

# **Gender and the Availability of Credit to Privately Held Firms: Evidence from the Surveys of Small Business Finances**

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## **Abstract:**

We use data from the nationally representative Surveys of Small Business Finances to analyze differences by gender in the ownership of privately held U.S. firms, and to examine the role of gender in the availability of credit. We document a series of empirical regularities regarding male- and female-owned firms. Female-owned firms are smaller, younger, have fewer and shorter banking relationships, and are more likely to be credit constrained. Female owners are younger, less experienced, and not as well educated. Differences in credit outcomes are rendered insignificant in a multivariate setting, where we control for other firm and owner characteristics. Finally, we test the robustness of our findings by means of the propensity score matching method.

**Keywords:** access to credit, denied borrower, discouraged borrower, discrimination, gender, SSBF

**JEL classification:** E43, L26, G21, D82

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## **Gender and the Availability of Credit to Privately Held Firms: Evidence from the Surveys of Small Business Finances**

### **1. Introduction**

Entrepreneurs and their investments in new ideas and businesses are highly important to overall economic growth in the United States and other nations around the world. In a real sense, entrepreneurs represent the engine of growth for the U.S. economy. Furthermore, this growth is very much dependent on efficient allocation of human resources. Therefore, given a tight managerial/entrepreneurial labor market in the United States, it is critically important to understand the role of gender in entrepreneurship. A better understanding of what influences the entrepreneurial activities of women relative to men is of importance to investors, practitioners, academics, regulators, and policy makers.

As recently as 1985, the U.S. Small Business Administration stated, “There is no total count of female-operated businesses in the U.S.”<sup>1</sup> A growing number of studies examine various aspects of gender and entrepreneurship,<sup>2</sup> but we are aware of only one study that establishes a baseline of “stylized facts” about the role of gender in entrepreneurship at U.S. firms. Fairlie and Robb (2009) analyze data from the 1992 Characteristics of Business Owners, a survey conducted by the U.S. Census, and provide a snapshot of U.S. firms in 1992. Our study updates and extends their analysis using data from the Surveys of Small Business Finances (SSBFs), a set of four surveys covering the period 1987 – 2003 conducted by the Federal Reserve Board. Each of these four surveys is representative of the population of small businesses in the United States as of a

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<sup>1</sup> See Report to the President 1985, p. 295.

<sup>2</sup> See, for example, Kallenberg and Leicht, 1991; Brush, 1992; Fay and Williams, 1993; Fischer, Reuber, and Dyke, 1993; Haynes and Haynes, 1999; Boden and Nucci, 2000; Coleman, 2000; Robb, 2002; Cassar, 2002; Marlow and Patten, 2005; Carrington 2006; and Fairlie and Robb 2009; Coleman, 2009; and Robb and Watson, 2011.

base year (1987, 1993, 1998, and 2003). The four surveys are used to provide snapshots of the role of women in U.S. small businesses over this 16-year period.<sup>3</sup>

We analyze entrepreneurship participation by gender for the various organizational forms (e.g., sole proprietorships, partnerships, and corporations) and by size of firm as measured by employment, sales, and assets. Anecdotal evidence suggests that women are predominantly involved in smaller firms; our research establishes nationally representative baselines.

We also document the degree of participation along many firm-level dimensions, including age, creditworthiness, industry, leverage, and profitability, and for entrepreneur-level characteristics, including age, creditworthiness, education, and experience. Furthermore, we examine how gender participation changed over time period covered by the SSBFs.<sup>4</sup>

Culture can be defined as shared patterns of behaviors and interactions, cognitive constructs and understanding that are learned by socialization. It can be seen as the growth of a group identity fostered by social patterns unique to the group. Consequently, we analyze the role of educational attainment in facilitating access to credit during the years, and its interaction with gender.

We also focus on the financial decisions made and outcomes realized by developing entrepreneurial firms, such as whether or not to apply for credit, whether or not the firm was extended credit by its prospective lender, which types of credit the firm sought (e.g., lines of credit versus loans, trade credit, and credit cards), and from how many financial institutions the firm sought financial services. These financial decisions reflect both the incentives of the entrepreneur, with her personal and financial stake in the success of the firm, and the incentives of other investors

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<sup>3</sup> Asiedu et al. (2012) focus on the 1998 and 2003 surveys.

<sup>4</sup> Cole (2008) reports that the percentage of privately held U.S. firms controlled by women rose from 14 percent in 1987 to 21 percent in 1993, to 24 percent in 1998, and to 26 percent in 2003. We explore in detail where among privately held firms this growth has occurred.

in the firm. Outcomes represent the evaluations of financial institutions regarding the prospects of these firms, as well as the importance of any taste-based discriminatory preferences.

We find that, when compared to male-owned firms, female-owned firms are 1) significantly smaller as measured by sales, assets, and employment; 2) younger as measured by age of the firm; 3) more likely to be organized as proprietorships and less likely to be organized as corporations; 4) more likely to be in retail trade and business services and less likely to be in the construction, secondary manufacturing, and wholesale-trade industries; and 5) have fewer and shorter banking relationships. Female owners are significantly younger, less experienced, and not as well educated than male small business owners.

Also examined here is the role of gender in the availability of credit to small privately held U.S. firms, and we find strong evidence of significant univariate differences. Specifically, female-owned firms are significantly more likely to be credit-constrained because they are more likely to be discouraged from applying for credit and more likely to be denied credit when they do apply. However, these differences are rendered insignificant when we control for other firm and owner characteristics. Our findings are in line with Delis et al. (2020) who use a unique sample of loan applications from small and micro-enterprises obtained by a major European bank between 2002 and 2017 find that, *ceteris paribus*, female entrepreneurs are more prudent loan applicants than are males because they are less likely to apply for credit or to default after loan origination.

We also test for taste-based discrimination against female-owned firms using the methodology proposed by Cavalluzzo and Cavalluzzo (1998), which utilizes differences in banking competition across markets. We find no evidence of such discrimination. In total, this evidence suggests that observed gender differences in credit availability are attributable to other differences in male-owned and female-owned firms, such as the firm's size and industry and the owner's age,

experience, and educational attainment. This evidence is supportive of the liberal feminist theory, which posits that women are just as capable as men and should perform just as well so long as there is not discrimination (Fisher et al., 1993; Robb and Watson, 2012).

A major concern for the observed effect of gender is that female-owned firms are not randomly drawn and they might be systematically different with respect to the male-owned ones. In the data, very different types of firms are included in both groups, and male-owned and female-owned firms so that the two groups turn out to be significantly different. For example, most male-owned are larger while female-owned ones tend to be smaller, or the former tend to be organized in a more highly structured business legal form than the latter. Therefore, we perform a robustness test by matching the female-owned firms to observationally similar firms that are not female-owned. The Propensity Score Matching (PSM) method allows to further consider the potential problem that male-owned and female-owned firms are different along some dimension, which also explains gender itself and, consequently, the outcome of our models of credit availability. This approach shows that our results continue to hold.

This study contributes to a number of different literatures, including that on entrepreneurship, relationship lending, and financial services. First, it establishes a set of stylized facts about female participation in entrepreneurship over time, about how female-owned firms differ from male-owned firms, and about how female owners differ from male owners. Second, it documents how the availability of credit differs across female-owned and male-owned firms. Third, it identifies important gender differences in the relationships between firms and their sources of financial services.

The findings of our research also can benefit policy makers. There is a large literature on the role of law and regulation in promoting employment and the availability of credit. Typically,

state and federal governments intervene when there is evidence of economic structures that impede healthy competition. The starting point for any sound intervention is documentation of facts. Accordingly, we identify areas of entrepreneurship where women actively participate and then examine those areas where they are less active. We find, among other stylized facts, that women are less likely to apply for credit when they need credit, which helps explain why female-owned firms are more likely to be credit-constrained; and that women are less likely to manage large private organizations, which helps explain why women have fewer opportunities to manage listed companies.

The paper is organized as follows. In Section 2 we review the literature, while in Section 3 we describe the dataset. The empirical models are described in Section 4, and we discuss the estimation results in Section 5. Section 6 concludes.

## **2. Previous Research**

Previous research has related gender differences in the use of funds to: (i) structural differences between male- and female-owned firms, such as their size, date of foundation, credit history, owner age, and the type of industry (Coin, 2011); (ii) demand-side differences between female-owned and male-owned firms, such as owners' aversion to risk and willingness to loosen control (Bönte and Piegeler, 2012; Abou-El-Sood, 2021); (iii) supply-side discrimination.

### **(i) Structural differences between male- and female-owned firms**

Among the studies that document structural differences between male- and female-owned firms, Brush (1992) reviews fifty-seven of the earliest empirical studies on women-owned businesses, which primarily were descriptive statistics on cross-sectional survey data. She summarizes the results of these studies as a guide for future researchers, concluding that women-

owned firms are similar to male-owned firms along numerous dimensions, such as “demographic factors, problems and business characteristics;” but differ across such owner characteristics as “education, work experience, skills, approach to venture creation/acquisition, business goals, problems and performance.” She suggests that differences in male and female psychology and sociology play major roles in explaining these differences.

The study by Kallenberg and Leicht (1991) is the first to rigorously explore whether differences in performance of entrepreneurial firms by gender are the result of discrimination or other factors. They analyze a sample of firms from selected industries in South Central Indiana over a three-year period, 1985-87, and find that female-owned firms were no more likely to go out of business or to be less successful (as measured by gross earnings) than firms owned by men.

Fischer, Reuber, and Dyke (1993) examine a more comprehensive set of performance measures than do Kallenberg and Leicht (1991). They find that women-owned firms are smaller, grow more slowly, and have lower sales revenues, and that their owners have less experience working in similar firms and less experience in start-up businesses. They also find that owner differences help explain differences in performance outcomes.

Robb and Wolken (2002) use data from the 1998 SSBF to analyze how gender influences outcomes in the credit markets. Specifically, they look at five variables related to the use of credit. They find significant univariate differences by gender in each variable; however, in a multivariate analysis, these differences are explained by other factors, such as the age and size of the firm.

Cassar (2002) analyzes capital structure and types of financing used by start-up firms in Australia. Using data from a survey conducted by the Australia Bureau of Statistics, he finds that both firm and owner characteristics influence the choice and magnitude of finance usage.

Robb (2002) compares business survival rates by gender and minority status. She finds that, after controlling for a firm's age, size, industry, location, and organizational form, businesses owned by women fared worse than those owned by men; however, among businesses owned by blacks, those owned by women did better than those owned by men.

For Italian firms, Stefani and Vacca (2013) argue that female-owned firms apparently do experience tougher access to finance, but this evidence is almost completely explained by the fact that male- and female-owned firms are structurally different. In the same direction, Bui et al. (2019) do not find any difference in credit access for female-owned firms in Vietnam borrowing from non-commercial banks, while approved loan size is higher for firms managed by female CEOs regardless of the borrowing source once controlled for firm characteristics and CEO demographic factors.

#### **(ii) Demand-side differences between female-owned and male-owned firms**

As for the research that focuses on demand-side effects on the use of funds, a strand of the literature argues that the gender cannot be ignored because it matters for effective investment strategies and related behavior, which is supported by a persistent argument that women are more risk-averse, resulting in more conservative investment choices than men (Han et al, 2021). In this vein, Jianakoplos and Bernasek (1998) assess the relative risk aversion of women versus men, by using data from the Federal Reserve System's 1989 Survey of Consumer Finances (SCF) to examine household holdings of risky assets. They find that, as wealth increases, the portion of risky assets increases by a smaller amount for women relative to men, a result they interpret as being consistent with the hypothesis that women are more risk-averse than men. They speculate that this may explain differences by gender in wealth endowments.



Sunden and Surett (1998) use data from the 1992 and 1995 SCFs to provide additional evidence on risk aversion for men versus women. They find that women make more conservative choices than men in their defined-contribution retirement plans.

Haynes and Haynes (1999) use data from the 1987 and 1993 SSBFs to examine the structure of debt held by small businesses that are owned by women and men. They find that, in 1987, women-owned firms relied more heavily on nontraditional debt instruments (i.e., lines of credit), but that this changed by 1993, when their access was similar to that of male-owned firms.

Coleman (2003) uses data from the 1998 SCF in yet another study on risk aversion for women versus men. She finds that women overall expressed higher levels of risk aversion than men overall, but that there were no such differences between younger women and men overall.

Recently, Bui et al. (2019) investigate the differences in credit access between male-managed and female-managed firms in Vietnam. Their findings reveal that women-managed firms are less likely to borrow from commercial banks than their male counterparts, even when controlling for other determinants such as CEO education and experience, firm size, and ownership.

### **(iii) Supply-side discrimination**

Financial discrimination exists when banks apply higher interest rates on loans to female entrepreneurs, and these higher interest rates do not depend on lower credit worthiness, which is an assessment of the likelihood that a borrower will not default on its debt obligations and is based on a borrower's credit history and structural characteristics (firm size, sector of activity, and the quality of its assets and liabilities) (Becker, 1957). A lower acceptance rate or higher refusal rate in granting loans may also be a sign of gender discrimination (Storey 2004).

Among the studies that analyze gender discrimination in access to credit, evidence is not unique.

Fay and Williams (1993) use an experimental procedure to test whether loan officers show evidence of gender bias in evaluation otherwise identical loan applications. They find that both sexes were equally likely to be approved for a loan, but that education was deemed more important for females.

Coleman (2000) uses data from the 1993 SSBF to analyze access to capital and terms of credit. She finds that women-owned firms are less likely to use external financing and that lenders do not appear to discriminate against women in providing access to capital. However, lenders do charge higher interest rates to women-owned firms, even though they are more likely to require collateral from women-owned firms.

Verheul and Thurik (2001) show that female and male entrepreneurs differ in the way they finance their businesses. This difference can be attributed to the type of business and the type of management and experience of the entrepreneur (indirect effect). Female start-ups may also experience specific barriers when trying to acquire start-up capital. These may be based upon discriminatory effects (direct effect). By using a panel of 2000 Dutch starting entrepreneurs for the year 1994, the authors find that female entrepreneurs have a smaller amount of start-up capital, but that they do not differ significantly with respect to the type of capital. On average the proportion of equity and debt capital (bank loans) in the businesses of female entrepreneurs is the same as in those of their male counterparts.

Muravyev et al. (2009) analyze cross-country data from the World Bank's Business Environment and Enterprise Performance Surveys (BEEPS) for differences in performance

outcomes. They find that female-owned firms have a lower probability of obtaining a bank loan and are charged higher interest rates than male-owned firms.

Orser, Riding and Manley (2006) use data on Canadian SME owners to examine gender differences in outside financing. They find that women-owned firms are just as likely as male-owned firms to seek all types of external financing, except for external equity capital.

Arenius and Autio (2006) use data from a self-conducted survey of Finnish entrepreneurs to examine how the financing of businesses differs by gender. They find “more similarities than differences . . . in business financing,” but do find that businesses are more likely to obtain financing from family when owned by a woman.

Trichel and Scott (2006) use data from the NFIB’s survey of Credit, Banks and Small Business to examine credit-market outcomes by gender—similar to what we do in our study. They find that women-owned firms are significantly less likely than male-owned firms to apply for a loan but are no more likely to be turned down for a loan.

In an experimental study similar to Fay and Williams (1993), Carter *et al.* (2007) examine how loan officers assess the creditworthiness of male-owned versus female owned firms. They find wide diversity in the criteria used by loan officers to assess loan applications but find little in the way of significant differences by gender.

Cole (2008) uses data from each of the four SSBFs to analyze capital structure at privately held firms. He finds that the proportion of women-owned firms in the U.S. population of privately held firms increased from 14 percent in 1987 to 21 percent in 1993, to 24 percent in 1998, and to 26 percent in 2003. He also finds that women-owned firms used significantly less leverage in 2003, which is consistent with previous studies finding that women are more risk-averse than men. Using US data from the Survey of Small Business Finance—SSBF, Asiedu *et al.* (2012) find that white

female firms did not face discrimination in terms of access to loans, and actually paid lower interest rates than did white male firms. In the same direction, Aterido et al. (2011) do not find evidence of a gender gap in the use of financial services by businesses and individuals in Sub-Saharan Africa.

Ongena and Popov (2016) investigate a detailed dataset on 6,000 small business firms from 17 countries and find that in countries with higher gender bias, female-owned firms are more frequently discouraged from applying for bank credit and reliant on informal finance. Furthermore, their findings are not driven by credit risk differences between female- and male-owned firms in high-gender bias countries or by any idiosyncrasies in the set of countries in their sample.

Mascia and Rossi (2017) address the question of whether the gender of a firm's leader affects the cost of bank funding faced by small and medium enterprises in Europe. Using a large sample of observations of non-financial firms, during the years 2009–2013, they test for the presence of discrimination, comparing female-led and male-led firms. After controlling for a rich set of variables and addressing potential endogeneity, the authors show that i) female-led enterprises are more likely to face worse price conditions for bank financing compared to their male-led counterparts and, ii) firms whose leadership changes from female to male are more likely to benefit from an improvement in interest rate levels.

Alesina et al. (2013) find that Italian female-owned firms are charged higher interest rates on their credit lines, while Bellucci et al. (2010) show that Italian female entrepreneurs face tighter credit availability, even though they do not pay higher interest rates. Cesaroni et al. (2013), using data from the Credit Register at the Bank of Italy for the period 2007–2009, find that female-owned firms faced more pronounced credit contraction with respect to other firms. Finally, Calcagnini et al. (2015) show that, even after controlling for loan, firm and bank characteristics,

gender does not affect the likelihood of obtaining a bank loan. However, in the case of female-owned firms, guarantees are less powerful instruments in gaining access to credit and the probability of having to pledge collateral is higher than for male-owned firms. Thus, their findings suggest that differences in credit access are the result of discrimination and structural differences between male- and female-owned firms.

In the closest study to our own, Fairlie and Robb (2009) use confidential micro-data from the 1992 Characteristics of Business Owners, a confidential survey conducted by the U.S. Census Bureau to investigate differences in the business performance (survival rates, profits, employment and sales) of female-owned versus male-owned firms. They find that female-owned firms are less successful because they have less start-up capital and less prior work experience.

Robb and Watson (2012) use data from the Kauffman Firms Survey to analyze differences in firm performance by gender. In general, they find that female-owned firms do not underperform their male-owned counterparts, once key controls are incorporated into their analysis. We find similar results with respect to the availability of credit by gender.

Finally, Wu and Chua (2012) using 1,577 small businesses from the 2003 National Survey of Small Business Finances by the Federal Reserve Board, resolving the gender assignment problem, and isolating the supply effects, detect a second-order gender effect in U.S. small business borrowing cost. Specifically, lenders charge female sole proprietorships an interest rate that is, on average, 73 basis points higher than rates charged for male sole proprietorships.

### 3. Data

We use data from four independent, cross-sectional surveys of U.S. small firms conducted by the Federal Reserve: the 1987, 1993, 1998, and 2003 Surveys of Small Business Finance (SSBF).<sup>5</sup> The firms in each survey constitute a nationally representative sample of small businesses operating in the United States in those years. A “small business” is defined as a nonfinancial, nonfarm enterprise employing fewer than 500 full-time-equivalent employees. The survey data are broadly representative of the firms operating in the U.S. as of the year-end (approximately three million firms in 1987, five million in both 1993 and 1998, and six million in 2003).

We impose a couple of restrictions on the SSBFs. In each survey, a very small number of firms had indicated that they were publicly traded. We exclude these firms so that our samples contain only privately held firms.<sup>6</sup>

In each survey, there also are some very large firms when measured by annual sales or total assets—some as large as \$250 million. The SSBFs are based on firms with fewer than 500 employees, but no restrictions are imposed on sales or assets. We exclude firms with more than \$10 million in annual sales or total assets (about 200-to-400 firms, but fewer than 30 female-owned firms, in each SSBF) in order to exclude what bankers refer to as “middle-market” firms. This also helps mitigate the skewness in the distributions of financial variables.

The SSBFs provide detailed information about the demographic characteristics of each firm's primary owner, including gender, race, and ethnicity. These characteristics enable us to identify and classify firms by gender. In addition, the SSBFs provide detailed information about

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<sup>5</sup> See Cox, Elliehausen and Wolken (1989), Cole and Wolken (1995), Bitler, Robb, and Wolken (2001), and Mach and Wolken (2006) for detailed descriptions of the 1987, 1993, 1998, and 2003 surveys, respectively.

<sup>6</sup> We exclude fifteen, thirty-two, ten, and nine publicly traded firms from the 1987, 1993, 1998, and 2003 SSBFs, respectively, in order to have clean samples of privately held firms.

each firm's 1) balance sheet and income statement; 2) credit history and use of financial services and institutions; and 3) characteristics, including standard industrial classification, organizational form (proprietorship, partnership, or corporation), and age. With the exception of the 1987 survey, the SSBFs also provide information on the primary owner's age, education, experience, and credit history. Balance sheet and income statement data are derived from the enterprise's year-end financial statements. Credit history, firm characteristics, and demographic characteristics of each firm's primary owner are taken as of year-end.

#### **4. Methodology**

To provide evidence on the differences in male- and female-controlled firms, we employ both univariate and multivariate techniques.

##### **4.1. Univariate Tests of Differences in Male- and Female-Controlled Firms**

First, we calculate and analyze descriptive statistics (primarily means and standard errors) for male- and female-owned firms by selected firm and owner characteristics. We then perform statistical tests for differences in means. These tests for each of the four SSBFs are performed in order to provide evidence on how the characteristics of these firms have changed over the sixteen years spanned by the four surveys. Because the surveys are stratified random samples, rather than simple random samples, we employ sampling weights that adjust for the nonrandom nature of the SSBFs.

##### **4.2. Multivariate Tests of the Availability of Credit**

Second, we estimate univariate- and bivariate-probit regression models to identify significant multivariate differences in the determinants of the availability of credit to male- and female-controlled firms. Following Cole and Sokolyk (2016), we estimate a series of three

equations related to credit outcomes:

- (i) Did a firm need credit during the previous three years? We refer to firms that indicated a need for credit as *Need-Credit Firms* and to firms indicating no need for credit as *No-Need Firms*.
- (ii) Among the firms needing credit, did a firm apply for credit? We refer to firms that needed credit but did not apply for fear of rejection as *Discouraged Firms* and to firms that needed credit and did apply as *Applied Firms*.
- (iii) Among firms that applied for credit, was the firm successful in obtaining funds from its prospective lender? We refer to successful firms as *Approved Firms* and to unsuccessful firms as *Denied Firms*.

We estimate this three-step sequential model using a univariate probit model at step 1 and using a bivariate-probit selection model (see Van de Ven and Van Pragg (1981) and Greene (1992, 1996)) at steps 2 and 3. This selection model is an extension of the bivariate-probit model, which itself is an extension of the univariate-probit model. We use a probit model because our dependent variables are binary (i.e., they take on a value of zero or one), and so the ordinary-least-squares model is inappropriate. We use a bivariate-probit selection model at steps 2 and 3 in order to account for a non-random selection mechanism operating on those firms that need credit and on those firms that applied for credit. We cannot use the standard Heckman (1979) selection model because the dependent variable in our second equation is binary; in Heckman's model, the dependent variable in the second equation is continuous and can be estimated by ordinary-least-squares. The bivariate-probit model consists of two equations

$$y^*_1 = \beta_1' x_1 + \epsilon_1, y_1 = \text{sign}(y^*_1) \quad (1)$$

and



$$y_2^* = \beta_2' x_2 + \epsilon_2, y_2 = \text{sign}(y_2^*) \quad (2)$$

where:

$$\epsilon_1, \epsilon_2 \sim \text{Bivariate Normal}(0, 0, 1, 1, \rho)$$

In the bivariate-probit selection model,  $[y_1, x_1]$  are only observed when  $y_2$  is equal to one, so the error terms in eq. (1) and eq. (2) must be re-specified as  $\epsilon_j = \exp(\gamma_j, z_j) u_j$ , where  $[u_1, u_2]$  have the bivariate standard normal distribution. The estimated correlation coefficient  $\rho$  (rho—the correlation between error terms  $\epsilon_1$  and  $\epsilon_2$ ) can be used to test for selection bias. If  $\rho$  is statistically significant, then we can reject the null hypothesis that selection bias is not present.

In our particular setting, the selection equation at step 2 is the *No-Need* equation that explains which firms do not need credit, and our primary equation of interest is the *Discouraged* equation that explains which firms needed credit but did not apply because they feared rejection. At step 3, the selection equation is the *Discouraged* equation and our primary equation of interest is the *Denied* equation, explaining which firms needed credit, applied for credit and were turned down by their prospective lender. We estimate these models using the QLIM procedure in the SAS statistical package. Our model takes the following form:

$$\text{DV} = f(\text{Firm Characteristics, Credit Market Characteristics, Owner Characteristics, Financing Characteristics})$$

where:

*DV* is one of three dependent variables: *No-Need*, *Discouraged*, and *Denied*.

*No-Need* is a binary variable that is equal to zero if the firm indicated that, during the previous three years, it had a need for credit and is equal to one otherwise.

*Discouraged* is a binary variable that is equal to zero if the firm needed credit and applied for credit and is equal to one if the firm needed credit but did not apply because it feared rejection. *Discouraged* is missing for firms that did not need credit.<sup>7</sup>

*Denied* is equal to zero if the firm applied for credit and was successful in obtaining credit and is equal to one if the firm applied but was refused credit by its prospective lender. *Denied* is missing for firms that did not apply for credit.<sup>8</sup>

*Firm Characteristics*, *Credit-Market Characteristics*, *Owner Characteristics* and *Financing Characteristics* are vectors of explanatory variables that we describe in the next section.

### **4.3. Explanatory Variables**

For guidance in selecting our explanatory variables, we rely upon the literature on the availability of credit to small firms. In particular, we draw upon Cole (1998a, 1998b), Blanchflower, Levine and Zimmerman (2003) and Cole, Goldberg, and White (2004), all which use data from the SSBFs to examine credit market outcomes. Table 1 summarizes the definitions of our analysis variables.

#### ***Firm characteristics***

For firm characteristics, we analyze a firm's size, age, profitability, leverage, liquidity, creditworthiness, organizational form, and industrial classification. Firm size influences the probability of financial distress. Larger firms are more diversified and have been shown to have

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<sup>7</sup> In each survey, there are a small number of firms reporting that they were discouraged, but also reporting that they applied for a loan. For these firms, we classify them as approved or denied based upon the outcome of their credit application.

<sup>8</sup> In the 2003 iteration of the SSBF, firms that had multiple loan applications provided information on both approval and denial if they had one loan approved and another denied. For these firms, we use the date of application to select the most recent loan application and classify them by the outcome of that application.

lower probabilities of default. Both theory and empirical evidence suggest a positive relation between firm size and the availability of credit. However, anecdotal evidence suggests that firms controlled by women are smaller than those controlled by men.<sup>9</sup>

To measure firm age, we use information on length of time since the firm was founded, purchased, or acquired. Younger firms need capital to finance growth. Younger firms also tend to be less creditworthy, less profitable, and less diversified than older firms, so they have higher probabilities of financial distress. Moreover, younger firms have less of a track record than older firms, having had less time to establish a reputation. For all of these reasons, younger firms are less likely to receive credit. Anecdotal evidence suggests that firms controlled by women are likely to be younger than firms controlled by men. We include the natural logarithm of firm age to perform this test. The log transformation is used because we believe a one-year difference in age is more important to the availability of credit to a young firm than to an old firm.

To measure profitability, we calculate return on assets (ROA) as net income divided by total assets. Firm profitability influences the probability of financial distress. The more profitable

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<sup>9</sup> Measuring the size of small privately held firms is problematic. Typically, three alternative variables are used in the finance literature to measure firm size: total assets, annual sales revenues, and total employment. Total assets are probably the most common measure of firm size in the literature; however, in our samples, this variable presents problems with respect to both missing values and outliers. First, many firms did not report total assets to SSBF interviewers, forcing Federal Reserve staff to impute these values. Second, many firms that did report total assets reported values that appear inconsistent with other measures of size. This is especially problematic for very small firms in the service industries that have few assets yet generate significant sales revenues and employ many workers. Sales revenues present similar but less severe problems. Many firms, especially very young ones, report zero or very small values of sales revenues. Total employment presents the fewest problems in both of these respects. Almost all firms report employment, and outliers are uncommon because firm size is limited to 500 or fewer employees. However, the surveys had to deal with how to classify the firms reporting zero employees. The early surveys replaced zero values with one-half of an employee, assuming the owner worked at least part time. The 2003 survey finally recognized that zero-employee firms are not unusual and that owners are not “employees” as defined by employment law. Because each of these size measures suffers problems, we test all three measures as proxies for firm size, but we focus on annual sales.

the firm, the less likely it is to default on its liabilities. Therefore, theory predicts a positive relation between profitability and the availability of credit. For a robustness test, we also construct a zero-one indicator variable for profitable firms, i.e., those firms reporting profits greater than zero. This measure is much simpler and cleaner than ROA because of the noise in the SSBF financial data.

To measure firm leverage, we use the ratio of total liabilities to total assets. Leverage is a key financial ratio used by virtually all lenders in evaluating loan applications. Firms with higher leverage face higher probability of financial distress and, thus, are more likely to be denied credit. Firms with higher leverage also are more likely to be discouraged because they would expect to be turned down because of their high leverage. Firms with higher leverage are less likely to be No Need firms because the pecking-order theory of capital structure predicts that such firms are likely to be more profitable and more reliant upon retained earnings for financing needs.

To measure firm liquidity, we use the ratio of cash to total assets. Lenders typically look at a firm's liquid assets as a measure of reserves available for making loan payments in times of low cash-flow, so more liquid firms should be less likely to be denied credit. Less liquid firms are more likely to fear a loan turndown and, as such, are more likely to be discouraged. No Need firms are expected to be more liquid as they are expected to be more profitable and have more retained earnings, some of which would be held as cash.

To measure the riskiness of a firm, the SSBFs provide a variety of variables. These include the number of times the firm was sixty or more days delinquent on business obligations, whether the firm paid late on its trade-credit accounts, whether the firm had ever been denied trade credit by a supplier, and, for the 1998 and 2003 SSBF, a categorical representation of the D&B credit score.

To measure organizational form, we use a series of zero-one variables indicating whether the firm is organized as a corporation, a partnership, or a proprietorship.<sup>10</sup> The proprietorship is the simplest form of business organization, often chosen by the smallest and youngest firms. If firms controlled by women are disproportionately younger and smaller than firms controlled by men, then we would expect the former to be overrepresented among proprietorships and underrepresented among corporations. Because of their unlimited liability, we would expect proprietorships to be less likely to be denied credit. Because proprietors are thought to be less financially sophisticated, they are expected to be more likely to be discouraged. Because they are constrained by the wealth of the proprietor, we also expect proprietors to be less likely to be *No-Need* firms.

To measure industrial classification, we use the SSBFs' two-digit industrial classification variable to construct a series of zero-one variables indicating the primary industry in which the firm is engaged. Certain industries are much more capital-intensive than others and as such may present obstacles to women seeking to start small businesses. If such is the case, then firms controlled by women will be underrepresented in these industries relative to firms controlled by men.

### ***Credit market characteristics***

Credit market characteristics are represented by an indicator variable for less competitive markets as measured by the banking industry *Herfindahl Index* and by a dummy for firms located in urban rather than rural areas. Previous research (e.g., Cole (1998a, 2008, 2013; Cetorelli and

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<sup>10</sup> The 1998 and 2003 SSBFs also classify firms as limited liability companies, either partnerships or corporations. Because of their small numbers, we pool these with traditional partnerships and corporations.

Strahan (2006)) has found that both market concentration and urban location play a role in the availability of credit to privately held firms.

### ***Owner characteristics***

For owner characteristics, we analyze the race, ethnicity, age, experience, education and the creditworthiness of the primary owner. While little is known about how these demographic characteristics of firm owners differ by gender, previous research has documented their importance in access to credit.

Each SSBF except for the 1987 iteration provides information on owner age, experience in “owning or managing a business,” and a categorical representation of educational attainment. We utilize three dummy variables constructed from the education variable for primary owners whose highest attainment was a graduate degree, a college undergraduate degree, or some college attendance that did not result in a degree. The omitted category is high school degree or less.

To measure the creditworthiness of the firm’s primary owner, the SSBF provides several variables, including the number of times the primary owner was sixty or more days delinquent on personal obligations, whether the primary owner has declared bankruptcy within the past seven years, whether any judgments have been rendered against the primary owner during the past three years, and, for the 1998 and 2003 SSBFs, the personal wealth of the primary owner, excluding the owner’s investment in the firm.

With respect to the availability of credit, theory predicts that firms with older, more experienced, and better educated owners should have greater access to credit. Empirical studies, such as Cavalluzzo and Cavalluzzo (1998), Blanchflower, Levine and Zimmerman (2003) and Cole, Goldberg and White (2004), provide strong evidence that minority-owned firms, and

especially African-American-owned firms, have less access to credit than do firms owned by Caucasians.

### ***Financing characteristics***

Each of the SSBFs except for 1987 provides information on the use of trade credit and the use of both personal and business credit cards for business expenses. Trade credit is viewed by some, such as Meltzer (1960), as a substitute for bank credit and, by others, such as Burkhart and Ellingsen (2004) and Cuñat (2007), as a complement. If female-owned firms are credit-constrained and trade credit is a substitute, then we would expect greater use of trade credit by female-owned firms; if a complement, then we would expect less use. Petersen and Rajan (2002) view the use of business credit cards as a measure of firm transparency, under the assumption that there is more public information available about such firms, such as information in credit bureaus. Use of the owner's personal credit cards to finance business expenses indicates that a firm is credit constrained and unable to obtain credit from other sources. We include indicator variables for firms reporting that they used trade credit, personal credit cards and business credit cards.

The SSBFs also provide limited information on the type of financial institution from which a firm obtains services. More specifically, they classify financial institutions into a number of categories, which we consolidate into four: commercial bank, savings association, finance company and other. We hypothesize that firms that rely upon or attempt to borrow from financial institutions other than commercial banks, which specialize in small-business lending, will realize less successful credit-market outcomes.

The SSBFs also provide information on the length of a firm's relationship with its financial institutions and the distance from the firm's main office to the office or branch where it primarily conducts business with its financial institutions. Previous research has shown that both the length

of relationship (Petersen and Rajan (1994), Berger and Udell (1995), and Cole (1998)) and the distance between the firm and its financial institution (Petersen and Rajan (2002)) are important determinants of credit-market outcomes.

For financial institution type, distance and length of relationship, we gather information for the firm's primary source of financial services, which each firm designates in the SSBFs, and use this in our first two models, for *No-Need* and *Discouraged* firms. For our final model of *Denied* firms, we gather this information for the financial institution where the firm applied for its most recent loan application.

## **5. RESULTS**

### **5.1. Univariate Results**

Table 2 presents some basic information about the distribution of our sample firms by gender and survey year. Panel A shows that the percentage of female-owned firms almost doubled from 1987 to 2003, rising from 14.02 percent in 1987 to 20.87 percent in 1993, to 24.13 percent in 1998, and to 26.27 percent in 2003.

Panel B presents a cross-tabulation of gender by firm size. One of the most prominent anecdotal "facts" about female-owned firms is that they are significantly smaller than male-owned firms. The table confirms this. Furthermore, our analysis shows that the percentage of female-owned firms declines in each of the four sales quartiles in all four survey years and that the difference in the ownership percentages in the smallest and largest quartiles widens over time. In 1987, 19.55 percent of the smallest sales quartile and 9.43 percent of the largest sales quartile were female-owned. By 2003, 40.1 percent of the smallest sales quartile and 12.6 percent of the largest sales quartile were female-owned. Not shown in Table 2 are similar cross-tabulations based on



total assets and total employment rather than annual size. Results from these cross-tabulations are broadly consistent with the findings in Table 2.

This evidence suggests that one explanation for the underrepresentation of female CEOs at public firms is the paucity of female owners among the largest privately held firms. This explanation follows from the fact that the CEOs of most newly public firms are the primary owners of the firms prior to its going public.

### ***Firm characteristics***

Tables 3 and 4 present descriptive statistics from each of the four SSBFs. Descriptive statistics are presented for all firms in Table 3 and separately, for male- and female-controlled firms, in Table 4. In Table 4, we also calculate the difference in means of male-owned and female-owned firms along with a *t*-statistic for testing for significant differences in these means. We report only results that are consistent in sign across the SSBFs for which a variable is available.

Based upon averages for each SSBF, female-owned firms are smaller than male-owned firms, as measured by annual sales, total assets, and total employment. By annual sales, female-owned firms are about half the size of male-owned firms (\$343,500 versus \$724,400 in 2003). By total assets, female-owned firms are less than two-thirds the size of male-owned firms in each survey year except 1987 (\$184,000 versus \$350,300 in 2003). By total employment, female-owned firms are about a quarter smaller than male-owned firms (5.5 versus 7.6 employees in 2003). Trend-wise, female-owned firms declined in size as measured by both annual sales and total assets from 1987 through 1993 and 1998, but then rose in 2003. One might expect a decline in size as the percentage of female-owned firms rose over time, as most new firms are quite small. The number of employees at female-owned firms declined from 6.3 in 1987 and 5.5 in 2003.

The average age of female-owned firms ranged between 10.3 years in 1987 and 12.4 years in 2003. In each survey year, female-owned firms are significantly younger than male-owned firms, with the difference ranging from 2.4 to 3.3 years. However, the difference has declined over time.

We find no significant differences in firm profitability by gender. In fact, profitability differs by no more than 4.4 basis points in any of the four surveys. Over time, the ROA of female-owned firms ranged between 0.53 in 1987 and 0.88 in 1998.

Except for 2003, no years showed significant differences in the leverage ratios of female-owned and male-owned firms as measured by the ratio of total liabilities to total assets. In 2003, female-owned firms reported significantly lower leverage than did male-owned firms (0.73 versus 0.89).

Female-owned firms are more liquid as measured by the ratio of cash to total assets. Over time, the cash-to-assets ratio of female-owned firms rose monotonically between 1987 and 2003, from 18% to 29% of assets.

There are strong and persistent differences in the organizational form of female- and male-owned firms. In each year, female-owned firms are significantly more likely to be organized as proprietorships and less likely to be organized as corporations than are male-owned firms. Among female-owned firms, proprietorships accounted for between 47 percent (1987) and 57 percent (1998) while corporations accounted for between 49 percent (1987) and 36 percent (1998).

We look at four different measures of a firm's credit quality, but only one of these—trade credit paid late—is available across all four surveys. This measure indicates that female-owned firms were less risky in 1998 and 2003, but not significantly different from male-owned firms in 1987 and 1993. The number of business obligations on which the firm is sixty or more days

delinquent is available for each SSBF survey year except 1987. Only in 1993 is there a significant difference, as female-owned firms reported significantly more delinquencies in that year. The Dun and Bradstreet credit score is available only from the 1998 and 2003 SSBFs and is coded from low to high in 2003 (lower values are more risky) but from high to low in 1998 (higher values are more risky). In both surveys, female-owned firms are significantly more risky than male-owned firms. An indicator for whether or not the firm had filed for bankruptcy during the previous seven years is available from the 1998 and 2003 surveys. By this measure, there are no significant differences in male- and female-owned firms.

We observe strong differences in male-owned and female-owned firms across industry. Across all four surveys, there are significantly fewer female-owned firms in construction, typically about eight-to-nine percentage points fewer; and there are significantly more female-owned firms in retail trade, and business services. The difference in retail trade has declines across each of the four surveys, falling from 13 percentage points in 1987 to only four percentage points in 2003. The difference in business services has been consistently in the range of seven-to-nine percentage points. In professional services, female-owned firms have gone from significantly under-represented in 1987 by eight percentage points to significantly over-represented in 2003 by five percentage points.

### ***Market characteristics***

Most firms are located in urban areas. This portion ranged from 76 percent in 1987 to 80 percent in 1998. In no year was this percentage significantly different for women-owned firms than for male-owned firms.

Differences in banking market concentration could account for observed differences in the availability of credit to female- and male-owned firms. Each of the SSBFs provides categorical

information on this measure. In both 1993 and 2003, female-owned firms were disproportionately located in concentrated banking markets.

### ***Firm owner characteristics***

Detailed information on owner characteristics is available from each SSBF except for 1987, when the only information available is on race and gender. Female owners are younger than male owners across the SSBFs, but this difference, while statistically significant, is only one to two years in magnitude and declines in each survey year. For female owners, the average age ranges from 47.8 in 1993 to 50.7 in 2003.

Greater differences are observed in owner experience. Female owners have from 4.5 to 5.2 fewer years of experience than male owners. Average experience for female owners ranges from 14.7 years in 1998 to 15.8 years in 2003.

We also observe significant differences in educational attainment. The portion of female owners with graduate degrees ranges from 14.2 percent in 1998 to 17.8 percent in 2003. This is significantly lower, by 4 to 6 percentage points, than the corresponding percentages for men. The portion of owners who attended college but did not graduate (referred to as *some college*) is 5 to 7 percentage points higher among female owners and accounts for between 30 and 32 percent of all female-owned firms.

In general, we find no significant differences by gender in race or ethnicity. The portions of owners who are Black and Hispanic are about the same for male-owned and female-owned firms, typically in the range of 3 to 4 percent of all firms. Only in 2003 do we find a statistically significant difference: 5.2 percent of the firms are owned by black women, but only 3.5 percent are owned by black men.

We examine four measures of personal credit quality for 1993, 1998, and 2003—owner bankruptcy, owner delinquencies, owner judgments, and owner personal wealth—none of which are available from the 1987 SSBF. Owner personal wealth is available only for 1998 and 2003. Among these variables, the only statistically significant differences in male- and female-owned firms show up in 2003—for owner bankruptcy, owner delinquencies, and owner personal wealth. In that survey year, female owners, in comparison to male owners, were significantly more likely to have declared bankruptcy during the previous seven years (3.6 percent versus 2.1 percent), significantly more likely to be delinquent on personal obligations (14.5 percent versus 11.2 percent), and had significantly less personal wealth.

### *Financing characteristics*

As shown in Table 4, female-owned firms were less likely to utilize trade credit than male-owned firms, and this difference is large and statistically significant in both 1998 and 2003, when the differences in incidence are 10.5 and 14.8 percentage points, respectively. If female-owned firms are credit-constrained, this is consistent with the view of trade credit as a complement, rather than as a substitute, for bank lending.

Some observers have speculated that female-owned firms are forced to rely on credit cards for financing to a greater extent than are male-owned firms, but the data from the surveys do not support this speculation. There are no significant differences by gender in the use of personal business credit cards, and the significant differences in the use of personal credit cards show that men were more likely than women to use personal credit cards for business expenses in both 1998 and 2003. The reverse was true during 1993. In 2003, 45 percent of female-owned firms used business credit cards for business expenses and 49 percent used personal credit cards for business expenses.

Tables 3 and 4 also present information on a number of firm-creditor relationship variables that previous studies have found important in explaining the availability of credit to small firms. These include the type of financial institution that is the firm's primary source of financial services (commercial bank, savings institution, finance company, or some other type of source) as well as the duration of the firm's relationship with its primary source, the distance between the firm and its primary source (Bellucci et al., 2019), and the number of bank and nonbank sources from which the firm obtains any financial services.

The statistics in Table 4 show that a female-owned firm is consistently less likely to choose a commercial bank and consistently more likely to choose a savings institution (savings and loan, savings bank, or credit union) as its primary source for financial services. In 1998 and 2003, a female-owned firm was also less likely to choose a finance company as its primary source. Table 4 also shows that a female-owned firm consistently has a shorter relationship with its primary source of financial services, but this disparity with male-owned firms has narrowed over time—from twenty months in 1987 and 1993 to only five months in 2003. Female-owned firms were significantly closer to their primary sources of financial services in 1987 and 2003 but were more distant in 1993 and 1998. Finally, female-owned firms obtained financial services from significantly fewer sources, especially bank sources, in each survey year except for 1987.

### ***Credit market outcomes***

Table 5 presents descriptive statistics for credit market outcomes: *No-Need*, *Discouraged*, and *Denied*. Data on these outcomes are not available from the 1987 SSBF. Female-owned firms are more likely to report no need for credit during the three years prior to the survey year, and this

difference is significant in 1993 and 2003. In 1993, 51 percent of female-owned firms reported no need for credit; for 1998 and 2003, the figures were 61 percent and 58 percent, respectively.

Female-owned firms are disproportionately likely to report that they needed credit but that fear of rejection kept them from applying. These so-called discouraged firms accounted for 36 percent of female-owned firms reporting a need for credit in 1993; the portion rose to 48 percent in 1998 and then declined to 37 percent in 2003. These percentages are 6, 10, and 17 percentage points higher than the corresponding percentages for male-owned firms, respectively.

Of the female-owned firms that applied for credit, 25 percent were denied credit in 1993; this share increased to 26 percent in 1998 and then declined to 15 percent in 2003. In each year, these numbers were 2 to 7 percentage points higher than the denial rates for male-owned firms, but this difference is statistically significant only for 1993, when the gap was 6.9 percentage points.

## **5.2. Multivariate Results for Availability of Credit**

Table 6 presents the results from estimating our three sequential credit outcome variables using the bivariate-probit selection model: *No-Need*, *Discouraged*, and *Denied*.<sup>11</sup> Each model includes, as explanatory variables, all of the variables defined in Table 1, but, for brevity, we present only the parameter estimates, marginal effects, standard errors, and t-statistics for our primary variable of interest—*female-owned*, which takes on the value of one for female-owned firms and zero for all other firms. Results for the full models appear in Appendix Tables 1 – 3. In order to explore what portion of the male-female differential is explained, we follow Blanchflower *et al.* (2003) in presenting marginal effects from a series of model specifications that start with a

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<sup>11</sup> For each of the three iterations of the SSBF, the correlation coefficient for the error terms of the *No-Need* and *Discouraged* equations are negative and statistically significant, indicating that sample selection bias is present. For two of the three SSBFs, the correlation coefficient for the error terms of the *Discouraged* and *Denied* equations are positive and significant, indicating that sample selection bias is present.

single indicator for female firms and then add an increasingly complete set of control variables.<sup>12</sup>

Panel A shows the estimates from the model where the dependent variable is *No Need*, a dummy variable equal to one if the firm indicated no need for new credit during the previous three years and is equal to zero otherwise. In our univariate analysis (shown in Table 5), we find that female-owned firms were significantly more likely to be “No-Need” firms than were male-owned firms in both 1993 and 2003. In our first model, which includes only an indicator variable for female-owned firms, we find similar results—female-owned firms are significantly more likely to be “No-Need” firms with marginal effects of 0.031 for 1993, 0.005 for 1998 and 0.025 for 2003; however, none of these are statistically significant. In our second model, we add firm size as measured by the log of sales. The marginal effect for 1993 drops to 0.000 while the marginal effects for 1998 and 2003 turn negative, but none of these are statistically significant. In the rest of our models, we add additional control variables that ultimately result in a positive and significant marginal effect of 0.033 for 1993, but insignificant marginal effects of 0.010 for 1998 and -0.026 for 2003. In summary, there are small but inconsistent differences in the need for credit by female-owned versus male-owned firms.

Panel B presents the estimates from our model where the dependent variable is *Discouraged* a dummy variable equal to one if the firm needed new credit during the previous three years but did not apply because it feared rejection and is equal to zero if the firm indicated it needed new credit during the previous three years and did apply. Our univariate analysis in Table 5 reveals that female-owned firms are consistently and significantly more likely to be discouraged

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<sup>12</sup> We also estimated the models separately by gender and used the results to conduct a decomposition as suggested by Oaxaca (1973) and Blinder (1973). The results from that analysis are qualitatively similar to those reported in Table 6 where we estimate a single model and use a dummy indicator for female-owned firms to measure the differences in availability of credit by gender. We choose the simpler format for ease of exposition and interpretation.



than male-owned firms—a difference that increased from 6.2% in 1993 to 10.4% in 1998 and a peak of 17.4% in 2003.

In our first probit model, where we include only an indicator for female-owned firms, we find similar results—positive and statistically significant marginal effects of 0.060, 0.101 and 0.155, respectively. In our second model, where we add firm size as measured by log of annual sales, the magnitude of these marginal effects are cut by a third to a half—to 0.025, 0.065 and 0.099, respectively, and result for 1993 loses statistical significance. In the rest of our models, we add additional control variables that ultimately result in marginal effects of 0.040, 0.037 and 0.019, respectively. Only the result for 1993 retains statistical significance. In summary, the very large and significant differences in discouragement between female-owned and male-owned firms are primarily attributable to differences in the characteristics of the firm and its primary owner.<sup>13</sup>

Finally, in Panel C are the estimates from our model where the dependent variable is *Denied*, a dummy variable equal to one if the firm applied for credit and was turned down by its prospective lender and is equal to zero if the firm applied for credit and was successful in obtaining new credit. In our univariate analysis shown in Table 5, we found that female-owned firms were 6.9%, 2.4% and 2.3% more likely to be denied credit in 1993, 1998, and 2003, respectively, and that this difference was statistically significant for 1993.

In our first probit model, where we include only a single indicator variable for female-owned firms, we find similar results—marginal effects of 0.064, 0.023 and 0.022, respectively, with only the 1993 result reaching statistical significance. When we add firm size and age, the

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<sup>13</sup> Kon and Storey (2003) theorize that discouragement is a function of firm transparency. Consequently, we follow Petersen and Rajan (2004) in using two SSBF variables—the ownership share of the primary owner and an indicator for firms that used financial records in responding to the SSBF—as proxies for transparency, and include them in the fully specified discouragement model.

marginal effects drop to 0.027, 0.007 and 0.008, respectively, none of which reaches statistical significance. In our final model, the marginal effects are 0.011, -0.001 and -0.002, none of which are statistically significant. In summary, there are small differences in denial rates between female-owned and male-owned firms, but these are attributable to differences in firm characteristics such as size and age.

Cavalluzzo and Cavalluzzo (1998) exploit Becker's (1957) seminal work on discrimination to develop a test for taste-based discrimination. Becker argues that taste-based discrimination is costly to the lender, so that more competitive industries should be less tolerant of such discrimination than more concentrated industries. Cavalluzzo and Cavalluzzo (1998) utilize the market-concentration variable in the SSBF to construct a test for whether observed differential in credit-market outcomes by race; they interact an indicator for highly concentrated (i.e., uncompetitive) banking markets with the indicator variable for minority-owned firms. If lenders are engaging in taste-based discrimination, then this interaction term should be positive and significant in explaining negative credit-market outcomes, such as discouragement and denial. Indeed, Cavalluzzo and Cavalluzzo (1998) do find that minority-owned firms pay higher loan rates in more competitive markets.

We follow Cavalluzzo and Cavalluzzo (1998) in constructing and performing such tests. Our results (not shown in our tables) produce insignificant interaction coefficients for each of our three equations in each of the three iterations of the SSBFs. Hence, we find no evidence that is consistent with taste-based discrimination against female-owned firms.

### 5.3. Robustness: Results Using a Propensity Score Matched Sample

To properly identify the effect of gender on credit market outcomes, we would ideally compare the outcomes obtained by female-owned firms and other firms that are otherwise identical. That is, to verify whether gender is a key variable of interest for lenders, we should ideally need female-owned and male-owned firms to be identical along every possible dimension other than gender. As seen in section 5.1, this assumption does not hold in our dataset, as very different types of firms are included in both groups, and male-owned and female-owned firms turn out to be significantly different, as shown from the descriptive statistics of Table 4. Therefore, to alleviate this concern, we perform a robustness test by matching the female-owned firms to observationally similar firms that are not female-owned. Thus, we need a method to further consider the potential problem that male-owned and female-owned firms are different along some dimension, which also explains gender itself and, consequently, the outcome of our models of credit availability, i.e., *NoNeed*, *Discouraged*, and *Denied*. Indeed, for example, most male-owned are larger while female-owned ones tend to be smaller, or the former tend to be organized in a more highly structured business legal form than the latter. This aspect is known as the ‘common support problem’: due to selection processes on the part of the banks that decide how to grant credit among firms, the group of female-owned firms is a special and selective one.

Thus, we use propensity score matching (PSM), as has been done by others, (e.g., Almus and Czarnitzki, 2003; Gorg and Strobl, 2007), whose research specifically deals with the potential common support problem in analyzing the impact of R&D subsidies on innovation. Under the matching assumptions, the only difference between the treated and the control group on observables is gender, and hence one can evaluate the effect of gender on bank contract

characteristics by estimating the difference in *NoNeed*, *Discouraged*, and *Denied* between the treated group (female-owned firms) and the matched control group (male-owned firms).

One crucial assumption of this approach, though, is unconfoundedness or conditional independence, i.e., that, controlling for observables, the outcomes of the control group are independent of gender (Rosenbaum and Rubin, 1983; Rubin, 2008). Under unconfoundedness, the basic idea is to find in a large group of male-owned firms similar to the female-owned ones in all relevant pre-treatment characteristics  $X$ . The match should be based on variables that (i) simultaneously influence the treatment status and the outcome variables (see e.g., Sianesi, 2004; Smith and Todd, 2005); (ii) are unaffected by treatment. Furthermore, over-parameterized models should be avoided for two reasons (Bryson et al., 2002), i.e.: (i) including extraneous variables in the propensity score model exacerbates the support problem; (ii) although the inclusion of non-significant variables in the propensity score specification will not bias the propensity score estimates or make them inconsistent, it can increase their variance. While it is not possible to test the validity of the conditional independence assumption formally (Almus and Czarnitzki 2003), our dataset contains a rich set of information that we believe makes the unconfoundedness a reasonable approximation, thus we assume that controlling for observables, the outcomes of the non-treated control group appear to be independent of gender itself.

Thus, based on previous findings in Section 5.1, our final PSM is performed on the following characteristics: (log) Sales, (log) Assets, (log) Employment, Organizational Form, (log) Firm Age, (log) Owner Age, (log) Owner Experience, and Education. While the first five measures represent firm characteristics, the latter capture the owner characteristics. The logistic equation (3) is as follows:

$Pr (Gender=1)_{ijt} =$

$$F(c + \alpha \text{Log Sales}_{it} + \beta \text{Log Assets}_{it} + \gamma \text{Log Employment}_{it} + \delta \text{Organizational Form}_{it} + \eta \text{Log FirmAge}_{it} + \varphi \text{Log OwnerAge}_{jt} + \lambda \text{Log Owner Experience}_{jt} + \mu \text{Education}_{jt}) + \varepsilon_{ijt} \quad (3)$$

Where  $i$  refers to firm characteristics,  $j$  to owner characteristics and  $t$  to the Survey year. Estimates of the propensity score for each survey are shown in Table 7.

We match observations on the odds ratio of the propensity score. Once we have matched each female-owned firm with a male-owned firm, we calculate the difference between the outcome of the treated units and the outcome of the matched control units. Finally, we calculate the Average Treatment effect on Treated (ATT) of interest by averaging these differences. ATT is identified only if the outcomes (*NoNeed*, *Discouraged*, and *Denied*) of firms, which are female-owned, and male-owned firms would not differ in the absence of the treatment (gender).

As shown in Table 8, the outcome variables (*NoNeed*, *Discouraged*, and *Denied*) do not show statistically significant differences after the PSM; indeed, for a given propensity score, exposure to treatment is random and therefore treated and control units should be on average observationally identical. That is, after controlling for observable differences, female-owned firms on average, do not face differences in access to credit when compared to male-owned ones. Thus, results are overall consistent with previous findings of Table 6.

#### **5.4. Discussion**

Earlier, we established that female-owned firms experienced worse credit-market outcomes than male-owned firms, especially with respect to discouragement, but that most of these differences disappear when we control for other firm and owner characteristics. At least two

concerns arise.

First, are the data from the SSBFs sufficiently broad and representative to pick up evidence of discrimination? One way to answer this question is to look at a group of firms that historically have faced discrimination in the credit markets—Black-owned firms. In Appendix Table 4, we replicate the analysis in Table 4, but replace female- and male-owned firms with Black- and White-owned firms. What we find is extremely strong disparities in credit market outcomes. In each of the three SSBFs (1993, 1998 and 2003), we see that Black-owned firms were significantly more likely to need credit, significantly more likely to be discouraged from applying for credit, and significantly more likely to be denied credit. Hence, the SSBF data do appear to be sufficiently broad and representative to pick up evidence of discrimination.

Second, is the bivariate-probit selection methodology sufficiently powerful to detect discrimination in a multivariate setting? Again, to answer this question, we look at the results for Black-owned firms. As shown in Appendix Tables 1 – 3, Black-owned firms were significantly more likely to need credit and significantly more likely to be denied credit in each of the three SSBFs and were significantly more likely to be discouraged in the 2003 SSBF, even after including the comprehensive set of controls available in the SSBF. Hence, the bivariate-probit methodology does appear to be sufficiently powerful to detect discrimination in a multivariate setting.

## 6. Summary and Conclusions

This study analyzes two decades of data from four nationally representative surveys of small privately held U.S. firms in order to establish a baseline of stylized facts about the role of gender in entrepreneurship and test for differences in the availability of credit by gender.

First, we find that, when compared to male-owned firms, female-owned firms are 1) significantly smaller as measured by sales, assets, and employment; 2) younger as measured by the firm's age; 3) more likely to be organized as proprietorships and less likely as corporations; 4) more likely to be in retail trade and business services and less likely to be in construction, secondary manufacturing, and wholesale trade; and 5) and more inclined to have fewer and shorter banking relationships. Moreover, female owners are significantly younger, less experienced, and not as well educated.

Second, we find strong evidence of significant differences in the availability of credit by gender. Specifically, female-owned firms are significantly more likely to be credit-constrained because they are more likely to be discouraged from applying for credit, though not more likely to be denied credit when they do apply. However, these differences are rendered insignificant when we control for other firm and owner characteristics. This evidence suggests that observed gender differences in credit availability are attributable to other differences in male- and female-owned firms, such as the firm's size and industry and the owner's age, experience, and educational attainment.

This study contributes to a number of different literatures, including that on entrepreneurship, relationship lending, and financial services. First, it establishes a set of "stylized facts" about female participation in entrepreneurship over time, about how female-owned firms differ from male-owned firms, and about how female owners differ from male owners. Second, it

documents how the availability of credit differs across female- and male-owned firms. Third, it identifies important gender differences in relationships between firms and creditors.

We expect our results to provide a new set of nationally representative baselines for researchers to use in assessing how gender affects entrepreneurship. We also believe our multivariate analysis establishes a new set of stylized facts about differences in female- and male-owned firms that can disentangle the effects of a firm's age and size from those truly attributable to gender.



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**Table 1:  
Definitions of Analysis Variables**

<b>Variable</b>	<b>Definition</b>
<i>Firm Characteristics</i>	
<b>Sales</b>	Annual sales (dollars)
<b>Assets</b>	Total assets (dollars)
<b>Employment</b>	Total employment
<b>Firm Age</b>	Age of firm under current management
<b>ROA</b>	Net Income divided by total assets
<b>Liabilities to assets</b>	Total Liabilities divided by total assets
<b>Cash to assets</b>	Cash divided by total assets
<b>Sales Growth Positive</b>	A dichotomous variable that takes the value of 1 if sales growth from previous reference year is positive, 0 otherwise.
<b>Corporation</b>	A dichotomous variable that takes the value of 1 if firm is organized as a corporation, 0 otherwise.
<b>Partnership</b>	A dichotomous variable that takes the value of 1 if firm is organized as a partnership, 0 otherwise
<b>Proprietorship</b>	A dichotomous variable that takes the value of 1 if firm is organized as a proprietorship, 0 otherwise
<b>Firm delinquencies</b>	Number of business obligations where the firm has been 60 or more days delinquent
<b>Paid late on trade credit</b>	Firm paid trade credit after bill was due in full
<b>Denied trade credit</b>	Firm was denied trade credit.
<b>D&amp;B credit score</b>	Categorical representation of firm's D&B credit score
<i>Industrial Classification</i>	
<b>Construction</b>	SIC 10 – 19
<b>Primary manufacturing</b>	SIC 20 – 29
<b>Other manufacturing</b>	SIC 30 – 39
<b>Transportation</b>	SIC 40 – 49
<b>Wholesale trade</b>	SIC 50 – 51
<b>Retail trade</b>	SIC 52 – 59
<b>Insurance and real estate</b>	SIC 64 – 69
<b>Business services</b>	SIC 70 – 79

**Professional services**

SIC 80 – 89

*Market Characteristics*

**MSA**

A dichotomous variable that takes the value of 1 if firm is located in a Metropolitan Statistical Area, 0 otherwise

**HHI high**

A dichotomous variable that takes the value of 1 if the banking market concentration ratio is high ( $>1,800$ ), 0 otherwise.



**Table 1 (cont.):****Definitions of Analysis Variables**

<b>Variable</b>	<b>Definition</b>
<i>Owner Characteristics</i>	
<b>Owner Age</b>	Age of primary owner
<b>Owner Experience</b>	Years of experience of primary owner
<b>Graduate Degree</b>	A dichotomous variable that takes the value of 1 if the primary owner has a graduate degree, 0 otherwise
<b>College Degree</b>	A dichotomous variable that takes the value of 1 if the primary owner has a college degree, 0 otherwise
<b>Some College</b>	A dichotomous variable that takes the value of 1 if the primary owner attended college, 0 otherwise
<b>Black</b>	A dichotomous variable that takes the value of 1 if the primary owner is African-American, 0 otherwise
<b>Asian</b>	A dichotomous variable that takes the value of 1 if the primary owner is Asian, 0 otherwise
<b>Hispanic</b>	A dichotomous variable that takes the value of 1 if the primary owner is Hispanic, 0 otherwise
<b>Owner Bankruptcy</b>	A dichotomous variable that takes the value of 1 if the primary owner has declared bankruptcy during previous seven years, 0 otherwise
<b>Owner Delinquency</b>	Number of personal obligations where primary owner has been 60 or more days delinquent.
<b>Owner Judgement</b>	Judgement against the primary owner has been rendered during past three years.
<b>Owner Personal Wealth</b>	Wealth of the primary owner, excluding value of the firm owned.
<i>Financing Characteristics</i>	
<b>Primary FI is comm bank</b>	A dichotomous variable that takes the value of 1 if the firm's primary source of financial services is a commercial bank, 0 otherwise
<b>Primary FI is sav inst</b>	A dichotomous variable that takes the value of 1 if the firm's primary source of financial services is a thrift or credit union, 0 otherwise
<b>Primary FI is finance co</b>	A dichotomous variable that takes the value of 1 if the firm's primary source of financial services is a finance company, 0 otherwise
<b>Primary FI is other</b>	A dichotomous variable that takes the value of 1 if the firm's primary source of financial services is some other type of source, 0 otherwise
<b>Months with primary FI</b>	Length of relationship between the firm and its primary source of financial services

**Distance to primary FI** Distance (in miles) between the main office of the firm and the office or branch of its primary source of financial services.

**Number of FIs** Number of financial institutions from which the firm obtains financial services

**Number of nonbank sources** Number of nonbank sources from which the firm obtains financial services

*Most Recent Loan ("MRL") Characteristics*

**MRL FI is comm bank** Firm's MRL source of financial services is a commercial bank

**Months with MRL FI** Length of relationship between the firm and its MRL source of financial services

**Distance to MRL FI** Distance (in miles) between the main office of the firm and the office or branch of its MRL source of financial services.

**Loan amount to assets** Amount of the MRL for which the firm applied divided by firm assets

**Table 2:****Distribution of Female-Owned Firms by Survey Year and Firm Size**

Panel A: Female-Owned Firms in the Surveys of Small Business Finances				
	<b>1987</b>	<b>1993</b>	<b>1998</b>	<b>2003</b>
Weighted Number of Firms	3,222,041	4,884,636	5,069,096	5,969,096
Weighted Number of Female-Owned Firms	451,730	1,019,424	1,223,173	1,568,082
Female-Owned Firms, Percent of Total	0.140	0.209	0.241	0.263
Panel B: Female-Owned Firms by Sales Quartile (Q1 is smallest, Q4 is largest)				
Sales Quartile	<b>1987</b>	<b>1993</b>	<b>1998</b>	<b>2003</b>
Q1 Percentage of Quartile	0.196	0.297	0.338	0.401
Percentage of Total	0.055	0.076	0.101	0.128
Weighted Number of Firms	178,179	370,255	509,951	765,835
Q2 Percentage of Quartile	0.136	0.200	0.243	0.235
Percentage of Total	0.035	0.049	0.070	0.074
Weighted Number of Firms	112,771	239,347	352,809	442,310
Q3 Percentage of Quartile	0.118	0.210	0.192	0.182
Percentage of Total	0.032	0.054	0.052	0.047
Weighted Number of Firms	104,072	261,816	263,593	277,563
Q4 Percentage of Quartile	0.094	0.124	0.133	0.126
Percentage of Total	0.018	0.030	0.019	0.014
Weighted Number of Firms	56,708	148,004	96,820	82,374

**Table 3:****Descriptive Statistics for Privately Held Firms**

This table presents descriptive statistics for variables used to explain differences in male-owned and female-owned firms. Data are from the 1987, 1993, 1998 and 2003 Surveys of Small Business Finances. Variables are defined in Table 1. For each variable in each survey, the table presents the mean and standard error.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Variable	1987		1993		1998		2003	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
Sales (\$000)	663.6	22.366	566.1	17.300	528.9	19.592	624.3	20.030
Assets (\$000)	293.5	12.932	277.7	10.989	249.1	10.815	306.6	12.148
Employment	8.826	0.320	6.780	0.219	7.092	0.277	7.024	0.218
Firm Age	13.164	0.211	14.114	0.183	13.193	0.191	14.190	0.181
ROA	0.565	0.015	0.709	0.021	0.882	0.024	0.607	0.014
Liabilities to Assets	0.476	0.009	0.599	0.009	0.759	0.020	0.845	0.032
Cash to Assets	0.163	0.004	0.197	0.004	0.246	0.005	0.261	0.005
Sales Growth Pos.	0.343	0.009	0.419	0.008	0.400	0.009	0.406	0.008
Corporation	0.505	0.009	0.480	0.008	0.429	0.009	0.464	0.008
Partnership	0.082	0.005	0.080	0.004	0.067	0.004	0.084	0.005
Proprietorship	0.412	0.009	0.440	0.008	0.496	0.009	0.452	0.008
Firm Delinquencies	N/A	N/A	0.191	0.006	0.137	0.006	0.157	0.006
Paid Late Trade Credit	0.419	0.009	0.362	0.007	0.266	0.008	0.245	0.007
Denied Trade Credit	N/A	N/A	0.061	0.004	0.055	0.004	0.047	0.004
D&B Score	N/A	N/A	N/A	N/A	2.993	0.018	3.610	0.024
<i>Industry</i>								
Construction	0.131	0.006	0.143	0.005	0.118	0.006	0.117	0.005
Primary Manufacturing	0.041	0.004	0.039	0.003	0.037	0.003	0.031	0.003
Other Manufacturing	0.048	0.004	0.041	0.003	0.046	0.004	0.040	0.003
Transportation	0.029	0.003	0.027	0.003	0.037	0.003	0.039	0.003
Wholesale Trade	0.095	0.005	0.082	0.004	0.068	0.004	0.057	0.004
Retail Trade	0.267	0.008	0.217	0.006	0.193	0.007	0.187	0.006
Insurance and Real Estate	0.069	0.005	0.068	0.004	0.064	0.004	0.067	0.004
Business Services	0.186	0.007	0.215	0.006	0.249	0.008	0.253	0.007
Professional Services	0.134	0.006	0.168	0.006	0.185	0.007	0.210	0.007
<i>Market Characteristics</i>								
Urban	0.757	0.008	0.786	0.006	0.798	0.007	0.793	0.007
High HHI	0.168	0.007	0.487	0.008	0.039	0.003	0.479	0.008

**Table 3 (cont.):****Descriptive Statistics for Privately Held Firms**

This table presents descriptive statistics for variables used to explain differences in male-owned and female-owned firms. Data are from the 1987, 1993, 1998 and 2003 Surveys of Small Business Finances. Variables are defined in Table 1. For each variable in each survey, the table presents the mean and standard error.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Variable	1987		1993		1998		2003	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
<i>Owner Characteristics</i>								
Black	0.023	0.003	0.030	0.003	0.041	0.003	0.039	0.003
Hispanic	0.020	0.003	0.043	0.003	0.057	0.004	0.044	0.003
Age	N/A	N/A	49.295	0.177	50.072	0.198	51.506	0.190
Experience	N/A	N/A	18.702	0.170	18.058	0.201	19.610	0.194
Grad Degree	N/A	N/A	0.202	0.006	0.184	0.007	0.208	0.007
College Degree	N/A	N/A	0.260	0.007	0.300	0.008	0.291	0.008
Some College	N/A	N/A	0.255	0.007	0.279	0.008	0.267	0.007
Owner Delinquencies	N/A	N/A	0.027	0.003	0.006	0.001	0.025	0.003
Owner Bankruptcy	N/A	N/A	0.137	0.005	0.126	0.006	0.121	0.005
Owner Judgment	N/A	N/A	0.051	0.003	0.038	0.003	0.023	0.002
Personal Wealth	N/A	N/A	N/A	N/A	0.524	0.019	0.700	0.016
<i>Financing Characteristics</i>								
Used Trade Credit	N/A	N/A	0.636	0.007	0.625	0.009	0.602	0.008
Used Pers. Credit Card	N/A	N/A	0.286	0.007	0.468	0.009	0.472	0.008
Used Bus. Credit Card	N/A	N/A	0.411	0.008	0.337	0.008	0.482	0.008
Number of Sources	2.009	0.022	2.067	0.021	2.034	0.024	2.371	0.025
Primary is Comm. Bank	0.902	0.005	0.821	0.006	0.823	0.007	0.801	0.007
Primary is Thrift	0.063	0.004	0.096	0.005	0.097	0.005	0.128	0.006
Primary is FiCo	0.007	0.001	0.014	0.002	0.018	0.002	0.010	0.002
Primary is Other	0.016	0.002	0.041	0.003	0.036	0.003	0.035	0.003
Length of Relationship	142.0	2.521	110.1	1.573	95.1	1.782	123.8	1.863
Distance to Source	8.511	1.704	13.862	1.500	32.480	3.573	32.911	3.134
<i>Most Recent Loan Application</i>								
MRL is Comm.Bank	N/A	N/A	0.806	0.009	0.686	0.015	0.747	0.011
Length of Relationship	N/A	N/A	87.478	2.062	56.520	2.600	34.635	1.321
Distance to Source	N/A	N/A	50.045	5.468	123.709	9.180	55.224	6.559
Loan Request to Assets	N/A	N/A	0.412	0.008	0.444	0.013	0.388	0.038

**Table 4:****Descriptive Statistics for Privately Held Firms by Gender of Ownership**

This table presents descriptive statistics for variables used to explain differences in male-owned and female-owned firms. Data are from the 1987, 1993, 1998 and 2003 Surveys of Small Business Finances. Variables are defined in Table 1. For each variable in each survey, the table presents the mean and standard error separately for male-owned and female-owned firms. In the far right columns are the difference between the means of male-owned and female-owned firms and a *t*-test for significant differences in means. \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Variable	1987			1993			1998			2003		
	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
Sales (\$000)	702.7	424.0	278.8 ***	621.0	358.1	262.9 ***	597.1	314.7	282.4 ***	724.4	343.5	380.9 ***
Assets (\$000)	294.9	285.1	9.8	308.4	161.3	147.1 ***	277.5	159.7	117.8 ***	350.3	184.0	166.3 ***
Employment	9.234	6.327	2.907 ***	7.208	5.159	2.049 ***	7.478	5.877	1.602 **	7.580	5.461	2.119 ***
Firm Age	13.624	10.349	3.275 ***	0.147	0.120	0.027 ***	13.841	11.154	2.688 ***	14.827	12.404	2.423 ***
ROA	0.571	0.532	0.038	0.718	0.674	0.044	0.882	0.879	0.003	0.601	0.624	-0.023
Liabilities to Assets	0.476	0.474	0.002	0.597	0.609	-0.012	0.753	0.778	-0.025	0.887	0.726	0.160 **
Cash to Assets	0.161	0.178	-0.017	0.195	0.201	-0.006	0.239	0.266	-0.027 **	0.249	0.294	-0.045 ***
Sales Growth Pos.	0.339	0.367	-0.029	0.694	0.723	-0.030	0.385	0.445	-0.059 ***	0.404	0.410	-0.007
Corporation	0.509	0.486	0.023	0.492	0.434	0.058 ***	0.451	0.359	0.092 ***	0.494	0.380	0.114 ***
Partnership	0.088	0.049	0.039 ***	0.079	0.084	-0.005	0.068	0.065	0.003	0.081	0.092	-0.010
Proprietorship	0.404	0.465	-0.061 **	0.429	0.482	-0.053 ***	0.474	0.567	-0.093 ***	0.425	0.529	-0.104 ***
Firm Delinquencies	N/A	N/A	N/A	0.184	0.221	-0.037 **	0.138	0.132	0.005	0.154	0.163	-0.009
Paid Late Trade Credit	0.417	0.428	-0.011	0.360	0.369	-0.009	0.274	0.241	0.033 *	0.255	0.217	0.038 **
Denied Trade Credit	N/A	N/A	N/A	0.059	0.069	-0.010	0.053	0.060	-0.007	0.051	0.036	0.016 **
D&B Score	N/A	N/A	N/A	N/A	N/A	N/A	2.972	3.058	-0.086 **	3.660	3.471	0.189 ***
<i>Industry</i>												
Construction	0.143	0.056	0.087 ***	0.162	0.071	0.092 ***	0.138	0.056	0.082 ***	0.137	0.061	0.076 ***
Primary Manufacturing	0.041	0.046	-0.006	0.038	0.039	-0.001	0.035	0.043	-0.008	0.033	0.025	0.007
Other Manufacturing	0.049	0.038	0.011	0.044	0.028	0.017 **	0.052	0.028	0.024 ***	0.047	0.018	0.029 ***
Transportation	0.029	0.024	0.005	0.027	0.030	-0.003	0.037	0.036	0.002	0.045	0.022	0.023 ***
Wholesale Trade	0.099	0.067	0.032 **	0.085	0.071	0.014	0.078	0.038	0.040 ***	0.062	0.041	0.021 **
Retail Trade	0.249	0.378	-0.130 ***	0.203	0.269	-0.066 ***	0.178	0.238	-0.060 ***	0.175	0.219	-0.044 ***
Insurance and Real Estate	0.068	0.080	-0.012	0.073	0.049	0.025 ***	0.067	0.056	0.011	0.071	0.057	0.014
Business Services	0.175	0.256	-0.081 ***	0.197	0.282	-0.085 ***	0.231	0.305	-0.074 ***	0.232	0.310	-0.078 ***
Professional Services	0.147	0.053	0.094 ***	0.170	0.162	0.008	0.182	0.192	-0.010	0.197	0.246	-0.049 ***
<i>Market Characteristics</i>												
Urban	0.757	0.757	-0.001	0.786	0.787	-0.001	0.796	0.804	-0.008	0.798	0.780	0.018
High HHI	0.164	0.192	-0.027	0.478	0.520	-0.042 **	0.105	0.095	0.011	0.468	0.509	-0.041 **

**Table 4 (cont.):**

**Descriptive Statistics for Privately Held Firms by Gender of Ownership**

This table presents descriptive statistics for variables used to explain differences in male-owned and female-owned firms. Data are from the 1987, 1993, 1998 and 2003 Surveys of Small Business Finances. Variables are defined in Table 1. For each variable in each survey, the table presents the mean and standard error separately for male-owned and female-owned firms. In the far right columns are the difference between the means of male-owned and female-owned firms and a *t*-test for significant differences in means. \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.



**Table 5:****Availability of Credit to Female-Owned and Male-Owned Firms**

*No-Need* is equal to one if the firm reported no need for credit during the previous three years and zero otherwise. *Discouraged* is equal to one if the firm reported that it needed credit but did not apply because it feared rejection and is equal to zero if the firm reported that it needed credit and did apply. *Denied* is equal to one if the firm applied for credit and was turned down and is equal to zero if it applied and was successful. Results are reported separately for female-owned and male-owned firms, along with a t-test for significant differences in the two groups.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	<u>Female-Owned</u>	<u>Male-Owned</u>	<u>Difference</u>
<b>No Need</b>			
	<b>1993</b>		
Obs.	805	3,357	
Mean	0.540	0.509	0.031 **
Std. Error	0.018	0.009	0.01
	<b>1998</b>		
Obs.	741	2,444	
Mean	0.613	0.608	0.005
Std. Error	0.018	0.010	0.01
	<b>2003</b>		
Obs.	847	2,776	
Mean	0.577	0.552	0.025 *
Std. Error	0.017	0.009	0.01
<b>Discouraged</b>			
	<b>1993</b>		
Obs.	425	1,859	
Mean	0.356	0.294	0.062
Std. Error	0.023	0.011	0.02 ***
	<b>1998</b>		
Obs.	299	1,014	
Mean	0.479	0.376	0.104
Std. Error	0.029	0.015	0.02 ***
	<b>2003</b>		
Obs.	384	1,389	
Mean	0.368	0.195	0.174
Std. Error	0.025	0.011	0.02 ***
<b>Denied</b>			
	<b>1993</b>		
Obs.	270	1,382	
Mean	0.250	0.181	0.069
Std. Error	0.026	0.010	0.017 ***
	<b>1998</b>		
Obs.	164	667	
Mean	0.259	0.235	0.024
Std. Error	0.034	0.016	0.024
	<b>2003</b>		
Obs.	274	1,389	
Mean	0.148	0.126	0.023
Std. Error	0.022	0.011	0.014



**Table 6:**

**Multivariate Differences in the Availability of Credit to Female-Owned and Male-Owned Firms**

Results from estimating a bivariate probit selection model where the dependent variable is one of three measures of the availability of credit to small firms—*No-Need*, *Discouraged*, or *Denied*—and the explanatory variables are as defined in Table 1. For brevity, only the results for the explanatory variable *Female-owned* are presented; full results appear in Appendix Tables. *No-Need* is equal to one if the firm reported no need for credit during the previous three years and is zero otherwise. *Discouraged* is equal to one if the firm reported that it needed credit but did not apply because it feared rejection and is equal to zero if the firm reported that it needed credit and did apply. *Denied* is equal to one if the firm both applied for credit and denied credit and is equal to zero if the firm both applied for credit and was successful in obtaining credit. *Female-owned* is an indicator variable that is equal to one if a firm is controlled by a female owner and is equal to zero otherwise. Results are presented separately for the 1993, 1998, and 2003 SSBFs. (These outcome variables are not available from the 1987 SSBF). \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	PANEL A: NoNeed			PANEL B: Discouraged			PANEL C: Denied		
	1993	1998	2003	1993	1998	2003	1993	1998	2003
<b>Specification: Variables Included</b>									
<b>Model 1: Gender</b>									
Marginal Effect	0.031	0.005	0.025	0.060	0.101	0.155	0.064	0.023	0.022
T-Statistic	1.610	0.240	1.310	2.400 **	3.170 ***	6.950 ***	2.500 **	0.620	0.960
McFadden's R-Square	0.001	0.000	0.000	0.023	0.006	0.027	0.004	0.001	0.001
<b>Model 2: Model 1 plus log of sales</b>									
Marginal Effect	0	-0.006	-0.018	0.025	0.065	0.099	0.041	0.012	0.011
T-Statistic	0	-0.28	-0.97	1.02	2.08 **	4.63 ***	1.63	0.31	0.46
McFadden's R-Square	0.019	0.003	0.0245	0.049	0.052	0.113	0.036	0.017	0.017
<b>Model 3: Model 2 plus log of firm age</b>									
Marginal Effect	0.013	0.011	-0.012	0.022	0.065	0.089	0.027	0.007	0.008
T-Statistic	0.71	0.53	-0.65	0.88	2.08 **	4.26 ***	1.1	0.2	0.35
McFadden's R-Square	0.036	0.022	0.032	0.049	0.052	0.133	0.058	0.031	0.032
<b>Model 4: Model 3 plus other firm characteristics</b>									
Marginal Effect	0.031	0.001	-0.029	0.009	0.048	0.0625	0.015	0.003	0.016
T-Statistic	1.71 *	0.06	-1.59	0.37	1.53	2.12 **	0.6	0.08	0.51
McFadden's R-Square	0.12	0.109	0.12	0.124	0.068	0.224	0.128	0.153	0.141
<b>Model 5: Model 4 plus owner characteristics</b>									
Marginal Effect	0.029	0.004	-0.002	0.016	0.04	0.049	0.019	-0.004	-0.017
T-Statistic	1.58	0.23	-0.09	0.66	1.27	1.64	0.79	-0.11	-0.56
McFadden's R-Square	0.14	0.132	0.143	0.15	0.102	0.278	0.15	0.184	0.199
<b>Model 6: Model 5 plus financing characteristics</b>									
Marginal Effect	0.033	0.01	-0.026	0.04	0.037	0.019	0.011	-0.0005	-0.002
T-Statistic	1.93 *	0.55	-1.52	2.08 **	1.51	0.91	0.52	-0.16	-0.09
McFadden's R-Square	0.162	0.181	0.241	0.197	0.187	0.311	0.156	0.2	0.232
<b>Observations</b>	4,162	3,185	3,623	2,284	1,313	1,773	1,652	831	1,456

**Table 7****Propensity Score Matching: Logistic estimation**

The table presents results from the PSM logistic regression, where the dependent variable *Gender* is equal to one if the firm's primary owner is female and equal to zero if the firm's primary owner is male. PSM is performed by using the `psmatch2` (Leuven and Sianesi, 2003) command in the Stata statistical software using the nearest neighbor option (within caliper, without replacement), and imposing common support. The definition and construction of the variables is provided in Table 1. \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Dependent variable: <i>Gender</i>	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
	1993		1998		2003	
Log Assets	-0.11***	0.032	-0.11***	0.028	-.17***	0.027
Log Sales	-0.09**	0.036	-0.07***	0.024	-.08***	0.022
Log Tot Employment	0.04	0.046	0.06	0.050	0.11**	0.046
Proprietorship	-0.05	0.100	-0.29	0.500	0.11	0.103
Partnership	0.002	0.161	-0.50	0.524	0.17	0.159
Log Firm Age	0.06	0.075	0.05	0.079	0.20***	0.064
Log Experience	-0.70***	0.084	-0.50***	0.080	-0.79***	0.084
Log Owner Ages	0.59***	0.219	0.36	0.235	0.66***	0.226
Graduate	-0.20	0.126	-0.48***	0.143	-0.37***	0.128
College	0.03	0.113	-0.16	0.121	-0.23**	0.116
Some College	0.29***	0.111	0.12	0.119	0.06	0.116
Constant	0.36	0.830	0.11	0.10	0.79	0.866
Observations		4,162		3,178		3,621
LR Chi2(11) (p value)		0.000		0.000		0.000
Pseudo R <sup>2</sup>		0.05		0.06		0.07

**Table 8****Propensity Score Matching: Outcome Variables**

The table presents outcomes (*NoNeed*, *Discouraged*, and *Denied*) before and after the PSM computed according to equations shown in Table 7. The “unmatched sample” refers to the mean value of outcome variables before the match. The “ATT” represents the mean value of outcome variables after the matching of female-owned and male-owned firms.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

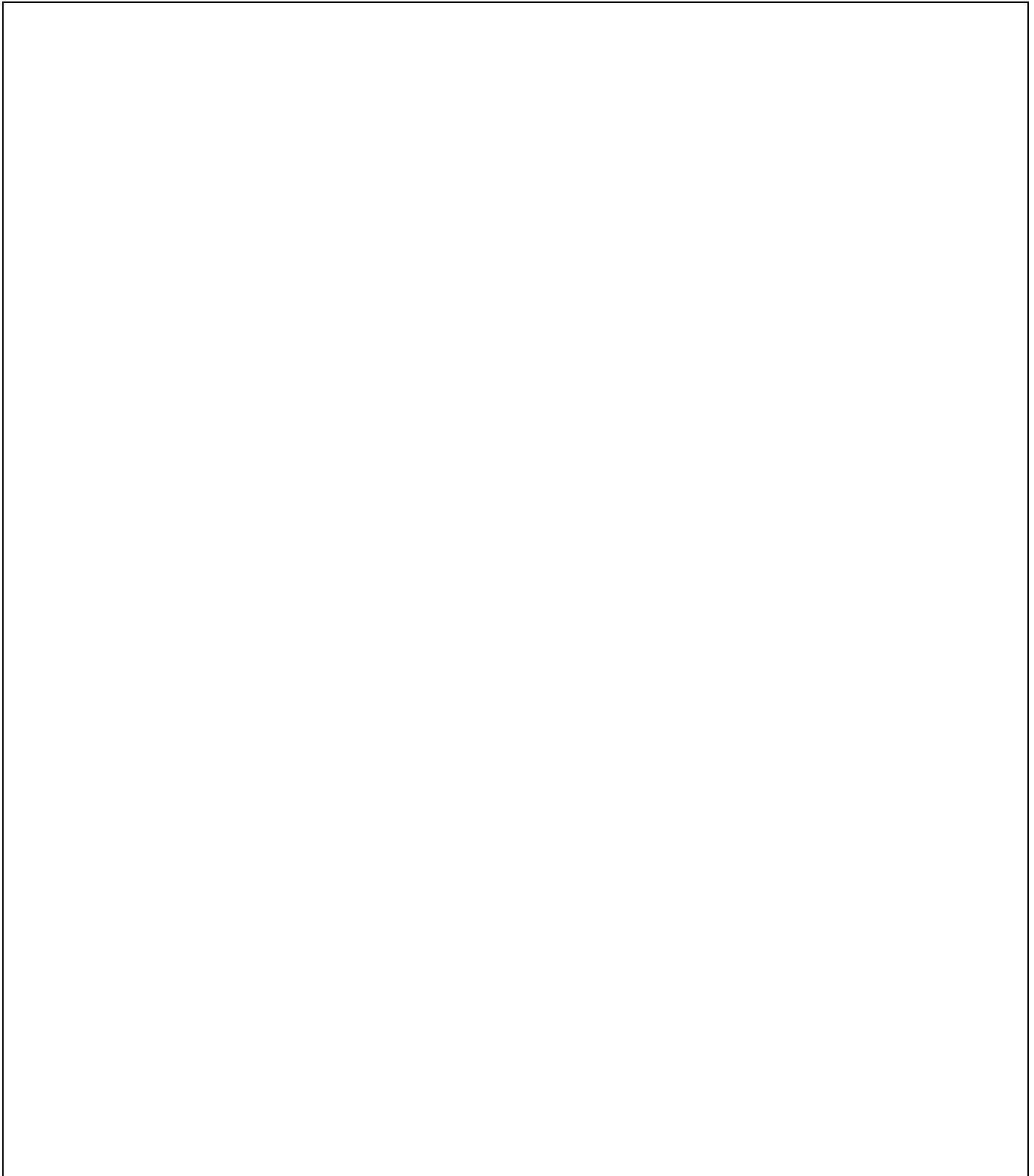
<b>Outcome</b>	<b>Sample</b>	<b>Treated (Gender=1)</b>	<b>Controls (Gender=0)</b>	<b>Difference</b>	<b>S.E.</b>	<b>T-stat</b>
1993. PSM Sample size: 1,548 firms						
<i>No Need</i>	Unmatched	0.472	0.446	0.026	0.019	1.32
	ATT	0.470	0.455	0.015	0.025	0.61
<i>Discouraged</i>	Unmatched	0.192	0.142	0.050	0.014	3.59***
	ATT	0.187	0.180	0.008	0.020	0.39
<i>Denied</i>	Unmatched	0.078	0.071	0.007	0.010	0.66
	ATT	0.080	0.092	-0.012	0.014	0.82
1998. PSM Sample size: 1,364 firms						
<i>No Need</i>	Unmatched	0.597	0.585	0.011	0.020	0.56
	ATT	0.585	0.570	0.015	0.026	0.55
<i>Discouraged</i>	Unmatched	0.181	0.142	0.039	0.015	2.63***
	ATT	0.183	0.167	0.016	0.020	0.78
<i>Denied</i>	Unmatched	0.054	0.059	-0.005	0.009	0.54
	ATT	0.056	0.079	-0.023	0.013	1.73
2003. PSM Sample size: 1,604 firms						
<i>No Need</i>	Unmatched	0.546	0.500	0.0470	0.020	2.40**
	ATT	0.536	0.549	-0.012	0.025	0.50
<i>Discouraged</i>	Unmatched	0.130	0.075	.055248645	0.011	5.00***
	ATT	0.126	0.120	.016209476	0.016	1.01
<i>Denied</i>	Unmatched	0.044	0.042	.001506228	0.008	0.19
	ATT	0.045	0.049	-.003740648	0.010	0.35

**Appendix Table 1**

**Multivariate Differences in the Availability of Credit: “No-Need” Firms**

Results from estimating a univariate probit model where the dependent variable is *No-Need*—and the explanatory variables are as defined in Table 1. *No-Need* is equal to one if the firm reported no need for credit during the previous three years and is zero otherwise. Results are presented separately for the 1993, 1998, and 2003 SSBFs.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.



**Appendix Table 2**

**Multivariate Differences in the Availability of Credit: “Discouraged” Firms**

Results from estimating a bivariate probit selection model where the dependent variables are *No-Need* and *Discouraged*—and the explanatory variables are as defined in Table 1. The selection equation is for *No-Need*, which is equal to one if the firm reported no need for credit during the previous three years and zero otherwise. The selected equation, where *No-Need* is equal to zero, is *Discouraged*, which is equal to one if the firm reported that it needed credit but did not apply because it feared rejection; and is equal to zero if the firm reported that it needed credit and did apply. Results are presented separately for the 1993, 1998, and 2003 SSBFs. \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 level, respectively.

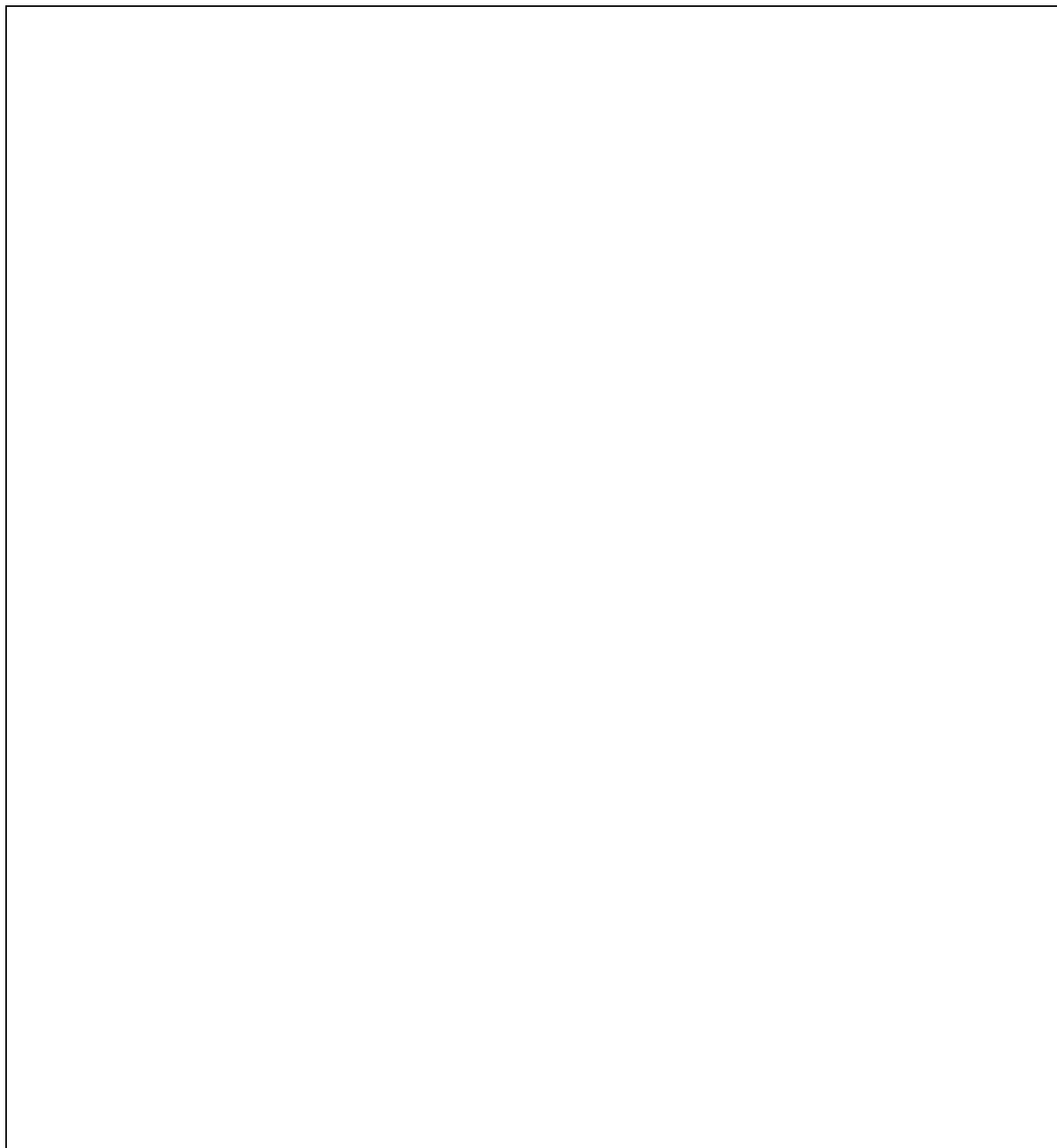


### Appendix Table 3

#### Multivariate Differences in the Availability of Credit: “Denied” Firms

Results from estimating a bivariate probit selection model where the dependent variables are *Discouraged* and *Denied*—and the explanatory variables are as defined in Table 1. The selection equation is for *Discouraged*, which is equal to one if the firm reported that it needed credit but did not apply because it feared rejection; and is equal to zero if the firm reported that it needed credit and did apply. The selected equation, where *Discouraged* is equal to zero, is *Denied*, which is equal to one if the firm both applied for credit and was denied credit and is equal to zero if the firm both applied for credit and was successful in obtaining credit. Results are presented separately for the 1993, 1998, and 2003 SSBFs.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.



## Appendix Table 4:

### Availability of Credit to Black-Owned and White-Owned Firms

*No-Need* is equal to one if the firm reported no need for credit during the previous three years and zero otherwise. *Discouraged* is equal to one if the firm reported that it needed credit but did not apply because it feared rejection and is equal to zero if the firm reported that it needed credit and did apply. *Denied* is equal to one if the firm applied for credit and was turned down and is equal to zero if it applied and was successful. Results are reported separately for Black-owned and White-owned firms, along with a t-test for significant differences in the two groups.

\*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	<u>Black-Owned</u>	<u>White-Owned</u>	<u>Difference</u>
<b>No Need</b>			
	<b>1993</b>		
Obs.	427	3144	
Mean	0.275	0.525	-0.250 ***
Std. Err.	0.022	0.009	0.023
	<b>1998</b>		
Obs.	249	2501	
Mean	0.363	0.623	-0.260 ***
Std. Err.	0.031	0.010	0.032
	<b>2003</b>		
Obs.	114	3223	
Mean	0.439	0.565	-0.126 ***
Std. Err.	0.047	0.009	0.048
<b>Discouraged</b>			
	<b>1993</b>		
Obs.	308	1671	
Mean	0.512	0.281	0.231 ***
Std. Err.	0.029	0.011	0.031
	<b>1998</b>		
Obs.	157	970	
Mean	0.588	0.386	0.202 ***
Std. Err.	0.039	0.016	0.042
	<b>2003</b>		
Obs.	71	1567	
Mean	0.466	0.220	0.2457 ***
Std. Err.	0.060	0.011	0.0605
<b>Denied</b>			
	<b>1993</b>		
Obs.	164	1318	
Mean	0.482	0.182	0.300 ***
Std. Err.	0.039	0.011	0.041
	<b>1998</b>		
Obs.	71	646	
Mean	0.566	0.199	0.367 ***
Std. Err.	0.059	0.016	0.061
	<b>2003</b>		
Obs.	41	1311	
Mean	0.638	0.109	0.529 ***
Std. Err.	0.076	0.009	0.076