1-1-2012

Credit Gap in Small Businesses: Some New Evidence

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

INTERNATIONAL JOURNAL OF BUSINESS, 17(1), 2012 ISSN: 1083−4346

Credit Gap in Small Businesses: Some New Evidence

Atreya Chakraborty[a] and Rajiv Mallick[b*]
[a] *University of Massachusetts-Boston, College of Management,*
100 Morrissey Boulevard, Boston, MA 02125
atreya.chakraborty@umb.edu
[b]*Amundi Alternative Investments, Inc.,*
1301 Avenue of the Americas, 38th Floor, New York, NY 10019
rajiv.mallick@nyc.amundi.com

ABSTRACT

What is the magnitude of credit constraint affecting small businesses? This paper provides estimate of the credit gap – defined as the difference between the desired and actual levels of debt for credit constrained small businesses. The estimated credit gap is approximately 20 percent, i.e., credit constrained small business on the average would desire 20 percent more debt. This credit gap varies considerably across industries, with manufacturing firms facing a significantly larger gap than firms in the wholesale or service industries.

JEL Classifications: G21, C31

Keywords: credit gap; small business; multiple selections; relationship banking

* The views expressed in this paper do not represent the views of Amundi Alternative Investments, Inc.

I. 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 no estimate on the magnitude of this constraint.[1] The primary purpose of this paper is to estimate the magnitude of this credit constraint or credit gap (defined as the difference between the *observed* and the *desired* level of debt). Ideally measuring the credit gap involves identifying credit-constrained borrowers – i.e., borrowers that did not apply for a loan, fearing denial of application; firms that were unable to acquire the amount for which they applied; and small businesses that do not have credit in their balance sheets. Such data is rarely available for small businesses. Fortunately, data from the National Survey 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 -- specifically questions J53 and J12 of the survey.

In theory, a significant credit gap is expected for small businesses due to acute information asymmetry between borrowers and lenders. Under information asymmetries, the excess demand for credit is partly due to the fact that lenders are unable to identify (and charge higher rates to) high-risk borrowers (Stiglitz and Weiss (1981)). In equilibrium, lenders will resort to rationing credit 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). Petersen and Rajan (1995) describe how 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. While anecdotal evidence on the severity of credit constraint among small business periodically surfaces in business press and policy discussions, evidence on the magnitude of this gap is nonexistent, mostly due to the absence of appropriate data.[2] Our results indicate that on average, credit-constrained small businesses desire 20 percent more debt. While there is extensive empirical work on measuring the credit gap for households, to the best of our knowledge we provide the first evidence on the magnitude of credit gap at the firm level for small businesses (see Hayashi (1985), Jappelli (1990), Duca and Rosenthal (1993), and Cox and Jappelli (1993)) for empirical evidence on credit gap for households). Our study extends the liquidity constraint literature on households and on relationship lending to small business finances.

Our empirical work highlights the importance 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 those that have no debt.[3] Our estimates of sample selection term coefficients confirm that the subsample is indeed nonrandom, that unobserved factors which increase the probability of holding debt also increase the demand for desired debt, and that unobserved factors which 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 firms that employ between 50-99 employees have a larger credit gap than those that employ 100-499 employees. 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. Because the magnitude of credit gap differs across firms, targeted policy intervention will become more effective as information on the magnitude of credit constraints among small businesses is made available (Gertler and Gilchrist (1994)). Information on credit gap will be instrumental in regulating the pool of funds designated to bank-dependent borrowers under a monetary policy as the "credit" or "lending" view would suggest.

II. BACKGROUND

Why are small businesses more likely to be credit constrained? We examine this question and survey current empirical work on small business lending with an emphasis on how banks have developed mechanisms to address the issue of information asymmetry that may contribute to alleviating or somewhat mitigating credit constraint. Small businesses are generally characterized by the opacity of their operations. Their owners know more about their business prospects and often have no credible mechanisms to convey such private information to lenders (Leland and Pyle (1977)). Mitigating information asymmetry is beneficial both to banks and small firms, and over time, sophisticated screening and monitoring mechanisms have been developed by banks to address this issue. Collaterals 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), and Diamond (1984)), and some of their contract features may reduce the cost of intermediation. Banks also use restrictive loan covenants to address the information problem. Covenants force borrowers to renegotiate when a strategic opportunity to enhance the value of a loan arises or the financial condition of the firm changes (Berlin and Loeys (1988), Melnik and Plaut (1986), and Berlin and Mester (1993)), and prevent borrowers from engaging in risk-shifting behaviors. Loan maturity can also be used to complement covenants. A sequence of short maturity loans forces firms to renegotiate contracts at expiration while covenants are renegotiated only if triggered by conditions enumerated and agreed upon.

Another effective mechanism 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 (see Boot (2000)). This information is derived from repayment histories, periodic submissions of financial statements, renegotiations, visits to banks, and other data associated with ongoing monitoring. Banks that provide a host of services to a borrowing business may be able to complement the usual information on credit balance and transaction activity with payroll data and get a unique perspective on the business's financial health. 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 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 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. Findings of Ongena and Smith (2001) from Norway suggest that benefits from the bank-borrower relationship may be inversely associated with the duration of relationship. Elsas and Krahnen (1998) do not find any relation between loan price and length of relation for German midsized companies. Harhoff and Korting (1998) conclude that a long-lasting relationship and concentrated borrowing were beneficial to small and medium-sized enterprises in Germany. They also find that duration of relationship has no impact on the cost of line of credit financing.

III. EMPIRICAL MODEL

We consider a firm as having its desired level of debt if it is not credit constrained and holds a positive level of debt (see 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, if a variable that affects a firm being credit constrained or having positive debt also affects the 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 a three-step generalized regression procedure which is an extension of Heckman (1979) 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. First equation represents the desired credit equation and the other two are Probit equations that describe the selection rules. For the *i*th firm, we have the following specification.

$$Y_i^* = \beta_1' X_{1i} + \varepsilon_{1i}, \tag{1}$$

$$\tau_i = \beta_2' X_{2i} + \varepsilon_{2i}, \text{where } T_i = \begin{cases} 1 \text{ if } \tau_i > 0 \\ 0 \text{ if } \tau_i \le 0 \end{cases}, \tag{2}$$

$$\theta_i = \beta_3' X_{3i} + \varepsilon_{3i}, \text{where } \Theta_i = \begin{cases} 1 \text{ if } \theta_i > 0 \\ 0 \text{ if } \theta_i \le 0 \end{cases}. \tag{3}$$

where Y_i^* is the desired debt for the ith 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 τ_i and θ_i determine whether a firm holds positive credit and whether a firm is credit constrained, respectively.

We define a firm to be credit constrained if it replied in the affirmative to one of the two following questions: (1) "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 (2) "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. X_{2i} is a vector of credit demand determinants and convenience proxies of using credit, and X_{3i} is a vector of credit demand determinants and credit constraint proxies. Convenience and constraint proxies do not affect the desired debt but affect the probability of a firm's holding credit and being unconstrained, respectively. From an empirical standpoint, our main result depends on the parameter estimates of equation (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 sources 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 is to use the first category ($\Theta_i = 1$ and $T_i = 1$) of firms to obtain consistent estimates of the reduced form of desired credit, taking into account the two sources of sample selection.

The expectation of desired credit for the first group of firms is $E(Y_i^* \mid T_i = 1, \Theta_i = 1) = X_1\beta_1 + E(\varepsilon_1 \mid T_i = 1, \Theta_i = 1)$. We further assume that each error term is normally distributed with mean zero and variance σ_i^2 (i=1, 2, 3). Using the standard Probit normalization $(\sigma_2 = \sigma_3 = 1)$, one can obtain consistent estimates of β_2 and β_3. The final estimation equation of Y_i^* for the subsample can be written as

$$Y_i^* = \beta_1' X_{1i} + \sigma_1\rho_{12}\frac{\phi(\tau_i)}{\Phi(\tau_i)} + \sigma_1\rho_{13}\frac{\phi(\theta_i)}{\Phi(\theta_i)}, \qquad (4)$$

where $\phi(\tau_i)/\Phi(\tau_i)$ and $\phi(\theta_i)/\Phi(\theta_i)$ are the inverse Mills ratios. The $\phi(.)$ and $\Phi(.)$ are the probability and cumulative distribution function of the standard normal distribution evaluated at the Probit. The ρ_{12} and ρ_{13} are the correlation between ε_1 and ε_2, and ε_1 and ε_3, respectively. The probability of being in the sample is $\Phi(\theta_i)^* \Phi(\tau_i)$.

Credit gap for a sample of firms is defined as the difference between the average desired debt ($\overline{D}^*$), and average actual debt as ($\overline{D}^a$).[4] $\overline{D}_c^*$ is the average desired debt of credit-constrained firms and can be written as $\overline{D}_c^* = \overline{X_c}\hat{\beta}_1$. Equation (4) provides the estimates for β_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., $\overline{Gap}_c = (\overline{D}_c^* - \overline{D}_c^a) = \overline{X}_c\hat{\beta}_1 - \overline{D}_c^a$).

IV. DATA

We use the data from the NSSBF (1993), a survey administered by the Federal Reserve Bank. The survey has 4,637 observations. It includes 3,355 firms with debt and 2,432 firms that are credit constrained as previously defined. There are 2,196 firms that have debt and are credit constrained and 1,358 firms that have debt but are not constrained, while 372 firms have no debt but are constrained and 712 firms have no debt and are not constrained. After accounting for missing data, our final sample has 4,348 observations out of 4,637 original observations.[5]

To estimate the credit gap, we first need to estimate equations (2) through (4), while controlling for the relationship, firm, and owner characteristics (Peterson and Rajan (1994), Cole (1998), and Berger and Udell (1995)). Creating a set of desirable variables to estimate equations (2) through (4) has been a considerable challenge. Given the interrelationship between presence of credit constraint (equation (2)), incidence of debt (equation (3)), and the desired debt (equation (4)) it is important to isolate identifying variables – i.e., variables that affect one of the relationships identified above but not the other. We have created two sets of proxies – the constraint and the convenience – to address this issue.[6] These proxies are far from optimal and at best can be considered adequate. Constraint proxies capture variables that may affect the probability of a firm's being credit constrained. Data on trade credit denial and payments to partners are our constraint proxies. Firms that have a history of trade credit denials may be more likely to be credit constrained, and firms with a history of significant payments to partners may be able to reschedule these payments and avoid being credit constrained. Similarly, convenience proxies capture the likelihood of using debt - firms for which the "convenience" of using debt is relatively high. Data on a firm's use of credit cards and the magnitude of internally available funds (the sum of retained earnings, and checking and savings account balances relative to assets (BALANCE)) are used as convenience proxies. Each of these variables makes it possible for firms to do business without borrowing from banks.

We use data on all firms to estimate equations (2) and (3), and data on firms that have debt and are not credit constrained to estimate equation (4). Table 1 presents univariate summary statistics of firm, owner, and relationship characteristics, and constraint and convenience proxies for four regimes of firms – constrained and unconstrained firms with debt, and constrained and unconstrained firms without debt. Most firms have been in business for over eleven years, and the years of relationship with the primary lender and the percentage of firms with checking accounts do not differ substantially across the four regimes of firms. Sales average about five times total assets both for firms that hold debt and are credit constrained and for firms that have debt but are unconstrained. Sales are nearly eight times total assets for firms that do not have debt. Unconstrained firms with no debt hold significantly less liability than other groups of firms, while having much larger profit-to-asset ratio, compared with unconstrained firms with no debt, a greater proportion of other firms were delinquent on business obligations. Nearly half of the unconstrained firms with no debt are proprietary firms.

Table 1
Firm, owner, and relationship characteristics and constraint/convenience proxies

	All Firms	Debt Holders	Non-Debt Holders	Constrained	Unconstrained
Total Number of Observations	4,348	3,355	993	2,432	1,916
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
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
# of Financial Institution	2.39	2.60	1.67	2.73	1.96
	(1.63)	(1.68)	(1.16)	(1.79)	(1.89)
# of Services (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

Table 1 (continued)

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[iv]/Assets	0.67	0.52	1.16	0.50	0.88
	(3.23)	(2.04)	(5.53)	(1.91)	(4.33)

[i]Debt is defined as the combined amount of total loans, mortgages, notes, bonds and capital leases.
[ii] Of 2,432 firms, 2,090 credit-constrained firms have positive amount of debt.
[iii] Of 1,916 firms, 1,265 credit-constrained firms have positive amount of debt.
[iv]BALANCE is a sum of checking and savings balances and retained earnings.
Standard deviations are given in brackets.

African-Americans own a large percentage of firms that are constrained and have no debt. Females own nearly one-fourth of all unconstrained firms with no debt. Owners who were delinquent on personal obligations own one-fourth of constrained firms with no debt. Constrained firms with debt receive more services from their primary lenders, more of them are likely to have trust services, and their checking and savings balances and retained earnings are nearly one and a quarter times the size of their assets.

V. ESTIMATION RESULTS

Our empirical work provides estimates of equations needed to estimate credit gap and also highlights the effects of relationships 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. Table 2 highlights the effect of lending relationships on a firm's being credit constrained. At the mean value of years of relationship with a primary lender, a 1 percent 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 of 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 such as judgments against an owner and owner delinquency increase the probability that firms will be denied credit by 10.6 and 8.9 percent, respectively. Businesses owned by African-Americans have a 12.3 percent greater probability of being credit constrained than other small businesses. Our result supports findings of Blanchflower et al. (1998) and Cavalluzzo and Cavalluzzo (1998) that African-American small businesses are more likely to face some type of discrimination than others are. The trade-credit-denied variable increases the probability of being credit constrained by 16.9 percent.

Our results of incidence of debt Probit highlight the role of relationship (see Table 3). 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 liabilities-to-asset ratio, and decreases by 0.2 percent with sales-to-asset

ratio. A greater profit as a percent of assets decreases the probability of holding debt by 0.3 percent. 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 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, and relationship characteristics and constrained proxies. The regression includes a constant. The marginal effects 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
Ln (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			
Ln (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
Judgment 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
Ln (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 observations	4,348

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

Table 3
Probit estimates: incidence of debt

	Coefficient	SE	Marginal Effect
Firm Characteristics			
Liabilities/Assets	0.076	0.063	0.020
Sales/Assets	-0.007 **	0.003	-0.002
Ln (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			
Ln (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
Judgment 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
Ln (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 observations	4,348

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

Our estimates of desired debt regression show that the length of relationship with a primary lender matters more than the firm's age (see Table 4).[7] One percent increases 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 less demand for debt. We observe that larger firms are more likely to use these services and are less likely to have the need to finance investments.[8]

Table 4

Ordinary least square 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
Ln (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
Judgment Against Owner	-0.291 ***	0.068
Relationship Characteristics		
Checking Accounts	-0.038	0.049
No. of Financial Institutions	0.000	0.012
Ln (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 observations	1,265	$R^2 = 0.25$

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

Our results also suggest that both sources of censoring render the sample nonrandom. The sign pattern for the selection terms conforms our conjecture. The positive coefficient for the selection term for debt incidence implies a positive correlation 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 unobservable variables 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 reduce the demand for desired debt.

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 VI 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 governance. 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%***

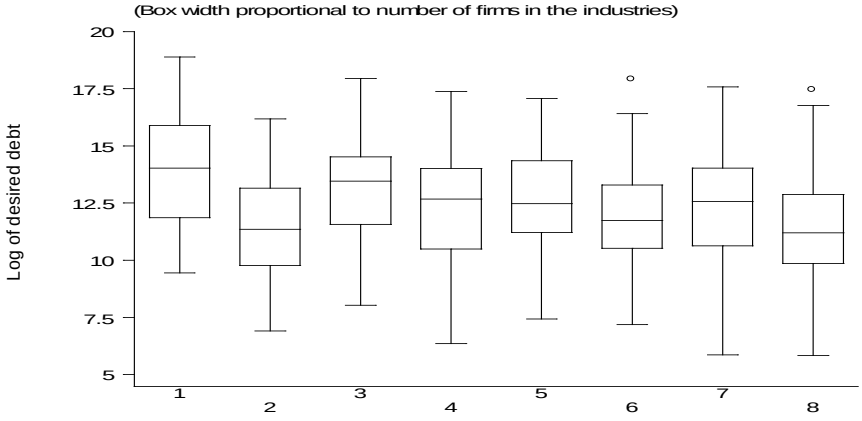
[1]The debt figures are in thousands of dollars. [2] The extent of credit gap is desired debt as a percentage of actual debt. ***, ** and * signifying the difference between desired and actual debt is significant at 1, 5, and 10 percent, respectively.

Our estimates indicate that credit-constrained firms with positive demand for debt have an average desired debt of $1,357,701. Small businesses would acquire on average 20 percent more debt if the credit constraints were removed (see Table 5). 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, $764,836, and manufacturing firms have the highest levels of debt, $3,006,222. Desired debt also

varies substantially across the size of small businesses. Small businesses that employ more than 99 employees have an estimated desired debt of $5,064,747, but it 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.

Our results indicate that manufacturing firms might increase their debt by nearly half if they could borrow more, whereas within the wholesale and service firms the debt levels would go up by 27 and 23 percent, respectively. Utilities, transportation, insurance, mining, and the retail sectors of small businesses experience no significant credit gap. Given that our findings pertain to an era of credit tightening, it is not surprising that the manufacturing sector is found to be severely credit constrained (Berger, Kyle, and Scalise (2000)). Results for the utility sector may reflect that it is usually not affected by general credit-tightening policies, and may resonate with the findings of Krishana, Rajan, and Zingales (1999) that utilities require little external financing relative to firms in other sectors, by virtue of their natural monopoly status. Figure 1 shows that there are distinct differences in the median values of the desired debt across industries. Individual series show some skewness, and in some cases the long appendages indicate the presence of long tails. The upper and lower quartiles also differ across the industries. More importantly, we record outliers in two industries.

Figure 1
Box-and-whisker plots of desired debt for one-digit industries



1 = Mining, 2 = Construction, 3 = Manufacturing, 4 = Utilities & Transportation, 5 = Wholesale Trade, 6 = Retail Trade, 7 = Insurance, and 8 = Service.

VII. CONCLUSIONS

Our findings indicate that credit-constrained small businesses face an average credit gap of 20 percent. As expected, firms with limited credit, shorter histories, and poor financial statements face tighter credit situations, consistent with various theoretical models of credit availability such as Bernanke and Gertler (1989) and Stiglitz and Weiss

(1981). 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 and 27 percent, respectively. Corporations on average have higher credit gaps than partnerships or proprietary small businesses. Our study indicates that an effective segmentation of small businesses according to their expected credit gaps would be essential to alleviating credit crunches and foster entrepreneurship.

The methodology used to obtain the results accommodates the nonrandom nature of the subsample (selection biases) used to estimate firms' 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 both sources of sample selection bias—the unobserved factors that increase the probability of a firm's holding debt and the unobserved factors that increase the probability of its being credit constrained—are statistically significant.

ENDNOTES

1. See, for example, Jaffee and Modigliani (1966), Jaffee (1971), Slovin and Sushka (1983), King (1986), Sofianos et al. (1990), and Stein (2002).
2. Berkowitz and White (1999) examine the effect of personal bankruptcy on small businesses' access to credit. Squires and O'Connor (1999) examine lending gap among small businesses in Milwaukee metropolitan area.
3. Cole (2010) models the credit allocation process among small businesses and comments on "non-borrowers" as these firms account for a large segment of the small businesses but has received limited attention in the literature.
4. We define actual debt (or credit) as the combined amount of total loans, mortgages, notes, bonds, and capital leases.
5. The variable representing the length of relationship with a primary lender has 221 missing observations. Missing observations for the checking account, the number of financial services from a primary lender, and the years of owner experience are 151, 98 and 18, respectively.
6. Cole (2009) discusses some the situations that may prohibit or prevent a small business from applying for credit.
7. We also ran a regression with data on firms that are only credit constrained results of which are available on request. Most of the coefficient estimates of the regression are comparable to those presented in Table 4.
8. Cole (2008) shows that the leverage is negatively related to the firm size.

REFERENCES

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

Berkowitz, J., and M. J. White, 1999, "Bankruptcy and Small Firms' Access to Credit." Presented at the Federal Reserve Conference on Business Access to Capital and Credit, February 1999.

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

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

Bernanke, B.S., and M. Gertler, 1989, "Agency Costs, Net Worth, and Business Fluctuations," *American Economic Review*, 79, 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, and 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, and G.F. Udell, 1991, "Secured Lending and Default Risk: Equilibrium Analysis and Policy Implications and Empirical Results," *The Economic Journal*, 101, 458-472.

Catsiapis, G., and C. Robinson, 1982, "Sample Selection Bias with Multiple Selection Rules: an Application to Student Aid Grants," *Journal of Econometrics*, 18, 351-368.

Cavalluzzo, K.S., and 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.

Cole, R.A., 2008, "What Do We Know About the Capital Structure of Privately Held Firms? Evidence from the Surveys of Small Business Finance," U.S. Small Business Administration, Office of Advocacy, Research Report no. 324, 1-52.

Cole, R.A., 2009, "Who Needs Credit and Who Gets Credit? Evidence from the Surveys of Small Business Finance," U.S. Small Business Administration, Office of Advocacy, Research Report no. 348, 1-136.

Cole, R.A., 2010 "Bank Credit, Trade Credit or No Credit: Evidence from the Surveys of Small Business Finances," U.S. Small Business Administration, Office of Advocacy, Research Report no. 365, 1-48.

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

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

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

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

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

Ham, J. 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, F., 1985, "The Effect of Liquidity Constraints on Consumption: A Cross-Sectional Analysis," *Quarterly Journal of Economics*, 10, 183-206.

Heckman, J., 1979, "Sample Selection Bias as A Specification Error," *Econometrica*, 47, 153–61.

Jaffee, D.M., and F. Modigliani 1966, "A Theory and Test of Credit Rationing," *American Economic Review*, 59, 850-872.

Jaffee, D. M., 1971, *Credit rationing and the commercial loan market*. New York, Wiley.

Jappelli, T., 1990, "Who Is Credit Constrained In The US Economy?" *Quarterly Journal of Economics*, 104, 219-234.

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

Krishna B., R.G. Rajan, and L. Zingales, 1999, "What Determines Firm Size?," *NBER Working Paper Series* 7208.

Leland, H.E., and D.H. Pyle, 1977, "Informational Asymmetries, Financial Structure, and Financial Intermediation," *Journal of Finance*, 32, 371-87.

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

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

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

Petersen, M.A., and R.G. Rajan 1995, "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics*, 110, 407-43.

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

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

Squires, G.D., and S. O'Connor, 1999, "Access to Capital: Milwaukee's Small Business Lending Gaps," in Blanton, J., A. Williams, and S. Rhine (eds) Business Access to Capital and Credit: A Federal Reserve System Research Conference. Conference Proceedings published by the Federal Reserve System.

Stein, J.C., 2002, "Information Production and Capital Allocation: Decentralization vs. Hierarchical Firms," *Journal of Finance*, 57, 1891-1921.

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

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