

ABSTRACT OF DISSERTATION

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The Graduate School
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A MEASUREMENT OF THE SMALL BUSINESS CREDIT GAP AND THE USE OF
CREDIT SCORING BY SMALL FINANCIAL INSTITUTIONS

ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in the College of Agriculture at the University of Kentucky

By

Jiang Hou

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and Dr. Eric Scorsone, Associate Professor of Agricultural Economics

Lexington, Kentucky

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Technological and regulatory changes and the consolidation trends of the last two decades are factors affecting the credit situation for small businesses. This dissertation begins with a theoretical framework summarizing potential factors that may lead to credit constraints for small businesses. An empirical model is used to measure the magnitude of the possible credit gap. Based on industrial economic theory, small financial institutions can play a role in reducing this credit gap. Because of the higher risk of small business customers, sustainability is of primary concern for small financial institutions. As an innovative solution, credit scoring for use by small financial institutions is then introduced and its effectiveness is demonstrated.

A theoretical background and general characteristics of the credit market, such as credit rationing, are first presented. Next, the phenomenon of less credit supply in rural areas or poor communities is analyzed, as well as how consolidation trends in the banking industry can contribute to the credit gap.

This dissertation then tests empirically whether credit constraints facing small businesses do exist. Possible credit constraints are quantified using the Call Reports of the 1990s and data from The National Survey of Small Business Finance, 1998. The potential credit gap is determined by the difference between the expected debt level and the actual debt level.

Small financial institutions are usually viewed as having the informational advantage and organizational flexibility to lend to small businesses. However, specializing in small businesses loans can bring high financial risk to small financial institutions because of the higher default risk of small businesses. The practice of credit scoring is introduced as a solution. Client data of one small financial institution, Community Ventures Corporation (CVC) of Kentucky, are used to test the effectiveness of the credit-scoring model.

The results of the tests on small-business lending presented in this dissertation show that: First, a credit gap does exist for small-business firms and its magnitude is quantified; Second, credit scoring can help small financial institutions by effectively revealing the characteristics of unqualified customers, guaranteeing the sustainability of small financial institutions and an expansion of their services to more small business customers.

Keywords: Credit Gap, Credit Risk, Credit Scoring, Information Asymetry, Small Business Lending,

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Chapter 1 Introduction

Small businesses in the United States are regarded as a means to economic opportunity and innovation, and as a source for the nation's economic growth. Most U.S. businesses are small- and medium-sized firms. According to Internal Revenue Service 2001 data, there were 16 million firms in non-farm industries. Using a sales value of less than US\$10 million as the criterion for a small business firm, more than 99 percent of businesses in the United States are financially small (IRS, 2001).

One of the most important factors for the survival and growth of a business firm is its ability to raise financial capital. The National Survey of Small Business Finance (NSSBF), 1998, indicates that small businesses rely heavily on financial intermediaries, especially commercial banks. In the past few decades, there have been great changes in the banking industry, including regulation by authorities and the consolidation of banks. Approximately 8,000 bank merged between 1980 and 1998, involving almost \$2.4 trillion in acquired assets (Stephen, 2000). Such trends in the financial sector raise concerns about the financial resources of small businesses because small commercial customers may seem less attractive to financial intermediaries (Berger, 1995; De Young et al., 2003).

Small-business lending has the general characteristics of other types of lending in the credit market. Demand, supply-side, and market structure determine quantities, price, and other terms of credit agreements, as well as the ability of certain borrowers to obtain a loan. On the demand-side, business owners will consider the profitability of a firm's prospects and internal financing solutions. If a project is profitable, given the costs of loans, a firm will borrow; the cost can include contracted interest, pledged collateral, or guarantees, etc. On the supply-side, lenders will balance the return on the interest with the expected risk level. The profitability of a given loan relates to the prospects of the borrowing firm and the conditions of its balance sheet. It is also associated with assessing and monitoring the cost of the risk. The establishment of mechanisms to screen and monitor loans will increase the transaction costs for such loans.

Financing conditions for small business firms are also affected by structural characteristics and cyclical conditions in loan markets. The competitive structure of business loan markets means there are more credit alternatives. Small business firms are

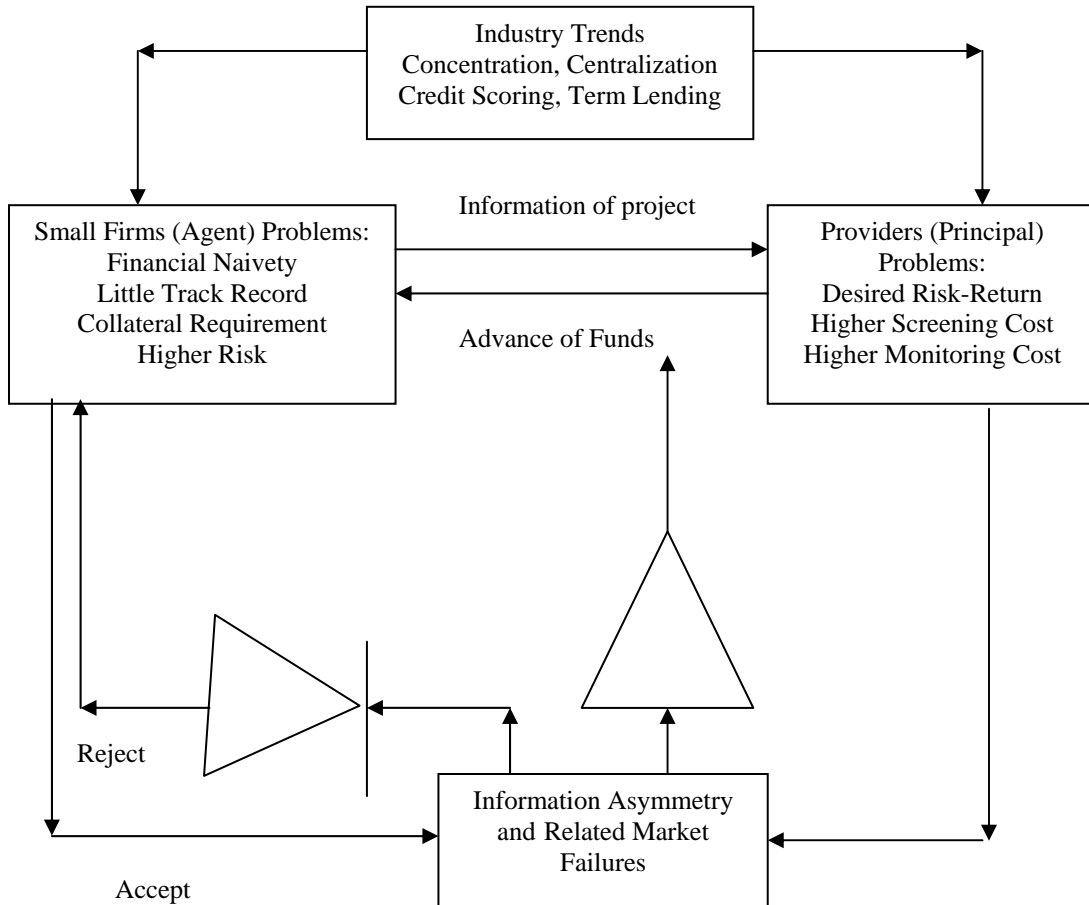
likely to obtain better credit terms in a highly competitive market. But small business firms are considered most vulnerable to the changing conditions over the business cycle. Economic downturn can depress a firm's property values, make its income prospects less certain, and hinder its access to loans

According to the neoclassic theory of investment, a firm has unlimited fund opportunities since financial markets are perfect. That means internal and external funds are perfect substitutes under the conditions that have no transaction costs or information costs (Modigliani and Miller, 1958). A firm could either use its own equity or borrow from the credit market at some interest to support its business. As a result, a credit gap between demand and supply does not exist. However, that conclusion is based on the assumption that lenders always have the same information about the profitability and risk of projects as borrowers do. Such a conclusion can hardly be valid because in most cases an asymmetric information condition does exist between lenders and borrowers. A substantial amount of literature suggests that the reduction of asymmetric information is at the heart of the financial intermediation process (e.g., Diamond, 1984; Boot 2000). Thus, information economics will be used as the main theoretical instrument to explain the potential gap in the small business firms' credit demand. However, this does not exclude other theories, such as, many small business firms do not seem to have enough credit, but do not face credit gap problems because owners are satisfied with their extant operating scale and do not want to borrow more. To test this, a further empirical model will be built to find whether a credit gap exists in different categories of small businesses.

Similar to other commercial loans, information asymmetries between lenders and borrowers may lead to credit rationing, with the result that some demands cannot be covered. Since small business firms often lack standard accounting procedures and other means to demonstrate the quality of their business methods, information asymmetry problems can be more serious for small businesses than for their larger counterparts. If a business is in its early or small stages, the business risk may be more significant than it would be for a mature or larger business, and banks will be more reluctant to lend to them. Another factor is the consolidation trends in the banking industry has resulted in more large banks that, due to the diseconomy of scale, often do not have the flexibility to

lend small loans to small businesses. Figure 1.1 is a model that illustrates the information asymmetry in small-business lending.

Figure 1.1 Information Asymmetry in Small Firm Lending



Source: Lean and Tuck, 2001

1.1 Objectives and Organization of the Dissertation

This dissertation tests whether credit constraints facing small businesses really do exist and investigates whether innovations in the financial market, such as credit scoring, could help small financial institutions manage default risk, thereby relaxing such credit constraints for small businesses. Thus, by a theoretical demonstration and empirical study of small-business lending, this dissertation examines the following issues:

1. Whether or not a credit gap exists for small-business lending, by quantifying the magnitude of the finance demand and supply for small business owners; and

2. Can credit scoring help small lending institutions control the default risk from small-business lending?

The dissertation first examines the economic theory underlying the credit market will be presented, revealing and explaining the possible credit constraints that affect small businesses, such as credit rationing due to information asymmetry. Information asymmetry also occurs across regions, e.g., in less developed areas, where small businesses may be found to be more credit constrained due to a lower number of transactions in these areas. Also, structural changes to the banking industry, such as the consolidation and acquisitions of the last two decades, are other important factors that limit the credit sources of small business firms.

Second, empirical models will be established to analyze the small business data to determine whether some business firms are experiencing constrained credit situations or not, and how large the credit gap between credit demand and supply is, in other words, to quantify the difference between the expected value of debt levels and actual debt levels. Data from the Call Reports of the 1990s (data from financial institutions—the supply-side of credit) and data from The National Survey of Small Business Finance, 1998 (information from small firms—the demand-side of credit) are the two main descriptive statistical sources used to show how trends in the credit market have affected the credit conditions of small businesses. A statistical model will be established to calculate the credit gap that may exist for those firms that are both credit constrained and indebted. It is assumed that a firm's credit demand is determined by four elements: 1) the operations of the firm; 2) the owner of the firm; 3) the relationship of the firm to the bank; and 4) the credit constraints and convenience to credit. Since only those firms that are both credit constrained and indebted are chosen, the sample selection bias problems must be dealt with.

Many researchers (Stain, 2000; Berger 2002; DeYoung et al., 2003) previously have pointed out that large banks tend to ignore the credit demand from small businesses, but small financial institutions have the informational advantage and organizational flexibility to lend to small businesses. However, specializing in small businesses loans can bring high financial risk to small financial institutions because the repayment risk (or

default risk) for small businesses is much higher than for large firms. It is necessary that some risk management mechanisms be established for small businesses lending.

In the final section, the practice of credit scoring in large financial institutions like credit card companies is considered as a solution to be used as a pre-transaction risk management strategy to screen out unqualified potential borrowers. By examining characteristics that determine the probability of repayment through the use of credit scoring, small financial institutions can quantify the default risk for each customer. Client data from Community Ventures Corporation (CVC), a small financial institution in Lexington, Kentucky, will be used to test the effectiveness of such a statistical credit-scoring mechanism.

Chapter 2 Theoretical Background

2.1 Market Failure for Small-Business Lending I: Information Asymmetry across Credit Markets

In classical economics, the market reaches equilibrium under the “unseen hand” mechanism, i.e., demand will always be met by supply under some price level with no supply surplus or demand gap. In the credit market, such equilibrium can hardly be reached because information between lenders and borrowers is not transparent, but always asymmetric. Asymmetric information leads to credit rationing — the credit supply is not large enough to cover the credit demand — creating a credit gap. Section 2.1 illustrates an ideal situation (without asymmetric information) between the lender and borrower. An economic background can illustrate why a credit gap may exist in the credit market, including small-business lending.

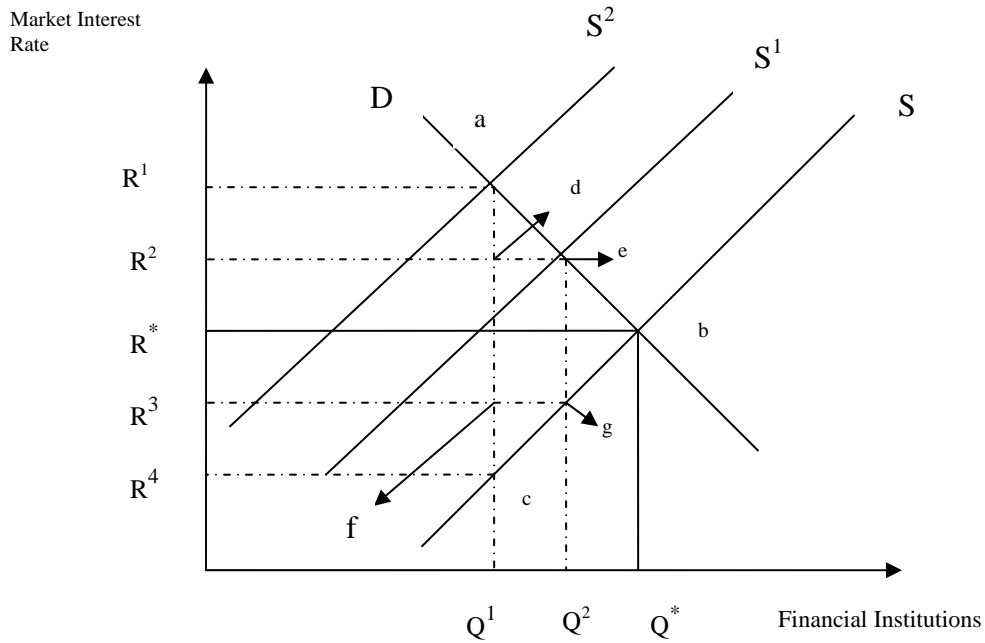
2.1.1 Supply-and-Demand Principles for Financial Intermediaries

Small-business lending institutions, which include banks that either accept funds or lend funds for consumption and investment, are one of the financial intermediaries in the credit market. Principles of supply-and-demand in the credit market can also be applied to these institutions.

Financial intermediaries can facilitate economic development by improving efficiency with which resources are allocated and utilized across distance and time. The economic theory that financial intermediaries in general improve the efficiency of the resources used will be illustrated by the following graphic analysis. An ideal situation will first be analyzed, in which transaction costs do not exist. Then economic factors that reflect reality will be added.

Figure 2.1 reflects the supply-and-demand environment of financial intermediation.

Figure 2.1 Supply and Demand of Financial Intermediaries



Source: World Bank, 1989

The supply curve (S) represents the economy's supply of funds. As the return (interest rate) increases, the supply (savings) will rise accordingly. The demand (D) represents the economy's demand for credit. The downward sloping of D means as the costs of borrowing increase, the demand for credit for investment or consumption will decline. In an ideal situation, without transaction costs, market equilibrium will be reached where the interest rate is R^* and the volume of financial intermediation would be Q^* . The market for the intermediation has reached Pareto efficiency, where the demand and supply are the same number. However, in reality, transaction costs do exist because the lender must have information about the borrower, which brings costs. The incurred costs are reflected in the lending interest rates. The increased interest rate that lenders must charge borrowers to cover the transaction costs leads the supply curve to shift from S to S^1 . The vertical distance is the transaction costs. The lender now would be willing to

supply Q^1 to earn R^4 . For such credit, the borrower would be paying R^1 . Transaction costs introduce a gap between the cost for borrowers and the return for lenders. The supply amount of the financial institution decreases from Q^* to Q^1 . Such a wedge makes the deadweight loss of social welfare equal to area, abc. Financial institutions can reduce the transaction cost by accumulating information over time as they become more specialized and utilize economic scale. Such actions can reduce the lenders cost from ac to eg, which is reflected by the shift of supply curve from S^2 to S^1 . The wedge between the costs to borrowers and the return to lender reduces and the credit supply increases to Q^2 . Now the deadweight loss to the social welfare is egb. The lower transaction costs and increased number of financial institutions can decrease the deadweight loss by areas ade and cfg, indicating social welfare is improved by more financial institutions.

The higher return for the lenders (from R^4 to R^3) and the lower the costs to borrowers (from R^1 to R^2) can also increase investment, consumption, and savings. The higher interest return will attract more savings and the lower cost of borrowing will produce more incentives to invest and consume.

2.1.2 Characteristics of the Credit Market

According to the neoclassic theory of investment, a firm has unlimited funding opportunities since financial markets are perfect. That means internal and external funds are perfect substitutes under the conditions of no transaction cost or information costs (Modigliani and Miller, 1958). However, such an assumption is invalid in the presence of asymmetric information. The fund lenders always have less information about the profitability and risk of the projects than the borrower firms themselves.

Asymmetric information within the credit market was first analyzed in the model of Stiglitz and Weiss (1981) showing that credit rationing happens as the result of information asymmetry between lenders and borrowers. The price of the loan, i.e., interest on the loans, is different from the expected return of the loans because the expected return of the loans also depends on the probability of the repayment. The interest rates also affect the repayment of loans because of moral hazard and adverse selection. When the borrowers are charged too high interest rates, the repayment

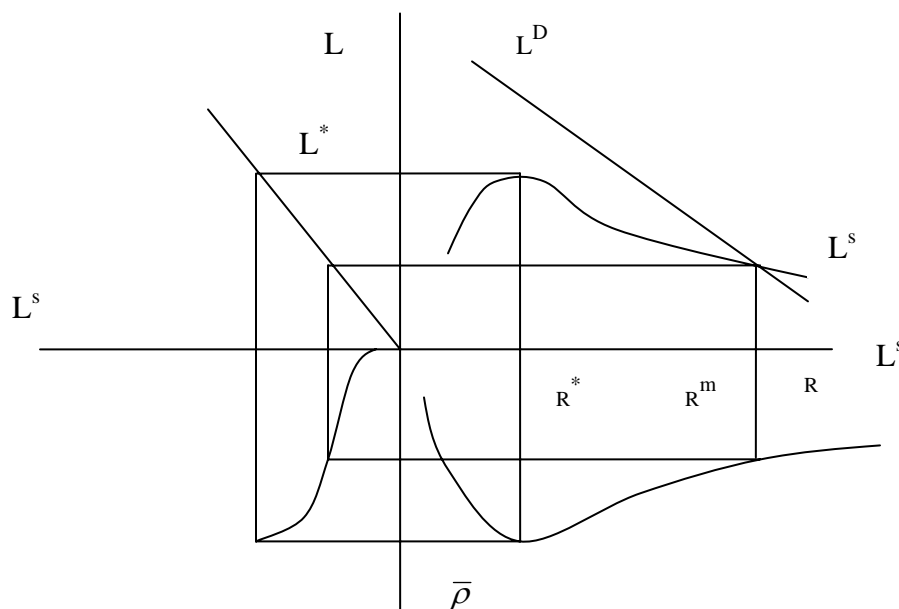
probability can be decreased for those two effects, which would reduce the expected return rate.

Adverse selection happens when lenders select the more risky borrowers and charge higher interest rates. According to Stiglitz and Weiss (1981), there are two effects from raising interest. The usual effect is that the expected return will rise as the interest charged on the loan rises. Another effect is the opposite effect brought by adverse selection, i.e., the pool of applicants increasingly contains borrowers with high-return, high-risk projects. Those borrowers who are willing to pay high interest rates usually have high-return, high-risk projects. The borrower with low-return, low-risk projects will be ruled out of the pool because the higher interest rates may be unaffordable for them. The adverse selection effect on the pool of borrowers produces a lower repayment probability and the expected return will decline.

Moral hazard is involved when an increase in interest rates adversely changes the behavior of borrowers. Stiglitz and Weiss (1981) show that increased interest rates can make riskier projects more attractive than lower-risk, lower-return projects. Raising interest rates may induce borrowers to change their risk attitude and take on riskier projects, also cutting down the expected returns to the bank.

A lender will balance the direct effect by raising the interest. Interest rates must also be raised to offset the side effects brought about by adverse selection and moral hazard. When the interest rate is low, the direct positive effect may be dominant. That is, the expected return rate has a positive relationship with the interest rates they charge when the interest rate is low. The expected return to the lender will attain a certain level. After that, the expected return will decrease because the higher interest draws the more risky customers and projects as the moral hazard and adverse selection effects become dominant. As a result, in response to the excess demand for credit, lenders will employ credit rationing rather than raising interest rates. The credit rationing mechanism is illustrated in Figure 2.2.

Figure 2.2 Determination of a Lender's Equilibrium Interest



Source: Stiglitz and Weiss, 1981

The demand of the loans (L^D) is a decreasing function of interest rates (R) charged on the loans, which is reflected by the downward slope. The shape of the supply of funds (L^S) is derived from the relationship between the expected return ($\bar{\rho}$) and the interest rate of the loan funds. The relationship between $\bar{\rho}$ and R is affected by adverse selection and moral hazard: $\bar{\rho}$ increases as R increases to R^* and decrease as R exceeds R^* . The supply of loans L^S is positively related to $\bar{\rho}$. At R^* , the supply of loans reaches its largest output. Any bank that raises its interest rate beyond R^* will lower its expected return. Therefore, no bank will raise the interest rate to eliminate the excess demand, resulting in credit rationing. At R^m , the loans supply equals the loan demand but it is not a final equilibrium interest rate. The banks can get the largest expected return at R^* rather than R^m . Therefore, the final loan supply L^* is less the loan demand L^D .

The existence of monitoring costs can produce equilibriums in which credit rationing happens, even without adverse selection and moral hazard problems. Williamson's model

(1987) complements Stiglitz and Weiss's (1981) conclusion by focusing on the monitoring cost. Debt contracts were derived endogenously as the optimal arrangements between borrowers and lenders. Such contracts can reduce monitoring costs. In a given debt contract, the probability is that monitoring happens and the expected costs of monitoring increases with the loans' interest rate. An equilibrium exists: higher bidders offer higher interests to the lenders and incur higher costs; but the final expected returns can still be greater for the lender, with results that some agents cannot receive loans. Bester (1985) argues that if there is a "signaling mechanism" that the bank requires collateral for their loans, credit rationing will not happen; and, if banks simultaneously (rather than respectively) choose the collateral requirement and interest rate as the screening instruments, credit rationing will not occur. Bester thinks that if the preference of borrowers depends on their risk types, the lower-risk borrowers are more inclined to accept the credit contract that demands higher collateral and lower interest risk. Lower-risk borrowers also think they have a lower probability to lose the collateral, which will make them benefit from the lower interest rate.

"The low-risk entrepreneurs have been assumed to be able to raise a sufficient amount of collateral to distinguish themselves from higher-risk ones." (Bester, 1985)

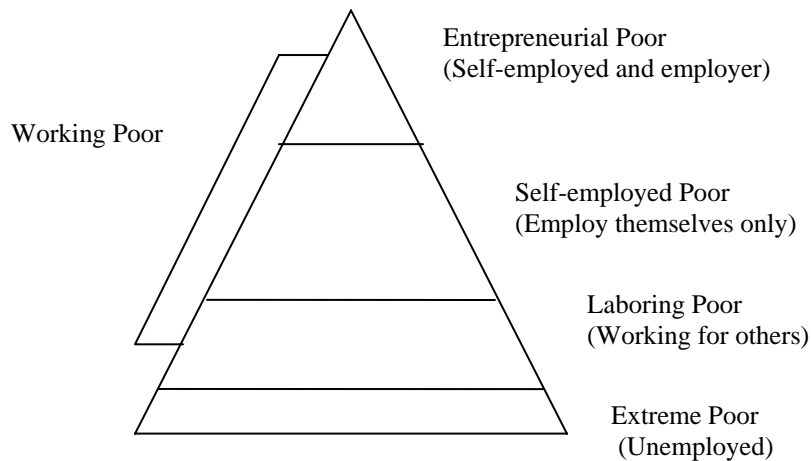
If there are enough banks offering different credit contracts, lower-risk borrowers who are denied their preferred loans will apply for other contracts chosen by less risky borrowers. Thus, "a credit rationing equilibrium always pools good and bad risks." High-risk borrowers select the credit contract with a higher interest rate and lower collateral requirement while low-risk borrowers select the opposite contracts.

Besides asymmetric information, there are several exogenous factors placing constraints on the supply of financial institutions, among them, interest rate floors and ceilings. Interest rate ceilings repress the loans suppliers' incentives and act as the main constraints for the low-income borrowers to obtain funds in markets. Hoff and Stiglitz (1990) argue that modest financial repression can lower borrower costs and boost their debt-to-equity ratio, leading them to invest more responsibly, since they have a larger stake in the project.

2.1.3 Special Market Participants in Small-Business Lending

A significant number of the clients of small-business lending are from the “working poor”: those who operate micro or small enterprises and/or work for wages or commissions (Remenyi, 1991). This term is similar to the definition, by Robinson (2002), of the “economically active poor” for customers of microfinance institutions. Contrary to the “extremely poor,” the economically active poor have some form of employment, are not destitute, and do not suffer a severe food deficit. The extreme poor exist below the minimum subsistence level. They include those who are unemployed or severely underemployed, as well as those whose work is so poorly remunerated that their purchasing power does not permit them to overcome malnutrition.

Figure 2.3 Clients of Small-Business Lending (Working Poor)



Source: Robinson, 2002

The characteristics of working-poor clients worsen the information opacity problems in small-business lending. In contrast to large firms, the small firms of the working poor normally do not enter into contracts that are generally known or visible to the public or are widely reported in the press. They cannot issue traded securities that are publicly priced in markets and even lack audited financial statements that could be shown to credit providers. As a result, these small firms have difficulty conveying their quality and overcoming their information opacity problems. The credit gap between the small firm’s

demand and the credit supply can be expected to be more serious than it is for large firms. In Chapter 3, such credit gaps in small business firms will be quantified using the 1998 National Survey of Small Business Financial Data.

2.2 Market Failure for Small-Business Lending II: Spatial Information Asymmetry across Regions

As illustrated in Section 2.1, credit gaps exist in financial markets when the information between borrowers and lenders is asymmetric. Such credit gaps are not homogenous across regions. Often, credit conditions for businesses in inner cities and rural areas are much more constrained than for businesses in more prosperous areas. The capital gap (including the credit gap) is regarded as the primary barrier to new markets in inner cities and rural areas. This phenomenon can be attributed to the inhomogeneous information distribution across regions, resulting from the differences in the production of public information in these areas.

2.2.1 The Vicious Cycle of Market Failure

Information production has costs like other market goods production (Stigler, 1961). Market failure will not happen if enough information is provided with marginal costs equaling the market benefit. However, such an ideal situation does not exist in real economic life. Grossman and Stiglitz (1980) illustrate that not all possible information will be produced. In equilibrium, market failure happens when the market does not produce all the possible information, especially in a low-volume market.

A similar but more general view regarding the economics of information Greenwald and Stiglitz (1986) is that when imperfect information exists, markets are not constrained by Pareto efficiency. This “pecuniary externality” can have real socioeconomic welfare consequences in the economies of imperfect information. The ability of government to improve the situation by a Pareto-improving exchange depends on the volume and quality of information (Stiglitz, 2000). Along with these views, government intervention in markets for welfare enhancement is also justified, but the successful functioning of such intervention depends on the availability of good information.

Weiler (2000) also discusses information distribution asymmetry across regions and its impact on economic development. The general assumption of classical welfare

economics, “regarding the efficiency of private markets that all actors have full information about market opportunities, cost, and benefit” is deemed invalid by Weiler (2000). In lagging regions, information that would positively affect market development is lacking. This deficiency of regional information can cause profitable investment opportunities to be ignored and local development will be negatively affected. Regional information also has the characteristics of public goods. Every agent in the market has access to it and can consume it to their maximum benefit, creating disincentives for information production. Less information production and accumulation in the less developed areas lead to less investment and business opportunities, forming a cycle of marginalization in market development. Government intervention by the public provision of information could help break the cycle and contribute greatly to market efficiency.

These principles are borrowed to analyze the financial market failure in peripheral markets that includes the rural credit markets and poor communities in urban areas, and explain why the credit demand of small businesses in these areas cannot be satisfied. In the markets of less developed areas that are restricted by low volume or geographic isolation, the costs of the information will be much higher than the benefits. Markets in less developed areas tend not to supply enough information for their development, forming a cycle destructive to local development.

Felsenstein and Fleischer (2002) also speak of the “thin” market, where small-business borrowers in peripheral areas are more credit constrained because of the information asymmetry existing between lenders and borrowers in these remote areas. Information scarcity brings higher transaction costs. The characteristics of microentrepreneurs (no qualified collateral, less experience, small loan amounts) further exacerbate the high cost problems and lead to the reluctance of lenders to provide loans for microentrepreneurs. Their research demonstrates how public intervention could promote microentrepreneurship by using data from a public program in Israel and empirically testing whether targeted programs could reduce information asymmetry, thereby making firms in peripheral areas more attractive to lenders. The regression results show that a public-intervention program could mitigate information asymmetry by helping small firms in remote locations generate more visibility. The problem of market imperfection may thus be addressed.

Scorsone and Weiler (2004) are the first to connect business- and policy-oriented research to the microeconomic foundation of informational asymmetries and market failures. Because of their isolation from the mainstream markets, “thin” markets face an “information hurdle” to increased economic activities. The information gaps in these markets are due to the lack of private-sector transactions. Along with the limited volume of transactions in the “thin” market, business investment will be negatively affected because of the unavailability of information about local economic conditions such as labor market conditions, government regulations, market competition, etc. In addition, information production has a high fixed cost, and only after more data and information flow in, can the accuracy of information be guaranteed and average costs of information be cut down. Less data in the “thin market” for fewer transactions will create disincentives for information production. The “thick market” has the information advantage due to more transactions and lower average costs of information. Capital and labor will flow to those thick markets where information costs are low and the “payoff and risks are subsequently more transparent,” resulting in “geographic adverse selection”. Even valuable projects in the peripheral markets may be ignored by the capital market.

“Although opportunities in thin markets may actually be of considerable quality, poor comparative information on related ventures in such areas implies that such projects will face adverse selection through no inherent weakness of their own. It is the thin market itself that hinder such projects, not the projects themselves.” The destructive cycle happens when “thin markets discourage good projects, ensuring that these markets will remain thin.” (Scorsone et al., 2004; p. 303)

Information on the local level also has a public goods characteristic. Once produced, any agent in the market can take a share in it. Because the high costs of production can make the private supply of such information impossible, there is a role for government provision of information that can address market failure in less developed regions and promote market efficiency and regional equity.

The pernicious cycle of neglect and marginalization will also happen in the peripheral (rural areas or poor communities in urban areas) credit markets. The number of transactions in the peripheral markets is very limited. “Such limited transactions in a stagnating market imply poor information and high variances.” (Scorsone and Weiler,

2004) The consequential high costs discourage credit suppliers from providing loans in these markets.

In summary, the credit gap in peripheral markets can be attributed to a lower level of development, resulting from a lower level of public information accumulation. The principle is as follows: the peripheral markets have less loan transactions and accumulate comparatively limited public information; such limited information increases the investment risk and results in less investment in local projects, which depresses external investments; and, the lack of investment and other financial services increases the marginalization of the peripheral market. A cycle destructive to development forms in these peripheral areas. If financial institutions could overcome the limited information obstacle, they might enter these markets and survive.

2.2.2 Necessity of Government Intervention

To realize the dual gain of market efficiency and regional equity, government can intervene to correct the failure of peripheral credit markets. However, direct government participation in these markets will produce public goods information, and can depress incentives to produce more information. Actually, government already participates indirectly in the markets. A model illustrating the relationship among small business firms, government, and small financial institutions is presented in Appendix 2. The government provides loans to small financial institutions and demands certain requirements from them including “social effect” and “self-sustainability.” These two goals compel small financial institutions to seek and lend to qualified local entrepreneurs, which lead to more transactions and contribute to local development. Local microentrepreneurs are familiar with the local demand and have a higher probability to succeed in initiating local businesses. During the process, small financial institutions work as intermediaries that speed-up information dissemination. More transactions will be produced. The demand gap of small businesses often ignored by the formal financial suppliers will be covered. A benevolent information cycle will also be created. The new credit market information initiative will promote both economic efficiency and equity by focusing on neglected business opportunities created by the small business owners.

2.3 Market Failure for Small-Business Lending III: A More Consolidated Market Structure

2.3.1 Consolidation Trends in the Credit Market

Both the banking consolidation of the last two decades and the tremendous change in the commercial banking industry during this period contribute to the existence of the credit gap for small business. Two important laws, the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Garn-St Germain Depository Institutions Act of 1982, removed many regulations that had limited competition between banks and nonbanks. As a result of these deregulatory acts, the banking industry experienced an intense period of consolidation. Nearly 3,000 banks merged from 1987 to 1994 (Ely et al., 2001). Another driving force behind the increased consolidation is the deregulation of restrictions on geographical expansion by the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. As a result of these policies, consolidation produced larger banking companies with more complex organizational structures.

The costs of lending to small business are higher for larger banks than for the reduced number of small banks because large bank's hierarchy systems' inability to deal with the relationship lending in small business loans (Berger and Udell, 1995; Strahan and Weston, 1998). As a result, access to credit by small businesses has diminished. The consolidation of banks raised policy concerns due to empirical research that shows large banking institutions devote proportionally less assets to small-business loans than small institutions (Berger and Udell, 1995; Strahan and Weston, 1998; Peek and Rosengren, 1998). Direct proof of this can be derived from the June, 1999 Call Reports data, showing banks with less than US\$100 million in assets had about 9 percent of their portfolios invested in small-business loans, while banks with over US\$10 billion in assets devoted only about 2 percent of their assets to these loans.

2.3.2 The Organizational Diseconomy of Consolidated Banks

The reasons for the disinclination of large banks to lend to small businesses have been put forth by much previous research. Small business loans are often involved with relationship lending. Large institutions can hardly provide relationship-driven loans

because the organizational structure of large banks makes it too costly to provide a relationship-based service that often demands intimate knowledge gained through contact over time with small business owners and their market (Williamson, 1987).

The reduction of asymmetric information is at the heart of the financial intermediation process. Economic theories of information can illustrate why the consolidated large financial institutions are disinclined to lend to small business, and why small financial institutions have an organizational and informational advantage over large financial institutions. The argument that small financial institutions can specially serve small businesses is based on a series of previous research results.

The phenomenon that the large formal financial institutions often ignore the credit demand from small businesses is concisely summarized by Berger and Udell (1998):

“The larger institutions created by consolidation may also choose to provide fewer retail services to small customers because of Williamson-type (1987) organizational diseconomy...This diseconomy may be most likely to arise in providing services to informationally opaque small businesses for whom intimate knowledge of the small businesses, its owner and its local market gained over time through a relationship with the financial institutions is important.” (Pp.165–6)

Several empirical studies complement the findings of Berger and Udell (1998). Nakamura (1994), Strahan and Weston (1998) illustrate that small banks invest a significantly larger share of their assets in small-business loans than do larger formal banks. Such a tendency becomes more obvious when after large banks acquire small banks (Peek and Rosengren, 1998). Many of the small-business loans cut in the process of consolidation are picked up by small banks in the local market. Although the research suggests that it may be disadvantageous for large financial institutions to lend to small businesses, it does not explain the reasons for this phenomenon.

Other research stresses that the complex organizational structure rather than the size of the bank makes it disadvantageous for a large bank to lend to small businesses (De Young, et al., 1997). Holding constant a bank's size and age, the number of a bank's branches has a significant relationship to the probability that a bank lends to small business. These studies focus on the form rather than size of the organization to explain a

bank's lending proclivity, but do not explain why the organizational form could affect a bank's lending inclination.

Other evidence shows some large formal financial institutions make loans to small businesses, but tend to avoid the small businesses that are not forthcoming with soft information that the financial institutions use to assess project worthiness. Berger and Udell (1995) find that large banks only lend to the small business with a "strong financial position" and that soft information may not be necessary. Through a 1993 survey of small business finance, Cole, et al. (1999) find that the loan approval patterns of different banks depend on what information they rely on. Large banks depend more on the ratios in the standard financial statement, while small banks deviate from those criteria and seem to rely to a larger extent on their impression of the character of the borrower. Soft information is the instrument that the small banks prefer to use to make loan decisions. The results of the study by Cole, et al. (1999) could explain the disparity of lending patterns among financial institutions, i.e., banks of different scale have different capacities to handle "soft information," which determines their niche preferences in the credit market.

2.3.3 The GHM (Grossman, Hart, and Moore) Paradigm and More

Within the theories of organizational economics, answers can be found to the question of why large and small financial institutions are better at carrying out specific tasks in their respective niches. The literature analyzes in more detail reasons why small financial institutions can have a comparative advantage in their niche market.

Coase (1937) raises the question of what determines the operational boundaries of firms by asking when vertical integration (upstream and downstream) activities could make sense for a firm's operation, as illustrated in the commercial banking industry, as to whether the consolidated large banks will behave differently than the small financial institutions that they are displacing. On the basis of transaction-cost economics, Williamson (1985) partly answered the question by showing that the advantage of integration in a large-scale operation is that "hold-up" problems in the competitive market can be mitigated, while the disadvantage of integration is not shown. Standing on the point of property rights, Grossman and Stiglitz (1986), Hart (1995), and Moore

(1990) (GHM) demonstrate the disadvantage of integration. At a very general level, the critical point of the GHM paradigm is that “in a world of incomplete contracts, agents’ ex ante incentives are shaped by the extent to which they have control or authority over some physical assets.” After integration, the previous president now may become subordinate to the president of the newly merged firm and become discouraged. Therefore, the manager’s ex ante investment may be reduced. The potential cost of integration and the large-scale operations is shown.

GHM paradigms have a great influence on the development theories of firms. Many empirical studies have focused on testing for a specific type of investment or in a particular institutional setting. The most direct theoretical background is established by Stein (2000). The subject of Stein’s research is not just constrained in the banking industry but applies generally to all industries. It answers the question of how the nature of an organization affects both the way it does business and the kinds of activities that it can efficiently undertake. Stein’s model shows how a small organization can perform some tasks better than a large organization.

Stein’s model also adopts insights from the GHM paradigm, such as, the allocation of control affects incentives, but his model provides a more microlevel analysis on the basis of information. It points out that different incentives are created in large and small firms for the production and use of various kinds of information. When information about a project is “soft” and cannot be communicated easily from one agent in the firm to another, small firms are at a comparative advantage in handling that kind of information and evaluating such investment projects. In contrast, large firms can easily handle “hard” information, which can be passed smoothly through their “hierarchical systems.” An example of soft information is a loan officer who has worked with a loan applicant and may know whether the borrower is honest and hard working or not, but cannot document this information in a report that can be passed on to the supervisor. This contrasts with the loan application approval process for a credit card or home mortgage, where decision-making mostly depends on “hard” or verifiable information such as tax returns or an annual balance sheet.

A more specific description of how organizational forms can affect operational goals and efficiency in specific markets is presented in the following example taken from Stein (2000).

For a loan officer who is also the president of a small bank, his judgment when determining which small loans are worth lending depends on how well he can produce the soft information and this, in turn, also affects his incentive. As the loan officer with the authority to allocate funds, he knows that his research will not be wasted and hence his incentives to research the information are strong. In a formal way, “the decentralization inherent in a small bank rewards an agent who develops expertise by ensuring that he will have some capital which he can use to lever the expertise.”

In contrast, incentives problems arise if the loan officer producing soft information is part of a large multi-branched hierarchical institution and a supervisor at a higher level than the loan officer has the final decision about the lending opportunities of the organization. In this case the authority to allocate funding is obviously separated from expertise if the loan officer has no chance to act on the soft information he produces. His advice is not accepted, his research efforts go to waste, and his incentives for future research are repressed.

However, if the information produced by the loan officer in a large institution can be “hardened” or easily transferred to supervisors, incentive problems will disappear as large financial institutions direct the efforts of their agents to more research. If the information can be “hardened” through statistical analysis or credit scoring, the loan officer can more easily provide verifiable information to his supervisor, demonstrating strong decision-making, which in turn, leads to an increase of control over the budget share. In a large institution, separating authority from expertise actually improves the research incentives of lower level loan officers who, by producing verifiable hard information, convince their supervisors they deserve more lending authority.

2.3.4 The Role of Small Financial Institutions

The studies above, especially Stein’s (2000) model, show that information and organization structure are key factors determining lending activity. The hierarchical structure of large financial institutions makes the transfer of soft information difficult, a

disadvantage causing them to avoid lending to small businesses. On the other hand, small financial institutions have a unique advantage in covering the finance gaps often neglected by mainstream financial suppliers, due to an organizational flexibility that more efficiently facilitates the production and utilization of soft information.

In Chapter 5, the role of small financial institutions in improving the credit situation for small businesses will be illustrated in more detail. Small financial institutions have the organizational flexibility to provide loans to small businesses. However, high default risk from small businesses can put small financial institutions under huge financial risk. It is necessary for the small financial institutions to establish some mechanism such as statistical credit scoring to pre-screen the potential defaulters. Credit scoring can help small financial institutions find the characteristics of the high-risk population. The loss rate will become predictable and controllable for small financial institutions by this risk-control mechanism.

Chapter 3 Measuring the Small Business Credit Gap

Chapter 2 summarized previous studies that provide a theoretical background to small business credit constraints, and presented new trends in the credit market that might reduce the availability of credit for the small businesses. In this chapter, an examination of the credit situation of small businesses based on a general statistical analysis of two important small business credit databases, the NSSBF, 1998, and the Call Reports, 1994-2000, will be provided. Then, an empirical model will be presented to calculate whether a credit gap exists and its magnitude.

3.1 The National Survey of Small Business Finance (NSSBF) 1998

The 1998 National Survey of Small Business Finance (NSSBF), conducted in 1999 and 2000 by the National Opinion Research Center (NORC) for the Board of Governors of the Federal Reserve System, covered a nationally representative sample of small businesses. The target population was U.S. domestic for-profit, non-financial, non-agricultural businesses with fewer than 500 employees, in operation before January 1, 1999.

The sample data of the NSSBF, 1998, were drawn from the Dun & Bradstreet Market Identifier File, which is broadly representative of all businesses in the United States. It has been estimated that the Dun & Bradstreet database covers approximately 93 percent of full-time business activity. The NSSBF asked sampled firms to report information on their outstanding loans, which included the balance due, the type of loans, the resource of the loans, and any collateral and guarantees. The respondents also provided detailed information about the terms of their most recent applications. Each business firm also reported their income statement and balance sheet information, as well as the demographic characteristics of the firms and their owners. The basic contents of the NSSBF, 1998, are shown in Table 3.1.

Table 3.1 The 1998 National Survey of Small Business Finance (Overview of Content)

<p>Firm Characteristics</p> <p>Includes:</p> <p>Standard Industrial Classification (SIC) code</p> <p>Legal organization type</p> <p>Year business was acquired</p> <p>Number of FTE employees</p> <p>Selected owner characteristics</p> <p>Use of Deposit Services</p> <p>Includes</p> <p>Checking accounts</p> <p>Savings accounts (any non-checking deposits)</p> <p>Up to three possible sources</p> <p>Up to three possible typical monthly balances</p> <p>Outstanding Credit and Financing</p> <p>Includes:</p> <p>Lines of credit</p> <p>Capital leases</p> <p>Mortgages</p> <p>Motor vehicle loans</p> <p>Equipment loans</p> <p>Any other loans</p> <p>Up to three possible sources</p> <p>Principal owed to each source</p> <p>Types of collateral</p> <p>Whether guarantees have been pledged</p> <p>Loans from partners/stockholders</p> <p>How many?</p> <p>Total principal owed</p> <p>Are they subordinated to other loans?</p>	<p>Use of Other Financial Services</p> <p>Includes:</p> <p>Transaction services</p> <p>Cash management services</p> <p>Credit-related services</p> <p>Pension/trust services</p> <p>Brokerage services</p> <p>Relationships with Financial Institutions</p> <p>Type of supplier</p> <p>How many years has used supplier?</p> <p>Distance between firm and supplier location</p> <p>Most frequent method of conducting business</p> <p>Most Recent Credit Application</p> <p>Includes</p> <p>Month and year applied (last three years)</p> <p>Amount applied for</p> <p>Primary use of loan or line proceeds</p> <p>Secured by real estate?</p> <p>Appraisal required?</p> <p>Cost of appraisal</p> <p>Environmental survey required?</p> <p>Cost of environmental survey</p> <p>Was application approved or denied?</p> <p>Information about lender applied to</p> <p>Type</p> <p>Length of relationship</p> <p>Distance between lender and firm</p> <p>Why firm applied to this particular lender</p> <p>Loan application accepted or denied?</p>
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Source: SBA Office of Advocacy, 2003

3.2 Call Reports Data

Another important source of data used to study the credit availability for small business is banking data on commercial loans from the Call Reports of the Federal Reserve Board's Survey of Bank Lending. Combined with other information about lending institutions and their markets, these data can be used to answer questions about how banks' small commercial loans portfolios are related to the structure and conditions of the banking industries. Since 1993, each commercial bank has reported its outstanding balance and number of business loans of US\$1 million or less in its June Call Report. These data identify the number and dollar volume of outstanding commercial and industrial loans for several loan-size classes.

The advantage of the Call Reports is that the data cover the entire population of banks and can be used to find out how the volume of small commercial loans held by a bank is related to other financial data also reported in the Call Reports. The format of the Call Reports focuses on the characteristics of loans and lending institutions and is of limited usefulness to the discovery of small business finance. For example, banks report data based on the size of the commercial loan, not on the size of the business borrower. Small business firms borrowing loans significantly larger than US\$1 million will be excluded from the small loans pool. However, the Call Reports data provide a complete picture of the loans suppliers, and market structure information is also reported. Combined with data from demand side (small firms), such as the NSSBF, a more complete picture can be drawn of the small-business credit market.

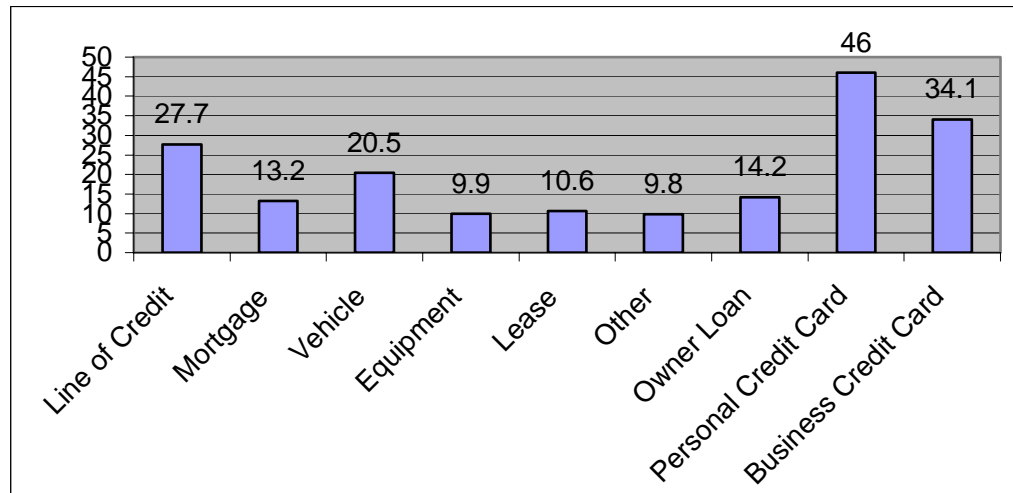
3.3 Financing Patterns Study Based on the NSSBF, 1998

3.3.1 The Users of Credit

Financing patterns for small firms can be derived from the NSSBF, 1998 data. More than 80 percent of the small businesses surveyed use some kind of credit and have outstanding debt. At least one type of traditional loan, including line of credit, mortgage, vehicle, equipment, leasing, and other loans, have been used by 55 percent of small firms. Almost 71 percent of small firms use non-traditional loans, such as owners' loans and credit cards. Credit cards, vehicle loans, and credit lines are the most popular types of credit used by small businesses. As shown in Figure 3.1, about 46 percent of small firms

use personal credit cards, 34 percent use business credit cards, 28 percent use credit lines, and 21 percent use vehicle loans.

Figure 3.1 Types of Traditional and Non-Traditional Credit Used by Small Business Firms (%)



Source: SBA Office of Advocacy, 2003

Internal finance is an important source of credit for small-business firms. For small corporations with one-to-four employees, the amount of debt owed to their owners accounted for more than a quarter of the total debt, more than doubling the amount of borrowing from any other source, except commercial banks. Approximately 30 percent of small corporations borrowed from their owners, as compared with 14 percent of all small businesses. For small corporations, borrowing from themselves, the banks, and the use of credit cards were the three most used financing sources, far exceeding borrowing from any other source. The small firms' dependence on credit in business operations is limited to some extent. Some 47 percent of small firms had no outstanding debt in the form of traditional loans; 25 percent had just one loan outstanding; 13 percent had two loans, and 15 percent had more than two loans on their books. Moreover, more than half of all firms with four or fewer employees had no outstanding debt in the form of traditional loans. Along with the phenomenon that many small firms obtain credit lines, a form of expensive credit, credit constraints can be common for small business firms.

Among all the financial institutions, banks are the most widely used source of credit for small firms — 38 percent have credit outstanding with commercial banks. Owners'

loans are used by 14.2 percent of small firms, and finance companies are used by 13.3 percent. Table 3.2 shows that smaller firms have less access to bank financing than larger firms. Only 70 to 80 percent of the two smallest firms with less than 4 employees have used some forms of credit, while the credit use for larger firms is more than 95 percent. Because of the likely potential of a credit gap, a small firm may turn to high-cost nontraditional forms of credit such as a personal credit card. Table 3.2 shows that the percentage of smaller firms using personal credit cards is much higher than larger firms, decreasing from 48 percent to 24 percent as the employee number increases.

Table 3.2 Percentage of Small Firms Using Credit by Organization Scale

Number of Employees	Any Credit	Line of Credit	Mortgage	Vehicle	Equipment	Lease	Other	Owner Loan	Personal Credit Card	Business Credit Card
0	70.2	12.8	6.5	12.3	3.9	3.2	5.8	0.2	48.2	17.4
1-4	80.3	21	12.5	17.9	7.8	7.5	8.9	12	46.7	29.3
5-9	89.6	34.8	15.5	25.1	14.6	14.6	9.3	19.3	43.2	44.1
10-19	94.1	49.2	19.5	31.3	12.9	22.3	15	29.1	52.2	51.8
20-99	95	59.9	21.1	32.9	22.1	23.3	19.3	32.9	38.8	57.9
100-499	99.6	74.9	18.8	29.8	25	28.3	22.7	27.6	23.7	62.5

Source: Federal Reserve Board, 1998 NSSBF

The percentage of small firms using credit increases with firm size. Only 13 percent of the smallest size firms used credit lines, compared with 75 percent of the largest. Only 17.5 percent of the smallest firms use business credit cards, compared to over 60 percent of firms with 100 or more employees. Similar trends are observed for equipment loans and leasing.

It can be concluded that there are two significant relationships between the firm size and the use of some kind of credit. First, there is a positive relationship between the firm size and the amount of commonly used credit. Second, a negative relationship exists between firm size and nontraditional credit because very small firms often lack the access to sources of cheaper financing and must turn to more expensive loan methods such as owner's loans and personal credit cards.

3.3.2 Distributions of Outstanding Debt Used by Small Firms

According to NSSBF data, small businesses firms using six traditional types of credit have US\$609 billion worth of debt outstanding, and an additional US\$86.5 billion worth of credit is attributed to small businesses owned in partnership. Personal and business

credit cards are the source of another US\$4.8 billion worth of credit. The total debt outstanding for small firms is US\$700 billion. Lines of credit and mortgage loans are the two most important types of credit used by small businesses, accounting for 61 percent of total borrowing. Mortgage loans amount to US\$214 billion and credit lines, US\$207 billion (SBA Office of Advocacy, 2003).

Banks are the most important among all credit suppliers, accounting for 56 percent (US\$361 billion) of credit. Owners' loans are next with 12 percent (US\$87 billion), followed by finance companies at 11 percent (US\$75 billion). Although many owners of small C and S corporations lend money to their businesses, the share of owners' loans of the total credit used for these corporations is not as large as is the frequency of their use—accounting for 13 percent and 18 percent, respectively, of all credit used by small C and S corporations (SBA Office of Advocacy, 2003). One explanation for this phenomenon is that the average-size loans from owners tend to be smaller and more frequent relative to loans from financial institutions.

3.3.3 Debt-Asset Structure of Small Business Firms

Small firms with more assets seem to have more equity than those small firms with fewer assets. The reason is that most small firms finance their assets through equity and retained earnings more than debt. The reason for this phenomenon may be that the small business firms have limited credit resources but for their own money. Therefore, the low debt-to-asset ratio for smaller firms illustrates to some extent that the credit situation for small businesses is constrained.

3.4 Analyzing Financing Trends from the Call Reports Data

The Banks' Reports of Condition and Income, or Call Reports, contain data collected at the supply side of the credit on small-business loans based on the size of the loan. Three categories are identified: loans with original amounts of US\$100,000 or less; US\$100,001–\$250,000; and US\$250,001–\$1 million. These data are collected annually and appear in the second quarter call report. In the following subsection, the trends in aggregate small-business lending of U.S. banks are analyzed.

3.4.1 Consolidation Trends

The consolidation trend in the industry is indicated by revealing banks' market shares in terms of total loans. The largest bank size classification records an increase in market share in the 1994-99 periods (Table 3.3). Banks with assets of US\$5 billion and above account for 72 percent of all loans in 1994; in 1999 this share increases to 77 percent. However, the other size classifications decline in their loan shares, especially banks with assets of less than US\$300 million, whose market share drops from 12 percent in 1994 to 9 percent in 1999.

Table 3.3 Trends of Banks' Market Share by Bank Size

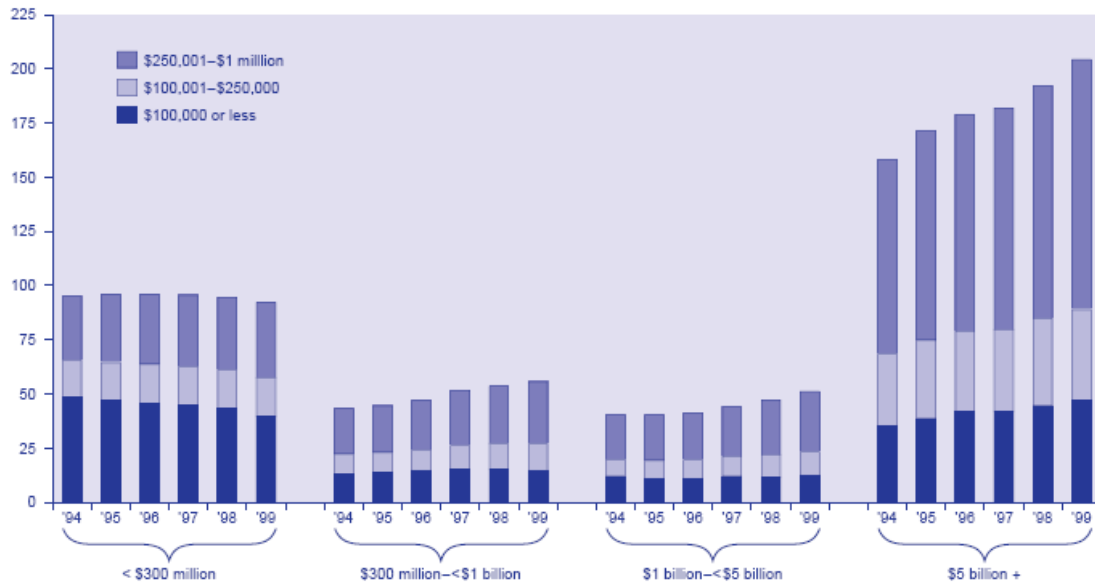
Asset Size	1994	1995	1996	1997	1998	1999
<= 300 Million	12	11	11	11	10	9
300 Million to 1 billion	7	6	6	7	7	6
1 billion to 5 billion	9	8	8	8	8	7
>= 5 billion	72	74	75	75	76	77

Source: Calculation from Report of Condition and Income, 2000

Consolidation trends are also reflected in Figure 3.2 (Ely and Robinson, 2001). One trend is the growing presence of the largest banks in the small-business loan market. However, the lending emphasis on the small businesses is decreasing, which is shown by the shrinking percentage of small-business lending.

While the value of loans lent by the smallest-sized banks in the 1994–99 period decreased from US\$95 billion to US\$92.3 billion, the holdings of banks with US\$5 billion or more in assets increased from US\$158.2 billion to US\$204.3 billion. Middle-sized banks do not experience much change in their small-business lending. Another trend seen in Figure 3.2 is the change of focus on the amount size of small-business loans. For the smallest banks, the value of loans of US\$100,000 or less decreases from US\$48.7 billion in 1994 to US\$39.8 billion in 1999, but loans greater than US\$100,000 increase. For the middle-sized banks, business loans of less than US\$100,000 increase between 1994 and 1999 but less so than loans in the ranges of US\$100,001–\$250,000 and US\$250,001–\$1 million. The largest banks' holdings of loans of US\$100,000 or less expand gradually from US\$35.4 billion in 1994 to US\$47.2 billion in 1999.

Figure 3.2 Small Business Loans Outstanding by Bank Size



Source: Calculated by Ely and Robinson, 2001

3.4.2 Shifting the Lending Emphasis

In this subsection, the Call Reports Data is analyzed to determine whether the small business loan with the outstanding amount of US\$100,000 or less has been ignored by the credit market. As shown in Table 3.4, for all banks, the aggregate ratio of loans of US\$100,000 or less to total loans decreases 20.67 percent. Such trends happen in others bank categories, especially the smallest. The aggregate loan share of banks with less than US\$300 million in assets declines from nearly 15.2 percent in 1994 to 12.7 percent by 1999.

These results show the industry has reduced its lending focus on the smallest size loans, which could reflect less lending demand or less supply or a combination of both (Ely and Robinson, 2001). Table 3.4 shows the largest banks have reduced their emphasis on this loan category by a smaller amount than other organizations. Ely and Robinson (2001) explain the reason for this phenomenon is that large banks' have adopted the practice of credit scoring for small-business loans. They point out that the cost reductions made possible by credit scoring might offset forces that cause the industry to cut back on supplying the smallest loans.

The total shares of loans valued at US\$100,000-US\$1 million decrease slightly for all banks in the 1994-99 period. However, these loan shares tend to increase for all but the

largest banks, demonstrating that the focus of the largest organizations' on larger loan categories has not kept pace with other size banks.

Table 3.4 Percentage of Small-Business Loans to Total Loans

Loan Size	Loan Percent				
	All banks	<=300Million	<=1 billion	>1billion	>5billion
<=100,000					
1994	4.23	15.17	7.59	5.23	1.9
1995	3.91	14.57	7.55	4.69	1.85
1996	3.81	14.13	7.66	4.63	1.88
1997	3.69	13.71	7.4	4.75	1.82
1998	3.54	13.42	7.19	4.59	1.82
1999	3.36	12.72	6.78	4.68	1.81
Change (94-99)	-20.57	-16.15	-10.67	-10.52	-4.73
100,001 to 250,000					
1994	2.59	5.23	5.12	3.59	1.78
1995	2.54	5.36	5.35	3.58	1.75
1996	2.5	5.51	5.31	3.7	1.69
1997	2.49	5.47	5.36	3.81	1.66
1998	2.48	5.55	5.46	4.1	1.65
1999	2.44	5.64	5.56	4.31	1.6
Change (94-99)	-5.8	7.84	8.59	20.05	-10.11
250,001 to 1 million					
1994	6.21	9.13	11.97	9.03	4.82
1995	6.06	9.71	12.06	8.96	4.65
1996	5.97	9.94	12.19	9.19	4.52
1997	5.96	10.07	12.48	9.06	4.46
1998	5.94	10.4	12.53	9.85	4.37
1999	6.1	11.15	13.22	10.8	4.43
Change (94-99)	-1.77	22.12	10.44	19.6	-8.09
All Small Business loans					
1994	13.03	29.52	24.68	17.85	8.5
1995	12.51	29.64	24.96	17.23	8.26
1996	12.28	29.58	25.17	17.52	8.09
1997	12.14	29.24	25.24	17.62	7.94
1998	11.96	29.37	25.18	18.54	7.84
1999	11.89	29.51	25.55	19.79	7.85
Change (94-99)	-8.75	-0.03	3.52	0.87	7.65

Source: Calculation by author based on Report of Condition and Income, 2000

The shift in small-business lending is also reflected in the fact that the small-business loans as a percent of all loans, has decreased for all banks. The lending ratio hardly changed in the smallest banks, increased slightly in medium-sized institutions, but declined greatly in the largest banks. We can find that the importance of smaller loans'

has declined for all types of financial institutions but this decline was more apparent for large banks.

The change of trends in lending shares indicates that more of the larger banks have decreased the share of small-business lending in their portfolios than have the smaller banks. Since consolidation trends have greatly increased the market share of large banks, there is a larger chance that the finance demands of small businesses are ignored by lending institutions. The finance gap between small business demand and credit supply would increase as consolidation trends accelerate.

3.4.3 Market Share Changes in Small-Business Lending

Another method that demonstrates the shrinking of small business financing is to analyze how the market shares of all levels of financial institutions change. The market shares of the three categories of small-business loan size classified by bank size are shown in Table 3.5 for the 1994–99 period. The market shares of small-business loans for banks with assets of US\$300 million to less than US\$1 billion and banks with assets of US\$1 billion to less than US\$5 billion have not experienced much change. However, the largest and smallest banks' market share in the smallest loan category have greatly changed. In 1994, 45 percent of small-business loans of US\$100,000 or less were held by banks with assets less than US\$300 million, and 32 percent of the small-business loans of this value were held by banks with assets of US\$5 billion and above. In 1999 the proportion of these loans held by the smallest banks fell to 35 percent while the proportion held by the largest banks increased to 41 percent (Ely and Robinson, 2001).

Table 3.5 Bank's Market Share of Small Business Loans (Categorized by Asset)

Loan Size	Percentage of small business loan					
	1994	1995	1996	1997	1998	1999
Banks with assets less than 300 million						
\$100,000 or less	45	43	41	40	38	35
\$100,001–\$250,000	25	24	24	23	22	21
\$250,001–\$1 million	18	18	18	18	17	17
Total small-business loans	28	27	26	26	24	23
Banks with assets US\$300 million to less than US\$1 billion						
\$100,000 or less	12	12	13	13	12	12
\$100,001–\$250,000	13	13	13	14	14	15
\$250,001–\$1 million	13	13	13	14	14	14
Total small-business loans	13	13	13	14	14	13
Banks with assets US\$1 billion to less than US\$5 billion						
\$100,000 or less	11	10	10	10	10	11
\$100,001–\$250,000	12	12	12	12	13	13
\$250,001–\$1 million	13	12	12	12	13	13
Total small-business loans	12	11	11	12	12	12
Banks with assets US\$5 billion and greater						
\$100,000 or less	32	35	37	37	39	41
\$100,001–\$250,000	49	51	51	50	50	51
\$250,001–\$1 million	56	57	57	56	56	56
Total small-business loans	47	49	49	49	50	51

Source: Calculation by author based on Report of Condition and Income, 2000

These data on market shares show that the banking industry is becoming more consolidated. Consequently, small businesses have become more dependent on large banking organizations. Because of higher information costs or probably a higher fixed cost of lending, larger financial institutions usually hesitate to make small-business lending. In recent years, many large institutions use new technology such as credit scoring as screening-out mechanisms. Since the credit score for an average small business owner is below the median level (see the case study in Chapter 5), it can be expected that small business financing will become more and more constrained.

3.5 Preliminary Conclusions

The analysis supports anecdotal complaints of credit shortages for small firms and the inefficient operation of small-business credit markets. However, such conclusions are qualitative at best. A better understanding of the various factors that contribute to

financing patterns requires a multivariate econometric analysis that also uses additional information on the factors affecting borrowing and lending conditions of small business credit markets. At the same time, the finance gap for these firms should be quantitatively determined by a statistical model, which is presented in Chapter 4.

Chapter 4 Quantification of the Credit Gap

As already illustrated, a significant credit gap is expected for small-business firms because of the information asymmetry between borrowers and lenders (Stiglitz and Weiss, 1981). In previous studies of the small-business lending, Peterson and Rajan (1994), Berger, et al. (2001), Berger and Udell (1995), and Cole (1998) empirically show the factors affecting the availability of credit to small businesses using different data sources. This literature suggests that credit constraints affect a significant number of small businesses, but places little emphasis on the magnitude of these credit constraints, except for Mallick and Chakraborty (2002), who, with research based on the NSSBF, 1993 database, calculate the difference between desired and observed levels of debt to determine the level of credit constraints for small business firms.

In this section, new evidence will be found using NSSBF, 1998 to determine whether the credit constraints for small business firms have been improved or not. Similar to the research methodology of Mallick and Chakraborty (2002), the credit gap between desired and observed debt for those credit-constrained firms that have a positive demand for debt will first be estimated. During the calculation process, the selection biases will be considered. To estimate the desired debt, the sample of firms that have positive debt and are credit constrained need to be identified. That means, for the econometric finding to be applied to all small business firms, it is necessary to control for the difference between the firms with or without debt, and for firms that are credit constrained or unconstrained.

Then, evidence for how the credit gap varies by industry type and other characteristics is presented. For example, the credit gap will be categorized by the type of industry, such as mining, manufacturing, service, utility, and insurance firms. It can also be differentiated by organization type, such as proprietary, partnership, and S- or C-corporation.

Finding the magnitude of the credit gap has important policy implications (Kashyap and Stein, 2000). The results can help target business firms that are more vulnerable to changing credit conditions. Also, because the magnitude of the credit gap may differ across firms and industries, policy interventions can become more effective when targeted toward firms that are more credit constrained. More appropriate tax and transfer

policies can be implemented to aid such small business firms. The results of measuring the credit gap can also be used to design policies that otherwise may have a “disproportionate” impact on borrowers with limited access to capital markets.

4.1 The Empirical Model

This subsection presents an estimate of the credit gap between the desired and actual debt for credit-constrained small businesses. A firm always has its desired level of debt if it is not credit constrained and holds a positive level of debt (Cox and Jappelli, 1993). Mallick and Chakraborty (2002) use estimates of a desired debt equation for indebted and credit-unconstrained firms to forecast the desirable level of debt for credit-constrained firms with positive demand for debt. Sample selection problems will arise for a variable that affects a firm being credit constrained, or, having positive debt may also affect the desired level of debt. As Mallick and Chakraborty suggest, “a firm with a better relationship with a lender may not be less likely to be denied a loan but, relative to firms with similar prospects, may be able to borrow more.” The work of Heckman (1979) accounts for the two sources of selection bias that jointly determine their inclusion in a sub-sample used in estimating the desired level of debt.

A three-step generalized regression procedure will be used to estimate the debt. Equation (1) represents the desired credit equation, and Equations (2) and (3) are Probit equations that describe the selection rules. Following Cox and Jappelli (1993), it is assumed that the desired debt for a firm is observed if the demand for debt is positive and the firm is not credit constrained. The procedures can be shown by the following equations:

$$\begin{bmatrix} Y_t^0 \\ Z_{1t}^0 \\ Z_{2t}^0 \end{bmatrix} = \begin{bmatrix} X_{1t}'\beta_1 \\ X_{2t}'\beta_2 \\ X_{3t}'\beta_3 \end{bmatrix} + \begin{bmatrix} \mu_t \\ \nu_t^1 \\ \nu_t^2 \end{bmatrix}, \text{ Where } \begin{bmatrix} \mu_t \\ \nu_t^1 \\ \nu_t^2 \end{bmatrix} \sim \text{NID} \left(0, \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{12} & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix} \right) \quad (1)$$

Y_t^0 is the desired debt for some firm and is only observed for the firms that are unconstrained and have positive levels of debt; X_{it}' is the vector of credit-demand determinants that include firm, owner, and relationship characteristics variables. Z_{1t}^0 and Z_{2t}^0 are the unobservable indices, which determined whether a firm holds positive credit

and whether a firm is credit constrained or not. ρ_{12} and ρ_{13} are the correlation coefficients between the error items $\text{Corr}(\mu_t, v_t^1)$ and $\text{Corr}(\mu_t, v_t^2)$.

$$\begin{aligned}
Y_t &= Y_t^0 \text{ If both } Z_{1t}^0 > 0 \text{ and } Z_{2t}^0 > 0; \text{ otherwise } Y_t \text{ unobserved;} \\
Z_{1t} &= 1 \text{ if } Z_{1t}^0 > 0; Z_{1t} = 0 \text{ otherwise;} \\
Z_{2t} &= 1 \text{ if } Z_{2t}^0 > 0; Z_{2t} = 0 \text{ otherwise;}
\end{aligned} \tag{2}$$

A firm is defined as constrained if the firm responded affirmative to one of the following questions in the survey: “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?”

As illustrated in Equation (2), the desired debt for a firm is observed only if the demand for debt is positive and the firm is not credit constrained. X_{2t} is a vector of credit demand determinants and proxies for the convenience of using credit. X_{3t} is a vector of credit demand determinants and proxies for credit constraints. These two proxies determine the probabilities that a firm holds debt or is credit constrained, respectively.

The main result of the finance gap will be derived from the parameter estimates of the first equation in Equation (2). Estimates of the second and third equations in Equation (2) will be used to construct the selection terms (Inverse Mills Ratio) to estimate the credit demand. The Inverse Mills Ratios are used to correct the problems brought by sample selection. The statistical background of the sample selection correction will be illustrated more specifically in Appendix 1.

The estimation methodology proposed here is to use part of the small businesses (when $Z_{1t} = 1$ and $Z_{2t} = 1$) to get the consistent estimates of the reduced form of desired debt. Two sources of selection bias will be considered at the same time. Thus the expectation of desired credit for these small businesses is

$$E(Y_t^0 | Z_{1t}^0 = 1, Z_{2t}^0 = 1) = X_{1t}'\beta + E(\mu_t | Z_{1t}^0 = 1, Z_{2t}^0 = 1) \tag{3}$$

The assumption will be made that each error term (μ_t, v_t^1 and v_t^2) is normally distributed with mean zero and some variance ($\sigma_1^2, \sigma_2^2, \sigma_3^2$). Using the standard Probit

normalization that means the variance of v_t^1 and v_t^2 ((σ_2^2, σ_3^2)) is equal to 1, we can obtain the consistent estimates of β_2 and β_3 . The final estimation of Y_t^0 for the sub-sample can be expressed as:

$$Y_t^0 = X_{1t}'\beta + \rho_{12}\sigma_1 \frac{\phi(Z_{1t}^0)}{\Phi(Z_{1t}^0)} + \rho_{13}\sigma_1 \frac{\phi(Z_{2t}^0)}{\Phi(Z_{2t}^0)} \quad (4)$$

where $\frac{\phi(Z_{1t}^0)}{\Phi(Z_{1t}^0)}$ and $\frac{\phi(Z_{2t}^0)}{\Phi(Z_{2t}^0)}$ are the Inverse Mills Ratios. $\phi(\cdot)$ is the probability density function while $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. The probability of being selected in the sample is $\Phi(Z_{1t}^0) * \Phi(Z_{2t}^0)$.

By Equation (4), the average desired debt for the small business firms in credit-constrained situation can be calculated as: $\overline{D}^* = \overline{X_{1t}'\hat{\beta}}$. We can compare the level of the desired debt to the average of the actual debt level \overline{D} . Then, the credit gap will be determined if \overline{D}^* is larger than \overline{D} for that firm. Finally, the distribution of the credit gap can be categorized by different industries, locations, and firm types.

4.2 Data and Variables

The data used are from the NSSBF, 1998, which provides information about a nationally representative sample of small businesses in the United States. The survey was conducted during 1999-2000 for the Board of Governors of the Federal Reserve System. The target population is the population of all for-profit, non-financial, non-farms business enterprises that had fewer than 500 employees and were in operation as of year-end, 1998. The sample was drawn from the Dun & Bradstreet Market Identifier File as of May, 1999. From this public-use dataset, a random sample of 3,561 firms is drawn from 5.3 million small businesses.

To estimate the credit gap, it is necessary to estimate the first equation in Equation (2), while controlling the firm, owners, and relationship characteristics variables. Such practices are the extension of previous research (Peterson and Rajan, 1994; Berger and Udell, 1995; Cole, 1998). All the control variables can thus be categorized into three groups: relationship, firm, and owner characteristics. The second and third equations in

Equation (2) find the probability of being credit constrained and holding debt. Therefore, variables that affect the firm's debt situation and credit convenience will also be included.

Firm characteristic variables include the firm's age, total liabilities, profit, and sales percentage in total assets, and the geographic variables. A firm's age can be used as proxy for public information about a firm (Dunkelberg, 1998). Longer age means that the firm has more experience and resources to overcome the problems of a new business. The ratio of sales to assets measures the firm's operation efficiency. A higher sales turnover ratio can mean that a firm operates more efficiently and may be less credit constrained. A firm with higher ratio of profit to assets means that the firm's market sustainability is stronger and a bank may be more willing to lend to such firms. The leverage ratio (debts to assets): can directly reveal the financial situation of a firm. A larger share of debt to total assets means the firm has limited resources to cover liabilities when facing financial crisis, and banks may avoid lending to such high-debt-ratio firms. The information about a firm's delinquency history will also be included, which can reveal the firm's potential problems. The four dummy variables will be assigned to describe the four firm organizational types that include sole proprietorship, partnership, S-corporation, and C-corporation.

Geographic variables describe the location characteristics of firms. Such variables can show whether location affects the credit availability of a firm, and can also show whether credit opportunities are equally distributed across regions. The regions were divided into nine areas: New England, Mid Atlantic, East N Central, West N Central, South Atlantic, East S Central, West S Central, Mountain, and Pacific. The second geographic variable describes whether the firms are located in urban or rural areas, shown also by a dummy variable. Another geographic variable that may affect the availability of credit is the distance (measured by miles) between firms and lending institutions. Regional boundaries can also form barriers for firms to borrow from other areas. Therefore, the variable that describes whether banks and firms are located in the same area will also serve to explain credit availability. The concentration or competition situation of the local banking market is shown as the Herfindahl Index of the metropolitan statistical area (MSA) or county where the firm's headquarters is located. The Herfindahl Index equals the sum of the squared market shares times 10,000. In the data of NSSBF, 1998, one

variable is defined as follows: 1 when $0 < \text{Herfindahl} < 1000$; 2 when $1000 \leq \text{Herfindahl} < 1800$; 3 when $1800 \leq \text{Herfindahl}$.

The relationship variables, i.e., the length and types of existing relationships, can reveal interactions between borrowers and lenders. A pre-existing relationship generates information regarding a firm's credit-worthiness (Foglia, et al., 1998; Farinha and Santos, 2005; Petersen and Rajan, 1994; Berger and Udell, 1995). The relationship between a bank and small firm often plays a key role that helps the bank evaluate the credit-worthiness of the firm. The number of years of a relationship with the primary lender variable can be regarded as a good proxy for the amount of private information a lender may have about a borrower's business. Through the financial services they provide, lending banks can retrieve private information about a borrower's business. Such a financial service exchange is often referred to as scope of relationship or as the multiplicity of relationship (Boot, 2000). For example, if a bank extends checking account services to a firm, the bank will have access to a very reliable and important source of information about the firm. 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 firm. The principle also applies to other services such as transaction services and trust services, by which the banks can monitor the firms' business in an even easier way. The number of financial sources used may indicate a firm's inability to meet its credit requirements from its primary lender. The number of the credit suppliers can tell whether the firm has many credit resources to choose from. More credit suppliers may mean that the firm is hardly credit constrained.

Owner characteristics such as bankruptcy, lawsuit, and delinquency history on personal obligations can seriously affect the credit availability of the business (Blanchflower, et al., 2003). The experience of owners can also be seen as the ability to manage firms, which will also be included into our control variables. As the research of Mallick and Chakraborty (2002) and Peterson (1994) shows, ethnicity and gender of owners will also serve as useful variables.

As has been illustrated in Subsection 4.1, some variables that determine the sample selection mechanism must be identified; otherwise, the estimates would be biased and

unreliable. Variables that affect the probability of holding debt are termed, “convenience variables,” which can be revealed by information about a firm’s credit card use (both business and personal) and its capacity for internal funding. The internal funding capacity is shown by the sum of retained earnings, and checking and savings accounts balances relative to assets. Variables that cause a firm to be credit constrained are termed, “constraint variables.” The interest rate of trade credit is often much higher than the other credit, and is often the last recourse for a firm without access to other sources of credit. Thus, trade credit denial history is a good indicator that determines whether a firm is credit constrained or not. Another variable revealing a firm’s credit situation is whether the firm has enough cash in hand. Table 4.1 shows the summary statistics of firm, geographic, owner, and relationship characteristics of small businesses, as well as their debt convenience variables and credit constraint variables.

Table 4.1 Firm, Geographic, Owner, and Relationship Characteristics of Small Businesses

Variable	Label	N	Mean	Std Dev
Firm Characteristics				
Asset	Total assets	3,492	1,487,342.00	5,373,931.00
Liab	Total liabilities	3,492	921,293.20	3,747,177.00
Sales	Total sales for current FY	3,492	3,490,517.00	15,107,330.00
Profit	Reported Profit	3,492	447,997.70	3,633,950.00
Debt	Total loans	3,492	538,966.40	2,745,031.00
C_FAGE	Age of firm in Years	3,492	14.51	12.13
Firmdelq	Delinquent on business obligations	3,492	0.35	0.90
Orgscorp	Organization type S-corporation	3,492	0.29	0.45
Geographic Characteristics				
MSA	Firms in urban or rural area	3,492	0.78	0.41
Region1	Firms in New England	147	0.04	0.20
Region2	Firms in Mid Atlantic	431	0.12	0.33
Region3	Firms in East N Central	477	0.14	0.34
Region4	Firms in West N Central	277	0.08	0.27
Region5	Firms in South Atlantic	629	0.18	0.38
Region6	Firms in East S Central	199	0.06	0.23
Region7	Firms in West S Central	374	0.11	0.31
Region8	Firms in Mountain	235	0.07	0.25
Region9	Firms in Pacific	723	0.21	0.41
HHI3_B	1999 Herfindahl Index of local banks	3,492	2.47	0.59
Distance	Distance between firm and primary Lender	3,492	33.39	191.97
Owner Characteristics				
C_EXP	Owner Experience	3,492	19.27	11.75
C_FAM	Family Owned	3,492	1.15	0.37
C_SEX	Female Owned	3,492	1.82	0.48
C_MGR	Management Responsibility	3,492	0.11	0.31
Jtagowner	Judgments against owner	3,492	0.96	0.19
Ownerbanr	Bankruptcy past seven years	3,492	0.03	0.15
Ownerdelq	Delinquent on personal obligations	3,492	0.27	0.80
Relationship Characteristics				
Checkornot	Use checking accounts	3,492	0.04	0.20
Monthpl	Months with the primary lender	3,492	93.88	99.45
Sevicenum	Number of services from the primary lender	3,492	2.32	1.42
Numfin	Number of financial institutions	3,492	2.30	1.67
Trser	Whether transaction service or not	3,492	0.47	0.50
Trustsr	Whether trust service or not	3,492	0.20	0.40
Credit Constraint/Convenience				
Crecardbs	Used business credit cards	3,492	0.60	0.49
Crecardper	Used owner's personal credit card	3,492	0.56	0.50
Tcdenied	Suppliers ever denied trade credit	3,492	0.94	0.24
Cashonhand	Cash on hand	3,492	125,076.50	919,256.00

Source: Calculated by author

Table 4.1 gathers data with typical characteristics of small-business lending. The mean of assets of all customers is US\$1,487,342. The loans borrowed for businesses average at US\$538,966, a small loan when compared to normal commercial loans. The average age for the firms is 14 months, and shows that most small-business loans go to young firms. In the US\$3492 business loan category, 2726 firms are located in urban areas, reflecting the geographic advantage of urban areas to win credit opportunities. The locations of these firms are covered by all 9 districts, indicating the data resource is nationwide. The average value of the Herfindahl Index of local banks is 2.4. Since the value of 3 represents the highest concentration in local banking industries, the concentration trend is very common across the United States. The average distance between the firms and their lending banks is close to 33 miles, indicating small firms tend to borrow from local banks. Contrary to expectations, firm owners seem very experienced, often having almost twenty years working experience. The variables of *Jtagowner* (judgments against owner) and *Ownerdelq* (times of delinquency on personal obligations) point to the credit history of the firm owners. Most of the owners (96 percent) do not have negative judgments against them, and 73 percent of the owners do not have a bad record of delinquency on their personal obligations. Only a very small number of firm owners (2.5 percent) have had a bankruptcy experience in the past seven years. These results indicate that most of the small firm owners have a good credit history. As to choices among banks and services, small business firms do not have many choices, and often have two financial institutions to provide two kinds of financial services. The credit convenience variables include two dummy variables signifying whether the firm owners have business or personal credit cards. The results show that most of firm owners (more than 50 percent) have credit cards. Most of the small firm trade credit applications turn out to be denied, which can indicate that to some extent, they are often credit constrained. Cash on hand is just US\$125,076 on average, which further demonstrates that most of the firms lack funding resources.

4.3 Estimation Results

As illustrated by the equations in Subsection 3.6.1, the final result measures how big the credit gap for small business firms is between their demand and actual use with the

following steps: 1) find the probability that the firms are credit-unconstrained; 2) calculate the probability that the firm is indebted; Under the two conditions above, 3) estimate the weight of each characteristic of small business firms; 4) calculate the expected debt level for credit-constrained and indebted firms; and 5) compare the expected debt level with the actual debt level, and determine whether the firm's demand for credit is satisfied or not, and how big the credit gap may be.

Table 4.2 shows how firm, owner, relationship, and geographic characteristics affect the probability that the firms are credit constrained. As illustrated, the dependent variable is whether the firm is credit constrained (1) or not (0). The independent variables comprise five categories of characteristic variables. Table 4.2 indicates that a firm's own financial situation (liability, sales, and profit) does not have a large impact on its credit situation. While the firm with a longer history has more freedom of credit, most of the owner characteristics have a great impact on their credit situation. Minority or female owners apparently tend to be more credit constrained. A bad credit history has a significant negative effect on the credit availability in future borrowing. Owners with bankruptcy histories have, contrary to expectations, some advantages; perhaps their operational histories motivate them to seek more credit resources. Trade credit is often the last recourse for firms. The firms with trade credit denials histories are often credit constrained, as the significant regression results suggest. It is also significant that firms with more cash on hand are hardly credit constrained. As for geographic variables, there are no significant differences in credit situations between urban and rural areas. Competition between local banks seems to have no effect on the supply of credit to small businesses. But the larger distance between firms and their primary lenders seems have a significant negative impact on the availability of credit, which may be because they know they will have trouble traveling further for loans.

Table 4.2 Probit Estimates: Whether Firms Are Credit Constrained

Parameter	Estimate	S.E	Ward Chi-Sqr	Pr >Chisq
<i>Firm Characteristics</i>				
Liabilities/asset	(0.0003)	0.0014	0.0441	0.8337
Sales/asset	(0.0001)	0.0003	0.2550	0.6136
Log (firm age)	(0.2395)*	0.0434	30.4473	<.0001
Profit/asset	0.0002	0.0003	0.4178	0.5180
Corporation	(0.0283)	0.0571	0.2459	0.6200
Firm delinquency	0.2005*	0.0287	48.7432	<.0001
<i>Owner Characteristics</i>				
Log (experience)	(0.0115)	0.0474	0.0586	0.8088
Female owner	0.0097	0.0608	0.0255	0.8731
Black owner	0.6336*	0.0914	48.0944	<.0001
Owner as manager	0.2683*	0.0873	9.4429	0.0021
Owner delinquency	0.7966*	0.0794	100.6698	<.0001
Judgment against owner	0.2589*	0.1299	3.9745	0.0462
Owner bankruptcy	(1.0302)*	0.1652	38.8911	<.0001
<i>Relationship Characteristics</i>				
Check or not	(0.2052)	0.1460	1.9768	0.1597
Log (months)	(0.0712)*	0.0257	7.6881	0.0056
Number of services	(0.0549)*	0.0203	7.2760	0.0070
Number of financial institutions	0.1132*	0.0163	48.0548	<.0001
<i>Credit Constraint Variable</i>				
Trade credit ever denied	0.6795*	0.1034	43.2170	<.0001
Cash/asset	(0.3264)*	0.0892	13.4066	0.0003
<i>Geographic Characteristic</i>				
MSA	(0.0173)	0.0650	0.0711	0.7897
HHI3_B	0.0389	0.0473	0.6770	0.4106
Log (distance)	0.0725*	0.0179	16.4103	<.0001

Source: Calculated by author

Table 4.3 shows how firm, owner, relationship, and geographic characteristics determine the incidence of debt in a firm. All four characteristics have significant impacts on a firm's decision to hold debt or not. The higher the sales turnover rate is, the more efficiently the firm operates, indicating the firm is less likely to seek higher debt. The older a firm is, the longer the accumulation period, therefore the less need for debt. Higher profits need more debt to finance operations. Both kinds of corporations tend to need more debts. The firms with delinquency histories seem to seek debt opportunities more actively. The interpretation of all the firms' variables is consistent with original expectations.

Table 4.3 Probit Estimates: Whether Firms Are in Debt

Parameter	Estimate	S.E	Pr>Chi-sq
Firm Characteristics			
Liabilities/asset	0.0949*	0.0155	<. 0001
Sales/asset	-0.00158*	0.000501	0.0016
Log (firm age)	-0.155*	0.0456	0.0007
Profit/asset	0.0011*	0.000488	0.0247
S-corporation	0.3402*	0.0655	<. 0001
C-corporation	0.4564*	0.0716	<. 0001
Firm delinquency	0.1247*	0.0368	0.0007
Owner Characteristics			
Log (experience)	0.0349	0.0495	0.4803
Female owner	-0.1352*	0.0622	0.0297
Black owner	-0.0643	0.0986	0.5141
Owner as manager	-0.0662	0.0921	0.4719
Owner delinquency	0.113	0.0908	0.2132
Judgment against owner	0.0103	0.1363	0.9397
Owner bankruptcy	-0.0392	0.1659	0.8132
Relationship Characteristics			
Check or not	0.0899	0.1542	0.5599
Log (months)	-0.0053	0.0268	0.8432
Number of services	0.3161*	0.0257	<. 0001
Number of financial institutions	0.4591*	0.0286	<. 0001
Credit Convenience Variable			
Business credit card	0.1877*	0.0587	0.0014
Personal credit card	0.1025*	0.0541	0.0583
Balance ratio	-0.0484*	0.0161	0.0026
Geographic Characteristic			
MSA	-0.194*	0.0685	0.0046
HHI3_B	0.00176	0.0484	0.971
Logdist	0.1117*	0.0211	<. 0001

Source: Calculated by Author

Among the owner characteristics, only gender is significant. Female owners of small business firms tend not to borrow money for their businesses. The coefficient of the relationship characteristics shows that the more financial resources and services a firm has, the more likely that firm will borrow. For the credit convenience variables, the coefficients of the dummy variables, business and personal credit cards, show both kinds of cards significantly increase the probability of holding some debt. As expected, the more funds in savings and checking accounts (shown by ratio to assets), the less need there is to apply for debt. The results of the geographic variables show that the firms in the MSAs are less likely to apply for credit than those firms in rural areas. The reason

may be that the firms in those areas have more finance opportunities other than loans. The log of distance between the financial institutions and the firms has an unexpectedly positive sign, which means the firms are not affected by the long distance and tend to borrow from banks faraway.

Under the assumption previously mentioned, the optimal debt level can only be attained in an unconstrained credit situation. The next step is to find statistically how the debt/asset levels are determined by the characteristics of a firm, using the regression on the sub-sample that includes only the observations of firms that have debt and are not credit constrained. The selection terms use the Mills ratio, computed from the Probit estimates of Equations (2) and (3).

Table 4.4 presents the estimates of the regression for desired debt. It can be seen that the asset scale has a negative effect on the debt ratio. As the asset increases to 1 percent, the debt to asset ratio declines by 0.21 percent. As the size of the firm increases, there tend to be a reduction in the loan amount and larger firms may use more internal equity. A higher turnover rate of sales means that a firm needs more of current assets to operate, which increases the ratio of debt. As the ratio of sales to assets increases to 1 percent, the debt-to-asset ratio will increase 0.12 percent. Older firms may have accumulated more experience with borrowing and tend to increase their debt level. On average, each year a firm operates, that firm will increase its debt level by 0.57 percent. There are no significant debt-level differences among different types of firms. The delinquency history of a firm may mean that the firm is more credit constrained. The results show that the firms with delinquency histories usually tend to borrow 0.31 percent less than those firms without such histories.

Among the owner characteristics, only an owner's history of delinquency is significant. As with the firms' delinquency histories variables, owners who have such histories are more credit constrained and on average borrow less (0.3 percent).

There are three relationship variables that are significant. If the credit line from each loan provider is limited, the firm must turn to more banks and because of this, the debt level is constrained. The results show that if the number of financial institutions a firm can use increases by one, the percent of the debt ratio will decline by 0.38 percent.

Table 4.4 Determination of the Debt Levels of Small Firms

Parameter	Estimate	S.E	Ward Chi- sqr	Pr>Chi-sq
<i>Firm Characteristics</i>				
Log(asset)	-0.2055*	0.0548	-3.75	0.0002
Sales/asset	0.1223*	0.0024	51.2	<.0001
Log(firm age)	0.5668*	0.1910	2.97	0.0031
Profits/asset	-0.0501*	0.0064	-7.84	<.0001
S-corporation	-0.7810	0.5705	-1.37	0.1712
C-corporation	-0.7960	0.5768	-1.38	0.1678
Sole proprietorship	0.4315	0.5893	0.73	0.4641
Partnership	-0.0050	0.6800	-0.01	0.9942
Firm delinquency	-0.3077*	0.1711	-1.8	0.0724
<i>Owner Characteristics</i>				
Log (experience)	-0.0858	0.1846	-0.46	0.6422
Female owner	0.2899	0.2456	1.18	0.238
Black owner	-0.5434	0.5527	-0.98	0.3256
Asian owner	0.3656	0.4240	0.86	0.3887
Owner as manager	-0.4166	0.2832	-1.47	0.1415
Owner delinquency	-1.6539*	0.6225	-2.66	0.008
Judgment against owner	0.9171	0.6323	1.45	0.1471
Owner bankruptcy	-1.8759	1.2556	-1.49	0.1354
<i>Relationship Characteristics</i>				
Check or not	0.6471	0.8392	0.77	0.4408
Log (months)	0.0212	0.1035	0.21	0.8374
Number of financial institutions	-0.3843*	0.1009	-3.81	0.0001
Transaction services	-1.0085*	0.2007	-5.03	<.0001
Trust services	-0.6500*	0.2370	-2.74	0.0062
<i>Geographic Characteristic</i>				
Metropolitan Statistical Area	0.4367	0.2381	1.83	0.0669
HHI3_B	0.1859	0.1704	1.09	0.2755
log(distance)	-0.0880	0.0760	-1.16	0.2473
<i>Selection Terms</i>				
lambda1(credit constrained)	-2.0614*	0.9809	-2.1	0.0358
lambda2 (incidence of debt)	-4.0264*	0.44655	-9.02	<.0001
R²:	0.82			

Source: Calculation by Author

All the firms in the nine regions have significant demands for debt, while whether the firms are in metropolitan area does not matter. Although the distance between a firm and a financial institution can affect the firm's decision to increase debt or not, distance does not affect the debt level significantly. Once a firm has determined to borrow, the distance does not affect the amount.

Similar to the result of Mallick and Chakraborty (2002), the regression also shows that both censorings equations make the sample nonrandom. The negative coefficient for the selection terms for credit constrained implies a negative correlation between the errors in the probability being credit constrained and the regression for desired debt. That is, the results illustrate that the factors that increase the probability of being credit constrained would reduce the demand of desired debt. Being limited by the credit environment, small business firms have to reduce their debt level. The negative coefficient for the selection term for debt incidence implies that the unobservable factors that increase the probability of holding debt reduce the demand for desired debt. Such a factor can limit financing capacity of small firms, which forces them to borrow from banks. However, their limited repayment capacity will also force them to reduce the scale of the loans. The regression results thus show that credit-constrained small businesses are more willing to borrow than the average business, but their debt level is hardly as satisfactory as it is for the average business.

4.4 Quantification of the Credit Gap for Small Businesses

A credit gap for small business firms will be defined as the difference between the average desired debt level $\overline{D_c^d}$ and the actual debt level $\overline{D_c^a}$ for firms that are both credit constrained and indebted. $\overline{D_c^d}$ can be expressed as $\overline{D_c^d} = \overline{X_c b}$.

Table 4.4 provides the estimates for b . X_c is the vector of observable variables for credit-constrained firms. The credit gap is calculated by $\overline{Gap_c} = \overline{D_c^d} - \overline{D_c^a} = \overline{X_c b} - \overline{D_c^a}$. The estimation results are illustrated in Table 4.6 for all credit-constrained and indebted firms. The estimations of the credit gap categorized by industry, size, and geographic area are shown in Table 4.5.

Such credit gaps vary greatly among the different industries. Only firms in the mining and finance-related industries do not face credit-constrained situations. Since there are only two observations for the mining industry, the credit gap for this industry needs to be validated with further research. The credit gaps for firms in all other industries are significantly larger than zero, at the 90 percent confidence level. The largest average credit gap (US\$2,729,519) occurs in the utilities industry, which includes transportation,

communication, electric, gas, and sanitary services. Service industries have the larger number of credit-constrained firms (386). The credit gaps for the credit-constrained and indebted small business firms categorized by industry, organizational type, operation size, and geographic variables are shown in Table 4.5.

Table 4.5 Credit Gap Estimation Categorized by Industry, Organizational Type, Size, and Geographic Areas

Variable	# of firms	Mean	Std Dev	Pr>T
<u>Industry</u>				
Mining	2	(124,306)	191,111	0.5266
Construction	123	2,680,256	15,575,864	0.0587
Manufacturing	110	6,415,448	24,858,480	0.0079
Utilities	53	2,729,519	6,407,567	0.0031
Trade	244	1,737,621	7,458,799	0.0003
Finance, Insurance, and Real Estate	42	(997,377)	8,739,458	0.4638
Service	386	742,979	2,952,988	<.0001
<u>Organizational Type</u>				
Sole Proprietorship	383	271,766	1,155,912	<.0001
Partnership	54	541,277	3,292,977	0.2325
LLP (tax filed as Partnership)	12	1,963,875	5,574,485	0.2478
LLP (tax filed as corporation)	7	424,138	326,791	0.0139
S-corporation	276	2,679,737	12,739,394	0.0006
C-corporation	225	4,207,681	18,147,588	0.0006
LLC (tax filed as Partnership)	2	1,637,570	1,645,085	0.3932
LLC (tax filed as corporation)	1	(449,883)	.	.
LLC (tax filed as Sole-proprietorship)	1	45,092	.	.
<u>Operation Size by Employment</u>				
0-19	746	460,294	2,154,920	<.0001
20-49	102	2,170,762	4,543,715	<.0001
50-99	64	9,958,717	24,331,094	0.0017
100-499	49	13,202,080	37,507,523	0.0174
<u>Region</u>				
New England	40	(4,302)	4,370,886	0.9951
Mid Atlantic	123	3,055,927	7,222,897	<.0001
East N Central	108	1,874,331	6,686,199	0.0044
West N Central	57	6,278,536	30,014,749	0.1199
South Atlantic	180	650,204	4,997,848	0.0826
East S Central	46	485,659	2,941,047	0.2687
West S Central	117	1,635,355	10,555,772	0.0965
Mountain	74	4,016,577	20,006,881	0.0884
Pacific	216	1,319,932	7,087,741	0.0067
<u>Metropolitan Statistical Area</u>				
Rural	200	2,360,580	13,592,120	0.0149
Metropolitan Area	761	1,809,383	10,608,095	<.000

Source: Calculation by Author

Next to be examined is whether there are some differences among firms of an organization type. Among all the organization types, 97.6 percent of the firms that are credit constrained (961) consist mainly of sole proprietorship (383), partnership (54), S-

corporation (276) and C-corporation (225). But the credit gap is not significant in the partnership firms at the 90 percent confidence level. The reason may be that multiple owners of a firm can bring more finance opportunities than other organization forms. The largest credit gap of US\$4,206,176 on average of 225 credit-constrained firms is in the C-corporation firms.

All the small business firms can be categorized into different scales of operation measured by the number of employees: from 1 to 19; from 20 to 49; from 50 to 99 and from 100 to 499. Among the 961 credit-constrained firms, 78 percent (746) have an employment scale below twenty employees. Credit demand gaps exist for all these categories at the 90 percent confidence level. It is also significant that the credit gaps increase as the scale of operation increases: US\$460,293 for level one; US\$2,170,761 for level two; US\$9,958,717 for level three; and US\$13,202,079 for level four. This is consistent with expectations. The larger firms often need more funding to support their operations but it is difficult for them to get enough funding due to the limitations of their credit environments.

As analyzed in the theoretical background, credit supplies may not be homogeneous across regions, and this is reflected in the results with two geographic variables. The first variable is the credit gaps differences among the nine regions. Only the firms in the New England area show no significant credit gap. The firms in the six areas: Mid Atlantic, East Northern Central, South Atlantic, West Southern Central, Mountain, and Pacific, show a significant credit gap between their demand and actual use, while credit gaps for firms in the West Northern Central and East Southern Central areas are not apparent.

The second geographic variable detects the credit gap distribution spatially by categorizing the firms by rural or metropolitan areas. In rural areas, the credit gap is significant at US\$2,360,475 on average of 200 credit-constrained firms. While the credit gap does exist for a firm in the metropolitan area, which is also significant at a 90 percent confidence level, the amount (\$1,808,944) on average of 761 firms is not as large as that in the rural area, which is to be expected because the facilities are normally more convenient for firms in metropolitan areas than their counterparts in rural areas.

4.5 Conclusion

The estimation of the credit gap indicates that only approximately 20 percent of the credit demand of credit-constrained businesses is satisfied. The magnitude of the credit demand gap varies greatly by industry, size, and organization of a firm.

The financial situation of small businesses determines their credit demand. Relationship lending is found to be another important factor that can affect the small business firms being credit-constrained and indebted. The location and the geographic characteristics of the small business firms are not key factors that determine the debt levels of small business firms. Results also indicate that the owner characteristics (except for the delinquency history) of small businesses do not affect their credit situation.

The estimation of the credit gap for the credit-constrained firms in different industries and areas is consistent with the results of other research (Bernanke, et al., 1996) that find small firms are disproportionately affected following a tightening of monetary policy. Finance institutions, insurance companies, and the real estate sector have better access to financial resources because of their informational and relationship advantages in these areas.

By the empirical analysis in this chapter, the credit gap for small business firms is quantified. In Chapter 5, the focus is on potential solutions for improving the credit situation of small businesses.

Chapter 5 Credit-Scoring Practices that Can Help Small Financial Institutions Serve Small Business Firms

5.1 The Role and Advantages of Small Financial Institutions

As illustrated in Chapter 2, especially by Stein's (2000) model, information and organizational structure are key factors that determine the activity of lending. One important role of banks is to offer relationship-lending services, which help resolve the problems of providing external finance to small businesses. In relationship lending, not only is relatively transparent information (a financial statement) collected, but much information is also gathered through contact over time with the firm and the owner, and also with the borrower's customers and suppliers. However, the production of relationship information is costly. Such costs are usually passed on to the relationship borrowers, and these informationally opaque firms are willing to accept such costs because of their constrained credit situations.

Large financial institutions often avoid small-business lending because producing soft information is unwieldy and difficult for them to transfer into their hierarchical systems, a disadvantage of a large lending institution. Relationship lending usually requires local knowledge, while large financial institutions usually are headquartered at long distances from potential small business borrowers. Local small financial institutions, including community banks, have the comparative advantage of gathering local information. Because small financial institutions have flexible organizational forms, they can be efficient in the production and utilization of soft information, and therefore have a unique advantage covering the finance gap often neglected by mainstream financial suppliers. An empirical study in Chapter 3 measures the magnitude of the finance gap for small businesses.

5.2 The Threat to Small Banks Trying to Retain Their Lending Niche

In this chapter, the emphasis is on specific measures that can be taken by small financial institutions to hold their lending niche. Credit scoring is an example of an innovation that can change a previous subjective decision-making procedure into a standard and objective mechanism, a process by which soft information can be "hardened" into a regular and formal database. Once credit-scoring systems are available,

financial institutions gain the capacity to evaluate and make small-business loans. Such major financial institutions as Wells Fargo and American Express have developed small-business lending operations and direct marketing techniques to attract customers based on credit-scoring results.

Credit scoring, a process of assigning a quantitative measure or score to a potential borrower, can be used to estimate the borrower's future loan performances (Feldman, 1997). The loan repayment prospects of small-business loans are highly predictive, especially for loans under US\$100,000 (Mester, 1997).

Credit scoring could make changes to small-business lending in three areas (Feldman, 1997): 1) The interaction between borrower and lenders will change. Credit scoring can allow the financial institutions to appraise and monitor loans without actually meeting the borrowers. The perceived advantages of relationship lending often held by small financial institutions no longer exist; 2) Credit marketing will become more targeted. The price of small-business loans would be reduced because high-quality borrowers need not bear the cost of extensive underwriting; 3) Competition to lend to small businesses will become more intense; more lenders will compete for an individual borrower's loan because barriers of distance have disappeared and automatic credit-scoring systems allow more lenders to participate in the market.

If small financial institutions cannot adopt such new decision-making mechanisms accordingly, their comparative advantage over large banks in the small-business lending sector may diminish. Peterson and Rajaan (2000) document that the physical distance between small firms and their bankers has increased on average from 16 miles in the 1970s to 68 miles in the 1990s, which means that more hard information (which may be gathered by phone or email) has been used to make loans decisions. In response, it is necessary for small financial institutions to consider adopting "hard-information" production mechanisms into their applicant-approval process and standardizing their credit approval process to save costs, thereby holding their small-business lending niche.

5.3 A Conceptual Framework (Using an SBA Lending Intermediary as an Example)

Credit scoring is often criticized as a mechanism that deprives poor populations of credit. In this section, it will be shown that even for a government-subsidized

organization like an SBA lending intermediary, credit scoring is still necessary to help the organization sustain itself. As shown in Appendix 2, an SBA intermediary must balance several factors when strategically and tactically analyzing their loan portfolios. The objective of the intermediary is to generate an economic and social impact from their loan portfolio investments. In the case of the SBA program, this is measured by several factors, including number of new businesses started, number of employees from new businesses, and the amount of new income generated.

Among the several constraints facing an SBA microlender intermediary are the following:

1. The most important constraint is the need to repay the government loan;
2. The government, similar to a commercial bank, requires a reserve amount of cash that covers a certain level of bad debt (called the loan loss reserve account);
3. Loan sizes are restricted to under US\$30,000;
4. A restriction is on the interest rate charged to microentrepreneurs;
5. The funds can only be used for working capital, equipment and other business purchases, excluding real estate down payments;
6. Loans are subject to a maximum maturity of six years. The intermediary may not charge points or fees for the loan other than charging the actual closing costs associated with processing the loan; and
7. The intermediary can only loan to individuals in their specified SBA-coverage area; each microloan intermediary is designated a certain geographic area and these areas do not overlap with one another.

Given this objective function and set of constraints, the intermediary must balance the desire to maximize the socioeconomic impact with the need to repay the government loan. One of the key parameters in this decision-making process is the level of risk associated with the loan portfolio, known as, portfolio-at-risk. Being too risk-averse, lenders may limit their ability to have a socioeconomic impact. On the other hand, lenders who are too risk loving may have a socioeconomic impact but be unable to repay the loan as the default rate rises. This decision-making process is known to investors in the financial markets as the risk-reward tradeoff. The lender seeks the optimal balance between accruing risk and making high-impact loans.

However, the word “optimal” is used lightly; the lender faces an environment of great informational uncertainty regarding several factors, including borrower characteristics, business-plan viability, and market dynamics. This informational uncertainty generates risks associated with the loan portfolio and each individual borrower. Small financial institutions must utilize several different techniques to manage risk. Unlike traditional banks, small-business lending institutions do not have options such as sufficient collateral to secure their loans.

5.4 Case Study: Credit Scoring in One Small Financial Institution, Community Ventures Corporation (CVC) of Kentucky

In this section, the potential of credit scoring for a small financial institution, Community Ventures Corporation (CVC) of Kentucky, will be analyzed. This small financial institution is not a purely commercial financial institution but receives subsidies from government (such as the SBA) and donors. The incentive mechanism of such a program is analyzed in Appendix 2, which shows that even in such half-commercial financial institutions, sustainability is still the highest priority, compelling the adoption of new procedures, like credit scoring, to manage risk and increase profits.

5.4.1 Background of CVC of Kentucky

The United States has the most advanced financial service system in the world, but as many as 12 to 15 million households have no access to basic mainstream financial services (Carr and Zhong, 2002). Lack of access to financial services hampers low-income households from being entrepreneurial and pursuing potentially profitable business opportunities that could lead to an improved standard of living and wider community benefits.

One particular federal program, the SBA Microloan Program or SBA 7(m), combines technical assistance and financial assistance. The SBA Microloan Program began as the Microloan Demonstration Program in 1991 (Public Law PL 102-140) under the Bush Administration. The program was designed to target underserved populations such as women, minorities, residents of rural areas, Indian tribes, and other potential microentrepreneurs. Originally, the program was only authorized as a pilot program in certain states.

In 1997, under the Small Business Reauthorization Act, the SBA Microloan Program became a permanent credit program authorized for the entire nation. The Microloan Program operates through an intermediary lending process. The SBA lends money to intermediary lenders who in turn loan money to small business owners. The intermediary lender is eligible to borrow a ten-year loan for up to US\$750,000. An intermediary may borrow up to US\$2.5 million because of their history of participation in the program. Under this law, small business owners were limited to borrowing up to US\$25,000 from an authorized SBA intermediary. In 1997 there were approximately 100 intermediaries who had loaned over US\$10.5 million.

In FY 2003, the SBA Microloan Program provided over US\$29 million in loans to over 2,400 small business owners. This is actually far less than the program has been authorized to lend. The original authorization included an annual funding of US\$100 million. However, Congress has never appropriated that amount of funding. In addition, this dollar amount is well below the potential demand of small businesses.

There are some unique characteristics of the Microloan Program that distinguishes it from other SBA loan programs. Most importantly, small business owners in the Microloan Program generally have little or no collateral and little business experience. These microentrepreneurs or small business owners generally have credit scores below 700; while most other SBA lending programs have borrowers with credit scores over 700 (SBA, 2005).

The objective of this section is to lay out a conceptual framework for the decision-making process facing a representative SBA microlender intermediary. Using this conceptual framework as a foundation, an econometric analysis of credit scoring will be carried out to test its potential as a loan portfolio risk management strategy that contributes to the sustainability of small financial institutions in the consolidated credit market.

Since the clients served by the small financial institutions often belong to the low-credit population with less access to formal financial services, there is a higher probability that they default on their loans. Small financial institutions would face great operations risk when many default cases occur. Therefore, it is necessary to establish some mechanism to screen the unqualified applicants before the transactions. In the

following sub-section, strategies that typical small financial institutions take to control risk will be analyzed. Then, a potential credit-scoring experience, similar to that in the commercial credit market, will be applied to the lending practices of CVC of Kentucky.

5.4.1.1 The Business Function of CVC of Kentucky

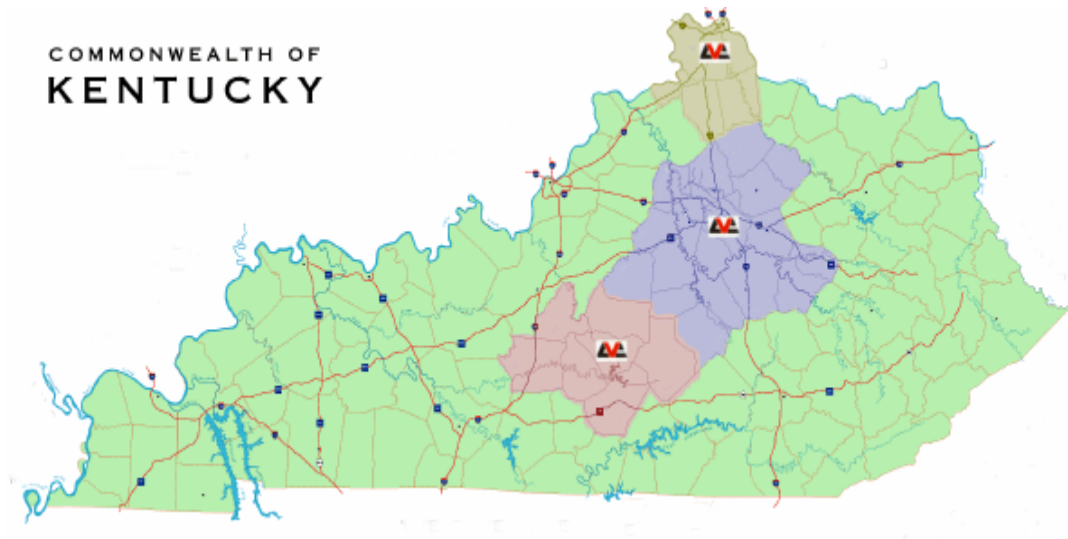
A case study was selected for empirical analysis. Data about small business lenders in the United States are usually very scarce. Neither the SBA nor the small financial industry group collects industry-wide data. CVC of Kentucky was selected because it was willing to provide information from its loan portfolio.

In central and northern Kentucky, CVC functions as a community-based organization that exists to improve the quality of life for urban and rural residents. Its central mission is to provide individuals and families with the skills, income, and assets that help them achieve financial independence and achieve some level of profitability for sustaining themselves.

CVC shares common characteristics with many U.S. microfinance institutions (MFIs). Microfinance refers to the provision of financial service (including credit, deposit, and insurance) to low-income clients. Contrary to other powerful financial intermediaries, microfinance originated and matured in developing countries like Bangladesh, Bolivia, and Indonesia and then spread to industrial economies including the United States and Europe.

CVC functions in three business areas: 1) Small business ownership; 2) Homeownership; and 3) Job creation through business expansion. CVC packages intensive training and technical assistance programs with flexible, affordable lending services to provide individuals with the skills and capital they need to start and grow a small business and to purchase homes. It serves 31 counties in central and northern Kentucky through its headquarters in Lexington and its two satellite offices in Covington and Campbellsville shown in the map in Figure 5.1.

Figure 5.1 CVC Service Distribution in Kentucky



Source: Website: www.cvcky.org

5.4.1.2 Small Business Ownership Program

CVC provides training and lending services to emerging entrepreneurs in central Kentucky. CVC was one of the original intermediaries associated with the SBA 7(m) program in the mid 1990's. Its staff assists clients in all phases of business development with lending services and training to both new business owners and existing businesses wishing to expand. CVC has trained over 700 individuals through its business planning courses, and 140 are now operating their own businesses in central Kentucky. The business types cover almost all the industry fields.

5.4.1.3 Homeownership Programs

Many people never experience the benefits of home ownership because of their inability to afford a mortgage loan. CVC offers three different programs to assist potential homeowners. Down payment and closing costs programs are prepared for the families who qualify for a home mortgage, but lack the down payment and up-front expenses, may qualify for this program. The lease purchase program helps families who want to own a home but do not qualify for a home mortgage. The family rents the home they want to own for up to two years while resolving any credit or debt issues. Once these

issues are resolved, the family assumes full home ownership. Low-cost mortgage programs offer below-market first mortgages to clients who cannot afford or do not qualify for traditional first mortgages.

5.4.1.4 Business Expansion Program

CVC offers technical assistance and loans to existing businesses desiring to expand. Existing businesses that have been turned down by a conventional bank or credit union, lack a solid financial history, or are creating five or more jobs are eligible for one of these programs. Such a program represents an entry-level solution for businesses wishing to expand. After receiving technical assistance from business consultants, clients may be able secure a loan of up to US\$35,000 which can be used to buy machinery, equipment, furniture, inventory, and supplies. The loan may also be used to provide working capital.

5.4.2 *Credit Risk Management Techniques*

There are several risk management techniques that are used by U.S. microlenders in order to address the need for repayment. The most obvious technique is the use of the loan loss reserve account that is mandated by the government. However, other techniques have been developed as well, including group or peer lending, dynamic repayment, training, and credit scoring. The following discussion focuses on common risk management techniques and their use in CVC.

5.4.2.1 Group Lending

Group lending provides a way to price discriminate. Forming a group of risky- and safe-type borrowers would bring no mutual benefit and would lead to risk type matching. A group lending activity can improve on repayment by inducing borrowers to invest in safe operations activities. Stiglitz's model (1990) shows that if the joint-liability payment is set high enough, borrowers will always choose the safe activity. Group lending actually burdens borrowers with more risk and is beneficial to lenders. From the other side, lenders can make sure the intention of borrowers is to invest in a safe activity and they can subsequently lower the interest rate to offset the burden and still use the liability payment to cover their costs. All in all, such peer-monitoring and group-enforcement arrangements can lower interest rates, provide higher welfare, and raise expected

repayment rates. In CVC, a peer group can be formed for loans up to US\$6000, available from the Bluegrass MicroEnterprise Fund, to start or operate a small business. At this time, there is limited use of this program, in part, due to the difficulty of the peer lending in a mobile society where social capital, such as that expressed in developing countries, is limited.

5.4.2.2 Dynamic Incentives

A second mechanism of ensuring high repayment rates in small financial institutions entails exploiting dynamic incentives. This includes lending to individuals in small amounts, which can be deemed as test lending and can help establish credibility. After several times of repayment, trust between the borrower and lender can be attained. The borrower's incentives can be further enhanced if they can assure repayment of a larger loan. In CVC, smaller money amounts can be lent to some borrowers to help them attain an improved credit record. After ensuring the repayment of such loans, they will have a chance for larger loan amounts. For example, a CVC client who completes the in-house training program is automatically eligible for a US\$500 loan with no collateral requirement. Repayment of this loan establishes a credit record with the organization, and provides the chance for larger loans in future.

5.4.2.3 Regular Repayment Schedule

Another mechanism exploited by small financial organizations is the use of a regular repayment schedule. Repayments begin immediately after the loan has been conferred upon the borrowers. Small lenders establish a way of repaying loan, which can be on a weekly basis. A regular repayment schedule can screen out undisciplined borrowers. The key point of such a mechanism is that periodical payment requires the households or individuals to have a stream of income to rely upon. Highly seasonal occupations such as agricultural cultivation can be excluded from the list of borrowers if there is no other guarantee. The loan officers in CVC often meet their clients monthly to make sure the loan has been used and repaid. Once they find that repayment is delayed or funding was dispersed "unwisely," they can demand the borrower come before CVC to explain or even clear the account.

5.4.2.4 Training

Training classes are provided in small financial institutions to impart the practical knowledge to undertake the activities necessary to start and sustain an enterprise in an advanced economy. Training has a role in monitoring and screening clients as well. A business plan can also help track self-employment efforts and indicate who is likely to be a successful entrepreneur. In the training classes for CVC, the potential client must complete the screening and assessment process. It includes a free two-hour orientation workshop to learn about the services that CVC provides. The process of assessing the client's readiness for self-employment proceeds concurrently. The training class also teaches skills such as business plan development. Once the training and business plan is complete, clients are eligible for CVC programs. The major downside of the training component is that it adds time and overhead expenses that impact the cost of running the loan program.

5.4.3 *Credit Scoring as a Risk Management Tool*

With the mechanisms listed above, small financial institutions can reduce default risk to some extent. However, the drawbacks of these methods can affect the sustainability of such financial institutions. Since human capital is very expensive in the United States, training can be a significant financial burden to lenders, and private training is often out-of-reach for many small business owners. A regular repayment schedule and the dynamic incentives, while effective, are often only useful after the loan has been processed and utilized by the borrowers.

Because of such disadvantages, scoring is another new and economical way to appraise the repayment risks. Scoring originated within credit card companies. Credit card lenders can make massive numbers of small, short, unsecured microloans at very low costs because they judge risk with statistical scoring models. Such scoring models can predict the future default risk of borrowers with quantitative probability. Likewise, scoring could reduce loan losses, enhance client loyalty, and help adjust interest rates to risk for small financial institutions. The time and cost spent in collecting information can also be greatly reduced. Such an explicit and quantitative analysis can be helpful to the

decision-making process of the loan officers of small financial organizations such as CVC.

5.4.3.1 Previous Credit-Scoring Research

To enhance the sustainability of small financial institutions, credit scoring has been introduced as a screening mechanism that differentiates unqualified applicants. Credit-scoring models and other experiences in formal financial institutions will be presented in the following sections, as well as several models utilized in the empirical study.

5.4.3.2 Pros and Cons of Credit Scoring

Generally, credit scoring could provide the following potential benefits (Barefoot, 1996): 1) Cost Reduction: the low-cost evaluation of credit-scoring systems could reduce the role of human evaluation, which could also reduce the cost of delivering credit; 2) Improved Accuracy: compared to the subjective evaluation, statistical scoring models usually are more effective at predicting loan performances; and 3) Better Products and Marketing Strategies: the credit-scoring models allow lenders to tailor the marketing strategies to meet the specific needs of market niches.

The disadvantage of credit scoring cannot be ignored: 1) Less Access: credit scoring may actually restrict credit to potential customers with limited credit histories whose strengths are hard to demonstrate on paper; 2) Disparate Impact: credit scoring may lead to unfair lending which may pose adverse effects on some populations such as minorities; and 3) Privacy: the database of credit-scoring systems and the results of credit-scoring models could lead to an infringement on privacy.

Even with these general concerns, researchers find that many customers and lenders do like credit scoring. For customers, credit scoring provides the following conveniences: a) a much simpler application process; b) a shorter timeframe to get answers to their credit requests; c) relatively reduced information requirements; d) access to credit when they need it. For the lenders, credit scoring could provide: a) a standardized product for decision-making, b) reduced costs of the loan evaluation process, c) more efficiency when executing transactions because of repetition, d) improved collection activity.

5.4.3.3 Models of Credit Scoring

Much research has focused on model establishment and effectiveness testing of credit scoring. Galindo and Tamayo (2000) find accurate predictors of individual risk in the credit portfolios of small credit lending institutions. They make a comparative analysis of different statistical and machine-learning models of classifications on mortgage loan data. A specific modeling methodology based on the study of error curves was introduced. Finally, Galindo and Tamayo discuss the possibility of using this type of accurate predictive model as an ingredient to institutional and global risk models.

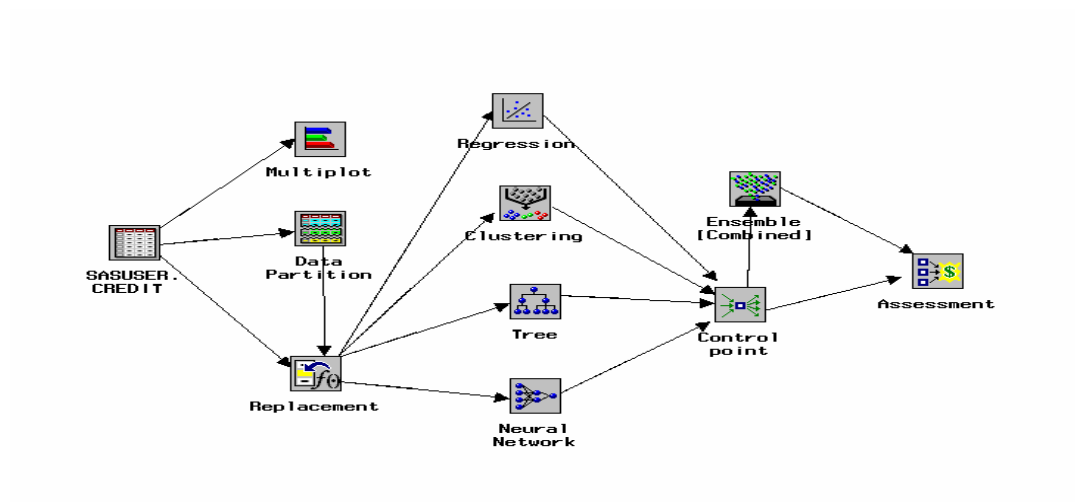
Many authors have examined credit scoring in the context of a traditional commercial credit environment. Mester (1997) first defines credit scoring and then analyzes the methodology as well as the pros and cons of credit scoring, and finally, illustrates the contribution of credit scoring to the securitization of a loan. Joose, et al. (1998) compare the performances of Logit analysis with decision trees in a credit classification environment. Both models were used on the extensive database of Belgium's largest banks. These research results show that Logit models are more consistent in the credit-decision process. Handzic, et al. (2003) consider three neural network models in the light of the credit loan application classification. Their goal was to find the best tool for decision-making, and the experimental results indicate that committee machine models were superior to others. Vasconcelos and Adeodato (1999) investigate a solution to a credit problem in a rather peculiar environment, characterized by a stabilized economy but subject to a high interest rate. A neural network-based credit-scoring system was developed and its performance was evaluated against that of a traditional discriminated analysis system.

Schreiner (2003) regards scoring as the new breakthrough in microcredit. He introduces the concept of credit scoring to microcredit managers, analyzing how scoring works, its limitations, and detailed technical models. The requirement for application of scoring for a small financial institution is also advanced.

5.4.3.4 Empirical Analysis: Estimating a Credit-Scoring Model for an SBA Microloan Intermediary (CVC of Kentucky)

In general, there are two types of scoring: subjective scoring and statistical scoring. Subjective scoring focuses mainly on the loan officer's sense of the personal character of the client. The predictive accuracy of subjective scoring can vary by lending officer and accuracy can hardly be guaranteed. Statistical credit scoring will be the focus of this analysis. It forecasts risk, based on quantified characteristics recorded in a database. Links between risk and characteristics are expressed as sets of rules or mathematical formulae that forecast risk explicitly as a probability. These formulae help detect historical links between repayment performance and the quantified characteristics of loan applications, assuming those links will persist over time, and then forecast future repayment risk based on the characteristics of current applications. The scoring process can be demonstrated by Figure 5.2. Many machine-mining models like neural networks models can provide powerful explanations, but often require more than 1000 data entries. In this case, the raw data records of all the clients in CVC are 467. Therefore, basic statistic models like the Logistic or Probit models are more appropriate to apply.

Figure 5.2 Diagram of the Credit-Scoring Process



Source: Drafted by Author

Logistic regression is used when the outcome is a proportion (repayment probability) assumed to have a binomial distribution, with a mean that is predicted by other factors (borrower characteristics). Instead of predicting the Y variable (which has values 0 and 1,

and expected value P that must lie between 0 and 1, the link function called the Logistic function will be used. The Logistic function transforms the predicted response to make sure it remains between 0 and 1. The proportion P with the non-linear logistic function will be modeled as Equation (5):

$$p = 1/(1+\exp(-\eta)) \text{ or equivalently } p = \exp(\eta)/(1+\exp(\eta)) \quad (5)$$

where the symbol η is the linear predictor, which is a linear function of the predictors

$$\eta = \alpha + \beta_1 * x_1 + \beta_2 * x_2 + \beta_3 * x_3 + \dots$$

5.4.4 Data and Variables

The CVC data include both demographic statistics and their business and loan information. The demographic statistics include the following parameters: geography by county; geography by zip code; geography by urban/rural; ethnicity, gender, and income as a percentage of the median; income as a percentage of poverty; income in dollars; house owning versus rent; citizenship; marital status; veteran status; education level; numbers in household; and numbers of dependents. Business and loan information includes: business status – startup versus existing; number of employees; training goals; total technical assistance hours; type of business; credit score; original loan amount; funding date; current balance; loan status – current/delinquent; and default rate.

The choices of the variables are determined by each loan's characteristics and limited by the data completeness. The macroeconomic factors that also affect the repayment rate of the loan are beyond this study. The important characteristics of one loan often include the interest rate the lender charged, the amount of principal, the length of terms, and the characteristics of the borrower that include the race, gender, income level, and credit score. These variables will be used to explain the difference of the default rate of loans. Therefore, the dependent variable write-off of this study is one dummy variable of whether the loan has been the written-off or not. If the loan has been repaid, it is equal to 1, otherwise 0.

The independent variables listed above have expected signs regarding their relationship to the default rate. Therefore the meanings of all variables are shown in Table 5.1. Table 5.2 shows the descriptive statistics for the CVC data.

Table 5.1 Variables Description Table

Written off	Dummy variable, whether the borrower repays loan or not
Orig_prin	The original amount of money that was lend out
Month_due	Terms of loan
Curr-int	Interest level of loans
Income amount	Yearly income level of loans
Housing	Dummy variables, 1 meaning the loans for housing program; 0 means the loans for enterprise program
Gend	Gender of Borrowers
White	Dummy variables, whether the borrowers are white people
Black	Dummy variables, whether the borrowers are black people
Lex	Dummy variable, whether the borrowers live in Lexington or not
CreditScore	Credit score provided by the credit agency

Table 5.2 Descriptive Statistics for the CVC Data

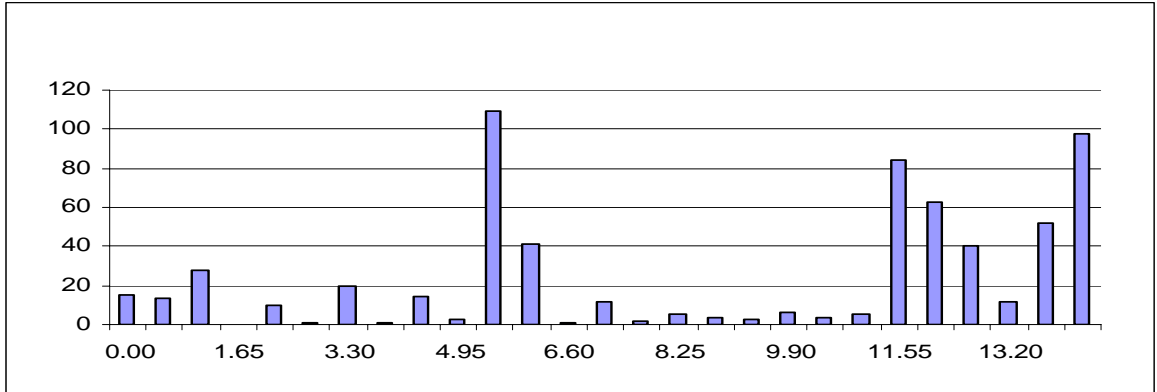
Variable	N	Mean	Std Dev	Minimum	Maximum
Written Off	646	0.89	0.32	0	1
Orig_prin	646	14,755.85	22,176.47	0	211,000
Months_due	646	103.66	118.09	1	372
Curr_int	646	8.84	4.43	0	14
Gend	646	0.07	0.25	0	1
Lex	646	0.57	0.49	0	1
Incomeamount	574	30,689.11	16,332.11	27	100,000
White	646	0.08	0.27	0	1
Black	646	0.06	0.24	0	1
Housing	646	0.37	0.48	0	1
CreditScore	525	606.75	71.78	433	804

Source: Calculation by author

Original principal (Orig_prin) is the principle of the loans that have been lent out, by which to make sure the amount of the loan has some effect on the repayment rate. More than 90 percent of the loans are less than US\$30,000. Month_due is the terms of the loan. Higher risk is often associated with long-term loans, so the sign of Month_due is expected to be negative. Normally, the term for the business program is less than 5 years.

Current interest rate (Curr-int) is the interest rate of the loan. In a classical financial analysis, the higher the interest rate, the higher the credit risks. Therefore, the sign of interest rate is expected to be positive. Shown in Figure 5.3, the interest rate of business loans is often concentrated in the 5 percent per year range.

Figure 5.3 Distribution of Interest Rates of Loans

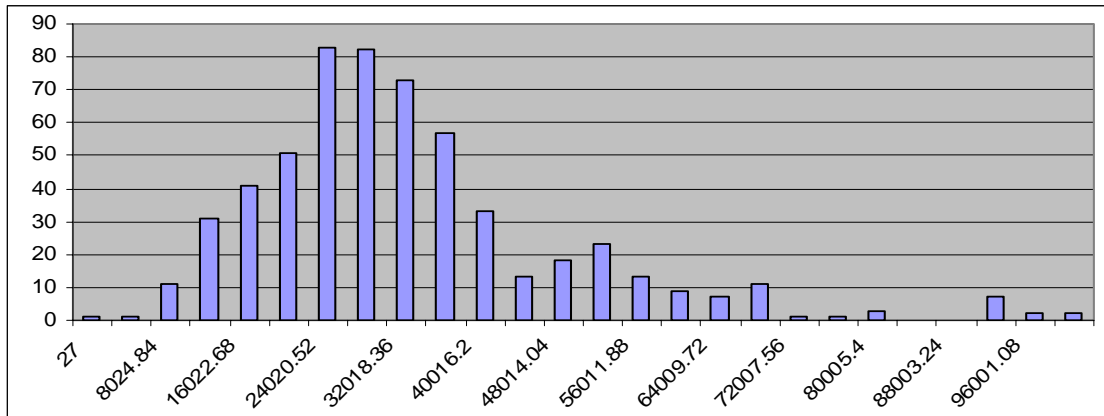


Source: Calculation by author

There are several social- and geographic-based variables. Gend is the Gender of the client. Lex is also a dummy variable that determines whether the borrower lives in Lexington or not. Because more than sixty percent of CVC clients live in Lexington, it is important to point out the location effect on the repayment rate. White/Black are both dummy variables that describe whether the clients' race is black or white. Housing means the use of loan is for housing or business.

Incomeamount is the amount of income associated with a borrower. Higher income normally means a larger capacity to repay the loan so the sign of Incomeamount is expected to be positive. As shown in Figure 4.4, the income level of the CVC borrower has an approximate normal distribution with a mean of about US\$30,000. CreditScore is the credit score provided by the credit bureaus such as Equifax. If the scoring system is effective, the sign should be significantly positive.

Figure 5.4 Distribution of the Income Level of Borrowers



Source: Calculation by author

In accordance with the suggested research method, the following model is specified as:

$$Pr ob(Writtenoff = 1) = f(\text{orig_prin Months_due curr_int gen Lex incomeamount white black housing creditscore})$$

5.4.5 Statistical Test of Variables

Before performing a regression analysis, a multicollinearity diagnostic test is necessary. Multicollinearity is a result of strong correlations between independent variables. The existence of multicollinearity inflates the variance of the parameter estimates. It may also result in wrong signs and magnitudes of regression coefficient estimates, and consequently in incorrect conclusions about the relationships between independent and dependent variables. The multicollinearity diagnostic statistics are based on the Inflation Factor for each variable. Since for each independent variable, Tolerance = 1 – Rsq, where Rsq is the coefficient of determination for the regression of that variable on all remaining independent variables, low values indicate high multivariate correlation. The Variance Inflation Factor is 1/Tolerance, which is the number of times the variance of the corresponding parameter estimate is increased due to multicollinearity as compared to as it would be if there was no multicollinearity. There is no formal cutoff value to use with VIF for determining presence of multicollinearity. Values of VIF exceeding 10 are often regarded as indicating multicollinearity. The test result for multicollinearity is

shown in Table 5.3. All the VIF values are less than 10, which indicate that no serious multicollinearity relationships between independent variables.

Table 5.3 Test Result for Multicollinearity of Independent Variables

Variable	Tolerance	Variance Inflation
Orig_prin	0.76354	1.30969
Months_due	0.34151	2.92819
Curr_int	0.22709	4.40353
Gend	0.99531	1.00472
Lex	0.97295	1.0278
Incomeamount	0.88143	1.13452
Housing	0.1537	6.50627
White	0.95692	1.04501
Black	0.95656	1.04541

Source: Calculation by author

5.4.6 Regression Results

The Logistic Model is specified and the results of the model are presented in Table 5.4.

Table 5.4 Regression Result of Logistic Model

Parameter	DF	Estimate	S.E.	Chi-Square	Pr > ChiSq
Intercept	1	4.107	2.595	2.504	0.114
Orig_prin	1	0.000073*	0.000012	6.215	0.013
Months_due	1	-0.011*	0.005	4.070	0.044
Curr_int	1	-0.450	0.158	8.115	0.004
Gend	1	-15.875	1182.800	0.000	0.989
Lex	1	1.137*	0.318	12.817	0.000
Incomeamount	1	0.000014	0.000008	1.659	0.198
Housing	1	0.868	1.627	0.285	0.594
White	1	0.025	0.557	0.002	0.965
Black	1	-0.336	0.476	0.498	0.481
CreditScore	1	0.003	0.003	1.690	0.194

Source: Calculated by Author

Examining the regression output, it can be found that the original principle, interest rate, term (months due) and location's effect on the repayment are significant. However not all these variables are consistent with the expected sign. The positive sign of the original principal means those larger loans tend to be repaid with higher probability. The clients in Lexington have a significantly higher repayment rate than in other areas. The negative sign of Months_due means a longer loan term brings a higher default risk. The

loan with a higher interest rate tends to default as shown by the sign of current interest. The effects of income amount and credit scoring are marginally significant, i.e., borrowers with higher income levels tend to repay loans but this effect is not very significant. Borrowers with higher credit scores are more inclined to repay loans. For the other variables, it can be found that race and gender of borrowers make no difference to a loan repayment. Whether the loan is used for business or housing also has no effect on the repayment of the loan. The Logistic model can be specified as:

$$Pr ob(Writtenoff = 1) = Logit(4.107 + 0.000073orig_prin - 0.0107Months_due - 0.45curr_int - 15.9gend + 1.137Lex + 0.000014incomeamount + 0.0246white - 0.336black + 0.868housing + 0.0034creditscore)$$

By the same procedure, the Probit model is specified and the results are presented in Table 5.5.

Table 5.5 Regression Results of the Probit Model

Parameter	DF	Estimate	Standard	Wald	Pr > ChiSq
			Error	Chi-Square	
Intercept	1	1.63190	1.31730	1.53480	0.21540
ORIG_PRIN	1	0.00004*	0.00002	5.92790	0.01490
MONTHS_DUE	1	-0.00523*	0.00253	4.29460	0.03820
CURR_INT	1	-0.21750*	0.07860	7.66160	0.00560
Gend	1	-5.87160	250.30000	0.00060	0.98130
Lex	1	0.65480*	0.17680	13.72100	0.00020
Incomeamount	1	8.05E-06	5.83E-06	1.9069	0.1673
Housing	1	0.4388	0.7822	0.3147	0.5748
White	1	-0.0566	0.2951	0.0368	0.848
Black	1	-0.2344	0.2755	0.7242	0.3948
CreditScore	1	0.00233	0.00143	2.6779	0.1017

Source: Calculation by author

By analyzing the results above, we can find they are consistent with that of the Logistic model. The hypothesis test used on the predictors for each model was based on the null hypothesis that the coefficient is equal to 0. At the confidence level of 90 percent, the variables that failed to reject the null hypothesis are Gend, Incomeamount, White, Black, Housing, and CreditScore. The estimation for the Probit model is

$$Pr ob(Writtenoff = 1) = \Phi(1.632 + 0.000037orig_prin - 0.00523Months_due - 0.2175curr_int - 5.8716gend + 0.6548Lex + 0.000008052incomeamount - 0.0566white - 0.2344black + 0.4388housing + 0.00233creditscore)$$

5.4.7 Estimates Comparison

It is necessary to calculate how each variable will affect the repayment rate quantitatively. Illustrated as an example, the interest rate will be allowed to vary. Other continuous variables such as original principal, terms of loans, income amount, and credit score will be fixed at the mean level of CVC clients. The typical clients are chosen as a white, male, living in Lexington, whose loan is not for housing. In other words, the dummy variables Gend, Lexington, White will set equal to 1 and Black, Housing to 0. The results are presented in Table 5.6 and indicate that as the interest rate increases the typical client is more likely to default.

Table 5.6 Estimated Repayment Probability That Changes as Interest Rates Vary

Interest	Probit Model		Logistic Model	
	X*Beta	$\Phi(X*\beta)$	X*Beta	$1/(1+\exp(-x*\beta))$
1	-1.699	0.04466	-7.7701	0.00042198
3	-2.134	0.01642	-8.6705	0.00017154
5	-2.569	0.00510	-9.5709	0.00006972
7	-3.004	0.00133	-10.4713	0.00002834
9	-3.439	0.00029	-11.3717	0.00001152
11	-3.874	0.00005	-12.2721	0.00000468
13	-4.309	0.00001	-13.1725	0.00000190
15	-4.744	0.00000	-14.0729	0.00000077

Source: Calculation by author

5.4.8 Marginal Effect Analysis

Next, the marginal impact of all variables at their mean levels is examined, i.e., how the change of the variables at their mean level will affect the probability of clients to repay their loans. The dummy variables will be fixed as the typical client described

above. For the Logit model, the marginal impact is expressed as:
 $\partial P / \partial X_i = L(X_i' \beta) \beta$, where, $L(X_i' \beta) = e^{(X_i' \beta)} / (1 + e^{(X_i' \beta)})^2$

For the Probit Model, such effect can be expressed as:

$$\partial P / \partial X_i = \phi(X_i' \beta) \beta,$$

$\phi(X_i' \beta)$ is the density of standard normal distribution.

The marginal effect of both models is shown in Table 5.7. For a white male with a mean living level who lives in Lexington and borrows money for non-housing use, for each unit of interest increase, the repayment probability will decrease 0.02 percent. As for other variables, like original principle, it can be explained that when the loan amount increases to US\$10,000, the repayment probability will increase for 0.45 percent for an average client.

Table 5.7 Marginal Effect Analysis of Variables

	Logistic	Probit
ORIG_PRIN	4.482E-08	9.02E-10
MONTHS_DUE	-6.33E-06	-1.3E-07
CURR_INT	-0.000263	-5.6E-06
INCOMEAMOUNT	9.753E-09	1.73E-10
CREDITSCORE	2.822E-06	.16E-08

Source: Calculation by author

5.4.9 Statistical Effectiveness Test

From the both Logistic and Probit models come similar results, in which the sign and significance of coefficient are the same, only the magnitude is different. Now, the effectiveness of the models is determined. The percentage of correct predictions will first be computed. A threshold of 0.5 was used to calculate the percent of correct predictions for the Logit and Probit models; for both the concordant percent of prediction is 85.3 percent, indicating the prediction power of both models based on CVC data can be reliable.

Then, the likelihood ration index (LRI) can be calculated using L_u , the value of the likelihood function when all parameters are present, and L_c , the value of the likelihood function when all the slope coefficients are restricted to zero $LRI=1- L_u/L_c$. From the

SAS output, we can find the null hypothesis that coefficients equal to zero can be rejected significantly, indicating the explanatory power of the variables in both models is satisfactory.

5.4.10 Conclusion

SBA microloan intermediaries face a complex decision environment. Their loan portfolios face the need to balance repayment of a government loan with the need to generate a significant social and economic impact. In fact, both the home ownership and business loan programs face this decision environment. To date, several risk management techniques have been used by microloan lenders to balance these requirements including dynamic incentives, training, and loan loss reserve accounts. Up to now, credit scoring has only been applied on a subjective basis for microloan lenders. This research attempts to estimate a credit-scoring model for a U.S. microloan intermediary. The focus of the analysis was CVC of Kentucky, which operates microloan programs, including business and housing programs, in central Kentucky.

Based on CVC data, two statistical models, Logit and Probit, were established. The selection of a proposed model estimating a relationship of variables to estimate the repayment rate of loan was undertaken. Several characteristics of the loan clients were chosen, including original principal, interest rate, demographic characteristics, income, and credit score. Based on the regression results, several significant variables were identified that affect a borrower's repayment of a loan. For rural borrowers, the results indicate that rural borrowers are less likely to repay loans. This result deserves further attention to its implications for rural microentrepreneurs.

In practice, such results may improve lending and risk management for small financial institutions. Such variables can be focused upon when the loan officer determines whether a loan be lent to an applicant. Using the coefficient of the variables, any applicant's repayment probability can be determined. To further quantify the probability of repayment, the marginal effect of the variables was analyzed. The effectiveness of such models was tested to show that it is statistically reliable. Therefore, these models can be applied in the CVC loan applicant evaluation practice, and can screen-out unqualified applicants at a satisfactory level.

This research serves to enhance CVC self-sufficiency, which is the precondition of large-scale outreach to the economically active poor. It assumes that by being profitable, CVC can grow to meet the widespread and long-standing client demand for convenient, appropriate financial service. However, several caveats are in order. Generally, credit-scoring models are estimated using much larger datasets. Thus, the inclusion of more data would be necessary to ensure the reliability of statistical credit scoring, and also it would be useful to obtain data from other small financial organizations in the United States. Finally, another statistical issue that still needs to be addressed is the potential bias from missing data related to those who did not receive a loan. At this time, such data are still unavailable. This would be particularly useful to determine if more small business owners are turned down because of their lack of resources. For a more comprehensive analysis, future research such as securitization of loans combined with portfolio theory could assess the whole range of risk management strategies as U.S. small financial institutions attempt to attain high-profit and operations levels.

Chapter 6 Summary and Conclusions

6.1 Summary of Research

The first aim of this thesis is to quantify the credit constraints faced by small businesses. Credit scoring as an innovation to the lending practices of small financial institutions is introduced to help mitigate the risk of lending to small businesses. The effectiveness of this proposal was tested using data from an SBA loan intermediary in Kentucky.

The first chapter lays out the rationale for this research against the background of the credit demand gap that exists for small business firms. In the last few decades, the deregulation and consolidation trends in financial industries can be seen to jeopardize the credit position of small business firms. The business cycle also destabilizes the credit supply for small business firms, and information asymmetry in credit markets can lead to credit rationing. Finally, after describing the methodology used to calculate the credit gap between the small businesses' need and actual supply, the usefulness of small financial institutions lending to small business is analyzed and credit scoring is introduced as a financial innovation to enhance their role in this field.

Chapter 2 provides the theoretical background of the credit gap of small business firms. In an ideal situation, where all transactions are transparent, there would be no credit gap, i.e., the credit demand would be satisfied by the supply. However, information asymmetry always exists between lenders and borrowers, leading to credit rationing so that part of the borrowers' demand cannot be covered. The special customers — the working-poor segment of the small-business population — exacerbate the information asymmetry problems for the small-business owner whose credit gap tends to be larger than that in the general credit market. Heterogeneous information distribution across regions is another factor contributing to the credit gap of small businesses in peripheral areas. Credit gaps can exist for small businesses in these less developed, marginalized areas because of lower levels of access to public information. The trend toward bank consolidation negatively affects the availability of credit to small businesses. As result of consolidation, larger banking companies have higher costs of lending to small businesses and are hesitant to lend to these customers.

Chapter 3 presents a quantitative measurement of the credit gap of small businesses. Descriptive statistics using two important small business credit databases (NSSBF, 1998; and Call Reports 1994-2000) were derived to find the credit situation for small business firms. The National Survey of Small Business Finance provides the data for the demand-side of the small business credit market. Credit access, especially to cheaper credit resources, is found to become limited as the scale of small business operations decrease. The supply-side data of small-business credit, from the Call Reports database, reveal the effects of the consolidation trend. Consistent with the theory presented in Chapter 2, as the result of consolidation, larger banks tend to decrease the share of small-business lending in their portfolios. Basically, the descriptive statistics confirm the anecdotal complaints of shortages of credit and the inefficient operation of credit markets for small firms.

Chapter 4 performs a multivariate econometric analysis to determine quantitatively the magnitude of the credit gap, i.e., to estimate the credit gap between the desired and actual debt for credit-constrained small businesses, assuming a firm will always have a desired level (positive level) of debt if it is not to be credit constrained. The preliminary process has three steps: 1) estimate the probability that the firms are credit-unconstrained; 2) calculate the probability that the firm is indebted; and 3) under conditions found in steps 1 and 2, estimate the expected debt level for credit-constrained and indebted firms. The magnitude of the credit gap is finally determined by comparing the expected debt level and actual debt level, and then categorized by the type and size of the industry and its geographic area.

Chapter 5 illustrates that small financial institutions with their flexible organizational structures and ability to produce and utilize soft information, have a unique advantage in bridging the finance gap often ignored by mainstream financial suppliers. Credit scoring as a financial innovation in small-business lending is proposed to enhance the market niche of small financial institutions. A standardization procedure like credit scoring, already employed by larger banks, could be used by small financial institutions to “harden” their soft information into regular and formal databases. Because credit scoring is often criticized as the tool that deprives poor populations of credit access, it is illustrated that, even for a government-subsidized organization like the SBA lending

intermediary, credit scoring is still a necessary mechanism that helps an institution remain financially sustainable in order to provide services to more small businesses. Next, the potential of credit scoring was analyzed using the case of a small financial institution (Community Ventures Corporation of Kentucky). Using the Logistic and Probit models as the basis, the probability of customer default was estimated. The effectiveness of these models was found to be statistically reliable. Therefore, these models could be applied to the evaluation process of the loan applicant.

6.2 Conclusions

As the theory indicates, information asymmetry between lenders and borrowers in credit markets leads to credit rationing so that part of the credit demand cannot be covered. The resulting credit gap could be larger than that in formal financial markets because the information in the small-business lending sector may be more vague. The empirical study in this dissertation confirms the hypothesis that credit gaps exist in most small businesses no matter the type of industry and its organization or geographical region. Previous research (Stein, 2000) suggests that, although diminished, small financial institutions have the organizational flexibility and informational advantage to lend to small businesses and cover the credit gap. Credit scoring as an innovation is introduced to improve the competitiveness of small financial institutions in the credit market. The effectiveness of this mechanism was tested using data from an SBA loan intermediary, Community Ventures Corporation of Kentucky. The modeling results show that credit scoring is efficient in screening-out unqualified borrowers and enhancing the sustainability of such small financial institutions. In total, the small financial institutions can serve more small businesses when they have established risk-control mechanism such as credit scoring.

6.3 Limitations of the Analysis and Suggestions for Further Research

There are several limitations in this analysis process. First, the variables selection faces many constraints when the credit gap is quantitatively determined. Although the NSSBF (1998) data on firm and owner characteristics are useful, they cannot be used to determine the financial conditions of small firms, e.g., the small business owner depends

heavily on their personal, or relative's, savings as their credit resource. The number of such credit resources may describe the credit condition (constrained or unconstrained) more precisely than the variables on hand, but such information is difficult to collect. In the future, perhaps a targeted survey could collect this data to measure more precisely the credit conditions of the small business owner.

When investigating the use of credit scoring, transaction characteristics and demographic variables have been used to estimate the default probability of borrowers. Actually, the default rate can also be affected by macroeconomy variables such the economy cycle. But the time series data during the business cycle are often unavailable for small financial institutions. Reliable data for some time intervals are very limited. When such data become available, the test should be made. Another shortcoming is that the analysis only emphasizes the benefits of credit scoring to small financial institutions. However, the disadvantages of credit scoring should not be ignored because any of the credit-scoring models could screen-out potentially qualified customers. A complete analysis should use historical data to calculate the benefit and cost. With a database like the CVC database of less than one thousand entries, the cost can hardly be calculated based on such a small sample. Finally, more advanced models like the neural network, decision trees that are often more effective than the traditional statistical models, are commonly applied to the credit scoring of large financial institutions. However, the requirement of more data entries (three thousand at least) limits their application here. In the future, as the databases of small financial institutions become larger, such models should be tested.

Appendix 1 Sample Selection Problems and Correction Methodology

To put the credit sample selection in a general framework, let the equation that determines the sample selection be

$$z_i^* = \gamma' w_i + u_i$$

And let the equation of primary interest be

$$y_i = \beta' x_i + \varepsilon_i.$$

The sample rule is that y_i is observed only when z_i^* is greater than zero. Suppose as well that ε_i and u_i have a bivariate normal distribution with zero means and correlation ρ . Then:

$$\begin{aligned} E[y_i | y_i \text{ is observed}] &= E[y_i | z_i^* > 0] \\ &= E[y_i | u_i > -\gamma' w_i] \\ &= \beta' x_i + E[\varepsilon_i | u_i > -\gamma' w_i] \\ &= \beta' x_i + \rho \sigma_\varepsilon \lambda_i(\alpha_u) \\ &= \beta' x_i + \beta_\lambda \lambda_i(\alpha_u), \end{aligned}$$

where $\alpha_u = -\gamma' w_i / \sigma_u$ and $\lambda(\alpha_u) = \phi(\gamma' w_i / \sigma_u) / \Phi(\gamma' w_i / \sigma_u)$. So

$$\begin{aligned} y_i | z_i^* > 0 &= E[y_i | z_i^* > 0] + v_i \\ &= \beta' x_i + \beta_\lambda \lambda_i(\alpha_u) + v_i \end{aligned}$$

Least squares regression using the observed data—in this case, OLS regression of Debt/Asset level on its determinants, using only data for those small business firms that are credit constrained and indebted—produces inconsistent estimates of β . This can be viewed as the problem of an omitted variable. Least squares regression of y on x and λ would produce consistent estimates, but if λ is omitted, then the specification error of

an omitted variable is committed. Even if λ_i were observed, then least squares would be inefficient. The disturbance v_i is heteroscedastic.

The marginal effect of the regressors on y_i in the observed sample consists of two components. There is the direct effect on the mean of y_i , which is β . In addition, for a particular independent variable, if it appears in the probability that z_i^* is positive, then it will influence y_i through its presence in λ_i . The full effect of changes in a regressor that appears in both x_i and w_i on y is

$$\frac{\partial E[y_i | z_i^* > 0]}{\partial x_{ik}} = \beta_k - \gamma_k \left(\frac{\rho \sigma_\varepsilon}{\sigma_u} \right) \delta_i(\alpha_u)$$

$$\text{where } \delta_i = \lambda_i^2 - \alpha_i \lambda_i.$$

Suppose that ρ is positive and $E[y_i]$ is greater when z_i^* is positive than when it is negative. Since $0 < \delta_i < 1$, the additional term serves to reduce the marginal effect. The change in the probability affects the mean of y_i in that the mean in the group $z_i^* > 0$ is higher. The second term in the derivative compensates for this effect, leaving only the marginal effect of a change given that $z_i^* > 0$ to begin with.

In most cases the selection variable z_i^* is not observed. Rather only its sign can be observed. To consider the two examples, it is typically observed only whether a firm is credit constrained and indebted or not. We can infer the sign of z_i^* , but not its magnitude, from such information. Since there is no information on the scale of z_i^* , the disturbance variance in the selection equation cannot be estimated. Thus such a model can be expressed as follows:

$$\text{Selection mechanism: } z_i^* = \gamma' w_i + u_i, z_i = 1 \text{ if } z_i^* > 0 \text{ and } 0$$

$$\text{Otherwise: } \text{Prob} (z_i = 1) = \Phi(\gamma' w_i) \text{ and}$$

$$\text{Prob} (z_i = 0) = 1 - \Phi(\gamma' w_i)$$

Regression model: $y_i = \beta' x_i + \varepsilon_i$ observed only if $z_i = 1$,

$$(u_i, \varepsilon_i) \sim \text{Bivariate normal } [0,0,1, \sigma_\varepsilon, \rho]$$

Suppose that, as in many of these studies, z_i and w_i are observed for a random sample of individuals but y_i is observed only when $z_i=1$. This model is precisely the one examined earlier, with $E[y_i|z_i = 1] = \beta' x + \rho\sigma_\varepsilon \lambda(\gamma' w)$

Estimation Methodology

The parameters of the sample selection model can be estimated by maximum likelihood. This is quite cumbersome, however, and an alternative procedure due to Heckman (1979) is usually used instead. Heckman's two-step estimation procedure is as follows:

1. Estimate the Probit equation by maximum likelihood to obtain estimates of γ . For each observation in the selected sample, compute $\hat{\lambda}_i = \phi(\hat{\gamma}' w_i) / \Phi(\hat{\gamma}' w_i)$ and $\hat{\delta} = \hat{\lambda}_i (\hat{\lambda}_i - \hat{\gamma}' w_i)$.
2. Estimate β and $\beta_\lambda = \rho\sigma_\varepsilon$ by least squares regression of y on x and $\hat{\lambda}$.

Appendix 2 Model Illustrating the Reality of Small-Business Lending in the United States

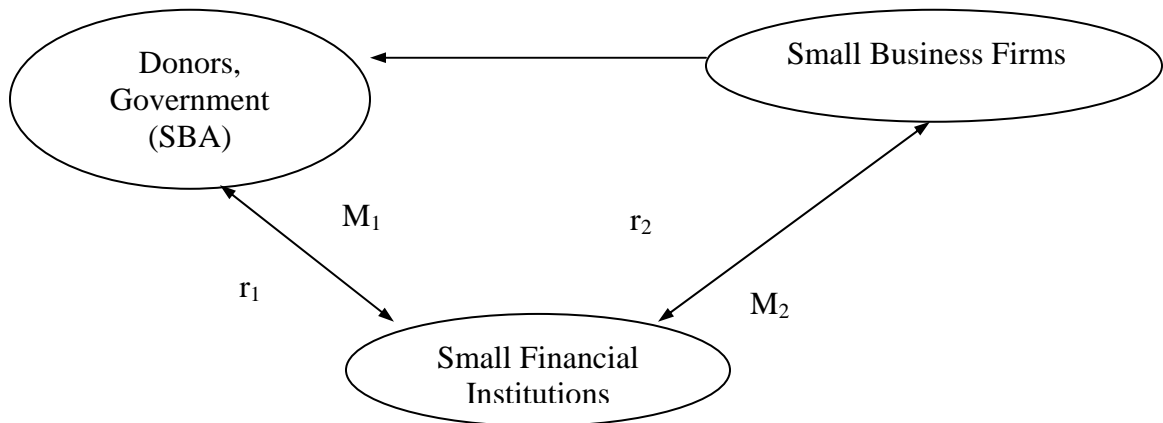
International experience with small business finance and microenterprise has tended to espouse a one-sided focus on self-sustainability, reflected in the dominant priority given self-sufficiency in the development of small business finance programs. However, in the United States, very few small business finance organizations have become self-sustainable. Most of the equities in small business financial institutions are provided by donors or government organizations (such as SBA loan intermediaries). The economic and political systems of the United States determine the unique characteristics of its small financial institutions, which always seek a balance between efficiency and social effect. In this appendix, funding strategies and incentive systems in small financial institutions like the SBA loans intermediaries of the United States will be presented. The relationship among the three participants (donors, SBA loans intermediaries, small businesses) will be interpreted by examining incentive mechanisms and the decision-making process of the lending environment. These analyses will illustrate the reality of small financial institutions in the United States and that sustainability has a high priority even for such government-subsidized financial programs as SBA financial intermediaries. This will provide an economic background for the use of mechanisms like credit scoring to enhance the sustainability capacity of small financial institutions.

The international microfinance experience makes clear that commercialization is the main outlet for small financial institutions. Commercialization depends on three assumptions: 1) profit can provide enough incentives for efficiency, which will decrease costs and increase benefits; 2) external subsidies are not large and stable enough to form dependency; and 3) the benefits of loans for small businesses are more than the costs that compel them return the loans in a timely manner.

Such assumptions are not valid in the United States. First, profits definitely provide incentives to promote efficiency, but government and donors can provide equivalent incentives, i.e., if small financial institutions can attain some social effects including the reduction the unemployment or poverty levels, the subsidies cannot be revoked. Second, in contrast to the huge microfinance programs in poor countries, the scale of small financial institutions in the United States is much smaller while the government is much

richer and has the capacity to provide large amount of subsidies. Third, the higher price of the loans charged by small financial institutions is hardly affordable by small business firms and thus, there is a decrease in social benefits. The relationships between the three participants can be shown by Figure A.2.1.

Figure A.2.1 Relationship of Small Business Firms, Small Financial Institutions, and Government



Small Business Firms

First, a small business firm has the incentive to pursue profits from its production. To simplify, inputs can be constrained to capital (loans) and human resources. Under some loan rate, market rate, price and wage level, entrepreneurs will determine the input amounts to make the largest profits, as shown by the following equation:

$$\text{Max}_{K_i, L_i} : \frac{p \cdot F(K_i, L_i) - (1 + r_2)K_i - \omega L_i}{1 + R}$$

For small business firm i , $F(\cdot)$ is the production function; p is the price of the output; r_2 is the interest rate of loan; K_i is the loan amount that the small business owner borrows from the small financial institutions, which forms the M_1 ; ω_i is the wage level; L_i is the labor inputs.

By profit maximization, the small business firm will determine the loan amounts K^* , labor inputs L^* , the final output O^* and profit π^* , which can be respectively shown as:

$$K_i^* = K(P, \omega, r_2, R) \quad L_i^* = L(P, \omega, r_2, R)$$

$$O_i^* = O(P, \omega, r_2, R) \quad \pi_i^* = \pi(P, \omega, r_2, R)$$

At the local level, the accumulated employee labor contributes to the reduction of the unemployment rate. The accumulated outputs form the development of local GDP. The profits above the sustenance level lead to reduction of the poverty level.

$$L^* = \sum_i L_i^*$$

The change of employment rate can be shown as $\Delta R_e = L^*/\text{Pop}$, Pop is the local population.

Using N to signify the number of families above the poverty level, S is the local sustenance level, the poverty reduction effect can be shown as $\Delta PR = \Delta N / POP$. Specifically, If $\pi_i^* > S$, then $N = N+1$. ΔN is the accumulated number of families above poverty level.

$$\text{The change of GDP can be shown as: } \Delta GDP = \sum_i O_i^*$$

Donors and Government

The social effects that small financial institutions produce determine the amount and interest i_1 of the money from the donors and government. As shown above, the social

effect can be shown by the change of the unemployment level ΔR_e , the rate of poverty reduction ΔPR and the increase of local GDP ΔGDP . Government or donor subsidies often constitute the largest part, or even the whole amount of the equity of a financial institution. Therefore, the loans M_1 and the accompanying interest rate r_1 (such as the SBA Microloan) can be shown by a function of those social effect ratios. The amount of the donation D_1 received by small financial institutions is also dependent on these ratios.

$$M_1 = G(\Delta PR, \Delta R_e, \Delta GDP \dots),$$

$$D_1 = D(\Delta PR, \Delta R_e, \Delta GDP \dots),$$

$$r_1 = R(\Delta PR, \Delta R_e, \Delta GDP \dots)$$

M_1 is the low-interest loans from the government to the small financial institutions. r_1 is the according interest rates. D_1 is the free donations received by the small financial institutions.

Small Financial Institutions

Many who research the small financial institutions of the United States (Morduch, 1999; Schreiner, 2002) agree that profitability is not a reasonable expectation. According to Schreiner (2002) “The profit motive is common and very powerful way—but not the only way—to generate incentives for efficiency and innovations.” When small financial institutions make decisions, they must consider direct and indirect returns. Direct returns are earned from the interest gaps between lower interest grants and loans lent out by a financial institution. Indirect returns are from donations that are free but constrained to the extent of the social effect. The loan intermediaries or other kind of small financial institutions must strike a balance between these two returns, e.g., the interest rate—small financial institutions, compared to the formal financial institutions, often must charge a higher interest than the market rate to sustain themselves against the larger collection costs of small loans. When the rate is too high, demand from small businesses will decrease sharply and the social effects illustrated above will vanish. Without such social welfare effects, bureaucrats will retract low-interest loans and the donors will stop donating. As stated above, grants often constitute the equity of small financial institutions, without which they would find it even harder to sustain themselves.

A constrained minimization problem can be established to illustrate on the process by which the interest rate and amount of loans lent out are decided. The subsidy dependency

index (SDI) designed by Yaron (1992) will be borrowed. SDI is the ratio of a small financial institution's annual subsidies to its annual interest income, which indicates the percentage by which the interest income of a small financial institution would have to increase in order to eliminate the need for subsidy. An SDI of 100 percent indicates that a doubling of the prevailing average on-lending rate will be required just to offset the elimination of subsidization. A negative SDI indicates that a small financial institution has achieved full self-sustainability and that its annual profits exceed the annual subsidies.

$$SDI = \frac{[D(R - r_1) + (E * R)]}{M_2 * r_2}$$

D is the annual average low-interest loan from the government or other organizations;
 r_1 is the weighted average interest rate paid by small financial institutions on its borrowed funds;

R is the market interest rate;

E is the free grants for donors that often form the equity of a small financial institution and is usually equal to D_1 in donor's decision equation.

r_2 is the weighted average on-lending interest on a small financial institution's loan portfolio

As analyzed, the low-interest loan amount D and the grants E are affected by the social effect ratio, which are determined by the loans lent out by small financial institutions. D and E should be expressed as some functions of M_2 and r_2 . Since the demand of the loans M_2 are also determined by r_2 , the formula of SDI can be express as

$$SDI = \frac{[D(r_2)(R - r_1) + (E(r_2) * R)]}{M_2(r_2) * r_2}$$

A small financial institution always has the incentive to pursue the largest profit and realize self-sustainability, which means it wants to minimize the SDI. Concurrently, it must face the dilemmas described above. First, they must repay the low-interest rate loan M_1 . The expectation of the repayment of the out-lending loans M_2 must be larger than the borrowed funding. If the average repayment rate of M_2 is Pr, then Pr* M_2 should be larger than M_1 to realized the basic sustenance. Second, the average interest rate of the

out-lending loans r_2 should be larger than that of the borrowed funding r_1 . Third, the donation received must be above some level \bar{E} to keep the operations function.

Therefore a small financial institution's decision-making is based on the following constrained minimization problems:

$$\text{Min}_{r_2} : SDI = \frac{[D(r_2) * (R - r_1) + E(r_2) * R]}{M_2(r_2) * r_2}$$

Subject to:

$$\text{Pr} * M_2 \geq M_1$$

$$r_2 \geq r_1$$

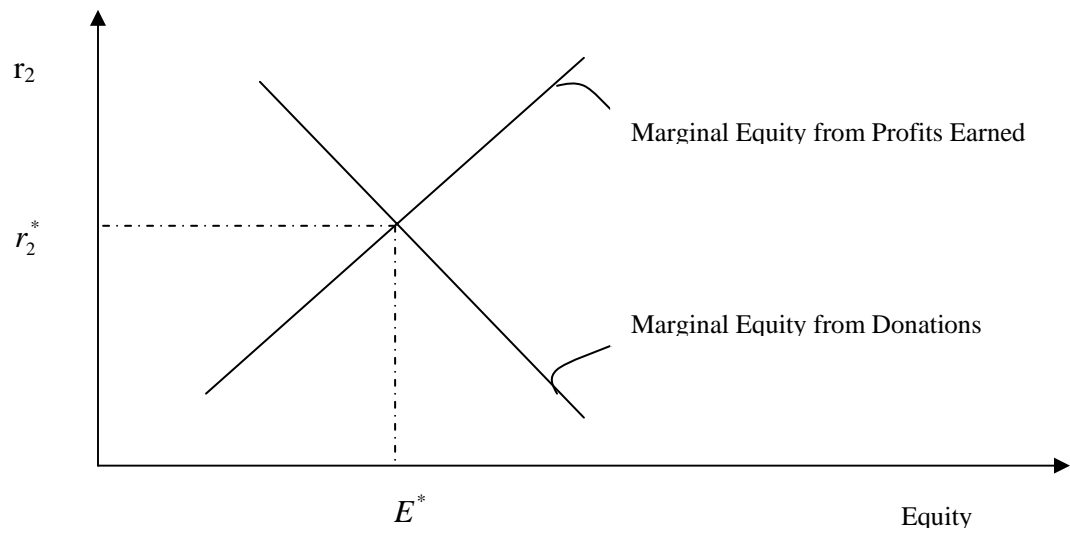
$$E(r_2) \geq \bar{E}$$

The solution of the problem will determine the interest of the out-lending loans r_2^* and the loan amount M_2^*

Equilibrium

Finally, equilibrium will be reached among the three small-business lending participants. The interest rate of out-lending loans r_2 will be taken as the example for partial equilibrium analysis. As r_2 increases, profits can be larger for a small financial institution. More loans tend to be lent out and more profits will contribute to the increase of the equity. However, the increased interest rates of the loans will restrain the demand from microentrepreneurs, which will discount the social effects of the loans. The reduction of start-up rates and other rates will compel the bureaucrats retract the grants and the donors stop donations that often form the bulk of a small financial institution's equity. Managers of small financial institutions must balance between long-run and short-run returns and reflect such a balance in their interest rate decisions. Such a balanced rate decision process is illustrated in Figure A.2.2.

Figure A.2.2. Interest Rate Charged in a Small-Business Lending Institution



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