credit constrained or having positive debt also affects the level of desired level of debt. For example, a firm with a better relationship with a lender may not only be less likely to be denied a loan but, relative to firms with similar prospects, may be able to borrow more. We adopt an extension of Heckman and Lee's works by Catsiapis and Robinson (1982), Ham (1982), and Tunali (1985) to account for two sources of selection bias, jointly determining inclusion in a subsample used in estimating the desired level of debt.

To estimate the debt, we use a three-step generalized regression procedure. The first equation represents the desired credit equation, and the other two are Probit equations that describe the selection rules.[11] For the *i*th firm, we have the following specification.

$$Y_i^* = b_1' X_{1i} + e_{1i}, \tag{1}$$

$$t_i = b_2' X_{2i} + e_{2i}, where\, \mathrm{T}_i = \begin{cases} 1\ if\ t_i > 0 \\ 0\ if\ t_i \le 0 \end{cases}, \tag{2}$$

$$q_i = b_3' X_{3i} + e_{3i}, where\, \Theta_i = \begin{cases} 1\ if\ q_i > 0 \\ 0\ if\ q_i \le 0 \end{cases}. \tag{3}$$

[11] See Cox & Jappelli (1993), Catsiapis & Robinson (1982), and Ham (1982) for empirical examples.

Y_i^* is the desired debt for the *i*th firm, and is observed only for firms that are unconstrained and have positive levels of debt. X_{1i} is a vector of credit-demand determinants, such as firm and owner characteristics and bank-firm relationship variables. The unobservable indices t_i and q_i, determine whether a firm holds positive credit and whether a firm is credit constrained or not, respectively.

We define a firm to be credit constrained if the firm replied in the affirmative to one of the two following questions.

(i) "With the most recent loan application, did a bank turn down the loan application or has the firm been unable to get as much as it applied for?"

(ii) "During the past three years, were there times when the firm needed credit but did not apply because it thought the application would be turned down?"

Following Cox and Jappelli (1993), we assume that the desired debt for a firm is observed if the demand for debt is positive and the firm is not credit constrained.[12] X_{2i} is a vector of credit demand determinants and proxies for the convenience of using credit, and X_{3i} is a vector of credit demand determinants and proxies for credit constraints. Convenience and Constraint proxies do not affect the desired debt but affect the probability of a firm holding credit and being unconstrained, respectively.

Equations 1 through 3 constitute the basic structure of the empirical model. From an empirical standpoint, our main result depends on the parameter estimates of equation

[12] Our specification calculates the credit gap by using firms that are unconstrained and have positive debt as a benchmark for desired debt. In Appendix 1A we expand our specification to include firms that have no

(1). Estimates of equations (2) and (3) provide probabilities of small firms holding debt and being unconstrained, respectively. These estimates are used to construct the selection terms (inverse Mills ratios) to estimate equation (1). The inverse Mills ratios from estimates of equations (2) and (3) are used to correct for issues of sample selection.

The two latent variables T_i and Θ_i admit four categories of firms: a) unconstrained firms with positive credit ($\Theta_i = 1$ and $T_i = 1$), b) unconstrained firms that choose not to hold credit ($\Theta_i = 1$ and $T_i = 0$), c) constrained firms with credit ($\Theta_i = 0$ and $T_i = 1$), and d) constrained firms that do not hold any credit ($\Theta_i = 0$ and $T_i = 0$). The estimation strategy proposed here is to use the first group ($\Theta_i = 1$ and $T_i = 1$) of firms to obtain consistent estimates of the reduced form of desired credit, taking into account the two sources of selection bias.

The expectation of desired credit for the first group of firms is $E(Y_i^* \mid T_i = 1, \Theta_i = 1) = X_1 b_1 + E(e_1 \mid T_i = 1, \Theta_i = 1)$. We further assume that each error term is normally distributed with mean zero and variance s_i^2 (i=1,2,3). Using the standard Probit normalization($s_2 = s_3 = 1$), one can obtain consistent estimates of b_2 and b_3. The final estimation equation of Y_i^* for the subsample can be written as

$$Y_i^* = b_1' X_{1i} + s_1 r_{12} \frac{f(t_i)}{\Phi(t_i)} + s_1 r_{13} \frac{f(q_i)}{\Phi(q_i)}, \quad (4)$$

where $f(t_i)/\Phi(t_i)$ and $f(q_i)/\Phi(q_i)$ are the inverse Mills ratios. The $f(.)$ and $\Phi(.)$ are the probability and cumulative distribution function of the standard normal distribution

---

debt and yet claim that they are not credit constrained into our benchmark. The coefficient estimates between both specifications are qualitatively similar.

evaluated at the Probit. The r_{12} and r_{13} are the correlation between e_1 and e_2, and e_1 and e_3, respectively. The probability of being in the sample is $\Phi(q_i)^* \Phi(t_i)$.

Credit gap for a sample of firms is defined as the difference between the average desired debt $\overline{D}^*$, and average actual debt as $\overline{D}^a$.[13] $\overline{D}_c^*$ is the average desired debt of credit-constrained firms can be written as $\overline{D}_c^* = \overline{X}_c \hat{b}_1$. Equation (4) provides the estimates for b_1, and $\overline{X}_c$ the mean of the vector of observable variables for the constrained firms, is constructed from the NSSBF data set. Credit gap is estimated as the difference between actual and desired debt (i.e., $\overline{Gap}_c = (\overline{D}_c^* - \overline{D}_c^a) = \overline{X}_c \hat{b}_1 - \overline{D}_c^a$).

4. Data

We use the data from the National Survey of Small Business Finances (1993), a survey administered by the Federal Reserve Bank. After accounting for missing data our final sample has 4,348 observations out of 4,637 original observations in the NSSBF (1993).[14] The final sample includes 3,355 firms with debt and 2,432 firms that are credit constrained.[15, 16]

Our primary focus is to estimate the magnitude of the credit gap small businesses face, and how "relationship characteristics" may affect small businesses' borrowing

[13] We define actual debt (or credit) as the combined amount of total loans, mortgages, notes, bonds, and capital leases.
[14] The variable representing the length of relationship with a primary lender has 221 missing observations, the checking account dummy variable has 151, the number of financial services from a primary lender has 98, and the years of owner experience has 18 missing observations.
[15] We define debt (or credit) as the combined amount of total loans, mortgages, notes, bonds, and capital leases.
[16] We define a firm to be credit constrained if the firm replied affirmatively to one of the two following questions. "With the most recent loan application did a bank turn down the loan application or has the firm been unable to get as much as it applied for?" and "During the past three years, were there times when the firm needed credit, but did not apply because it thought the application would be turned down?"

behavior.[17] To estimate the credit gap, we first need to estimate equations (2) through (4), while controlling for the appropriate relationship, firm and owner characteristics (Peterson and Rajan, 1994; Cole, 1998; and Berger and Udell, 1995). We group the control variables into three categories—relationship, firm and owner characteristics. In addition, the estimating procedure requires identifying variables that may affect the probability of holding debt and the probability of being credit constrained, but not necessarily the demand for desired debt. We call these variables "Constraint" and "Convenience" proxies, respectively.

The relationship variables, such as the length and types of pre-existing relationships, may influence the interactions between borrowers and lenders. The number of years of relationship with primary lender variable is a good proxy for the amount of private information a lender may have about a borrower's business. Such a pre-existing relationship generates information regarding a firm's credit-worthiness (See Foglia, Laviola and Reedtz, 1998; Farinha and Santos, 2001; Harhoff and Korting, 1998; Petersen and Rajan, 1994; Berger and Udell, 1995).

Lenders can also monitor a borrower's business through various financial services they provide—sometimes referred to as scope of relationship (Boot, 2000) and, in some instances as the multiplexity of relationship (Uzzi, 1999). For example, a bank that extends (exclusive) checking services to a firm has access to a very reliable and important source of information. Movements in checking account balances are closely related to changes in a firm's accounts receivables and inventories, and checking accounts data can provide a relatively cost effective way to monitor the business activities of a borrowing

[17] Credit gap is the difference between estimated desired debt and actual debt.

firm (Mester, Nakamura, and Renault, 1998). We also control for the number of financial sources from which a firm borrows.[18] The number of financial sources used may indicate a firm's inability to meet its credit requirements from its primary lender (Haines, Riding and Thomas, 1991).

Firm characteristics, such as firm age, total liabilities, profit and sales as percentage of total assets, is another set of control variables that we use. Age of the firm may proxy for public information about the firm, and its ability to overcome problems associated with new businesses (Dunkelberg, 1998). The sales-asset ratio indicates how does a firm fare in its product markets. A firm with greater sales to asset may be less likely to be credit constrained and more likely to have credit because greater sales require greater liquidity. Similarly, a profitable firm may be less likely to face a credit constraint, and banks would be more willing to lend to it. In addition, banks incorporate firm delinquency on business obligations. Such delinquency may signal a firm's existing and potential credit problems. We also include dummy variables for a firm's organizational form.

We also use owner characteristics as a set of control variables in our regressions. It is widely considered that small business loans are similar to consumer loans, and there is the lack of distinction between business and owner for legal and tax purposes. We include ownership characteristics, such as the ethnicity of owners, dummy variables indicating their bankruptcy and delinquency on personal obligations (Blanchflower et al., 1998; Cavalluzo & Cavalluzo, 1998). Banks may also consider owners' experience as their ability to manage firms in difficult product and credit market conditions.

[18] Degryse and Ongena (2001) examine the relationship between multiple bank relationship and

The estimation procedure also requires identifying variables that may affect the probability of holding debt (equation (2)) and the probability of being credit constrained (equation (3)) but not necessarily the demand for desired debt (equation (4)). We call these variables convenience and constraint proxies.[19] Constraint proxies try to capture variables that may affect the probability of being credit constraint. Similarly, convenience proxies try to capture the likelihood of using debt - firms for which the "convenience" of using debt is relatively high.

We use information on trade credit denial and payments to partners for our constraint proxies. Firms that have a history of trade credit denials may be more likely to be credit constrained. Firms with a history of significant payments to partners may be able to reorganize these payments and avoid being credit constrained. Information on firm's use of credit cards and the magnitude of internally available funds (sum of retained earnings, checking and saving account balances relative to assets (BALANCE)) are used as our convenience proxies. Each of these variables makes it possible for a firm to do businesses without explicitly borrowing banks.

Table 1 presents some univariate summary statistics of firm, owner, relationship characteristics, and constraint and convenience proxies for all firms and for firms in the four regimes—constrained and unconstrained firms, and firms with debt and without debt. Most firms have been in business for 11 years, and the years of relationship with the primary lender and the percent of firms with checking account do not differ across four regimes of firms. Sales average about five times total assets for firms that hold debt

---

profitability for Norwegian publicly listed firms.

and are credit constrained, nearly eight times for firms that do not have debt, and six times for unconstrained firms. Debt holders and credit-constrained firms have a larger share of liabilities and lower profits than do other firms. Proportionately more debt holders and credit-constrained firms are delinquent on business obligations. However, more proprietary firms do not have debt and are unconstrained. We also find that firms holding debt and credit-constrained firms are more alike in two respects—number of borrowing sources and number of financial services from their primary lenders.

Compared with owners of unconstrained firms, nearly twice the owners of constrained firms are delinquent on personal obligations and have some judgment rendered against them. More African-American firms are credit constrained, and nearly one-fifth of businesses run by females are credit constrained. The BALANCE and payment to partners as percent of assets, respectively, are the lowest for debt holders and credit-constrained firms. A greater proportion of firms uses business credit cards and was denied trade credit. Personal credit card usage is similar across all four regimes of firms.

5. Estimation Results

As explained above, the results attempt to explain the effect of relationship on small business borrowing behavior in three different ways: (1) the probabilities of being credit constrained, (2) the incidence of debt, and (3) the demand for desired debt. We then use these estimates to compute the credit gap in the next section.

[19] The nature of the problem is such that not identifying variables that affect the selection mechanism may produce unreliable estimates. However given the interrelationships between holding debt, being credit constrained and the optimal level of debt, it is difficult to identify these proxies in it's purest sense.

Table 2 highlights the effect of lending relationships on a firm being credit constrained. We find that the greater the length of relationship between firms and banks, the lower the probability of firms being credit-constrained. At the mean value of years of relationship with primary lender, one percentage increase in years of relationship lowers the probability of credit constraint by 2.1 percent. While older firms face a lower probability of being credit-constrained by a magnitude 2.7 percent, firms delinquent on business obligations increase their probability of being credit-constrained by 15.4 percent.

Empirical results also indicate that owner characteristics play a significant role in credit availability to small businesses. Judgment against owner and owner delinquency increase the probability that firms will be denied credit by 10.6 and 8.9 percent, respectively. The empirical evidence also indicates that businesses owned by African-Americans are more likely to be more credit constrained than other small businesses, by about 12.3 percent. Trade-credit-denied variable increases the probability of being credit constrained by 16.9 percent.

Table 3 presents Probit results of relationship variables on the incidence of debt. Using more services from the primary lender increases the probability of holding debt, and older firms are less likely to hold debt. The probability of holding debt increases with a liabilities to asset ratio and decreases by 0.2 percent with sales to asset ratio. A greater profit as percent of assets decreases the probability of holding debt by 0.3 percent. Firm owners with more years of experience are less likely to hold debt. We also find that firms owned by African-Americans and females have significantly lower probabilities of holding debt -- 5.2 and 4.2, respectively. The coefficient on the dummy variable for

personal credit cards used for business is significant and, as expected, increases the probability of holding some debt by 3.9 percent.

Table 4 presents estimates of the regression for desired debt.[20] There are two main results of this regression. First, we find that relationship matters. Our results show that the length of relationship with a primary lender matters more than the firm's age. One percent increase in the length of relationship with the primary lender increases the debt-asset ratio by three percentage points, while firm age does not have any significant effect. Though checking accounts do not affect the demand for debt, we find that using transaction and trust services decreases the demand for debt -- firms with deep pockets have lesser demand for debt.

Our results suggest that both sources of censoring render the sample nonrandom. The sign pattern for the selection terms confirms with intuition. The positive coefficient for the selection term for debt incidence implies a positive correlation coefficient between errors in the Probit for incidence of debt and the regression for desired debt. As expected, the results confirm that the unobserved factors that increase the probability of holding debt also increase the demand for desired debt. The coefficient on the credit-constrained selection term implies a negative correlation between unobservables in the Probit for being constrained and those in the regression for desired debt. Therefore, the unobserved factors that increase the probability of being credit constrained reduces the demand for desired debt.

6. Quantifying the Credit Gap

Credit gap for a sample of firms is defined as the difference between the average desired debt $\overline{D}^*$, and average actual debt as $\overline{D}^a$.[21] $\overline{D}_c^*$ is the average desired debt of credit-constrained firms with debt can be written as $\overline{D}_c^* = \overline{X}_c \hat{b}_1$. Table 4 (the results from Equation 4) provides the estimates for b_1, and $\overline{X}_c$ the mean of the vector of observable variables for the constrained firms, is constructed from the NSSBF data set.

Results indicate that credit-constrained firms with positive demand for debt have an average desired debt of $1,357,701. However, we find that there is a substantial variation in the desired debt across the sample. For example, service firms have the lowest average desired debt level of $764,836, but manufacturing firms have the highest levels of debt of $3,006,222 (see Table 5). Desired debt also varies substantially across the size of a small business. Small businesses that employ more than 99 employees have an estimated desired debt of $5,064,747, but this desired debt falls to $1,875,420 for firms employing 50 and 99 employees. Similarly, desired debt for S corporations is about two-thirds of what C corporations have (see Table 5).

Credit gap is estimated as the difference between actual and desired debt (i.e., $\overline{Gap}_c = (\overline{D}_c^* - \overline{D}_c^a) = \overline{X}_c \hat{b}_1 - \overline{D}_c^a$), and is reported in column 5 of Table 5. Our estimates indicate that small businesses would acquire an average 20 percent more debt if the credit constraints were removed. The credit gap, however, varies significantly across industries. Credit-constrained manufacturing firms would acquire nearly half of their

[20] We also run a regression with data on firms that are only credit constrained. Table 1A in appendix presents the results. Most of the coefficient estimates are comparable to the estimates presented in Table 4.
[21] We define actual debt (or credit) as the combined amount of total loans, mortgages, notes, bonds, and capital leases.

actual debt more if constraints were removed, whereas debt levels should go up by 27 and 23 percent in the wholesale and service sectors, respectively. Results also indicate that the utilities, transportation, insurance, mining, and retail sectors of small businesses experience no significant credit gap.

Given that our findings pertain to an era of serious credit tightening (Berger, Kyle and Scalise, 2000), it is not surprising that the manufacturing sector was severely credit constrained. In fact, findings from both Bernanke, Gertler and Gilchrist (1996) and Gertler and Gilchrist (1994) indicate that, following a tightening of monetary policy, small firms are disproportionately affected. Results on the utility sector may be due to the nature of business in that sector, which are usually not affected by general credit-tightening policies. For example, Krishana, Rajan and Zingales (1999) find that the utility sector, which normally enjoys a natural monopoly, requires little external financing relative to firms in other sectors.

Box-and-whisker plots are useful to visualize the distribution of the desired debt across each industry (see Figure 1). The graph plots the median, the upper (.75 quartile), and the lower quartiles (.25 quartile) of the distribution with adjacent and outside values. The adjacent values are upper or lower quartile plus or minus 1.5*r*, where *r* is the interquartile range. The outside values, if any, are values beyond the adjacent values, and are graphed individually. Figure 1 shows that there are distinct differences in the median values of the desired debt across industries. Individual series have been skewed somewhat, and in some cases, the long appendages indicate presence of long tails. The upper and lower quartiles also differ across the industries. More importantly we do not observe many outliers—we record just two outside values.

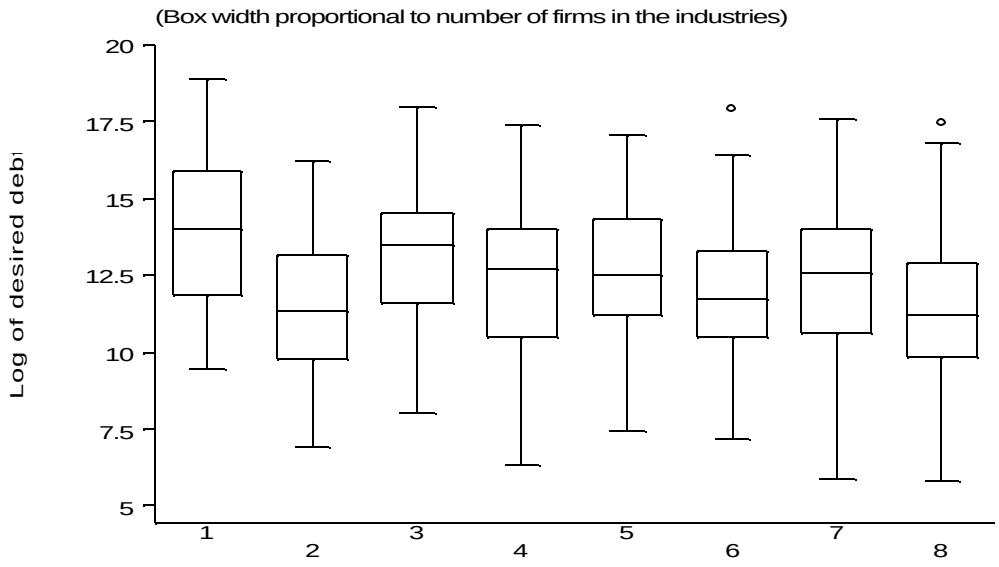

Figure 1: Box-and-whisker plots of desired debt for 1-digit industries; 1 = Mining, 2 = Construction, 3 = Manufacturing, 4 = Utilities & Transportation, 5 = Wholesale Trade, 6 = Retail Trade, 7 = Insurance, and 8 = Service.

7. Conclusions

Our findings indicate that credit-constrained small businesses face an average credit gap of 20 percent. The magnitude of credit gap varies considerably across industries, size of firm, and the nature of business organization. Manufacturing firms face an average credit gap of 46 percent, while the credit gap for services and wholesale firms is estimated at 23 percent and 27 percent, respectively.

The methodology used to obtain the results accommodates the nonrandom nature of the subsample (selection biases) used to estimate the firm's demand for desired debt (i.e., firms that have positive debt and are not credit constrained). We achieve this by adopting an extension of Heckman's correction procedure for multiple selections. We find that the both sources of sample selection bias—the unobserved factors that increase

the probability of holding debt and the unobserved factors that increase the probability of being credit constrained—are statistically significant.

Results also indicate that small firms with intrinsically strong preferences for holding debt are more likely to be constrained. As expected, firms with limited credit, shorter histories, and poor financial statements face tighter credit situations, consistent with various theoretical models of credit availability (e.g., Bernanke and Gertler, 1989, 1990; and Stiglitz and Weiss, 1981).

Consistent with previous finding on the importance of relationship lending, we find that preexisting relationships play an important role in firms being credit constrained and holding debt. Bank-borrower relationships generate valuable private information about the firm's financial prospects. Results also indicate that owner characteristics affect the credit gap—firms run by delinquent owners, owners with judgment against them, and owner-managers are more likely to be credit-constrained with larger credit gaps.

We also find that controlling for firm and owner characteristics explains much of the observed difference in access to credit between minority and other firms. Even after accounting for firm and owner characteristics, a significant race effect remains, which is consistent with recent studies that have examined the role of discrimination in the small business credit market (Cavalluzzo and Cavalluzzo, 1998, and Blanchflower, Levine, and Zimmerman, 1998).

From a policy perspective, our results indicate that credit policies may be more effective if they are customized to industry needs. The magnitude of credit gap differs substantially across firms from different industries and of sizes. Before drawing an

initiative to promote availability of credit to small businesses in economic downturns, our study indicates that an effective segmentation of small businesses according to their expected credit gaps would be essential to alleviate credit crunches.

Reference

Allen, L., A. Saunders, G. F. Udell, 1991, "The pricing of retail deposits: Concentration and information." *Journal of Financial Intermediation* 1, 335-361.

Avery, R. B., A.N. Berger, 1991, "Loan Commitments and Bank Risk Exposure." *Journal of Banking and Finance* 15, 173-192.

Berger, Allen N., Gregory F. Udell, 2001, "Small business credit availability and relationship lending: the importance of bank organizational structure." Finance and Economics Discussion Series (2001-36), Board of Governors of the Federal Reserve System. 1-36.

Berger, Allen N., Leora F. Klapper, Gregory F. Udell, 2001, "The ability of banks to lend to informationally opaque small businesses." Finance and Economics Discussion Series (2001-34), Board of Governors of the Federal Reserve System. 1-47.

Berger, Allen N., Margaret K. Kyle, Joseph M. Scalise, 2000, "Did U.S. Bank Supervisors Get Tougher During the Credit Crunch? Did They Get Easier During the Banking Boom? Did It Matter to Bank Lending?" NBER Working Paper No. 7689.

Berger, A. N., G. F. Udell, 1998, "The Economics of Small Business Finance: The roles of Private Equity and Debt Markets in the Financial Growth Cycle." *Journal of Banking and Finance* 22, 613-673.

Berger, A. N., G. F. Udell, 1995, "Relationship Lending and Lines of Credit in Small Firm Finance." *Journal of Business* 68, 351-382.

Berger, A. N., G. F. Udell, 1992, "Some Evidence on the Empirical Significance of Credit Rationing." *Journal of Political Economy* 100, 1047-1077.

Berlin, M., J. Loeys, 1988, "Bond Covenants and Delegates Monitoring." *Journal of Finance* 43, 397-412.

Berlin, M., L. J. Mester, 1993, "Debt Covenants and Negotiation." *Journal of Financial Intermediation* 2, 95-133.

Bernanke, Ben, Mark Gertler, Simon Gilchrist, 1996, "The Financial Accelerator and the Flight to Quality." *Review of Economics and Statistics* 78, 1-15.

Bernanke, Ben S., Alan S. Blinder, 1992, "The Federal Funds Rate and the Channels of Monetary Transmission." *American Economic Review* 82, 901-21.

Bernanke, Ben, Mark Gertler, 1989, "Agency Costs, Net Worth, and Business Fluctuations." *American Economic Review* v79, n1 (March 1989): 14-31

Bester, H., 1985, "Screening vs. Rationing in Credit Markets with Imperfect Information." *American Economic Review* 75, 850-855.

Blanchflower, D. G., P. B. Levine, D. J. Zimmerman, 1998, "Discrimination in the Small Business Credit Market." NBER Working Paper Series 6840.

Boot, A. W. A., 2000, "Relationship Banking: What do we know?" *Journal of Financial Intermediation* 9, 7-25.

Boot, A. W. A., A. V. Thakor, G. Udell, 1987, "Competition, Risk Neutrality and Loan Commitments." *Journal of Banking and Finance* 35, 899-920.

Boot, A. W. A., A. V. Thakor, G. Udell, 1991, "Secured Lending and Default Risk: Equilibrium Analysis and Policy Implications and Empirical Results." *The Economic Journal* 101, 458-472.

Catsiapis, George, Chris Robinson, 1982, "Sample Selection Bias with Multiple Selection Rules: An application to Student Aid Grants." *Journal of Econometrics* 18, 351-368.

Cavalluzzo, K. S., L. C. Cavalluzzo, 1998, "Market Structure and Discrimination: The case of Small Businesses." *Journal of Money, Credit, and Banking* 30, 771-792.

Cole, R. A., 1998, "The Importance of Relationships to the Availability of Credit." *Journal of Banking and Finance* 22, 959-977.

Cox, D., T. Jappelli, 1993, "The Effect of Borrowing Constraints on Consumer Liabilities." *Journal of Money, Credit, and Banking* 25, 197-213.

Degryse, H. and S. Ongena, 2001, "Bank Relationships and Firm Profitability." *Financial Management* 30: 9-34.

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

Duca, J. V., S. S. Rosenthal, 1993, "Borrowing Constraints, Household Debt, and Racial Discrimination in Loan Markets." *Journal of Financial Intermediation* 3, 77-103.

Dunkelberg, William C., 1998, "Credit, Banks and Small Business in America." *Journal of Banking and Finance* 22, 1085-88.

Elsas, Ralf, Jan Pierter Krahnen, 1998, "Is Relationship Lending Special? Evidence from Credit-File Data in Germany." *Journal of Banking and Finance* 22, 1283-1316.

Farinha, L.A. and J.A.C. Santos, 2001, "Switching from Single to Multiple Bank Lending Relationships: Determinants and Implications." *Journal of Financial Intermediation*, forthcoming.

Foglia, A., S. Laviola, and P. Reedtz, 1998, "Multiple Banking Relationships and the Fragility of Corporate Borrowers." *Journal of Banking and Finance* 22: 1441-1456.

Gertler, M., Simon Gilchrist, 1994, "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms." *Quarterly Journal of Economics* 109, 309-340.

Haines, George, Allan Riding, Roland Thomas, 1991, "Small Business Bank Shopping in Canada." *Journal of Banking and Finance* 15, 1041-56.

Ham, John C., 1982, "Estimation of a Labour Supply Model with Censoring Due to Unemployment and Underemployment." *Review of Economic Studies* 49, 335-354.

Harhoff, D. and T. Korting, 1998, "Lending Relationship in Germany - Empirical Evidence from Survey Data." *Journal of Banking and Finance* 22, 1317-1353.

Hayashi, Fumio, 1985, "The Effect of Liquidity Constraints on Consumption: A Cross-sectional Analysis." *Quarterly Journal of Economics* 10, 183-206.

Jaffee, D. M., Modigliani F., 1966, "A theory and test of credit rationing." *American Economic Review* 59, 850-872.

Jaffee, Dwight M., 1971, "Credit rationing and the commercial loan market." New York, Wiley.

Jappelli, Tullio, 1990, "Who is credit constrained in the US economy?" *Quarterly Journal of Economics* 104, 219-234.

Kashyap, Anil K., Jeremy C. Stein, 2000, "What Do a Million Observations on Banks say about the Transmission of Monetary Policy?" *American Economic Review* 90, 407-28.

Kashyap, Anil K. Jeremy C. Stein, David W. Wilcox, 1993, "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance." *American Economic Review* 83, 78-98.

King, S R, 1986, "Monetary Transmission: Through Bank Loans or Bank Liabilities?" *Journal of Money, Credit, and Banking* 18, 290-303.

Krishna B. Kumar, Raghuram G. Rajan, Luigi Zingales, 1999, "What Determines Firm Size?" NBER Working Paper No.7208

Leland, Hayne E., David H. Pyle, 1977, "Informational Asymmetries, Financial Structure, and Financial Intermediation." *Journal of Finance* 371-87.

Melnik, A., S. E. Plaut, 1986, "Loan Commitment Contracts, Terms of Lending, and Credit Allocation." *Journal of Finance* 41, 425-435.

Mester, Loretta J, L. I. Nakamura, M. Renault, 1998, "Checking Accounts and Bank Monitoring." Federal Reserve Bank of Philadelphia Research Working Paper: 98/25

Nakamura, L.I., 1993, "Commercial Bank Information: Implications for the Structure of Banking." In: Klausner M., White, L.J. (eds), Structural Change in Banking. Irwin, Homewood, IL pp. 131-160.

Petersen, M. A., R. G. Rajan, 1994, "The benefits of Firm-Creditor Relationships: Evidence from Small Business Data." *Journal of Finance* 49, 3-37.

Romer, Christina D., Romer, David H. 1990, "New Evidence on the Monetary Transmission Mechanism." *Brookings Papers on Economic Activity* 149-98.

Slovin, M. B., M. E. Sushka, 1983, "A Model of the Commercial Loan Rate." *Journal of Finance* 38, 1583-96.

Sofianos, G., P. Wachtel, A. Melnik, 1990, "Loan Commitments and Monetary Policy." *Journal of Banking and Finance* 14, 677-689.

Stein, J. C., 2000, "Information Production and Capital Allocation: Decentralization vs. Hierarchical Firms." NBER Working Paper Series 7705.

Stiglitz, J., A. Weiss 1981, "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71, 393-410.

Thakor, A. V., G. F. Udell, 1987, "An Economic Rationale for the Pricing Structure of Bank Loan Commitments." *Journal of Banking and Finance* 11, 271-289.

Tunali, I. F., 1985, "Migration, Earnings and Selectivity: From Theory to Fact – Evidence from Turkey, 1963-73." Doctoral Dissertation, University of Wisconsin-Madison.

Uzzi, Brian, 1999, "Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness." *Administrative Science Quarterly* 42, 35-67.

Appendix I

Derivation of Econometric Model[22]

The residuals of equations 1, 2 and 3 have zero mean and covariance matrix Σ:

$$\Sigma = \begin{bmatrix} 1 & r_{12} & r_{13} \\ r_{12} & 1 & r_{23} \\ r_{13} & r_{23} & 1 \end{bmatrix}.$$

The tobit regression for the sub-sample can be written as:

$$E(Y_1 \mid X_1, N) = b_1' X_1 + s_1 E(e_1 \mid X_1, N) \qquad (6)$$

where the conditioning argument N denotes the joint outcomes of the two selection rules. If $E(e_1 \mid X_1, N) \neq 0$, then a Tobit regression with the relevant sub-sample will result in inconsistent estimates. We require some additional structure on the conditional distribution of residuals to obtain consistent estimates of the parameters.

Let $\xi = (\varepsilon_1, \varepsilon_2, \varepsilon_3)'$, and assume $\varepsilon_i \sim N(0, \Sigma)$, for $i = 1,2,3$, independent across firms, and of the right hand side variables.[23] Our data set allows full information on the outcomes of the two selection rules, giving four distinct groups of firms. Given the trivariate normal specification, the probability density function for Y_i^* can be computed for each group.

For $t_i = q_i = 1$, equation (6) can be rewritten as

$$E(Y_1 \mid e_2 > -C_2, e_3 > -C_3) = b_1' X_1 + s_1 E(e_1 \mid e_2 > -C_2, e_3 > -C_3)$$

The conditional expectation on the right hand side for a trivariate normal specification is:

22 Appendix I is based on Tunali (1985), Ham (1982) and Catsiapis and Robinson (1982).
23 The residuals are likely to be correlated between individual firms. The correction for sample selection accounts for the existing correlation (see pages 353 and 354 of Catsiapis and Robinson, 1982).

$$E(e_1 \mid e_2 > -C_2, e_3 > -C_3) = r_{12}\frac{f(C_2)\Phi(C_3^*)}{P_4} + r_{13}\frac{f(C_3)\Phi(C_2^*)}{P_4}$$

$$E(e_1 \mid e_2 > -C_2, e_3 > -C_3) = r_{12}l_2 + r_{13}l_3 \qquad (7)$$

where f (.) and F (.) denote the standard univariate normal density and distribution functions, respectively. $C_2^* = \frac{C_2 - rC_3}{(1-r_{12}^{\ 2})^{1/2}}$, $C_3^* = \frac{C_3 - rC_2}{(1-r_{13}^{\ 2})^{1/2}}$, and $l_2 = \frac{f(C_2)\Phi(C_3^*)}{P_4}$, $l_3 = \frac{f(C_3)\Phi(C_2^*)}{P_4}$. The two l's are analogous to the inverse Mill's ratio used in Heckman's two step correction for selection bias. Substitute equation (7) in equation (6), we get the expression that takes explicit account of two sample selection rules. $P_4 = P(t_i = 1, q_i = 1) = P(\mathrm{T}_i > 0, \Theta_i > 0) = P(e_1 > -b_1^{'}X_1, e_2 > -b_2^{'}X_2) = G(C_2, C_3; r_{12})$, where $G(C_2, C_3; r_{12})$ denotes the standard bivariate normal distribution function (with correlation coefficient $\pm r_{12}$) and $C_t = b_t^{'}X_t; (t = 1,2)$. Therefore, we can rewrite equation (1) as:

$$Y_1 = b_1^{'}X_1 + s_1 r_{12} l_2 + s_1 r_{13} l_3 + s_1 V_1$$

$$= b_1^{'}X_1 + g_1 l_2 + g_2 l_3 + s_1 V_1 \qquad (8)$$

where $V_1 = e_1 - r_{12}l_2 - r_{13}l_3$ with $E(V_1 \mid Y_1^* > 0, Y_2^* > 0) = 0$. Tunali (1985) suggests that given the highly non-linear nature of l_2 and l_3, one can obtain estimates of l_2 and l_3 by univariate probits, and then substitute the estimated value in equation (9) to obtain estimates for the rest of the parameters.

Table 1

Firm, Owner, Relationship Characteristics and Proxies

This table provides the mean of each variable for all firms, and for firms in four regimes - firms with debt and no debt, constrained and unconstrained firms. The first panel lists firm characteristics, followed by owner, bank relationship characteristics and constraint and convenience proxies. Debt is defined as the combined amount of total loans, mortgages, notes, bonds and capital leases. BALANCE is a sum of checking, savings balances and retained earnings. Standard deviations are given in the brackets.

	All Firms	Debt Holders	Non-Debt Holders	Constrained	Unconstrained
Total Number of Observations	4,348	3,355	993	2,432	1,916
Firm Characteristics					
Ln (Assets)	12.14	12.48	10.96	12.57	11.58
	(2.50)	(2.21)	(2.17)	(2.32)	(2.16)
Liabilities/Assets	0.65	0.72	0.43	0.76	0.51
	(1.35)	(0.87)	(2.30)	(1.74)	(0.55)
Sales/Assets	5.75	5.05	8.11	5.33	6.29
	(11.69)	(10.21)	(15.40)	(11.01)	(12.48)
Profits/Assets	0.75	0.50	1.59	0.55	1.01
	(4.67)	(3.25)	(7.61)	(3.50)	(5.80)
Debt/Assets	0.51	0.51	0.00	0.55[!]	0.45[!!]
	(0.68)	(0.68)		(0.79)	(0.46)
Ln (Firm Age)	2.43	2.42	2.46	2.38	2.49
	(0.81)	(0.81)	(0.82)	(0.80)	(0.82)
Firm Delinquent	860	704	156	661	199
Proprietary	1,330	877	453	597	733
S-Corporation	1,056	873	183	642	414
Corporation	1,646	1,367	279	1,025	621
Independent	4,161	3,182	979	2,328	1,834
Owner Characteristics					
Ln (Years of Experience)	2.81	2.81	2.81	2.79	2.84
	(0.67)	(0.65)	(0.71)	(0.65)	(0.69)
African American Owners	395	280	115	269	126
Female Owners	779	554	225	406	373
Owner Delinquent (Personal)	541	414	127	396	145
Owner-Manager	3,495	2,646	849	1,936	1,559
Judgment against Owner	226	178	48	168	58
Owner Bankruptcy	119	90	29	64	55
Relationship Characteristics					
No. of Financial Institution	2.39	2.60	1.67	2.73	1.96
	(1.63)	(1.68)	(1.16)	(1.79)	(1.89)
No. of Services from Primary Lender	3.29	3.64	2.13	3.85	2.59
	(0.37)	(0.36)	(0.41)	(0.33)	(0.42)
Ln (Years with Primary Lender)	1.85	1.82	1.92	1.76	1.96
	(0.89)	(0.88)	(0.94)	(0.87)	(0.92)
Checking Account	4,076	3,113	963	2,248	1,828
Transaction Service	1,345	1,136	228	475	874
Trust Service	835	675	130	289	540
Constraint/Convenience Proxies					
Trade Credit Ever Denied	331	277	54	277	54
Partners' Payment/Assets	0.36	0.28	0.61	0.26	0.48
	(2.65)	(1.67)	(4.58)	(1.43)	(3.64)
Credit Card - Business	1,430	1,183	247	910	520
Credit Card - Personal	1,594	1,269	325	965	629
BALANCE/Assets	0.67	0.52	1.16	0.50	0.88
	(3.23)	(2.04)	(5.53)	(1.91)	(4.33)

[!] Of 2,432 firms 2,090 credit constrained firms have positive amount of debt.

[!!] Of 1,916 firms 1,265 credit constrained firms have positive amount of debt.

Table 2

Probit Estimates: Presence of a Credit Constraint

The dependent variable is 1 if the firm is credit constrained, 0 otherwise. The independent variables are firm, owner, relationship characteristics and constrained proxies. The regression includes a constant. The marginal effect for dummy variables are the discrete change in them from 0 to 1, and for all other variables it is computed at their mean values. The following are the estimates of equation (3).

	Coefficient		SE	Marginal Effect
Firm Characteristics				
Liabilities/Assets	0.229	***	0.043	0.090
Sales/Assets	-0.001		0.002	-0.001
Log (Firm age)	-0.068	*	0.037	-0.027
Profits/Assets	-0.002		0.005	-0.001
Corporation	0.100	**	0.044	0.039
Firm Delinquent	0.409	***	0.063	0.154
Owner Characteristics				
Log (Years of Experience)	-0.048		0.039	-0.019
Owner-Manager	0.077		0.053	0.030
African-American	0.328	***	0.078	0.123
Gender (Female Owner)	-0.083		0.054	-0.033
Owner Delinquent	0.233	***	0.076	0.089
Owner Bankruptcy	-0.092		0.118	-0.036
Judgement against Owner	0.281	***	0.108	0.106
Relationship Characteristics				
Checking Accounts	-0.101		0.090	-0.039
No. of Financial Institutions	0.002		0.017	0.001
Log (Years with Primary Lender)	-0.055	*	0.029	-0.021
No. of Services from Primary Lender	0.258	***	0.016	0.101
Constraint Proxies				
Trade Credit Ever Denied	0.461	***	0.098	0.169
Partners' Payment/Assets	-0.019		0.014	-0.008
Log likelihood	-2,534		Pseudo R^2	0.15
Prob > Chi squared	0		Total obs	4,348

*, **, and *** signify significance at 10, 5 and 1 percent, respectively.

Table 3

Probit Estimates: Incidence of Debt

The dependent variable is 1 if the firm has debt, 0 otherwise. The independent variables are categorized as firm, owner, relationship characteristics and convenience proxies. The regression also includes a constant. The marginal effect for dummy variables are the discrete change in them from 0 to 1, for other variables it is computed at their mean values. The following are the estimates of equation (2).

	Coefficient	SE	Marginal Effect
Firm Characteristics			
Liabilities/Assets	0.076	0.063	0.020
Sales/Assets	-0.007 **	0.003	-0.002
Log (Firm Age)	-0.080 *	0.044	-0.021
Profits/Assets	-0.011 *	0.006	-0.003
Corporation	0.096 *	0.051	0.025
Firm Delinquent	0.057	0.069	0.015
Owner Characteristics			
Log (Years of Experience)	-0.057	0.044	-0.015
Owner-Manager	-0.094	0.062	-0.024
African-American	-0.184 **	0.077	-0.052
Gender (Female Owner)	-0.153 ***	0.057	-0.042
Owner Delinquency	0.020	0.079	0.005
Owner Bankruptcy	-0.041	0.135	-0.011
Judgement against Owner	0.057	0.104	0.015
Relationship Characteristics			
Checking Accounts	-0.183	0.115	-0.045
No. of Financial Institutions	0.059 **	0.027	0.016
Log (Years with Primary Lender)	-0.005	0.034	-0.001
No. of Services from Primary Lender	0.296 ***	0.023	0.078
Convenience Proxies			
Credit Card/Business	0.001	0.052	0.000
Credit Card/Personal	0.152 ***	0.048	0.039
"Balance"/Assets	-0.020	0.015	-0.005
Log likelihood	-1,971	Pseudo R^2	0.16
Prob > Chi squared	0	Total obs	4348

*, **, and *** signify significance at 10, 5 and 1 percent.

Table 4

OLS Estimates: Determinants of Firms' Debt

The dependent variable is the debt/asset ratio. The subsample includes observations on firms that have debt and are not credit constrained. The regression also includes seven industry dummies based on one digit SIC code, and six of them are significant. The Mills ratios are computed from the Probit estimates of equations (2) and (3). The following is the estimate of equation (4).

	Coefficient		SE
Firm Characteristics			
Log (Assets)	-0.055	***	0.007
Sales/Assets	-0.003	**	0.001
Log (Firm age)	0.010		0.019
Profits/Assets	-0.018	***	0.003
C-Corporation	-0.013		0.046
S-Corporation	0.022		0.047
Proprietary	0.008		0.046
Franchise	0.024		0.050
Firm Delinquent	-0.428	***	0.049
Owner Characteristics			
Owner-Manager	-0.155	***	0.030
African-American	-0.580	***	0.054
Asian/Pacific Islander	0.071	*	0.040
Gender (Female Owner)	-0.064	**	0.030
Owner Bankruptcy	0.082		0.066
Owner Delinquent	-0.218	***	0.049
Judgement against Owner	-0.291	***	0.068
Relationship Characteristics			
Checking Accounts	-0.038		0.049
No. of Financial Institutions	0.000		0.012
Log (Years with Primary Lender)	0.030	*	0.017
Transaction Services	-0.109	***	0.030
Trust Services	-0.145	***	0.035
Selection Term - Credit Constrained	-3.037	***	0.183
Selection Term - Incidence of Debt	5.403	***	0.474
Total obs	1,265	R^2	0.25

*, ** and *** are significant at 10, 5 and 1 percent.

Table 5

Estimation of Credit Gap

This table presents estimates of the credit gap for constrained firms with positive demand for debt. The magnitude of credit gap is desired debt as a percentage of actual debt (See Section 6 for more details). The estimated credit gap is stratified by industries based on one digit SIC code, number of employees, and forms and types of corporate goverence. Desired debt is computed by multiplying predicted debt-asset ratios with total assets.

	# of Firms	"Desired Debt"[1]	Actual Debt[1]	Extent of Gap[2] (%)	
Industry					
Mining	15	9,723	9,135	106%	
Construction	239	602	492	122%	
Manufacturing	311	3,006	2,053	146%	***
Utilities & Transportation	99	1,281	1,917	67%	
Wholesale Trade	219	1,593	1,253	127%	*
Retail Trade	440	1,019	937	109%	
Insurance	124	1,594	1,594	100%	
Service	642	765	622	123%	**
Firm Size by Employment					
0 - 19	1,107	207	234	89%	
20 - 49	254	787	716	110%	
50 - 99	361	1,875	1,421	132%	***
100 - 499	327	5,064	4,250	119%	**
Corporate Governance					
Proprietary	452	137	132	104%	
Partnership	146	1,651	2,309	72%	
S-Corporation	573	1,292	1,081	120%	**
Corporation	919	1,952	1,469	133%	***
Independent/Franchise					
Independent	1,986	1,330	1,101	121%	***
Franchise	104	1,886	1,719	110%	
Overall	2,090	1,358	1,132	120%	***

[1]The debt figures are in thousands of dollars. [2] The extent of credit gap is desired debt as a percentage of actual debt. "***", "**" and "*" signify the difference between "desired" and actual debt is significant at 1, 5 and 10 percent, respectively.

Appendix - Table 1A

OLS Estimates: Determinants of Firms' Debt

The dependent variable is the debt/asset ratio. We present estimates for the unconstrained firms, which may have zero debt (see the footnote 11). Excluding constrained firms (unlike the estimates of Table 5) requires using the Heckman's two step procedure. The regression also includes seven industry dummies based on one digit SIC code, and five of them are significant.

	Coefficient		SE
Firm Characteristics			
Log (Assets)	-0.059	***	0.008
Sales/Assets	0.004	**	0.001
Log (Firm age)	0.024		0.020
Profits/Assets	-0.009	***	0.004
C-Corporation	-0.025		0.048
S-Corporation	0.017		0.049
Proprietary	-0.011		0.049
Franchise	-0.053		0.053
Firm Delinquent	-0.174	***	0.047
Owner Characteristics			
Owner-Manager	-0.042		0.030
African-American	-0.257	***	0.049
Asian/Pacific Islander	-0.017		0.138
Gender (Female Owner)	-0.014		0.031
Owner Bankruptcy	-0.246	**	0.114
Owner Delinquent	-0.072		0.050
Judgement against Owner	-0.121	*	0.071
Relationship Characteristics			
Checking Accounts	0.045		0.051
No. of Financial Institutions	-0.035	***	0.012
Log (Years with Primary Lender)	-0.005		0.017
Transaction Services	-0.139	***	0.031
Trust Services	-0.135	***	0.037
Selection Term - Credit Constrained	-2.501	***	0.223
Total obs	1,265	R^2	0.161

*, ** and *** are significant at 10, 5 and 1 percent.