Examining the Impact of Credit Access on Small Firm Survivability

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2011-35

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August 9, 2011

Abstract

This paper examines the effects of credit availability on small firm survivability over the period 2004 to 2008 for non-publicly traded small enterprises. Using data from the 2003 Survey of Small Business Finances, we develop failure prediction models for a sample of small firms that were confirmed to have been in business as of December 2003, with particular attention to the impact of credit constraints. We find that credit constrained firms were significantly more likely to go out of business than non constrained firms. Moreover, credit constraint and credit access variables appear to be among the most important factors predicting which small U.S. firms went out of business during the 2004-2008 period even though an extensive set of firm, owner, and market characteristics were also included as explanatory factors.

Introduction

The recent economic turmoil beginning in late 2007 has challenged businesses of all sizes. Firms have been faced with a great deal of uncertainty regarding sales and the economic outlook. At the same time, the recent downturn has dramatically impacted the availability and terms of credit. Over the 2007-2009 period, financial institutions have reported tightening their credit standards for approving loans (SLOOS).[1] Many small business owners rely on personal assets to guarantee or collateralize loans for their firms. As their equity in real estate holdings has generally declined in value during the recent turmoil, owners' ability to tap into personal balance sheets to secure their business credit needs has also shrunk (NFIB 2010).[2]

This paper examines the effects of credit availability on small firm survivability over the period 2004 to 2008 for non-publicly traded small enterprises. We develop failure prediction models for a sample of small firms that were confirmed to have been in business as of December 2003, with particular attention to the impact of credit constraints.[3] We find that credit constrained firms were significantly more likely to go out of business than non constrained firms. Moreover, credit constraint and credit access variables appear to be among the most important factors predicting which small U.S. firms went out of business during the 2004-2008 period even though an extensive set of firm, owner, and market characteristics were also included as explanatory factors.

Baseline data are taken from the 2003 Survey of Small Business Finances (SSBF) and provide information on the balance sheets, credit use, and credit constraints faced by a

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[1] Senior Loan Officer Opinion Survey on Bank Lending Practices
http://www.federalreserve.gov/boarddocs/SnloanSurvey/

[2] National Federation of Independent Businesses *Small Business Economic Trends*
http://www.nfib.com/tabid/83/Default.asp. See also Avery et al (1998).

[3] More precisely, to be eligible for the survey, a firm had to have been in business at the end of 2003 and at the time of the interview which was conducted during 2004. For more information, see Mach and Wolken 2006.

representative sample of more than 4,000 firms that were in operation at the end of 2003. The SSBF allows construction of standard financial balance sheet and income ratios that are used in many failure prediction models (Altman 1968).[4] In addition to financial ratios, the SSBF data are rich in firm (e.g., employment, organizational form, location, age and industry) as well as owner characteristics (e.g., race, education, experience, home ownership and value of home). Importantly for this study, the data also contain many measures of credit constraint, including a firm credit score, self-reported credit history variables such as late payments and bankruptcy for firm and principal owner, recent credit application experience of the firm, and whether firms borrow using trade credit and credit cards.

Our measure of survivability is constructed from the NETS database from Walls & Associates.[5] The NETS database takes cross-sectional data from the Dun & Bradstreet Market Identifier File and constructs a panel of sales and employment over time. These data allow us to track which firms closed or went out of business, were absorbed by another firm, or continued operations in each year subsequent to 2004. We estimate a reduced-form logistic model of a firm being in business in 2008. The results indicate that credit access and credit quality are significant indicators of the firm still being in business. We then estimate a proportional hazard model with yearly indicators of the firms' operational status. The hazard model further underscores the importance of credit access and quality in the ability of the firms to continue operations.

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[4] Altman, Edward I. (1968), "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance,* 23: 4(September), pp. 589-609. Typically, balance sheet or income information is not available for small firms.

[5] http://www.youreconomy.org/nets/?region=Walls

The literature on default prediction studies is voluminous and involves several approaches.[6] The earliest, most well-known and widely applied technique to firm failure prediction models uses financial ratio analysis. Following the introduction of such models in the 1960s, researchers provided theoretical arguments for failure that tended to argue one or both of the following hypotheses. The first is that firms will fail because the present value of their costs exceeds their revenues. The second is that inefficiencies in capital markets can lead to failure among firms with positive net present values. While financial statement data are required for ratio analysis studies, the theoretical literature on firm failure has suggested other variables, including firm and owner characteristics other than financial statement variables, local and macro economic conditions, as well as indicators of credit access and credit quality. The various approaches will be discussed below. [7]

Financial ratio analysis

Studies predicting failure of businesses began with work in the 1930s that established that accounting ratio measures exhibited by discontinuing firms were different from measures exhibited by surviving firms (Shailer (1989). Following up on this finding, Beaver (1966) and Altman (1968) explored the differences on small samples of failed and non-failed businesses. Beaver examined some fourteen financial ratios individually on a matched sample of 79 failed and 79 non-failed institutions. Altman (1968) is often credited as the first to apply multivariate techniques to failure analysis. He applied mutiple discriminant analysis to a sample of 33 failed and 33 non-failed institutions that filed bankruptcy petitions during the period 1946-65. From an

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[6] For summary articles, see Hall (1992) and Keasey and Watson (1991).
[7] In addition to studies predicting failure or discontinuance, there are also studies of entry and exit rates among businesses. The entry-exit studies provide some useful insights into reasons underlying failure, even though such studies may be largely descriptive. See Hall (1992), p. 239, and also Dunne et al (1988), Headd (2003) , Hudson (1986), and Boden (2000).

initial 22 ratios, Altman settled on five ratios as providing in combination the best overall

prediction of corporate bankruptcy. The ratios included measures of liquidity, profitability,

leverage, solvency and activity ratios.

Many studies since Altman (1968) have added further support to the potential usefulness

of such models for failure prediction. The literature is quite large and studies that provide

reviews of earlier works include Ohlson (1980), Taffler (1982), and Altman and Sabato (2007).

Such studies have used various statistical techniques (e.g., multiple discriminate analysis, logistic

and probit analysis, and factor analysis) and have been applied to several countries including the

United States and Great Britain. It is fair to say that most such studies have been concerned with

large publicly traded (listed or quoted) firms – in part because financial statements for such

companies are generally available.

Because the focus has been on larger concerns, samples of failed enterprises in these

studies tend to be quite small. The early work generally drew matching samples of non-failed

companies, whereas more recent studies have included far larger samples of non-failed

institutions. For example, Altman and Sabato (2007) employ a sample of about 2000 firms

between 1994 and 2002. However, only 120 observations were observed failures.

Little attention was initially given to small or private enterprises. Publicly available

datasets are heavily biased towards large firms and usually contain little or no information on

small firms. However, some efforts to study small firm failure have produced encouraging

results, although often the variables and models used for small enterprise studies differ from the

ratio analysis described above. This is in large part because financial statement data for smaller

enterprises or for non-publicly traded enterprises is often unavailable.[8] Studies of private

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[8] There are ratio studies that claim to have examined small firms. However, most of these studies use publicly available information which generally includes firms that are publicly traded (or "quoted" or "listed" or "not

companies using financial ratio analysis are reviewed by Shailer (1989). With the exception of Edminster (1972) – who used a sample of 21 firms reporting losses and 21 non-failed businesses drawn from the US Small Business Administration borrowers for 1954-69 – these studies have generally analyzed private United Kingdom (Briggs and MacLennan (1983), Peel and Peel (1987)) or Australian companies (Shailer (1986)). Samples were typically on the order of 100 or less observations. In- sample predictions averaged around 75 percent accurate. But when applied to a hold-out sample, Peel and Peel's models exhibited high classification error rates. Differences in the variables used between small (private) company models and large (public) company models as reported in these studies suggest that small business failure models may be a separate avenue of research.

Net present value

Employing the hypothesis that survival is dependent upon a positive net present value (of revenues and costs), several studies have identified firm characteristics other than financial ratios that are likely associated with increasing the difficulty firms have in maintaining solvency. Models formulated by Argenti (1976), Jovanovic (1982) and Dunne, Roberts and Samuelson (1988) indicate that firms fail because of their management structure or because they are unlucky or inefficient. Argenti (1976) viewed financial ratios as symptoms of failure, not the cause.[9] Rather, the process of failure is based on a number of defects in the organization and financial structure of the company. Based on case studies, Argenti concludes that factors reflecting the management structure and the adequacy of the accounting information system such as one-man

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private). For example, Altman and Sabado (2007) wrote on failure prediction for SMEs. In their study, an SME is a firm that has less than $65 million in sales but is available on Compustat. Compustat in 2007 contained about 24,000 listings. There are approximately 24 million enterprises in the United States.
[9] Credit quality or credit access may also be a symptom, rather than a cause if it is firm actions (risk taking, performance, etc.) that result in the credit constraints. On the other hand, credit constraints resulting from frozen credit markets or deterioration of the financial institution used by the firm may be causal. Future research on this topic will attempt to sort out the nature of the credit constraints and their effect on survivability.

rule, lack of management depth and experience, and concentration of resources into a single project are factors that are associated with failure. Although not specifically examining small firms, these factors are usually characteristics of small firms. Studies that included some of these factors include Storey et al (1987) and Keasey and Watson (1986). Both studies included financial ratios as well as some variables reflecting management structure. They found that the nonfinancial ratio variables increased the predictive accuracy somewhat. The results are generally supportive of the Argenti model of business failure. Such variables also have some practical advantages in that some of the information required is available for small firms, whereas financial statement variables are difficult to obtain for non-traded enterprises.

Jovanovic provides a two period model of firms' costs and Dunne et al test some of the implications to further explore why failures are more likely among small and young enterprises. In these models, small and young firms are likely to be more vulnerable because it takes time to acquire the information and knowledge to better predict their costs and revenue functions than it does for larger and older firms.

Hall (1992, p. 240) further argues that small firms have limited portfolios – first with respect to the opportunity-sets of products or services they offer or markets in which they operate, and second with respect to the human capital embodied in management, which is likely less vis-à-vis larger firms. Both the degree of diversification and level of human capital will likely increase with the size of the company. Consequently, small firms are more prone to failure. Limited portfolios will lower the expected earnings and increase the variance of small vis-à-vis larger firms. And a result of a lower volume of human capital is that the income streams that it generates may be both lower and more sensitive to the situation being faced. These observations reinforce the importance of accounting for shocks to the firms' operation.

But they also suggest that the characteristics of management – including factors such as experience, education, and breadth of management – may be important to identifying firms likely to fail.

Capital market imperfections, credit constraints, and credit quality

Another line of research focuses on capital market imperfections (Wadhwani (1986), Hudson (1986), Simmons (1989), and by implication credit constraints and credit quality. Inefficiencies in capital markets can lead to failure among firms with positive net present values. In particular banks (and other lenders) have been accused of charging small firms too much, demanding too high a level of collateralization, being inefficient in their procedures for credit assessment (or economies of scale with firm size), and in some cases unwilling to lend to smaller firms. As a result of these imperfections, small firms facing such constraints will be less able to adjust to shocks to their operations than larger firms.

Early tests of failure models based on capital market imperfections use variables that were intended to be surrogates for shocks to cost or revenue flows, as was true of the studies by Dunne et al (1988), Storey et al (1987) and Keasey and Watson (1986). Hudson includes a variable of company profits to company GDP which might be considered a surrogate for net present values; Wadhwani does not include inflation but does find that interest rates are positively correlated with the numbers of liquidations.

The literature also suggests several indicators of credit access and credit quality that are likely related to the probability of discontinuance. Applying and being denied credit signals that a firm is unable to secure the desired level of credit. Credit constrained firms have less access to credit which may also force them to use relatively more expensive shorter term debt to finance their operations. Such restrictions and costs may leave them vulnerable to shocks in their cash

flow. This in turn puts them at a higher risk of failure (Keasey and Watson (1991)). It may also constrain the firm from initiating new projects, expanding operations, investing in research and development, or even making its payroll, and ultimately affect the firm's probability of survival. For example, Musso and Schiavo (2007), using an index of financial constraint, report a significant relationship between survival and financial constraint.

Such constraints may cause firms to turn to alternative but somewhat more expensive types of credit. For example, borrowing using credit cards or using trade credit are often more expensive than traditional bank loans. Blanchflower and Evans (2004) found that firms that had their credit access constrained–i.e., denied credit or feared applying because they thought they would be denied–were significantly more likely to borrow using credit cards. In a recent study of start-up firms, Scott (2009) reports a negative correlation between the level of credit card debt and subsequent survival. And Peterson and Rajan (1997) report that firms that had loans requests denied were more likely to borrow using trade credit.

In addition to credit constraint indicators, the credit quality of firms may also be related to subsequent survival. Several studies have found that firms with poor credit histories (e.g., bankruptcy, delinquency on current debt, and judgments), or low credit scores, are less likely to have loan requests approved (e.g., Blanchflower, et al (2004), Cavalluzzo and Wolken (2002), Ayytinen and Pajarinen (2007). Robb and Robinson (2010) examine differences between surviving and failing "new" firms and report that firm credit scores are positively associated with indicators of success – revenues, assets, profits, and employees larger than the sample median levels.

In sum, the literature regarding predicting business failure has used a variety of approaches, starting with financial ratio analysis in the 1960s. Since then, researchers have

identified a number of other factors likely to affect the probability of failure, in part due to the

development of theoretical models to help understand what leads to failure and in part due to

necessity owing the lack of publicly available financial data for small firms. The literature

indicates that factors that are associated with (small) firm insolvency include financial ratios as

well as other income and balance sheet variables such as size. Moreover, other firm

characteristics (e.g., age) and owner/manager characteristics (experience, education) are likely

important, as are variables reflecting credit constraints and credit quality of the firm. Finally,

given that firm performance is likely to be affected to some degree by the general health (or

change in the health) of the local and national economy, it may be important to include such

variables as well. [10]

The Data

2003 Survey of Small Business Finances (SSBF)

The majority of data for this paper come from the 2003 Survey of Small Business

Finances (SSBF). The 2003 SSBF was conducted to collect information from the owners of a

nationally representative sample of more than 4,000 U.S. small business enterprises. Owners

were asked about firm income statements; balance sheets; financial relationships; credit

experiences; lending terms and conditions; the number of branches and firm headquarters

location; the types of, and locations of financial institutions that were used; and about various

other firm characteristics.[11]

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[10] See Holman and Fletcher (1989). They examine factors affecting failure rates and find that macroeconomic factors such as the money supply, real GNP, and real corporate profits are highly significant in predicting firm failure.)

[11] For detailed information about the 2003 SSBF, see 2003 Methodology Report (National Opinion Research Center, 2005). Selected survey results are summarized in Mach and Wolken, 2006. The database includes a credit score for each firm purchased from Dun and Bradstreet.

The target population of the survey was defined as for-profit, non-governmental, non-depository and non-agricultural enterprises with fewer than 500 employees. Firms in the sample had to be either single establishments, or the headquarters of multiple establishment enterprises that were not majority owned subsidiaries of other firms. Additionally, in order to be eligible, firms had to have been in business during December of 2003 and at the time of the interview. The majority of interviews occurred between June and December of 2004.

The Dun and Bradstreet (D&B) Market Identifier file (DMI) was used to construct the sampling frame for the 2003 SSBF. The DMI contains minimal basic company data on U.S. businesses. It is a meant to be a snapshot of active businesses *at a particular point in time*.

National Establishment Time-Series (NETS) Database

In order to incorporate a time element into the SSBF cross-section, we merge in data from the National Establishment Time-Series (NETS) Database. The NETS Database is constructed from 20 "snapshots" taken every January since 1990 of all active Dun and Bradstreet establishments (currently over 24 million). Each year, the snapshot is compared to information from the previous years. No establishments are ever deleted from the database; but their last year in business is indicated making it possible to follow a firm over time. Walls & Associates maintains the NETS database and continues to update estimates before the next annual release.[12]

One unique feature of the NETS database is that it allows the researcher to distinguish between a firm that is no longer in business and one that has been purchased by another firm or changed its organizational form but essentially continues to operate. On the D&B DMI file,

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[12] For more information on the construction of the NETS database, see Walls & Associates, 2009. As new data becomes available (the next year), Walls and Associates reexamines and corrects, if necessary, previous years' data as well. The results reported in this paper are for the NETs database as of 2009. Due to the dynamic nature of the database, results may be slightly different if the models were to be estimated with a different release of the NETs database even if the same time period were examined.

firms that were purchased by other firms or changed organizational form are assigned a new

DUNS number. Thus, comparing two point-in-time snapshots of the D&B file without the

quality control implemented for the NETS database would make these firms that went out of

business appear identical to firms that were still operating with different names or forms.

However, the NETS database does not allow us to differentiate between firms that

went out of business due to bankruptcy or poor performance from those that closed down

because the owner simply retired.[13]

The NETS database also contains several other yearly measures of firm characteristics

such as employment, sales and credit ratings. Because our experience with the employment and

sales numbers from the DMI file have indicated that these numbers are not very accurate, we do

not use this information in analysis[14]. However, because D&B specializes in credit rating, this

measure may be more informative. The credit rating is a composite credit worthiness measure;

unlike the credit score, which provides a *relative* ranking of firms, the credit ranking is *specific*

to the firm.[15]

House Price Indices

Many small business owners rely on personal assets to guarantee or collateralize loans for

their firms. As their equity in real estate holdings has generally declined in value during the

recent turmoil, owners' ability to tap into personal balance sheets to secure their business credit

needs has also shrunk (National Federation of Independent Businesses 2010). In order to account

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[13] The models control for this possibility by including a variable on the owner's age. See below.

[14] For example, the correlation coefficient of total sales provided on the D&B DMI and total sales provided by the individual firms is 0.6 and the correlation coefficient of employment is similar.

[15] A detailed interpretation of the credit ranking can be found at http://www.dnb.com/about-dnb/15062603-1.html. The variable is a multi-tiered variable based both on the firm's credit history and size. For our analysis, we construct a discrete variable with 5 categories: high, good, fair, limited, or not rated. Its value may change from year to year.

for this shrinking source of credit, we incorporate the change in the house price index into the model. The most prominent of such indices are from the Federal Housing Finance Agency (FHFA)[16] and LoanPerformance (LP)[17]. Both indices have the same basic foundation of identifying and utilizing sales pair data, there are a few major differences to point out and remember when analyzing the index results. The most important distinction between the indices is that the FHFA uses only loans purchased by Fannie Mae or Freddie Mac. The LP data is obtained from their real estate database. In addition, the weighting scheme with respect to the price of the property differs. FHFA's index weights changes in house prices equally for all properties and the LP HPI creates sub-indices to breakout different home price levels about the area average.

These indices have diverged fairly substantially over the last several years. The FHFA index peaked at a much lower level later than the LP index. For example, using the 2000 index as a baseline, the FHFA home prices appreciated around 65 percent, peaking mid-2006. In 2008, the FHFA index was 45 percent higher than it had been in 2000. In contrast, the LP index appreciated 95 percent, peaking mid-2005; by fourth quarter of 2008 it was 60 percent above its 2000 level. Because it is unclear which one of the indices is best, we run the model separately for each index. The percentage change in the index between 2004, the time of the SSBF interview, and 2008, the last year for which NETS data are available, is merged with the SSBF by the state in which the firm's headquarter office is located.

Geographic Controls

Because the location where the firm operates is likely to have an impact on the survivability of the firms, we also include a limited number of measures of the economic environment. Using the MSA or

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[16] For more information on the construction of the FHFA index, see Calhoun, 1996.
[17] For more information on the construction of the LoanPerformance index, see http://www.corelogic.com/Products/CoreLogic-HPI.aspx#container-Overview

rural county where the firm's headquarters is located, we merge in measures of population and establishment density from Census data, the average wage per job and per capita income from BEA, and the unemployment rate from BLS. As an area becomes more densely populated, we would expect the firm to have more demand for its products, increasingly the likelihood that the firm will stay in business. The relationship with the number of establishments in the area is theoretically less clear. While higher densities of businesses would likely be associated with better infrastructure decreasing the cost of doing business, more businesses could also mean more competition. Because small businesses are also potential employers, rising wages in the area where the firm operates is likely to increase the cost of production; thus, we would expect to see an inverse relationship between average wages and firm survivability. Per capita income, on the other hand, should have a positive relationship with survivability as more wealthy residents would be more capable of buying the firm's output. We would expect unemployment rates to be negatively associated with survivability.

To capture the changing nature of the economic environment, we use the percentage change in these measures between 2004 and 2008 when we estimate the logistic models and the one-year lagged value (time-varying) when we estimate the proportional hazard model.

The Sample

Of the 4,240 firms that completed the 2003 SSBF, 4,230 were successfully matched to firms on the NETS database.[18] Of those firms, 332, just under 8 percent, were no longer in business as of January 2008 (Table 1). This represents slightly less than 10 percent of the population. Statistics on new employer firms indicate that 69 percent survive at least the first two years and 51 percent survive at least five years (Small Business Administration, 2009). Because the 2004 SSBF firms are not all new firms—the median firm was 12 years old—and

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[18] The 10 firms that did not match up are still being investigated. The most likely explanation is that the D&B number was incorrect on one of the files.

they are not all employer firms, one would not expect the survival rates to match perfectly, but the 8 percent does not seem extraordinarily high or low.

In order not to bias the results, we did not want to include firms in the analysis that already looked defunct when they were interviewed in 2004. For the analysis, we eliminated firms that reported assets of less than $0 or sales of less than $1,000. Because the SSBF were multiply imputed, this restriction led to slightly different numbers of firms being used for each implicate. Table 2 provides the breakdown of the sample by implicate. Between 158 and 162 firms were dropped from analysis. About double the fraction of these marginal firms were no longer in business in 2008 than the other firms. The analysis that follows was conducted using the remaining firms in the 2003 SSBF.

Data Descriptives

Table 3 provides some descriptive statistics of the sample by whether or not the firm was still in business by 2008.[19] Definitions of variables are summarized in Appendix A. A quick overview of the data shows that the firms that were still in business by 2008 looked different than those that were not when they were interviewed in 2004. In terms of credit history, the firms that were no longer in business in 2008 had credit scores that were 10 percentage points lower than their counterparts. In 2003, the majority of small firms were not rated by D&B—an indicator of the opacity of small firms. However, firms that were no longer in business by 2008 were much more apt to have not been credit rated by D&B, likely making it more difficult for potential lenders to evaluate their credit worthiness. The discontinued firms were also more likely to report that the owner or the firm had been 60 or more days delinquent in paying 3 or more bills in the past three years or had a judgment rendered against them.

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[19] Descriptive statistics and model estimates are based on the fully imputed data with standard errors adjusted to take into account the multiple imputations; they are also weighted to take into account sample design.

Discontinued firms were generally smaller than continuing firms, and reported smaller amounts for both balance sheet and income items: Discontinued firms had smaller sales and profits; they had lower liabilities and accounts receivable as well. As a baseline comparison to the early failure prediction literature, we construct the financial ratios suggested by Altman. These ratios include multiple measures of leverage, liquidity, activity (e.g., sales to assets), profitability, and coverage (e.g., pre-tax profit to loans). There were large differences in the average ratios across the two groups, although few differences are statistically significant. For instance, discontinued firms reported average short-term debt to equity ratios of around 10 while continued firms reported an average near 75. However, their medians were quite similar. This gives some idea of how heterogeneous the finances of small businesses are and possibly some insights into the potential (or lack thereof) of financial ratios to predict the discontinuance of very small businesses.

In terms of firm demographics, the discontinued firms tended to be younger and smaller, although the differences in size measures (assets, sales, profits, and employment) other than profits are not statistically different. There is virtually no difference in forms of organization. There are only small differences in the characteristics of the owners of the firms that were discontinued; they were slightly more likely to be minority owned and had less formal education and less business experience.

Econometric Results

The data contain five completely imputed datasets. We utilize Rubin's formulas to use the imputed datasets to account for imputation error. In addition, all estimates are weighted to reflect unequal selection probabilities and response rates. All models are estimated in Stata.   We estimate two types of models. The logistic model, which reports estimates of log odds ratios, estimates the probability

that a firm that was in business during 2004 went out of business sometime between 2004 and 2008. We then estimate a proportional hazards model including information on credit ratings and geographic controls that vary over the 2004-2008 period. For each, several model variants are estimated: The baseline model (model 1) includes most variables. Models 2-6 adds owner experience and age; model 3 adds the FHFA real estate prices and model 4 uses the alternative LP real estate prices. Models 5 and 6 add geographic controls to models 3 and 4, respectively.

Logistic Model

The variables described above are used to predict the probability of discontinuance using reduced form logistic models (Table 4). The dependent variable is equal to one if the firm in the 2004 sample discontinued sometime between 2004 and 2008.

Baseline model: The baseline model includes (column 1) credit quality variables, credit access measures, basic firm characteristics, financial ratios,[20] and dummies for Census divisions and major SIC industries. Results from this model are provided in column 1 of Table 4. Results for joint hypotheses tests of groups of variables (e.g., credit quality variables) are reported at the bottom of table 4. By groups, we find that the credit quality and access measures are jointly significant at the one percent level, as are the Census division dummy variables, and financial ratios and credit constraint variables were significant at the five percent level. By group, firm size measures -- employment, sales, assets, profit and firm age— and industry dummies were not significant.

On an individual basis, several of the credit quality and credit access variables are significant. Table 4 provides the log odds ratios for each of the controls. For each percentage point the firm's credit score (which ranges from 1 to 100) is above the average score, the odds of

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[20] We include only one financial ratio of each type. The specific ratio chosen from each of the five types of financial ratios was the one that performed best in predicting that the firm was out of business.

no longer being in business decreases 0.6 percent. Being rated by D&B, regardless of the rating, decreases the likelihood of the firm being out of business by 2008 significantly. Having judgments in 2004 against the firm or its owner increase the odds of the firm no longer being in business 1.5 times. And borrowing on credit cards and trade credit in 2004—an indicator of restricted access to credit—increases the odds that a given firm will no longer be in business by 2008 by 41 and 53 percent, respectively.

Owner age and experience: The NETS data provide no indication of why a firm is no longer in business. It could be that the firm became unprofitable and had to shut down. However, it could also be the case that the owner simply decided to close the firm, perhaps to retire. In column 2, we add in measures to control for the age and experience to try to control for this uncertainty. Neither of these variables is marginally significant and the rest of the results are largely unchanged.

House prices: The next two models incorporate information on the changes in real estate prices that occurred over this period. In general, we would expect increasing prices to be associated with increasing access to credit and a negative correlation with firms no longer being in business in 2008. Column 3 uses the FHFA index and column 4 uses the LP index. As with the addition of the owner characteristics, the effects of other coefficients are largely unchanged. Both indices predict an inverse relationship between firm discontinuance and real estate prices, but neither index is significant at traditional levels.

Geographic controls: The final two models (columns 5 and 6) include additional measures specific to the geographic area where the firm is located. These measures include percentage changes between 2004 and 2008 in population density, average wages, unemployment rate, establishment density, and per capita income. Jointly, these measures are

not significant and, again, the other coefficients are robust to their inclusion. Individually, increases in average wages are significantly associated with an increase in the odds of failure by 2008.

Proportional Hazard Model

The NETS data provide a yearly measure of whether the firm was in operation which allows us to incorporate a sense of timing into the estimates. We estimate a proportional hazard model of firm survival: given that the firm has survived until time t, what is the likelihood that it will fail at time t+1. We use the same controls that we used in the logistic models, but examine failure in each year. The resultant hazard ratios are presented in Table 5. These models are also estimated using 5 implicates and weights, as discussed above.

The results are similar to the logistic models; variables that are significant in the logistic models are generally significant in the hazard models and vice versa. As with logistic model, the hazard ratios are very robust across specifications.

Baseline model: Results from the baseline model are provided in column 1 of Table 5. By groups, we find that only the credit quality and Census division dummy variables are jointly significant at the one percent level. None of the other groups of variables are jointly significant at traditional levels, although the credit constraint variables are significant at the fifteen percent level.

Individually, the credit score is once again significant. However the estimated impact is near zero. A judgment rendered against the firm or owner increases the likelihood of going out of business by 10 percent. Not being rated by D&B increases the likelihood of the firm going out of business by 11 percent in each period. And borrowing trade credit in 2004—an indicator

of restricted access to credit—increases the yearly likelihood that a given firm will go out of business by 4 percent. Borrowing on credit cards is marginally significant at the 15 percent level.

Owner age and experience: Column 2 adds in measures to control for the age and experience to try to control for this uncertainty about why the firm is no longer in business. As with the logistic model, neither of these variables is marginally significant and the rest of the results are largely unchanged.

House prices: The next two models incorporate information on the changes in real estate prices that occurred over this period. The LP index is significant at the 10 percent level, but the model predicts a positive relationship between increasing home prices and the likelihood of a firm going out of business. This is counter to what theory would predict. As with the addition of the owner characteristics, the effects of other coefficients are largely unchanged.

Geographic controls: The final two models include additional measures specific to the geographic area where the firm is located. These measures include percentage changes between 2004 and 2008 in population density, average wages, unemployment rate, establishment density, and per capita income. Jointly and individually, these measures are not significant and, again, the other coefficients are robust to their inclusion.

Conclusions and Further Work

In sum, the results suggest that there are large differences between the continuing and discontinuing firms. Generally, credit access and credit quality measures in 2004 are important indicators of whether the firm will be in business in by 2008. Other significant characteristics include being headquartered in the West North Central, East North Central or South Atlantic Census divisions or being a construction or retail trade business.

It is important to keep in mind that the recent economic turmoil is not representative of all periods. Despite the extraordinary times, the credit access measures do seem to be predictive of firm performance. In future research we would like to address the question of whether some of the credit constrained firms may have fared better had the economy performed better by comparing firm failure during this period to earlier.

Table 1: Firms out of business, by last year in business

Last year in business	Unweighted Frequency	Unweighted Percent	Weighted Percent
2004	45	1.06	1.25
2005	104	2.46	2.90
2006	109	2.58	3.21
2007	74	1.75	2.18
Total	332	7.85	9.54

Table 2: Sample restrictions by implicate

	Dropped Sample			Sample Used in Estimation		
Implicate	Assets < $0 or Sales <$1,000	Still in business in 2008	Not in business by 2008	Total	Still in business in 2008	Not in business by 2008
1	162	138	24	4,068	3,760	308
2	161	137	24	4,069	3,761	308
3	162	137	25	4,068	3,761	307
4	158	135	23	4,072	3,763	309
5	160	135	25	4,070	3,763	307

Table 3: Means and Medians by Out of Business Status in 2008 -

	Out of business by 2008		Still in business in 2008	
	Mean	Median	Mean	Median
Credit Quality Variables				
Firm credit score	45.29***	42.00	53.20	58.00
Firm or owner declared bankruptcy	0.04	0.00	0.03	0.00
Firm or owner delinquent 3+ times	0.14**	0.00	0.09	0.00
Judgment against firm or owner	0.09**	0.00	0.04	0.00
Zero or negative equity indicator	0.19	0.00	0.19	0.00
High or good D&B credit rating in 2003	0.03***	0.00	0.11	0.00
Fair D&B credit rating in 2003	0.03***	0.00	0.09	0.00
Limited D&B credit rating in 2003	0.00***	0.00	0.02	0.00
No D&B credit rating in 2003	0.94***	1.00	0.78	1.00
Credit Access Variables				
Firm applied for credit	0.38	0.00	0.35	0.00
Denied credit	0.15	0.00	0.15	0.00
Did not apply for credit fearing denial	0.23	0.00	0.17	0.00
Borrowed on credit cards	0.30**	0.00	0.22	0.00
Used trade credit	0.64	1.00	0.62	1.00
Borrowed on trade credit	0.33**	0.00	0.24	0.00
Denied trade credit	0.06	0.00	0.05	0.00
Used real estate as collateral	0.24	0.00	0.20	0.00
LP home prices (% Δ 2004-08)	6.42	7.42	6.45	7.42
FHFA home prices (% Δ 2004-08)	18.72	18.10	19.08	18.60
Balance Sheet Variables				
Accounts payable	61,979.53	0.00	64,263.11	0.00
Total loans†	304,160.85	14,001.00	219,344.76	8,001.00
Current liabilities	27,667.18	0.00	41,631.81	0.00
Other liabilities	1,148.43	0.00	1,612.73	0.00
Total liabilities†	396,447.06	25,001.00	327,185.69	21,988.00
Cash on hand	66,329.07	7,500.00	55,687.24	7,500.00
Accounts receivable	76,883.76	1,135.00	106,460.77	1,432.00
Inventory merchandise	122,571.96	678.00	91,607.79	500.00
Current assets	54,636.26	0.00	53,782.25	0.00
Total investments	29,331.03	0.00	18,321.86	0.00
Book value of land	128,469.92	0.00	48,122.68	0.00
Book value of depreciable assets	234,575.46	15,000.00	171,255.53	13,600.00
Other assets	13,491.31	0.00	9,145.51	0.00
Total assets	729,968.33	79,214.00	555,363.76	75,000.00
Log of total assets	11.27	11.28	11.21	11.23
Equity†	328,800.69	27,519.00	227,797.29	31,001.00
Short term debt	89,419.78	1,000.00	105,787.54	2,000.00
Working capital	264,224.79	27,000.00	252,867.64	25,000.00
Income Statement Variables				
Profits	131,919.01	20,000.00	191,021.60	25,000.00
Pretax profit	132,358.87	20,000.00	193,997.48	25,400.00

Table 3: Means and Medians by Out of Business Status in 2008 — continued

	Out of business by 2008		Still in business in 2008	
	Mean	Median	Mean	Median
Sales	983,413.95	198,000.00	1,155,161.30	212,000.00
Log sales	12.18	12.20	12.26	12.26
Other income	8,192.62	0.00	19,207.65	0.00
Total cost	858,898.33	165,697.00	982,148.22	150,000.00
Corporation tax	3,722.54	0.00	19,539.82	0.00
Financial Ratios				
Leverage				
Short term debt/ (equity†) ratio	10.32	0.00	79.14	0.00
Liabilities/(equity†) ratio	10.86**	0.09	246.53	0.06
Short term debt/assets ratio	0.20	0.01	0.23	0.03
Liabilities/assets ratio	0.96*	0.33	1.83	0.28
Liquidity				
Cash/assets ratio	0.23	0.12	0.24	0.13
Working capital/assets ratio	0.54	0.54	0.54	0.59
Cash/sales ratio	0.20*	0.04	0.13	0.04
Activity				
Sales/assets ratio	26.92	2.85	15.88	3.01
Accounts payable/sales ratio	0.04	0.00	0.05	0.00
Accounts receivable/sales ratio	0.11	0.01	0.10	0.01
Profitability				
Profits/assets ratio	6.92	0.21	4.64	0.33
Pre-tax profit/assets ratio	6.93	0.22	4.66	0.34
Profits/sales ratio	0.03	0.17	0.15	0.16
Pre-tax profit/sales ratio	0.03	0.17	0.16	0.16
Coverage				
Pretax profit/(loans†) ratio	51,517.10	1.57	57,478.23	2.24
Pretax profit/(liabilities†) ratio	25,411.04	1.08	15,177.11	1.04
Firm Information Variables				
Firm age	12.55***	10.00	14.65	12.00
Log of firm age	2.15***	2.30	2.34	2.48
Total employment	7.94	3.00	9.00	4.00
Number of owners	2.08	1.00	3.17	1.00
Proprietorship	0.43	0.00	0.44	0.00
Partnerships	0.09	0.00	0.08	0.00
S-corporations	0.32	0.00	0.32	0.00
C-corporations	0.16	0.00	0.16	0.00
Owner Information Variables				
White	0.88	1.00	0.91	1.00
Black	0.06	0.00	0.03	0.00
Hispanic	0.03	0.00	0.04	0.00
Asian	0.06	0.00	0.04	0.00
Native American	0.01	0.00	0.01	0.00
Male	0.66	1.00	0.66	1.00

	Out of business by 2008		Still in business in 2008	
	Mean	Median	Mean	Median
Equal	0.13	0.00	0.13	0.00
Female	0.20	0.00	0.21	0.00
Years of owner experience	18.18	17.00	19.55	19.00
Owner managed	0.96	1.00	0.94	1.00
Primary owner share	80.67	100.00	81.50	100.00
High school	0.17*	0.00	0.22	0.00
Some college	0.33	0.00	0.32	0.00
Completed college	0.50	0.00	0.46	0.00
Own home	0.90	1.00	0.89	1.00
Home equity	267,726.66	150,000.00	259,254.53	150,000.00
Net worth	710,933.71	160,000.00	848,937.90	200,000.00
Primary owner age	50.64	50.00	51.72	52.00
Older than 60 indicator	0.19	0.00	0.20	0.00
More > median experience	0.37	0.00	0.42	0.00
Industry Variables				
Construction and mining	0.15	0.00	0.12	0.00
Manufacturing	0.07	0.00	0.07	0.00
Transportation	0.03	0.00	0.04	0.00
Wholesale trade	0.05	0.00	0.06	0.00
Retail trade	0.21	0.00	0.18	0.00
Insurance agents and real estate	0.09	0.00	0.07	0.00
Business services	0.21	0.00	0.25	0.00
Professional services	0.19*	0.00	0.21	0.00
Business or professional services	0.39*	0.00	0.46	0.00
Division Variables				
New England	0.11**	0.00	0.15	0.00
Mid Atlantic	0.06	0.00	0.05	0.00
East N Central	0.09***	0.00	0.14	0.00
West N Central	0.13**	0.00	0.07	0.00
South Atlantic	0.04*	0.00	0.06	0.00
East S Central	0.20	0.00	0.16	0.00
West S Central	0.19	0.00	0.19	0.00
Mountain	0.07	0.00	0.07	0.00
Pacific	0.13	0.00	0.10	0.00
Market Condition Variables				
Population density (% Δ 2004-08)	178.85*	145.93	149.76	98.56
Unemployment rate (% Δ2004-08)	6.31	2.96	5.88	5.25
Establishment density (% Δ 2004-08)	4.94	5.33	4.30	3.85
Per capital income (% Δ 2004-08)	20.10	20.11	20.24	20.03
Average wage (% Δ 2004-08)	16.53	15.89	16.10	15.69

Notes: Means and medians are based on the firms that were matched to the NETS database and had assets greater than zero and sales of more than $1,000 when interviewed in the 2003 SSBF and have been weighted to account for sampling. Standard errors have been adjusted to account for the multiple imputation * significant at 10%; ** significant at 5%; *** significant at 1%. † indicates $1 was added to the value to avoid $0 in the denominator.

Table 4: Log odds ratios from logistic models of going out of business

	Baseline model (1)	(1) + owner experience & age (2)	(2) + real estate prices (FHFA) (3)	(2) + real estate prices (LP) (4)	(3) + geographic controls (5)	(4) + geographic controls (6)
Credit Quality Variables						
Firm credit score	0.994	0.994	0.994	0.994	0.994	0.994
	(2.12)**	(2.12)**	(2.07)**	(2.14)**	(2.08)**	(2.14)**
Firm or owner declared bankruptcy	1.088	1.084	1.120	1.093	1.118	1.096
	(0.20)	(0.19)	(0.27)	(0.21)	(0.27)	(0.22)
Firm or owner delinquent 3+ times	1.306	1.340	1.302	1.326	1.321	1.341
	(1.14)	(1.25)	(1.11)	(1.20)	(1.16)	(1.24)
Judgment against the firm or owner	2.529	2.501	2.496	2.526	2.586	2.595
	(2.81)***	(2.78)***	(2.78)***	(2.81)***	(2.86)***	(2.87)***
Had no D&B rating in 2003	6.175	6.326	6.338	6.358	6.392	6.404
	(5.29)***	(5.32)***	(5.28)***	(5.29)***	(5.31)***	(5.33)***
Credit Access Variables						
Firms fearing denial	0.884	0.892	0.909	0.903	0.897	0.892
	(0.54)	(0.50)	(0.42)	(0.44)	(0.48)	(0.50)
Borrowing on credit cards	1.409	1.435	1.437	1.430	1.451	1.447
	(1.70)*	(1.80)*	(1.81)*	(1.79)*	(1.87)*	(1.85)*
Borrowing on trade credit	1.528	1.563	1.578	1.571	1.592	1.585
	(2.17)**	(2.29)**	(2.33)**	(2.32)**	(2.39)**	(2.38)**
Been denied trade credit	0.873	0.874	0.865	0.861	0.863	0.860
	(0.38)	(0.38)	(0.41)	(0.42)	(0.42)	(0.43)
Firms using real estate as collateral	1.191	1.201	1.201	1.205	1.185	1.184
	(0.86)	(0.90)	(0.90)	(0.92)	(0.84)	(0.83)
LP home prices (% Δ 2004-08)				0.991		0.996
				(1.44)		(0.60)
FHFA home prices (% Δ 2004-08)			0.990		0.993	
			(1.64)		(0.97)	
Firm/Owner Variables						
Firm age	0.990	0.986	0.986	0.986	0.985	0.985
	(1.28)	(1.61)	(1.58)	(1.60)	(1.68)*	(1.69)*
Firms employment	1.000	1.000	1.000	1.000	1.000	1.000
	(0.05)	(0.02)	(0.00)	(0.01)	(0.06)	(0.07)
Log of firm assets	1.082	1.077	1.076	1.077	1.079	1.080
	(1.21)	(1.12)	(1.10)	(1.12)	(1.17)	(1.18)
Log of firm sales	1.018	1.027	1.025	1.025	1.025	1.026
	(0.24)	(0.37)	(0.35)	(0.34)	(0.34)	(0.35)
Firm has zero or negative equity	1.073	1.066	1.055	1.053	1.047	1.046
	(0.32)	(0.29)	(0.24)	(0.23)	(0.21)	(0.20)
Financial Ratio Variables						
Liabilities/assets ratio	0.978	0.976	0.976	0.976	0.976	0.977
	(1.25)	(1.25)	(1.31)	(1.26)	(1.35)	(1.31)

Table 4: Log odds ratios from logistic models of going out of business — continued

	Baseline model (1)	(1) + owner experience & age (2)	(2) + real estate prices (FHFA) (3)	(2) + real estate prices (LP) (4)	(3) + geographic controls (5)	(4) + geographic controls (6)
Cash/sales ratio	1.397	1.399	1.398	1.399	1.401	1.403
	(2.73)***	(2.82)***	(2.76)***	(2.76)***	(2.77)***	(2.78)***
Accounts payable/sales ratio	0.411	0.406	0.400	0.404	0.402	0.405
	(1.78)*	(1.77)*	(1.71)*	(1.71)*	(1.76)*	(1.77)*
Pretax profit/asset ratio	1.002	1.002	1.002	1.002	1.002	1.002
	(0.88)	(0.86)	(0.91)	(0.86)	(0.96)	(0.94)
Pretax profit/liabilities ratio	1.000	1.000	1.000	1.000	1.000	1.000
	(0.87)	(0.90)	(0.87)	(0.90)	(0.86)	(0.88)
Division Variables						
New England	0.708	0.720	0.607	0.616	0.637	0.650
	(1.23)	(1.16)	(1.66)*	(1.59)	(1.37)	(1.27)
Mid Atlantic	0.986	1.008	0.993	1.028	0.956	0.965
	(0.03)	(0.02)	(0.02)	(0.07)	(0.10)	(0.08)
East N Central	0.584	0.588	0.592	0.603	0.618	0.628
	(1.86)*	(1.83)*	(1.81)*	(1.74)*	(1.49)	(1.45)
West N Central	1.939	1.973	2.103	2.050	2.065	2.047
	(2.28)**	(2.34)**	(2.56)**	(2.46)**	(2.23)**	(2.19)**
South Atlantic	0.568	0.578	0.513	0.529	0.550	0.569
	(1.39)	(1.35)	(1.62)	(1.56)	(1.39)	(1.32)
East S Central	1.261	1.281	1.202	1.204	1.235	1.262
	(0.89)	(0.95)	(0.70)	(0.72)	(0.73)	(0.83)
Mountain	0.980	1.010	0.933	0.938	1.015	1.034
	(0.06)	(0.03)	(0.19)	(0.18)	(0.04)	(0.09)
Pacific	1.105	1.109	1.079	1.103	1.226	1.272
	(0.34)	(0.35)	(0.26)	(0.33)	(0.57)	(0.68)
Industry Variables						
Construction and mining	1.904	1.937	1.933	1.949	1.975	1.990
	(2.29)**	(2.35)**	(2.35)**	(2.36)**	(2.44)**	(2.46)**
Manufacturing	1.593	1.570	1.548	1.576	1.549	1.568
	(1.51)	(1.46)	(1.40)	(1.47)	(1.40)	(1.44)
Transportation	1.115	1.120	1.110	1.130	1.137	1.152
	(0.25)	(0.26)	(0.24)	(0.28)	(0.30)	(0.33)
Wholesale trade	1.344	1.311	1.311	1.317	1.305	1.312
	(0.79)	(0.72)	(0.73)	(0.74)	(0.72)	(0.73)
Retail trade	1.588	1.569	1.565	1.560	1.601	1.601
	(1.95)*	(1.90)*	(1.89)*	(1.88)*	(1.96)*	(1.96)*
Insurance agents and real estate	1.556	1.516	1.510	1.494	1.532	1.523
	(1.24)	(1.17)	(1.15)	(1.12)	(1.19)	(1.18)
Professional services	1.131	1.124	1.120	1.125	1.135	1.137
	(0.51)	(0.48)	(0.47)	(0.49)	(0.52)	(0.52)

Table 4: Log odds ratios from logistic models of going out of business — continued

	Baseline model (1)	(1) + owner experience & age (2)	(2) + real estate prices (FHFA) (3)	(2) + real estate prices (LP) (4)	(3) + geographic controls (5)	(4) + geographic controls (6)
Owner over 60 years old		1.373	1.385	1.377	1.351	1.344
		(1.48)	(1.52)	(1.49)	(1.41)	(1.39)
Owner > median experience		1.023	1.016	1.021	1.036	1.041
		(0.11)	(0.08)	(0.10)	(0.18)	(0.20)
Geographic Variables						
Population density (% Δ 2004-08)					1.000	1.000
					(0.24)	(0.31)
Average wage (% Δ 2004-08)					1.046	1.045
					(2.03)**	(1.98)**
Unemployment rate (% Δ 2004-08)					1.003	1.003
					(0.54)	(0.55)
Establishment density (% Δ 2004-08)					0.986	0.983
					(0.58)	(0.70)
Per capital income (% Δ 2004-08)					0.969	0.967
					(1.59)	(1.70)*
	0.994	0.994	0.994	0.994	0.994	0.994
Observations	.	.	.	.	.	.
F Test: Division Variables $= 0$	2.58	2.59	2.97	2.80	1.85	1.79
P-Val: Division Variables $= 0$	0.01	0.01	0.00	0.00	0.06	0.08
F Test: Quality of Credit Variables $= 0$	8.21	8.31	8.20	8.30	8.31	8.42
P-Val: Quality of Credit Variables $= 0$	0.00	0.00	0.00	0.00	0.00	0.00
F Test: Constraint Variables $= 0$	2.21	2.43	2.54	2.48	2.59	2.54
P-Val: Constraint Variables $= 0$	0.05	0.03	0.03	0.03	0.02	0.03
F Test: Size Variables $= 0$	1.01	1.31	1.24	1.26	1.33	1.35
P-Val: Size Variables $= 0$	0.41	0.26	0.29	0.28	0.25	0.24
F Test: Ratio Variables $= 0$	2.27	2.45	2.42	2.41	2.43	2.43
P-Val: Ratio Variables $= 0$	0.05	0.03	0.03	0.03	0.03	0.03
F Test: Industry Variables $= 0$	1.24	1.25	1.24	1.24	1.30	1.32
P-Val: Industry Variables $= 0$	0.28	0.27	0.28	0.28	0.24	0.24
F Test: Geographic Variables $= 0$					1.08	1.11
P-Val: Geographic Variables $= 0$					0.37	0.35

Notes: t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimates and standard errors have been adjusted for multiple imputations.

Table 5: Hazard ratios from proportional hazard model of time until out of business

	Baseline model (1)	(1) + owner experience & age (2)	(2) + real estate prices (FHFA) (3)	(2) + real estate prices (LP) (4)	(3) + geographic controls (5)	(4) + geographic controls (6)
Credit Quality Variables						
Firm credit score	1.000	1.000	1.000	1.000	1.000	1.000
	(1.76)*	(1.77)*	(1.77)*	(1.69)*	(1.75)*	(1.68)*
Firm or owner declared bankruptcy	0.996	0.996	0.995	0.996	0.997	1.000
	(0.10)	(0.09)	(0.12)	(0.08)	(0.07)	(0.01)
Firm or owner delinquent 3+ times	1.035	1.036	1.037	1.038	1.035	1.036
	(1.19)	(1.24)	(1.28)	(1.31)	(1.21)	(1.23)
Judgment against the firm or owner	1.106	1.105	1.105	1.104	1.108	1.106
	(1.70)*	(1.69)*	(1.68)*	(1.67)*	(1.72)*	(1.70)*
Has a no D&B rating	1.114	1.114	1.113	1.113	1.113	1.112
	(6.08)***	(6.08)***	(6.08)***	(6.06)***	(6.07)***	(6.06)***
Credit Access Variables						
Firms fearing denial	0.986	0.986	0.986	0.986	0.986	0.986
	(0.59)	(0.57)	(0.57)	(0.58)	(0.58)	(0.59)
Borrowing on credit cards	1.032	1.034	1.034	1.034	1.035	1.035
	(1.51)	(1.57)	(1.57)	(1.58)	(1.61)	(1.61)
Borrowing on trade credit	1.040	1.040	1.040	1.040	1.040	1.040
	(1.86)*	(1.91)*	(1.91)*	(1.90)*	(1.90)*	(1.90)*
Been denied trade credit	0.989	0.989	0.989	0.988	0.986	0.986
	(0.27)	(0.28)	(0.27)	(0.30)	(0.33)	(0.34)
Firms using real estate as collateral	1.015	1.016	1.015	1.015	1.015	1.015
	(0.73)	(0.78)	(0.76)	(0.75)	(0.74)	(0.76)
LP home prices (% Δ year$_{t-1}$-year$_t$)				1.003		1.003
				(1.67)*		(1.61)
FHFA home prices (% Δ year$_{t-1}$-year$_t$)			1.001		1.001	
			(0.60)		(0.63)	
Firm/Owner Variables						
Firm age	0.999	0.999	0.999	0.999	0.999	0.999
	(1.33)	(1.53)	(1.55)	(1.60)	(1.38)	(1.42)
Firms employment	1.000	1.000	1.000	1.000	1.000	1.000
	(0.57)	(0.62)	(0.65)	(0.68)	(0.71)	(0.74)
Log of firm assets	1.006	1.006	1.006	1.006	1.006	1.006
	(1.02)	(0.93)	(0.89)	(0.87)	(1.00)	(0.98)
Log of firm sales	1.005	1.006	1.006	1.007	1.006	1.006
	(0.77)	(0.87)	(0.90)	(0.95)	(0.83)	(0.86)
Firm has zero or negative equity	0.999	0.999	0.999	1.000	0.997	0.997
	(0.03)	(0.07)	(0.05)	(0.02)	(0.13)	(0.13)
Financial Ratio Variables						
Liabilities/assets ratio	0.999	0.999	0.999	0.999	0.999	0.999
	(0.72)	(0.74)	(0.73)	(0.72)	(0.78)	(0.78)

Table 5: Hazard ratios from proportional hazard model of time until out of business — (continued)

	Baseline model	(1) + owner experience & age	(2) + real estate prices (FHFA)	(2) + real estate prices (LP)	(3) + geographic controls	(4) + geographic controls
	(1)	(2)	(3)	(4)	(5)	(6)
Cash/sales ratio	1.036	1.036	1.036	1.037	1.036	1.036
	(2.27)**	(2.31)**	(2.30)**	(2.34)**	(2.25)**	(2.30)**
Accounts payable/sales ratio	0.966	0.965	0.965	0.965	0.965	0.964
	(2.35)**	(2.47)**	(2.42)**	(2.46)**	(2.58)***	(2.62)***
Pretax profit/asset ratio	1.000	1.000	1.000	1.000	1.000	1.000
	(0.73)	(0.75)	(0.74)	(0.73)	(0.80)	(0.79)
Pretax profit/liabilities ratio	1.000	1.000	1.000	1.000	1.000	1.000
	(0.52)	(0.54)	(0.54)	(0.56)	(0.51)	(0.53)
Division Variables						
New England	0.967	0.968	0.965	0.964	0.961	0.960
	(1.54)	(1.50)	(1.51)	(1.64)	(1.54)	(1.67)*
Mid Atlantic	1.001	1.002	0.995	0.979	1.000	0.984
	(0.03)	(0.06)	(0.11)	(0.49)	(0.01)	(0.36)
East N Central	0.961	0.961	0.957	0.943	0.950	0.932
	(1.93)*	(1.90)*	(1.86)*	(2.25)**	(1.68)*	(2.15)**
West N Central	1.068	1.069	1.066	1.069	1.068	1.072
	(1.81)*	(1.83)*	(1.74)*	(1.82)*	(1.77)*	(1.87)*
South Atlantic	0.957	0.958	0.956	0.945	0.934	0.925
	(1.65)*	(1.60)	(1.63)	(1.89)*	(2.03)**	(2.25)**
East S Central	1.014	1.015	1.020	1.028	1.010	1.017
	(0.56)	(0.59)	(0.70)	(1.01)	(0.37)	(0.60)
Mountain	1.000	1.001	0.995	0.985	0.988	0.980
	(0.01)	(0.02)	(0.12)	(0.37)	(0.31)	(0.51)
Pacific	1.013	1.013	1.005	0.996	1.001	0.993
	(0.44)	(0.44)	(0.15)	(0.11)	(0.02)	(0.21)
Industry Variables						
Construction and mining	1.059	1.061	1.061	1.060	1.063	1.063
	(2.00)**	(2.05)**	(2.05)**	(2.04)**	(2.12)**	(2.12)**
Manufacturing	1.038	1.037	1.038	1.038	1.038	1.038
	(1.48)	(1.44)	(1.46)	(1.49)	(1.46)	(1.48)
Transportation	1.007	1.008	1.007	1.007	1.012	1.012
	(0.20)	(0.22)	(0.22)	(0.21)	(0.35)	(0.34)
Wholesale trade	1.024	1.021	1.022	1.021	1.023	1.022
	(0.85)	(0.77)	(0.78)	(0.76)	(0.83)	(0.79)
Retail trade	1.037	1.036	1.036	1.036	1.036	1.036
	(1.73)*	(1.68)*	(1.68)*	(1.68)*	(1.67)*	(1.66)*
Insurance agents and real estate	1.041	1.038	1.039	1.039	1.035	1.035
	(0.98)	(0.92)	(0.93)	(0.95)	(0.83)	(0.83)
Professional services	1.007	1.007	1.007	1.007	1.006	1.006
	(0.37)	(0.34)	(0.36)	(0.35)	(0.32)	(0.29)
Owner over 60 years old		1.023	1.023	1.023	1.022	1.022

	Baseline model	(1) + owner experience & age	(2) + real estate prices (FHFA)	(2) + real estate prices (LP)	(3) + geographic controls	(4) + geographic controls
	(1)	(2)	(3)	(4)	(5)	(6)
		(1.20)	(1.20)	(1.19)	(1.17)	(1.15)
Owner > median experience		0.998	0.998	0.999	0.998	0.999
		(0.10)	(0.10)	(0.08)	(0.10)	(0.08)
Geographic Variables						
Population density (year $_{t-1}$)					1.002	1.002
					(0.23)	(0.29)
Average wage (year $_{t-1}$)					1.000	1.000
					(0.97)	(0.96)
Unemployment rate (year $_{t-1}$)					0.995	0.995
					(1.02)	(0.98)
Establishment density (year $_{t-1}$)					1.000	1.000
					(0.70)	(0.58)
Per capital income (year $_{t-1}$)					1.000	1.000
					(1.29)	(1.15)
Observations	.	.	.	.	.	.
F Test: Division Variables = 0	2.24	2.23	2.12	2.13	2.03	2.09
P-Val: Division Variables = 0	0.02	0.02	0.03	0.03	0.04	0.03
F Test: Quality of Credit Variables = 0	8.84	8.88	8.84	8.76	8.95	8.88
P-Val: Quality of Credit Variables = 0	0.00	0.00	0.00	0.00	0.00	0.00
F Test: Constraint Variables = 0	1.65	1.77	1.75	1.75	1.75	1.77
P-Val: Constraint Variables = 0	0.14	0.12	0.12	0.12	0.12	0.12
F Test: Size Variables = 0	1.34	1.52	1.54	1.59	1.38	1.41
P-Val: Size Variables = 0	0.24	0.18	0.17	0.16	0.23	0.22
F Test: Ratio Variables = 0	1.30	1.36	1.33	1.39	1.33	1.40
P-Val: Ratio Variables = 0	0.27	0.24	0.25	0.23	0.25	0.23
F Test: Industry Variables = 0	1.08	1.06	1.07	1.08	1.08	1.09
P-Val: Industry Variables = 0	0.37	0.39	0.38	0.38	0.37	0.37
F Test: Geographic Variables = 0					0.79	0.88
P-Val: Geographic Variables = 0					0.55	0.49

Notes: t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimates and standard errors have been adjusted for multiple imputations.

Variable	Definition
Credit Quality Variables	
Firm credit score	Firm D&B credit score ranking percentile; 0-100, with 0 being the worst ranking
Firm or owner declared bankruptcy	Indicator if either firm or owner declared bankruptcy in past 7 years; yes=1, no=0
Firm or owner delinquent 3+ times	Indicator if either firm or owner was 60+ days delinquent on payments 3+ times in the past 3 years; ; yes=1, no=0
Judgment against the firm or owner	Indicator if either firm or owner had a judgment rendered against them in the past 3 years; yes=1, no=0
Had high or good D&B rating in 2003	D&B creditworthiness assessment based on both payments and financial stability information of the individual firm; good or high=1, else=0
Had fair D&B rating in 2003	D&B creditworthiness assessment based on both payments and financial stability information of the individual firm; fair=1, else=0
Had limited D&B rating in 2003	D&B creditworthiness assessment based on both payments and financial stability information of the individual firm; limited=1, else=0
Had no D&B rating in 2003	Creditworthiness not assessed by D&B due to lack of information; no score=1, else=0
Credit Access Variables	
Firms fearing denial	Indicator that the firm did not apply for credit because it was afraid of denial; yes=1, no=0
Borrowing on credit cards	indicator that firm carried a balance on a credit card; yes=1, no=0
Borrowing on trade credit	Indicator that the firm paid trade credit after the grace period; yes=1, no=0
Been denied trade credit	Indicator that the firm applied for and was denied trade credit; yes=1, no=0
Firms using real estate as collateral	firm has at least one loan collateralized by real estate; 1=yes, 0=no
LP home prices (% Δ 2004-08)	Percentage change in house price index within the MSA/rural county where the firm's headquarters was located, using the CoreLogic LoanPerformance price index. Note in Hazard models, one year changes are used.
FHFA home prices (% Δ 2004-08)	Percentage change in house price index within the state where the firm's headquarters was located, using the FHFA price index. Note in Hazard models, one year changes are used.
Firm/Owner Variables	
Firm age	Firm age in years

Appendix A: Variable Descriptions — continued

Variable	Definition
Firms employment	Total firm employment
Log of firm assets	
Log of firm sales	
Firm has zero or negative equity	Indicator that the firm has zero or negative equity; yes=1, no=0
Financial Ratio Variables	
Liabilities/assets ratio	Leverage ratio: liabilities/assets
Cash/sales ratio	Liquidity ratio: cash/sales
Accounts payable/sales ratio	Activity ratio: accounts payable/sales
Pretax profit/asset ratio	Profit ratio: pretax profit/assets
Pretax profit/liabilities ratio	Coverage ratio: pretax profit/liabilities
Division Variables	
New England	Indicator that firms headquarters are located in the New England Census Division; yes=1, no=0
Mid Atlantic	Indicator that firms headquarters are located in the Mid Atlantic Division; yes=1, no=0
East N Central	Indicator that firms headquarters are located in the East North Central Census Division; yes=1, no=0
West N Central	Indicator that firms headquarters are located in the West North Central Census Division; yes=1, no=0
South Atlantic	Indicator that firms headquarters are located in the South Atlantic Census Division; yes=1, no=0
East S Central	Indicator that firms headquarters are located in the East South Central Census Division; yes=1, no=0
West S Central	Indicator that firms headquarters are located in the West South Central Census Division; yes=1, no=0
Mountain	Indicator that firms headquarters are located in the Mountain Census Division; yes=1, no=0
Pacific	Indicator that firms headquarters are located in the Pacific Census Division; yes=1, no=0
Industry Variables	
Construction and mining	Indicator that the firm's primary industry is construction or mining; yes=1, no=0
Manufacturing	Indicator that the firm's primary industry is manufacturing; yes=1, no=0
Transportation	Indicator that the firm's primary industry is transportation; yes=1, no=0

Variable	*Definition*
Wholesale trade	Indicator that the firm's primary industry is wholesale trade; yes=1, no=0
Retail trade	Indicator that the firm's primary industry is retail trade; yes=1, no=0
Insurance agents and real estate	Indicator that the firm's primary industry is insurance agents or real estate; yes=1, no=0
Business services	Indicator that the firm's primary industry is business services; yes=1, no=0
Professional services	Indicator that the firm's primary industry is professional services; yes=1, no=0
Additional Owner Variables	
Owner over 60 years old	Indicator that the owner with largest share of business was more than 60 in 2004; yes=1, no=1
Owner > median experience	Indicator that the owner with largest share of business had more than 20 years of experience running the business in 2004; yes=1, no=1
Geographic Variables	
Population density	Persons per square mile within the MSA/rural county where the firm's headquarters were located
Average wage	Average wage earnings per job within the MSA/rural county where the firm's headquarters were located
Unemployment rate	Unemployment rate within the MSA/rural county where the firm's headquarters were located
Establishment density	Establishments per square mile within the MSA/rural county where the firm's headquarters were located
Per capita income	Per capita income within the MSA/rural county where the firm's headquarters were located

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