2012

Three Essays on Financing and Investment Decisions in Small U.s. Firms

F. Blaise Roncagli
Cleveland State University

THREE ESSAYS ON FINANCING AND INVESTMENT DECISIONS IN SMALL U.S. FIRMS

F. BLAISE RONCAGLI

Bachelor of Science in Chemistry
John Carroll University
May 1975

Master of Business Administration
John Carroll University
January 2002

submitted in partial fulfillment of requirements for the degree

DOCTOR OF BUSINESS ADMINISTRATION

at the

CLEVELAND STATE UNIVERSITY

DECEMBER 2012

This dissertation has been approved

for the Department of FINANCE

and the College of Graduate Studies by

_____

Dissertation Chairperson, Dr. Chenchu Bathala

_____

Department & Date

_____

Dr. Ravi Kamath

_____

Department & Date

_____

Dr. Walter Rom

_____

Department & Date

_____

Dr. Billy Kosteas

_____

Department & Date

THREE ESSAYS ON FINANCING AND INVESTMENT DECISIONS IN SMALL U.S. FIRMS

F. BLAISE RONCAGLI

ABSTRACT

This dissertation consists of three essays related to the financing and investment decisions of small U.S. firms. Each of the essays presents interesting and original empirical research questions, with hypotheses well-grounded in finance and economic theories. The empirical methodology, data and models that are used to test the hypotheses are presented for each essay. The three empirical questions addressed are (1) Why don't small firms take every trade credit discount offered to them? (2) What determines the cash holdings of small firms? and (3) Why do small firms make investments unrelated to their core business? This dissertation answers these questions by analyzing the data available in the National Survey of Small Business Firms (NSSBF) conducting in 1998 and 2003.

Essay 1 investigates the usage of trade credit discounts by small firms and examines the determinants of the buyer's decision to accept or reject discounts that have been offered by the seller as part of their trade credit terms. It draws upon two theories to illuminate the firm's motivation for taking or rejecting trade credit discounts, i.e., the Pecking Order Theory of capital structure originated by Myers and Majluf (1984), and the theory of manager-shareholder agency conflict first described by Jensen and Meckling (1976). Both theories offer empirically testable and competing hypothesis that relate the firm's decision to accept or reject discounts to the firm's capital structure, its ability to meet financial obligations in a timely manner, and agency costs. This essay contributes to the literature on trade credit discount usage in a number of ways. First, this

is the first study that examines the failure to take trade credit discounts as a possible agency cost to the firm to examine the effect of credit card usage by small firms on taking trade credit discounts. This is also the first study to consider the transaction costs of taking trade credit as a determinant in the decision to do so.

Essay 2 examines variations in firms' cash holdings and will relate them to agency costs and management monitoring, substitutes for cash, short and long-term financial obligations, management/firm competency in cash management, and other control variables. It builds upon previous work by Ang, Cole and Lin (2000) on agency costs in small firms, as well as work by Opler, et al. (1999) on the determinants of cash holdings. This essay also draws upon the literature on bank monitoring, relationship lending and shareholder-creditor agency problems in small firms for determinants of agency costs in this sample of small firms. Further, it builds on the work of Faulkender (2002) to examine the hypotheses that accumulation of cash is a form of non-value-maximizing behavior for the small firm owner and may represent an agency cost to the firm in the presence of other shareholders. In addition, the consideration of the impact of family ownership and the inherited/purchased status of the firm on cash holdings is unique to this essay. The results of separate estimations using the data from 1998 and 2003 surveys have enabled interpretation of some of the observed results in the context of the very different macroeconomic environments. Such comparisons between the results of the two estimations provided an additional dimension to the analysis that had not previously been undertaken.

Essay 3 examines why some small firms choose to invest in assets that are not necessarily related to or supportive of their core business, such as loans to shareholders, mortgages, investments in other firms, and artwork. Two finance theories that are

examined to explain the motivations of small firm owners and managers in the area of firm investments are the Agency Theory of Jensen and Meckling (1976) and the Free Cash Flow Theory of Jensen (1986). The "other investments" made by the small firm is modeled as a function of agency costs and management monitoring, firm's free cash flows, and diversification potential. The NSSBF surveys used for this study provided a unique opportunity to relate the degree of the primary owner's commitment of wealth to the firm, to the firm's other investments. This made it possible to investigate a personal diversification motive as the reason for the small firm's investment in non-core investments. Further, results from separate estimations using the 1998 and 2003 NSSBF surveys lent themselves to interpretation of some of the results from the standpoint of the prevailing macroeconomic environments.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Small firms of less than 500 employees constitute the majority of firms in the U.S., and are collectively the largest employer in the U.S. These firms tend to be owned by individuals, small groups of investors or families, with other minority equity holders represented by angel investors, extended family, friends, and venture capitalists. Small firms are very closely held, with one or a small group of owners owning a controlling interest in the firm. Unlike large, publicly-owned corporations, small firms possess certain unique ownership and governance structures. They also largely differ from publicly-owned firms in matters relating to corporate governance, agency problems, and information asymmetry which in turn have implications for the financing sources, relation to capital providers, heavy reliance on bank financing and the associated lending relationships, and so forth. This dissertation addresses some of these peculiarities through the hypotheses and data analyses in three different essays. For empirical examination, the dissertation uses the National Survey of Small Business Finance (NSSBF) data from two different surveys, 1998 and 2003. The chapters that follow provide a disposition of the theoretical constructs that provide a framework for the development of hypotheses, empirical methodology, and inferences from the findings.

The NSSBF data and the different variables to be used in the dissertation are also included. Finally, the contributions from the dissertation are briefly narrated.

1.1 Ownership and Structure of Small Firms

The model of a firm held by a single primary owner who owns 50% or more of the firm, who in most cases is also the manager of the firm, is frequently encountered among the population of small firms. According to the 2003 National Survey of Small Business Finance (NSSBF), 18% of the population of 6.3 million small U.S. firms has a primary owner who holds exactly 50% ownership in the firm, while 58% have a primary owner who holds 100% ownership in the firm. Ninety percent of small U.S. firms are exclusively owned by a single family, and 94% of all small firms are managed by one of the owners rather than a hired professional. The age of small U.S. firms ranges from 1 to 103 years, with a mean of 14.3 years. Seventy-nine percent of small U.S. firms were founded by their current owners, while 3.7% were inherited and 17.3% were purchased.

Regarding industry affiliation, 11.5% are in construction, 3.8% are in transportation, 5.9% are in wholesale, 18.4% are in retail, 7.1% are in manufacturing, 45.8% are in services, 0.3% are in mining and 7.2% are in financial services. Most small U.S. firms (79.4%) are located in an urban MSA; only 20.4% are located in a rural area.

Regarding number of owners, 58% of small U.S. firms have one owner, 31% have two owners, 5.5% have three owners, 2.7% have four owners, and the remaining 2.8% of the population of small firms have ownership spread between 5 and 3800 owners. It is very common for owners to also work for the firm. Twenty-seven percent of small firms are entirely staffed by owners, while 17% employ owners as 50% of their workforce, 11% employ owners as 33% of their workforce, and 7% employ owners as 25% of their workforce. Only 1.2% of small firms employ no owners at all in their workforce.

Regarding firm organization type, 42.5% are sole Proprietorships, 5.5% are partnerships, 31.0% are S-corporations, 14.4% are C-corporations and the remaining 6.6% of small U.S. firms are structured as limited liability partnerships (LLP) or limited liability corporations (LLC). Only 0.04% of small U.S. firms are publicly traded. Thirty-four percent of small firms having a single owner are structured as sole proprietorships, while 15% of single owner firms are S-Corporations, and 5.7% of single owner firms are C-Corporations. Even among single owner firms, the benefits of incorporation in separating the assets of the entrepreneur from the liabilities of the firm are apparently appreciated.

Only 3.3% of small firms had declared bankruptcy within the seven years preceding the survey date, or had a judgment against them within the three years preceding the survey date. However, 15.7% had been more than sixty days delinquent on an obligation one or more times within the three years preceding the survey date.

Regarding owner characteristics, in 22.3% of small U.S. firms women hold more than 50% of the ownership stake, while 9.3% are minority-owned. The owners' age ranges from 19 to 93 years, with a mean of 51.5 years. The owners' experience managing any business ranges from 0 to 65 years, with a mean of 19.3 years. The highest level of education attained by the owner is High School graduate for 19.3%, some college but no degree for 16.3%, Associate Degree for 9.2%, Trade School graduate for 6.9%, a college degree for 26.3% and a post-graduate degree for 20.4% of owners.

Only 4.4 % of small firm owners had declared bankruptcy within the seven years preceding the survey date, or had a judgment against them within the three years preceding the survey date. However, 12% of those owners had been more than sixty days

delinquent on a personal obligation one or more times within the three years preceding the survey date.

1.2 Financing Sources for Small Firms

Most small U.S. firms are not publicly traded and issue no public debt or equity, but rely on financial institutions such as banks and finance companies, trade credit, and even friends and family members or other shareholders, for debt financing. These firms also tend to be informationally opaque relative to large public corporations. A lack of participation in public financial markets means that little information is publicly available regarding the firm's history, current condition or future prospects.

According to the 2003 NSSBF survey, 84.2% of small U.S. firms report using a commercial bank as their primary source of financial services, 8.2% report using a savings bank, 1.3% report using a savings and loan, 3.7% report using a credit union, 1% report using a finance company, 0.8% report using a brokerage or mutual fund company, and only 0.2% report that family or another individual is their primary source of financial services. Regarding loans as a source of finance, 13.3% report holding a mortgage, 25.5% report having a motor vehicle loan, 10.3% report having a loan for equipment, 30.3% report accepting loans from firm owners, 10.1% report having miscellaneous other loans, and 8.7% report using leasing as a source of financing.

During the three years preceding 2003, 34.2% of small U.S. firms reported applying for one or more loans or renewal of a line of credit. Of those firms that did apply, 14.9% reported being turned down on at least one of these applications. Of those who were turned down, 46.2% of rejections were for a new line of credit, 0.7% were for a capital lease, 14.8% were for a mortgage for business purposes, 4.9% were for a business vehicle loan, 12.7% were for an equipment loan, 13.2% were for an "other" type of loan

and 7.4% were for a line of credit renewal. Approximately 17.9% of small firms stated that they did not even bother to apply for a loan during that period because they feared they would be turned down, even though they needed credit. The most common reason cited by 21.4% was "poor balance sheet or financial situation", followed by "credit history" cited by 14.2%, "firm not in business long enough (including young management)" by 13.4%, "personal credit history" by 9.0%, "large amount of outstanding loans, overextended" by 8.2%, "firm too small for institution, too few assets" by 6.5%, "insufficient collateral or no guarantee available" by 4.5%, "experience with previous loan applications" by 3.4%, "firm would fail institution's guidelines" by 2.8% , "other" by 2.7%, "firm in decline or risky industry" by 2.6%, "firm too highly leveraged, too little equity" by 2.1%, "not ascertainable" by 1.2% and "slow, weak economy" by 1.1%.

The fact that 30.3% of small firms that accept loans from firm owners is notable, as accepting such loans does not obligate the firm to outside entities or their scrutiny, and does not put control of the firm at risk as a loan from a financial institution would. Of those firms that report having loans from shareholders, 71% report having one loan, 17.4% report having two loans, 5% report having three loans, 2.6% report having four loans and 1.2% report having five loans. The remaining 2.8% of small firms report having from 6 to 24 loans from shareholders. The outstanding principal owed on all of the firm's shareholder loans to the total reported liabilities of the firm, on average, stands at 122%

No sole proprietorships reported having shareholder loans. All other forms of firm organization did report having shareholder loans, though, in the following order: C-

Corporations 17.5%, S-Corporations 8.4%, Limited-liability Partnerships and Corporations 2.3%, Partnerships 2.1%.

The average length of the relationship between a small U.S. firm and its primary financial institution is 124 months. The average distance to that primary financial institution is 34.4 miles. The average length of the relationship between the firm and the financial institution with which it has had its longest relationship (not necessarily the primary one) is 146 months and the average distance to that institution was 7.1 miles. On average, small firms maintained relationships with 2.4 separate financial institutions. Small firms tend to benefit from developing long-term relationships with lenders, which allows the lender time to gather information about the prospects and character of the firm and its owners, thus alleviating the information asymmetry problem between firm and lender (Elyasiani and Goldberg, 2004).

Small firms also use credit cards as a source of financing, with 46.7% reporting that they use the owner's personal credit card to pay business expenses, and 48.1% reporting that they use the firm's credit card to pay business expenses. As high as 72.8% of firms using the owner's personal card pay the balance in full each month, and 70.7% of firms using the firm's card pay the balance in full each month. The average interest rate reported for the owner's credit card is 8.0%, and 6.7% for the firm's credit card. The survey does not indicate whether or not either the owner's credit card or the firm's credit card has a grace period during which interest is not accrued on new charges. However, the large percentage of firms reporting that they pay the card balance in full each month would suggest that they do have a grace period, as carrying a zero balance month-to-month is a prerequisite in many cases for the grace period to take effect. The advantage

of having a credit card with a grace period is that it could potentially be used as a source of very inexpensive or free short-term credit for a firm that paid the card off every month.

Trade credit is an important source of short-term finance for small firms, with 60% of firms reporting that they made purchases on credit within the past 12 months. on average, the purchases made on credit was 64.4% of their total purchases. Discounts for early payment were offered on average by about 17.8% of the firm's trade credit suppliers. Firms took on average 53.5% of the discounts offered, choosing 46.5% of the time to use expensive trade credit instead of taking the discount. Trade credit represents on average about 27% of the total liabilities of the typical small U.S. firm, so it is a significant source of finance for these firms.

Equity financing is not a frequently used source of financing for the majority of small U.S. firms. Only 2.8% of sole proprietorships and partnerships reported receiving an equity investment from new or existing owners/partners within the past 12 months. Fifty-one percent of those firms report using that equity for working capital, 14.6% report using it for land and buildings, 11.8% for equipment or machinery, 4.7% for debt relief, 4.5% for "other", 4.0% for leasehold improvements, 3.8% report using it for "multiple uses", 2.3% for furniture and fixtures, and 1.9% for motor vehicles.

Coincidentally, only 2.8% of S-Corporations and C-Corporations reported receiving an equity investment from new or existing shareholders within the past 12 months. As indicated before, only 0.04% of small U.S. firms are publicly traded, so most of that equity investment came from private investors. For those firms that did receive an equity investment, 92.9% received it from individual investors, 0.6% from venture capitalists, 0.3% from public sale, and 6.6% from "other". Of the firms that received an equity investment from individual investors, 81% received it from the original founders,

7.4% from angel investors, 1.7% from employees, and 13.9% from "other individuals". In short, most equity investment was "internal equity", coming from the original founders or other individuals who are friends or family of the existing owners. "External equity" from those not close to the firm was a very small portion of the equity investment received by small U.S. firms. Regarding the uses to which small S-Corporations and C-Corporations applied their equity investment, 71% percent report using the equity for working capital, 9.4% for "other", 6.9% for debt relief, 3.7% for inventory accumulation, 2.5% for equipment and machinery, 2.5% for "multiple uses", 1.5% for land and buildings, and 1% for motor vehicles.

For those firms that did receive equity however, the equity was an important source of funding for the firm. For sole proprietorships that issued equity within the past 12 months, the ratio of the new equity issued to the firm's total assets, on average, is 0.56, while for S-Corporations and C-Corporations, the ratio of the new equity issued to the firm's total assets, on average, is 0.46. The picture that emerges is that few small U.S. firms resort to the issuance of equity as a source of finance, but for those that do, it is a large and apparently important infusion of finance. Ou and Hanes (2006) used data from the 1993 and 1998 NSSBF surveys to determine the characteristics of small U.S. firms that issue internal equity. They found that younger firms and those in financial distress tended to issue internal equity. In short, firms that would have difficulty obtaining finance from more traditional sources relied upon equity infusions from existing owners and those close to them.

1.3 Value Maximization, Agency Costs and Small Firms

The theory of agency costs has largely been formulated from the context of large, publicly owned firms. Therefore, it is important to describe the nature and implications of

agency costs in large firms and then relate them from the perspective of small firms. This study will first summarize the classical finance theory of agency and agency costs, then describe potential issues to consider when applying this theory to small firms.

Economic theory asserts that the managers of a firm are agents of the owners, who accept funds for investment from the owners and who invest those funds in production opportunities that maximize the value of the owners' investment in the firm. In the presence of perfect capital markets in which individuals can borrow and lend at the same market-determined rate, the personal preferences of the owners for current versus future consumption are separated from the firm's optimal investment decision. This is the principal of Fisher Separation, which describes how investors (owners) can turn their funds over to managers of the firm in the knowledge that those funds will be invested in the optimal set of production possibilities. All owners of the firm are unanimous in their investment decision, though they may differ in their time preferences for consumption, and will borrow or lend at the market rate to satisfy those preferences (Copeland, Weston, and Shastry, 2005).

There are a number of imperfections in the real world that cause deviations from pure Fisher Separation, not the least of which is the fact that the rate at which investors can borrow is generally higher than the rate at which they can lend. An important imperfection that is of particular interest in Finance is the fact that the managers of a firm cannot always be depended upon to pursue the goals of shareholder value maximization to which they are entrusted.

Managers have a large and undiversified commitment of their human capital to the firm. In the absence of an ownership share in the firm that would serve to align their interested with those of other owners (Jensen and Meckling, 1976), such managers may

take measures which will protect their personal investment of human capital, such as the selection of lower-risk (lower return) projects over higher-risk (higher return) ones, to the detriment of their mandate to maximize shareholder value. Managers also have their own personal time preferences for consumption and utility functions, which may motivate them to extract non-pecuniary benefits from the firm today in lieu of value-maximizing investments for the firm's future. Shirking, expenditures on expensive office trappings, artwork, unnecessary use of corporate vehicles and aircraft, meals or social events expensed to the firm, and other perquisites that benefit the manager at the expense of the owners all represent an agency cost to the firm.

Jensen and Meckling (1976) applied agency theory to the relationships between managers and shareholders, and between shareholders and debt holders. Shareholder-manager agency costs arise when the objectives of management and shareholders are not perfectly aligned toward the goal of maximizing shareholder value. It is characterized by misuse of company assets for personal or professional gain by managers, to the detriment of shareholder value. Shareholder-manager agency costs decline as the ownership share of the manager increases, since the manager bears an increasing cost of her non-value maximizing use of the firm's assets. According to Jensen and Meckling, in the limiting case of a manager who owns 100% of the firm, the owner/manager no longer represents the interests of anyone but herself, and no shareholder-manager agency cost would exist.

Shareholder-debtholder agency costs arise when firms undertake projects that increase the risk of the firm beyond what debtholders have anticipated (and have priced into their lending agreements) in order to gain higher returns for shareholders. This action effectively transfers wealth from debtholders to shareholders, since the shareholders realize the benefit if the projects succeed, while debtholders bear the risk of

default if they fail. One of the solutions proposed by Jensen and Meckling for mitigating both the agency costs of equity and debt was monitoring of the firm's management, in the former case by shareholders, and in the latter case by debtholders. Monitoring does not come without a cost however, which shareholders factor into what they will pay for the firm's equity, and which debtholders factor into the price of the firm's debt. This type of agency cost can arise even when shareholder-manager agency issues do not exist.

Though the general framework of agency costs are applicable to small firms, there are certain differences that are important particularly from the hypotheses and empirical analyses developed in this dissertation. Small firms range from sole proprietorships, small partnerships and closely held corporations, to small public corporations whose shares are publicly traded on an exchange. In proprietorships, small partnerships and closely held corporations, ownership and control are not separated, and the agency costs that arise as ownership and control of the firm's assets are separated are not yet a problem for the firm (Jensen 1998). Ownership of the firm is restricted to a few individuals, who take all of the risk and reap all of the reward. These individuals may also choose to extract non value-maximizing pecuniary and non-pecuniary benefits from the firm. This was recognized by Jensen and Meckling as resulting in a reduction of the value of the firm, but they also recognized that it was not inconsistent with efficiency.

As firms grow they tend to assume an organizational structure that supports the increasing needs of the firm for risk sharing, raising capital, and specialization of management, such as the open corporation form of firm organization (Jensen 1998). As the gap between the ownership and control of the firm's assets widens, firms also enter into an increasing number of agency relationships between the firm's managers and suppliers, new shareholders, employees and lenders. Each of these relationships offers

the opportunity for increased agency costs for the firm. Jensen and Meckling hypothesized that ownership costs would increase as the ownership share of the firm's manager decreased. Among small firms where the transition from majority ownership to minority ownership can more readily be observed than for large firms, one would expect this hypothesized result to be particularly evident.

For the small firm that is 100% owned by a single investor or closely related group of investors with common investment objectives (husband-wife, parent-child, small family group), the firm's assets are under the control of that owner and can be used for whatever (legal) purpose that the owner chooses. The owner may choose to maximize her investment in the firm by choosing only projects whose return is greater than or equal to the firm's market-determined cost of capital, she may choose to forego some of these projects in exchange for current wages and dividends that effectively trade-off future consumption for current consumption, or she may even invest in non-pecuniary perquisites which increase her personal welfare but do not necessarily contribute to firm value. In any case, she is making decisions about the use of firm assets that are consistent with her personal time preference for current versus future consumption, rather than with firm value maximization. Since there are no other owners of the firm, shareholder-manager agency is not an issue, although shareholder-debtholder agency may be if the owner makes decisions to invest in risky projects that result in a shift of wealth from debtholders to shareholders.

When the owner's share of the firm is less than 100%, the value reducing behaviors of the owner/manager will create an agency cost to the firm. As Jensen and Mecking point out, as the ownership share of the primary owner/manager drop below 100%, some of the costs of the value-reducing behaviors of the manager are pushed onto

the other shareholders, which can provide an incentive for the manager to increase such behaviors, which reduces the value of the firm to an even greater extent.

Ang, Cole and Lin (2000) investigated owner-manager agency costs in small firms using the 1993 National Survey of Small Business Finance (NSSBF) database created from survey data compiled by the U.S. Federal Reserve Bank. In their study, they developed a model which relates two measures of agency cost to a set of ownership variables and a set of external monitoring variables. Those measures of agency cost were (1) Operating Expenses / Annual Sales, and (2) Annual Sales / Total Assets. Their ownership variables included measures of manager ownership, family ownership and number of non-manager shareholders. Their monitoring variables included length of longest banking relationship, number of banking relationships and the debt-to-asset ratio. They focused on a sub-sample of S- and C-Corporations, excluding sole proprietorships and partnerships from their sample in order to test their agency cost hypotheses against a sample of firms for which agency could possibly be a problem.

Ang, Cole and Lin found that agency costs are higher when an outsider manages the firm than when an owner manages it, and that agency costs vary inversely with the principal owner's ownership share, both of which are consistent with the original theory of Jensen and Meckling (1976) on owner-manager agency costs. They found that agency costs increase with the number of non-manager owners, consistent with decreased aggregate monitoring by shareholders as their numbers increase, due to the free-rider problem.

They also determined that external monitoring variables that are commonly associated in the banking literature with monitoring of borrowers by lenders were found to be significant determinants of owner-manager agency costs in small firms. These

variables are the length of the firm's longest banking relationship (negative), the number of banking relationships (negative) and the debt-to-assets ratio (positive) which tend to attract the attention of lenders concerned about the ability of the firm to meet its debt obligations.

Brau (2002) investigated whether banks price owner-manager agency costs into the loans they make to small businesses. Using the 1998 NSSBF database, Brau regressed interest rates and collateral requirements against the same ownership structure and monitoring variables used by Ang, Cole and Lin, and found that firm ownership structure had no effect upon either the interest rate charged or the requirement for collateral, for small business loans. However, he found that the monitoring variables significantly affected both interest rates and collateral requirements, consistent with prior research in the banking literature on the determinants of loan characteristics. Brau concluded that based on the lack of effect of ownership structure on the terms of bank loans, banks do not price owner-manager agency costs into their loans.

Anderson, Mansi and Reeb (2003) examined the agency costs of debt in firms with some level of founding family ownership, using a selection of large firms from the S&P500 during the period 1993 through 1998. They found that these firms pay up to 32 basis points less in interest on their debt than firms with no founding family ownership present. The effect was strongest for firms with less than 12% founding family ownership. The authors suggest that founding families have interests that are more in alignment with debtholders than other shareholders, such as firm survival and reputation, rather than wealth maximization. Furthermore, founding family owners are likely to be undiversified and have much of their investments tied up in the firm, making them more risk averse, similar to debtholders. They also suggest that the longevity of family

ownership means that debtholders will continue to deal with the same corporate governing structure over an extended period of time, and will develop a relationship with that governing structure that will contribute to the reduction of agency costs. The authors also found, however, that having a family member as CEO resulted in a higher cost of debt due most likely to debtholder concerns about competence and entrenchment.

Anderson and Reeb (2003) examined the performance of a sample of firms from the S&P500 with some degree of family ownership, over the period 1992 through 1999. Using ROA as a measure of performance, they found that family firms are significantly better performers than non-family firms, particularly when the founder or an outsider serves as CEO, but not when another family member serves as CEO. They find that performance rises as family ownership rises, but starts to decrease above approximately 30 percent family ownership, which they attribute to entrenchment effects. Even above 30 percent, however, family firms continue to outperform non-family firms. The authors interpret these results to mean that for public firms in well-regulated markets, family ownership decreases agency problems. They suggest that family owners are more concerned with firm survival than short-term profitability, and this leads them to invest in projects that maximize long-term value.

Vos et al. (2006) showed in a study of U.S. and U.K. small firms that the managers of small firms are not always motivated by the goal of firm value maximization. They find that many small firms are content to enjoy moderate growth and fund that growth with internal sources of funding as often as possible, while the higher growth small firms are more likely to apply for external debt financing. Parker (2004) cites numerous studies that support the contention that in many cases, the small firm is viewed by its owners as a means to independence, increased personal wealth,

increased job satisfaction and as an alternative to unemployment in their local geographical region. Walker and Brown (2004) surveyed 290 Australian small business owners and found that these owners valued non-financial lifestyle criteria over financial criteria in measuring their success. They found that non-pecuniary goals such as personal satisfaction and achievement, pride in the job and a flexible lifestyle were valued over wealth creation by the surveyed owners.

1.4 Information Asymmetry and Financial Constraints in Small Firms

As indicated earlier, most small firms are closely held and are not required to comply with the public disclosure regulations placed upon publicly-traded firms. The firm's owners and those close to them may possess good information about the firm's financial condition and prospects, but those outside that privileged circle may not. This condition of information asymmetry between the firm insiders and potential outside investors has repercussions on the small firm's ability to attract capital that have been extensively studied.

Stiglitz and Weiss (1981) developed an equilibrium model in which imperfect information between borrowers and lenders, and the lenders' resulting concern about the quality of the borrowers and the riskiness of their projects, will naturally lead to an equilibrium in which the supply of credit is not necessarily equal to the demand at the interest rate that lenders are willing to charge. Lenders believe that increasing the interest rate or collateral requirements charged on their loans will either attract less desirable borrowers who are less likely to repay (adverse selection) or will induce borrowers to undertake riskier projects with potentially higher returns to compensate for the higher cost of the loan (asset substitution). For this reason, lenders fix the rate and collateral requirements at a level that accounts for information asymmetry. This rate represents a

trade-off between the increasing return to the lender, and the increasing costs of adverse selection and asset substitution, as the interest rate is increased.

Leland and Pyle (1977) recognize that in a financial market in which information asymmetry between borrowers and lenders exists, and where borrowers wish to finance a mix of good and bad projects whose quality is known to the borrowers but invisible to the lenders, lenders may drive up the cost of funds such that some good projects do not receive financing. They assert that for good projects to be funded, information must be transferred between borrower and lender. One mechanism that they suggest would signal to lenders the quality of a firm's projects is the amount of equity that the firm's owners are willing to invest. The more equity they invest, the more likely it is that the firm's projects are sound. The owners incur a welfare cost because they must invest more equity than they would if information could be directly transferred between borrower and lender, for the same set of projects. Leland and Pyle derive the result that the firm's debt will be an increasing function of the owners' equity position whenever the owners' equity position is greater than 18.6 percent of the cost of the firm's project. In short, increasing the owners' equity position improves the firm's ability to raise debt financing for a project, even when the project itself is invisible to lenders.

Small firms are generally started through an equity investment by the original owner(s), and are sustained by periodic infusions of equity or loans from the existing owners and others very close to the firm and its owners. According to Leland and Pyle, these infusions of equity can send a signal to outside investors regarding the owners' internal knowledge of the firm's conditions and prospects. One would expect that outside investors would want to see that the investment was sizable relative to the owner's total wealth.

1.5 Pecking Order Theory and Small Firms

The Pecking Order Theory was originally developed by Myers and Majluf (1984) to describe the effect on the firm's capital structure of information asymmetry between a firm's managers and investors regarding its future prospects, under the assumptions that (1) managers will act to maximize the value of the existing shareholders' investment rather than the new shareholders' investment, (2) that existing shareholders are passive investors who do not adjust their holdings of the firm's stock in response to changing information[1], and (3) that firms have access to capital markets that are perfect and efficient with respect to publicly available information. Under these conditions, they show that any issuance of new equity by the firm will be interpreted by financial markets as a signal from management that the firm's shares are overvalued. This will cause the firm's share price to drop, reducing the value of the firm for existing shareholders. In order to avoid this situation, they show that managers who follow a policy of maximizing the value of the firm for existing shareholders will choose to finance new investments using internal equity first[2], followed by risk-free debt, then risky debt, and then external equity last, until all available projects with a positive net present value have been funded or until funding can no longer be obtained. As pointed out by Tirole (2006), the Myers and Majluf ranking of financing sources is in increasing order of "information intensity", from those that are least sensitive to information asymmetry between the firm and investor to those that are most sensitive to information asymmetry between the firm and

[1] Myers and Majluf feel that these first two assumptions best support the available empirical evidence regarding the effect of equity and debt issuance on a firm's share price in public markets

[2] Internal equity in this context refers to retained earnings, cash infusions from the entrepreneur(s), or additional shares sold to current owners or those very close to the firm.

investor. It is the idea that information asymmetry leads to a ranking of financing sources that is the central concept of the Pecking Order Theory.

The fact that small firms are very information-opaque would suggest that the Pecking Order Theory might be especially relevant to explaining their capital structure. In examining how this theory might be applied to small firms, a number of important characteristics of small firms must be considered. The assumption that small firms have access to perfect and efficient capital markets in general does not hold. Small firms issue very little external equity, and generally do not issue debt through public markets, but tend to rely on financial institutions and the firm's shareholders or other individuals for debt and equity financing when internally-generated funds are inadequate. When applying the Pecking Order Theory to small firms, therefore, one must consider how information asymmetry between the small firm and each of its funds providers impacts the cost of that finance and thus its position in a small firm financing pecking order.

The assumption that management acts to maximize the value of the existing shareholders investment in the firm is one that bears closer analysis for small firms. This assumption was essential to the Myers and Majluf theory in order to align it with empirical observations of the effect of equity and debt issuance announcements on the price of a firm's external equity and debt. However, the owner/managers of small closely-held firms may have their own total welfare in mind rather than firm value maximization, as has been indicated earlier. Maximizing their investment in the firm may not be as important as other personal goals toward which the firm is used a means to an end. As a result, the owner/managers of the small firm may choose to implement negative NPV projects, or may choose to implement a set of non-optimal (non-maximizing) positive NPV projects. Based on their personal preference for risk, they

may choose projects that are higher risk (return) than lenders would prefer but are favorable to equity investors, or they may choose "safe" projects that promote slow growth and firm longevity and which are more in alignment with the interests of lenders. It is this information asymmetry with regards to both the intentions and the project opportunities of the small firm that must be overcome by outside investors. The relative difficulty experienced by an investor in overcoming this information asymmetry will determine the position of that investor's financing in the Pecking Order hierarchy.

A survey of the small firm financing literature indicates that in the absence of public markets to provide information about the small firm, investors must rely on two mechanisms to overcome the information asymmetry problem: reputation and relationship. Reputation refers to those aspects of the history of a small firm that matter to investors, such as firm performance, payment history as reflected in the firm's credit rating, past debt repayment history and trade credit history, and the human capital embodied in the firm's management, such as experience, education and age. For small firms that are too young to have established their own reputation, the reputation of the firm's owner(s) and their willingness to commit their personal wealth to the firm and to secure the firm's debt with personal collateral and guarantees may be substituted for the firm's reputation.

Relationship refers to the knowledge about the firm and its owners obtained by executing multiple business transactions with them over time; knowledge that reduces the information asymmetry problem and may facilitate investment in the firm. A rich body of literature exists showing how an ongoing relationship between a small firm and a financial institution may facilitate lending under more favorable terms than would exist without that relationship. Since small firms rely heavily on debt financing from banks

and other financial institutions, reducing the information asymmetry between the firm and a lending institution by establishing and maintaining a long-term relationship can be essential to obtaining the debt financing required by the small firm. Relationship can also refer to the relationship between the small firm and its suppliers, who extend trade credit to the firm to facilitate purchasing of goods or services from the supplier. Not only is trade credit an important form of finance for the small firm, but a successful buyer-seller relationship can provide a signal to financial institutions regarding the reliability of the small firm in paying its debts, which in turn can facilitate lending by those institutions.

What then is the Pecking Order of financing choices for small firms? As predicted by Myers and Majluf, retained earnings ("slack") will be first in the pecking order since information asymmetry is not an issue when the firm is using its own funds. Next in the pecking order will be other sources of finance provided by the existing owners, such as internal equity and loans from shareholders. Information asymmetry is not an issue when the firm's owners choose to invest additional funds in the firm in support of project opportunities of which they have full knowledge. Issuance of internal equity is one way for small firms to receive additional funding, but it is not without problems. Without capital markets to price the equity, firms must rely on financial statement data, prices of previous equity issuances or simply what participants agree to pay in order to determine a share price.

Furthermore, unless participants believe that the firm's prospects are so good that there will be future buyers for their shares at a price consistent with the future value of alternative investments of comparable risk, they may choose to diversify and take their money elsewhere rather than purchase more shares in the firm. Owners who are already heavily invested in the firm and thus poorly diversified may be unwilling to invest yet

more of their personal wealth into the firm. Dilution of ownership share will be an issue for any owner of an S-Corporation or C-Corporation that does not participate in an internal equity issue in an amount proportional to her existing ownership share.

Regarding debt, the Pecking Order Theory indicates that firms will issue risk-free debt, followed by risky debt in order of increasing risk (cost), where "risk" refers to default risk. How does a firm issue "risk-free" debt? Tirole (2006) indicates that senior debt fully collateralized by the salvage value of the firm's assets and hence immune to announcements of good or bad fortune by the firm, would be considered risk-free by the investor. For large firms that are publicly traded and that issue debt in public markets, the default risk of debt is reflected in ratings applied to each debt issuance by firms that specialize in this service.

For a small firm however, the risk of default is more difficult to assess due to the scarcity of publicly available information. Banks and other financial institutions, which are the traditional lenders to small business, rely upon financial statements, firm and owner credit ratings, credit scoring models and information gleaned from an extended relationship with a firm to assess the risk of lending to a small firm. To reduce the lender's exposure to default, lenders often require that the firm or owner(s) pledge assets as collateral, or that the owner(s) provide personal guarantees that the debt will be repaid out of personal assets in case of firm default. Small firm owners that borrow from traditional sources soon find that the risk of loss of their personal wealth is tied to the default risk of the firm's debt. Rational owners will limit their exposure to this risk by limiting their borrowing from traditional sources, based on their personal preferences for risk. Also, since an asset can only be pledged as collateral for one loan, the value of the

small firm's real assets (or those of its owners) may place a constraint on the total value and type of loans received.

Small firms do have an alternative borrowing source to the traditional financial institutions. As was shown earlier, loans from shareholders are a significant source of financing for small firms. Such loans do not require that the firm's owners pledge personal collateral or guarantees, since the loans are coming from the firm's owners themselves. Unlike an external financial institution, the firm's owners are not likely to force the firm into bankruptcy if the firm defaults on debt payments, but will likely show forbearance until such time as the firm is in a position to repay the debt. Also, such loans do not insert an external financial institution ahead of the owners in claims upon the firm's assets in case of bankruptcy. Loans from shareholders can provide the same tax advantages to the small firm as loans from traditional financial institutions. These loans also do not change the relative ownership structure by changing the distribution of equity across the owners. Since the loans are provided by the owners themselves, pricing issues due to information asymmetry are unlikely to be an issue.

Given these advantages, why don't small firms avoid loans from traditional sources altogether, and just borrow funds from their shareholders? Shareholders, unless exceptionally wealthy, may not be able to provide enough debt financing to meet the needs of a growing firm. Even if they are able, they may be unwilling to take such an undiversified stake in the firm, acting as both debt and equity investor in the firm. Finally, the idea of using loans from shareholders instead of loans from outside investors defeats one of the key benefits of leverage, namely that using debt from outside investors increases the returns to equity for the firm's shareholders.

Another source of finance available to small firms is supplier financing, more commonly known as trade credit. Trade credit is basically a form of lending from a supplier to a buyer in which the buyer may purchase goods or services from the seller and take delivery of them, then provide payment at a later time, according to terms established between buyer and seller. Typical trade credit terms specify payment within 30 days, and although that may vary by seller and industry, the point is that trade credit is a form of short-term financing. Trade credit during the credit term is free to the buyer, unless the seller offers a discount for early payment, in which case it can become quite expensive as will be shown in the first essay of this paper. Extending payment beyond the credit term may subject the buyer to late payment penalties, denial of future trade credit, and if consistently practiced, can result in a reduction of the firm's credit rating.

However, empirical evidence suggests that suppliers tend to show a considerable degree of forbearance in the collection of their accounts receivable from customers, tolerating late payments and even allowing some customers to take trade credit discounts beyond the end of the discount period. Preservation of the ongoing buyer-seller relationship in anticipation of future business may be a powerful motive for this observed behavior. The apparently lower costs of financial distress for trade credit over other forms of external financing may reduce the real cost of this form of credit to small firms relative to those other source, even in the presence of trade credit discounts. Huyghebaert, Van de Gucht and Van Hulle (2007) examine the use of bank loans in the debt mix of Belgian start-up firms, and obtain empirical results that suggest that firms evaluate not only the cost of debt, but the differences in liquidation policy on default, and so tend to use less bank loans relative to trade credit in their debt mix as a result.

Ng, Smith and Smith (1999) present results that support the hypothesis that buyers and sellers use trade credit terms to resolve the two-way information asymmetry that exists between them. Buyers lack information about the quality of seller's goods or services and desire time to assess the quality before making payment. Sellers do not know the creditworthiness of buyers, and would like to limit their exposure in case the buyer does not pay. Buyer or seller reputation can mitigate this information asymmetry to some extent. However, small firms, particularly younger ones, may not have an established reputation. For small firms, trade credit is an important means of resolving information asymmetry and as was shown earlier, is a major source of financing.

So where then does trade credit fall in the small firm Pecking Order hierarchy? Petersen and Rajan (1997) and Nilsen (2002) show that firms that are credit constrained tend to turn to trade credit financing, which is available when other forms of external financing are not. Biais and Gollier (1997) derive an equilibrium model in which firms use trade credit to convey a signal to lenders that they are reliable, which in turn facilitates access to external financing. Their model suggests that the reason that firms use trade credit, which can be more expensive than bank financing, is to provide a signal that resolves the information asymmetry between the firm and potential lenders, and facilitates access to less expensive forms of credit offered by financial institutions. In their model, Biais and Gollier establish a causal link between trade credit and bank financing. All of this suggests that trade credit precedes bank financing in the small firm Pecking Order hierarchy, even though trade credit may in fact be nominally more expensive than bank financing.

With all of these caveats about small firms in mind, what then would be the Pecking Order of financing for small firms? Using increasing information intensity as

the sorting criteria, the order would be retained earnings, internal equity issues and shareholder loans, followed by supplier financing (i.e. trade credit), then financing from traditional lenders (i.e. leases, bank loans and lines of credit), and last of all, external equity.

1.6 The Three Essays

This dissertation comprises three essays that will address three major empirical questions related to the financing and capital structure of small U.S. firms. The empirical questions are:

1. Why don't small firms take every trade credit discount offered to them?
2. What determines the cash holdings of small firms?
3. Why do small firms make investments unrelated to their core business?

These three empirical questions are stated and discussed in the following three separate chapters of the dissertation. For each question, the appropriate theoretical and empirical background, testable hypotheses, data, methodology, results and analysis are described.

CHAPTER II

ESSAY 1: WHY DON'T SMALL FIRMS TAKE EVERY TRADE CREDIT DISCOUNT OFFERED TO THEM?

It is worthwhile to open this question by reviewing the basics of trade credit and how it is offered by suppliers to buyers. Trade credit is the provision of short-term financing by a seller to a buyer in order to facilitate trade between the two parties. The seller delivers goods or services to the buyer, and grants deferred payment privileges to the buyer for those goods or services under terms specified by the seller. Typical trade credit terms can be structured as one-part or two-part terms. One-part terms simply specify a date by which full payment of the invoice amount is due. For example, "Net 30" terms would indicate that the full amount of the invoice is due no later than 30 days from the date of the invoice, or from some other date established as part of the terms.

Two-part terms are used when trade discounts are offered. These terms specify a discount amount, a period during which the discount may be taken, and a final date by which payment in full must be received if the discount is not taken. For example, "2/10 Net 30" terms specify that if the buyer pays within 10 days, they can take a 2% discount from the invoice amount, otherwise payment in full is expected within 30 days. The first 10 days of credit are essentially "free", but the additional 20 days can only be bought at

the cost of refusing the 2% discount. It is a standard exercise in introductory Finance textbooks to show that borrowing the full invoice amount for an additional 20 days can cost the buyer 37% on an average annual basis.[3] This makes trade credit a very expensive form of credit if discounts are not taken. In fact, an APR of 37% for typical "2/10 Net 30" terms makes trade credit more expensive than bank loans, credit cards and most other legal forms of financing.

It is important to note that this problem does not arise in one-part trade credit terms. In such terms, the entire credit period essentially represents "free" credit. The buyer gets to borrow their own money, equal to the full amount of the invoice, for the full credit period. It is only when discounts are offered that an opportunity cost arises associated with refusing the discount. This creates a powerful incentive for sellers to offer trade discounts in order to encourage firms to pay within the credit period, and thus reduce their own collection costs (Ferris, 1981).

2.1 Theory and Testable Hypotheses

Why then would a rational firm that was offered terms such as "2/10 Net 30" choose to decline the offer of a 2% discount and 10 days of free credit, and choose instead to pay a 37% annualized rate of interest for an additional 20 days of credit? There are three possible explanations: (1) they *cannot* take the discount due to inadequate financing, (2) they *will not* take the discount due to an intention to use accounts payable to fund other management initiatives, or (3) they *do not understand* the cost of forgoing discounts and using expensive trade credit. A firm that maintains a consistent policy of refusing trade discounts and paying invoices at the end of the full trade credit period can accumulate 30 days or more of working capital. If these funds are not invested in

[3] See Brigham & Besley, Chapter 15

inventory, they can be held in cash or marketable securities to be used at the discretion of management. Furthermore, if these funds are not eventually invested in projects whose internal rate of return exceeds their 37% annual cost, the firm's management is not engaging in value maximizing behavior.

This suggests that failure to take trade discounts may in some cases represent an agency cost to the firm. If this is the case, then empirically one would expect to find that variables that traditionally proxy for agency costs, such as ownership share of the firm's manager or variables that proxy for monitoring of management by shareholders and debtholders (Jensen and Meckling 1976), would be significant determinants of trade credit discount usage. This leads to the first testable hypothesis:

H1: Trade Credit discount usage is negatively related to agency conflict in the firm.

Firms that cannot take the discount are those firms with inadequate internally generated cash flows or cash reserves to make early payments, and whose access to less expensive forms of debt financing is limited. Such firms may find it impossible to obtain bank loans, lines of credit, or credit cards, or may have access to such sources of credit but are carrying such a high burden of debt that payments on that debt constrain their ability to make early payments to suppliers. These firms find it necessary to allow their accounts payable to grow, and pay the oldest payables first as accounts receivable are collected. They essentially exist by "hand to mouth".

Empirically for small firms, one would expect to find that variables that proxy for firm liquidity and the availability of other less expensive sources of finance would be significant positive determinants of trade credit discount usage. The term "less expensive" here is defined as the Pecking Order theory would indicate, described in

section 1.5 of this dissertation. Variables that proxy for firm distress and financial constraints in raising capital would also be significant negative determinants of trade credit discount usage, as firms that could not find other forms of financing would certainly be forced to fall back on taking full advantage of trade credit and eschewing discounts. This leads to the second testable hypothesis:

H2: Trade Credit discount usage is positively related to firm liquidity and to availability of less expensive forms of finance.

There is another possibility that must be explored related to management and firm competence, where "competence" is defined for the purposes of this study as a combination of business experience and education. It is generally assumed that large firms will have among their management staff individuals that are educated and experienced in the field of corporate finance, and who will be able to determine the costs and trade-offs associated with taking or deferring trade credit discounts. These individuals are often supported by complex accounting software systems that can help manage the firm's cash, payables and receivables according to policies established by management, carefully timing payments and purchases to meet corporate liquidity targets.

Small firms on the other hand may be owned or managed by a young high school graduate or someone with specialized education and experience in the firm's field of business, but having little or no formal finance education. The high cost of consistently deferring trade credit discounts may not be familiar to them, and their bookkeepers, accountants or other financial advisors may not effectively convey that cost to them. Such owners or managers may ignore trade credit discounts out of ignorance, deciding

that the discounts are a small payment to make for the extra weeks of credit, failing to take into account the cumulative cost of following this policy over time.

Does management "competence" have a measurable effect on firm performance? Bates (1990) uses a sample of 4,429 U.S. firms owned by non-minority entrepreneurs to model firm survival as a function of human and financial capital inputs. He finds that entrepreneur education is a positive determinant of firm longevity, with owners having four or more years of college showing the strongest positive effect on firm longevity.

Bosma et al. (2004) used data from a 1994 survey of 2000 Dutch entrepreneurs to determine if there exists a relationship between the Human and Social characteristics of the entrepreneur and three measures of the performance of the entrepreneur's firm: survival probability, profitability and employment created. They find that the entrepreneur's business experience and industry experience are positive determinants of firm survival. They find that business experience and industry experience along with the entrepreneur's education level are positive determinants of the profitability of the firm. They find that industry experience and the entrepreneur's previous experience as an employee are positive determinants of employment creation. In summary, they find that entrepreneur experience and education are positive determinants of some important dimensions of firm performance.

Coleman (2007) used data from the 1998 National Survey of Small Business Finance (also used in this study) to show that the education and experience level of the owner has a positive effect on the profitability of small women-owned firms in the service and retail industries. She also found that prior business experience was a positive determinant of profitability in male-owned firms.

Given that management "competence", defined as the entrepreneur's education and/or previous business experience, has been shown to be a positive determinant of firm profitability, how does that relate to the use of trade credit discounts? Basic accounting principles would indicate that firms that consistently take trade credit discounts offered will pay less for supplies and raw materials, thus reducing their operating expenses and cost of goods sold. This will have a direct positive effect on their operating profits. Small firms having managers who are aware (through education or experience) of the benefits of a policy of taking trade credit discounts offered and who make the decision to take them may improve the profitability of the firm. Thus the empirically observed relationship between management competence and firm profitability could be driven at least in part by a relationship between management competence and the trade credit discount usage decision. This leads to the third testable hypothesis:

H3: Trade Credit discount usage is positively related to management competence as measured by education and experience.

Partially offsetting the cost of not taking trade credit discounts that are offered is the cost to the small firm of setting up and administering the process of paying vendors that offer discounts on a different schedule than those who do not. Unlike large firms that have highly automated accounting systems and accounts payable specialists to manage payments, small firms are likely to have more simplified, sometimes manual accounting systems and may use the firm's owner, owner's family or a hired bookkeeper to manage accounts payable. Under these circumstances, firms that are not offered significant trade credit discounts that can offset the perceived cost of administering them may choose to forego discounts. Similarly, small firms that use manual rather than automated accounting systems may also determine that the cost of managing trade credit

discounts exceeds the benefit of taking them. These factors should be taken into account when examining the determinants of trade credit discount usage in small firms.

Ferris (1981) develops a theory of trade credit usage that is based on transaction costs. In his model, both supplier and buyer use trade credit to smooth otherwise stochastic flows of payments between them, reducing their need for precautionary money holdings and the opportunity cost associated with holding those funds. Thus, trade credit reduces the cost of the transaction for both buyer and seller relative to what would occur if no trade credit were used. Buyers and sellers are motivated to enter into trade credit agreements for the joint reduction in transaction costs they can both enjoy from that relationship.

In Ferris' model, discounts for early payment provide a mechanism for the seller to reallocate some transaction costs back to the buyer. Those reallocated costs are those associated with the effort required on the seller's part to collect payments from the buyer, as well as other costs related to the extension of financing from seller to buyer for the longer time period. Discounts should induce buyers to pay earlier, reducing the seller's average level of Accounts Receivable and the costs associated with working capital financing. The buyer should be motivated to use the discounts offered in order to resist this cost transfer. Ferris suggests that the benefits to the buyer of refusing discounts and using the longer and costlier trade credit period would have to be substantial in order for the buyer to take this course.

If the buyer's internal transaction costs associated with processing early discount payments for some suppliers while paying others on a different schedule are sufficiently high, then the buyer may decide that refusing the discounts and using costly trade credit is a more attractive alternative. For small firms with limited administrative resources and

simple or even manual accounting systems, this may be the case. In Ferris' model, if the buyer's internal transaction costs associated with processing discounts exceed the transaction costs transferred from buyer to seller through the discount mechanism, then the buyer would obtain more value from eschewing the discounts entirely. If the firm's internal transaction costs can be reduced below the level of the transferred transaction costs, then taking discounts becomes an attractive option. This leads to the fourth testable hypothesis:

H4: Trade Credit discount usage is negatively related to the firm's transaction costs of taking discounts.

2.2 Review of Empirical Studies

There are numerous empirical studies in the trade credit literature that examine the determinants of trade credit usage from either the buyer side, the supplier side, or both. Most papers use some variant of accounts payable or accounts receivable for their independent variable in a linear regression model, and examine the determinants of that variable. If discounts are used at all in these models, they are used as a regressor variable to reflect the cost of trade credit. Few studies specifically model the trade credit discount decision, perhaps because few finance databases offer data that specifically reports the results of that decision by firm management. It generally must be inferred from other variables.

Perhaps the most often referenced empirical paper in the trade credit literature is Peterson and Rajan (1997). They empirically model the determinants of trade credit usage from both the supplier and the buyer side, using a sample of small firms from the 1987 NSSBF database, and a sample of large firms from the COMPUSTAT database. They find that profitable firms use less trade credit, as do firms with large unused lines of

credit. Also, firms that have longer relationships with their bank use less trade credit. Regarding discounts, their results indicate that the decision to take discounts and avoid expensive trade credit is driven by the availability of less expensive credit to the firm. They indicate that their results are consistent with the Pecking Order theory.

Three papers that are notable for their focus on the trade credit discount decision are Danielson and Scott (2000), Bopaiah (1998), and Burkart, Ellingsen and Giannetti (2011).

Danielson and Scott (2000) investigate the use of trade credit discounts by firms facing credit rationing, using data taken from the 1995 National Federation of Independent Business (NFIB) Credit, Banks and Small Business Survey. This survey asks the question "How often do you take advantage of trade credit discounts offered?" and allows the respondent to reply with one of four answers: "Always", "Usually", "Rarely" or "Never". Converting this to a binary variable with values ALWAYS or NEVER, the authors find that firms that have been turned down on a recent loan request, have a shorter relationship with their banker, have a fixed term loan outstanding, or have had more bank account manager turnover are less likely to take all discounts offered than other firms. Firms that consider retained earnings to be an important source of funds tend to take more trade discounts. In short, firms that have access to internal funding take more discounts, but firms that have difficulty obtaining external credit or that must service existing debt take less discounts.

Bopaiah (1998) examined the availability of credit to family businesses using data from the 1987 NSSBF survey. The NSSBF surveys ask the question "What percentage of trade credit discounts offered do you take?", and prompts the user to reply with a numeric percentage between 0% and 100%. Using OLS regression, he regressed the

percentage of discounts offered that were taken by the firm (same dependent variable as used in this study) against variables that represent management characteristics (but not "competence" related variables), financial performance and risk, banking relationships and general firm characteristics. He finds that family owned firms, more profitable firms, firms with more liquidity, firms with longer relationships with their bank, older firms and larger firms take more discounts than others. Firms with higher debt ratios, firms that have relationships with a large number of banks, firms that are corporations and firms that were required to post collateral for their last loan take less discounts than other firms. These results are consistent with the results of Danielson and Scott.

Burkart, Ellingsen and Giannetti (2011) used the same NSSBF survey data and dependent variable as the Bopaiah study, but modeled the trade credit decision against a (mostly) different set of variables. Using OLS regression, they find a significant and positive relationship between the size of discount offered by the main supplier and the percentage of discounts used. They find a significant negative relationship between variables that proxy for firm distress, and percentage of discounts used. They also find a negative relationship between profitability and percentage of discounts used. Although they do not offer a direct explanation for this observation, it would be consistent with their other observation that more profitable firms are offered less trade credit and are less likely to use it. A negative relationship between log assets and discounts used is not explained, but could be explained by their other observation that larger firms are offered bigger discounts but for a shorter period. Finally, they observe a significant positive relationship between length of bank relationship (a proxy for better access to bank credit) and discounts used, consistent with both Bopaiah and Danielson and Scott.

Existing empirical evidence is thus consistent with the idea that firms that have difficulty obtaining credit take less trade credit discounts, while firms that have access to credit or have internal funds available take more trade credit discounts. No empirical studies have been identified that address the relationship between agency costs and trade credit discounts, manager and firm competence and trade credit discounts, or transaction costs and trade credit discounts.

2.3 Model, Variables and Data

The model chosen to test the hypotheses is shown below. This model defines the percentage of trade credit discounts offered that are actually taken by a firm as a function of variables that proxy for agency costs and monitoring, variables that proxy for sources of financing that affect the firm's capital structure, variables reflecting financial distress (lack of availability of capital), variables that proxy for management competence, variables that proxy for transaction costs associated with trade credit discounts, and firm characteristic control variables. Including all of the variables explicitly, the model can be written as:

$$\begin{aligned}PCTDISCOUNTS_i = {} & \beta_{0i} + \beta_{1i}FEMOWN_i + \beta_{2i}MINOWN_i + \beta_{3i}OWNEXP_i + \\ & \beta_{4i}OWNEDU_i + \beta_{5i}PCACCTNG_i + \beta_{6i}MAINSUPL_i + \beta_{7i}OWNSHR_i + \\ & \beta_{8i}OWNMGR_i + \\ & \beta_{9i}USEDCARD_i + \beta_{10i}LnUNUSEDLOC_i + \beta_{11i}LnQUICKRATIO_i + \\ & \beta_{12i}LnPROFTOINCOME_i + \beta_{13i}DBSCORE_i + \beta_{14i}PAIDLATE_i + \\ & \beta_{15i}FIRMDISTRESS_i + \beta_{16i}LnDEBTRATIO_i + \beta_{17i}LnINVRATIO_i + \varepsilon_i\end{aligned}$$

The specific variables chosen in each category are summarized in table 2.1, along with their hypothesized relationship (+ or -) to PCTDISCOUNTS. There is also a column in the table that indicates which of the four hypotheses (H1 through H4) is being tested by the inclusion of that variable in the model. In the model, PCTDISCOUNTSi is the percentage of the offered discounts that were taken during accounting period "i". The

accounting period represented by "i" is either fiscal year 1998 or fiscal year 2003, depending upon the NSSBF survey used. Balance sheet and income statement quantities for the period "i" were for the full fiscal year.

The data sources to be used to estimate the model and test the hypotheses are the 1998 and 2003 National Surveys of Small Business Finance (NSSBF) databases. Since these databases are used for all three surveys in this dissertation, their description has been relegated to Chapter V of this document. The unique design aspects of these survey databases that influence the choice of model estimation methodology are described in that chapter.

The mapping between these model variables and the raw variables in the 1998 and 2003 National Survey of Small Business Finance (NSSBF) survey databases is described in Section 5.3 of this document. In some cases, the model variables are directly mapped to variables in the survey database. In other cases the model variables are calculated as a combination of survey variables, or are dummy variables derived from variables in the survey database. Due to the similarities between the 1998 and 2003 surveys, the variables in table 2.1 have the same meaning when estimating the model using the 1998 database as when using the 2003 database.

2.3.1 The relationship between discounts, profitability and liquidity. Two previous studies that used some version of the NSSBF database (Bopaiah, and Burkart et al.) included firm profitability as a regressor when modeling trade credit discount usage. Bopaiah used both profitability and liquidity in his model of trade credit discount usage. Their reasoning was that more profitable firms and firms with more liquid assets (i.e. cash and equivalents) would be in a position to take more trade credit discounts. Both profitability and liquidity have been included in the model to test hypothesis H2.

However, one concern that must be considered is the possibility that both profitability and liquidity are endogenous to the model. That is, they are both determinants of, and determined by, trade credit discount usage. This possibility was not addressed by any of the previous papers on this topic.

First will be addressed the potential endogeneity of profitability in the model. Profitability may provide a firm with the cash flow required to support making purchases on discount. Less profitable firms may not have adequate cash flow to take discounts as they are made available, and may have to defer payment through use of trade credit until sales can be made or receivables converted to cash. This is the basis of the argument for including profitability as a regressor in the model to test hypothesis H2.

On the other hand, use of trade credit discounts reduces the firm's total expenses, increasing the firm's operating profits on a dollar-for-dollar basis. (In the 1998 and 2003 NSSBF, the variable PROFIT is the difference between total income and expenses from the fiscal year income statement as reported by the survey respondent firms.) This would suggest that profitability is determined at least in part by trade credit discount usage. However, upon further scrutiny, this relationship is actually very small. As reported in Section 1.2 using the 2003 NSSBF survey data, only 17.8% of the firm's suppliers on average offer discounts, and only 53.5% of those discounts on average are taken by the firm. Considering that a typical discount for early payment is around 2%, the total reduction in firm expenses (increase in profits) due to trade credit discounts is on average much less than 1%. Regressing LnPROFTOINCOME on PCTDISCOUNTS using the 1998 NSSBF data shows a very weak positive relationship (β=0.0003, t=1.98, P>|t|=0.048, F=3.92, Prob>F=0.048, R-squared=0.0056).

Performing the same regression using the 2003 NSSBF data shows no significant relationship. This result suggests that the endogeneity of profitability in the model is not an issue. The variable LnPROFTOINCOME therefore will not be instrumented in the model estimation.

Second, the endogeneity of liquidity in the model will be addressed. Liquidity on the balance sheet indicates that the firm maintains adequate supplies of cash and near-cash assets that will be available when the opportunity arises to take a trade credit discount. This is the basis of the argument for including liquidity as a regressor in the model to test hypothesis H2.

Examination of the current asset accounts affected by the use of trade credit discounts shows that the taking of trade credit discounts itself has an immediate effect on the balance sheet within the same period. The firm's cash balance is reduced by less than it would have been if the discounts had not been taken for the firm's purchases, effectively contributing the amount of the discounts to the firm's cash balance for that period. This has a positive effect on firm liquidity for the period relative to what it would have been without the discounts. This would suggest that liquidity is determined at least in part by trade credit discount usage. Regressing LnQUICKRATIO on PCTDISCOUNTS using the 1998 and 2003 NSSBF data confirms that that PCTDISCOUNTS is a significant positive determinant of LnQUICKATIO for both surveys. This result suggests that LnQUICKRATIO may be endogenous within the model and may require instrumental variable (IV) regression estimation methods to properly estimate, though additional testing will be required to confirm or deny this assumption. That testing will be addressed in the methodology section of this essay.

Table 2.1

Independent Variables and Their Hypothesized Relationship to PCTDISCOUNTS

Independent Variable	Description	Hypothesized Relationship to Discount Usage	Hypothesis Tested	Comments
Agency:				
OWNSHR	Percentage of business owned by principal owner	(+)	H1	Increasing firm ownership share reduces agency conflict (Jensen and Meckling 1976)
OWNMGR	Dummy, 1 = firm is managed by an owner	(+)	H1	Having firm managed by owner reduces agency conflict (Jensen and Meckling 1976)
Liquidity and Credit Availability:				
FEMOWN	Dummy, 1 = greater than 50% female ownership	(-)	H2	Proxy for credit discrimination = less likely to take TC discounts
MINOWN	Dummy, 1 = greater than 50% minority ownership (African-American, Asian, Pacific Islander, American Indian, Alaska Native)	(-)	H2	Proxy for credit discrimination = less likely to take TC discounts
USEDCARD	Dummy, 1 = firm has used owner's or businesses' credit card for purchases during 1998 or most recent fiscal year	(+)	H2	Credit cards are nominally less expensive than TC with discounts
LnUNUSEDLOC	Natural log of the ratio of unused balance on all Lines of Credit, to Total Assets	(+)	H2	Line of credit is nominally less expensive than TC with discounts. Firm should tap line of credit to take discounts.
LnQUICKRATIO	Natural log of the ratio of Cash plus Accounts Receivable to Current Liabilities	(+)	H2	Firms with more liquid internal working capital will take more discounts
LnPROFTOINCOME	Natural log of the ratio of Profit to Total Income	(+)	H2	More profitable firms may have more retained earnings to support taking more discounts
DBSCORE	Dun & Bradstreet Credit Score (higher score = greater risk)	(-)	H2	Firms with poor credit scores are credit constrained and cannot take discounts
PAIDLATE	Dummy, 1 = if firm paid any invoice beyond end of the credit period during 1998 (2003) or most recent fiscal year	(-)	H2	Firms with history of late payments may be in distress and cannot take discounts

Independent Variable	Description	Hypothesized Relationship to Discount Usage	Hypothesis Tested	Comments
FIRMDISTRESS	Dummy, 1 = firm declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years	(-)	H2	Distressed firms lack access to internal or external sources of funding and must make use of trade credit financing
LnDEBTRATIO	Natural log of the ratio of Total Liabilities to Total Assets.	(-)	H2	Firms with higher debt ratio will need to service debt rather than take discounts, to avoid default .
Mgmt Competence:				
OWNEXP	Number of years of experience of principal owner managing this or other business	(+)	H3	More experience = more likely to know when to take TC discounts
OWNEDU	Less than High School = 1 High School graduate = 2 Some college but no degree = 3 Associate Degree/occupational = 4 Trade School/vocational program = 5 College degree = 6 Post-graduate degree = 7	(+)	H3	More education = more likely to know when to take TC discounts
Transaction Costs:				
LnINVRATIO	Natural log of the ratio of Inventory to Total Assets	(+)	H4	Firms that maintain higher inventory levels use TC discounts to reduce cost of inventory.
PCACCTNG	Dummy, 1 = firm uses PC's to automate accounting	(+)	H4	Automation of accounting lowers the cost of taking discounts = more likely to take TC discounts
MAINSUPL	Dummy, 1 = firm's main supplier offers TC discounts	(+)	H4	Firm may find it cost effective to process TC discounts for its largest supplier (largest single source of discounts). This will also help the firm maintain a good credit rating with that supplier.

2.3.2 Sample size and summary statistics for numeric variables. Sections 6.2 and 6.3 of this document describe the transformation and clean-up applied to the 1998 and 2003 NSSBF sample data prior to analysis. In that section it was indicated that 120 observations (out of a total of 3,561) in the 1998 NSSBF are excluded and 627 observations (out of a total of 21,200) in the 2003 NSSBF are excluded, due to failure to meet the "going concern" criterion.

An additional 2,313 observations are excluded from the 1998 NSSBF data due to missing items for independent variables the trade credit regression model, or because OFFEREDTCD=0 (so that PCTDISCOUNTS is missing), or due to negative or outlier values for QUICKRATIO and DEBTRATIO (Values of QUICKRATIO greater than 300 and DEBTRATIO greater than 100 were set to missing). This leaves 1,128 complete observations for analysis from the 1998 NSSBF data base. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3.

An additional 13,285 observations are excluded from the 2003 NSSBF data due to missing items for independent variables in the trade credit regression model or because OFFEREDTCD=0 (so that PCTDISCOUNTS is missing), or due to negative or outlier values of QUICKRATIO and DEBTRATIO (Values of QUICKRATIO greater than 300 and DEBTRATIO greater than 100 were set to missing). This leaves 7,288 complete observations for analysis. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3. Finally, selection of implicate #3 only as described in section 6.4, results in 1,458 complete observations for analysis from the 2003 NSSBF data base.

Note that some of the variables in the model have been transformed to their natural log form and Winsorized. This has been done to reduce the rather large skewness and kurtosis typical of the untransformed numeric variables in the 1998 and 2003 NSSBF samples. Sections 6.2 and 6.3 describe the rationale behind this and the transformation methodology used. Figures 2.1 and 2.2 below provide sample statistics for the numeric variables in the model, including the mean, standard deviation, skewness and kurtosis. The untransformed and transformed variables are included in the table for comparison, and to show how the logarithmic transformation and Winsorization of the variables have reduced skewness and kurtosis.

variable	N	mean	sd	max	min	skewness	kurtosis
PCTDISCOUNTS	1128	54.27482	44.57126	100	0	-.173667	1.203019
OWNEXP	1128	21.67819	11.40308	72	0	.6536732	3.37928
OWNSHR	1128	70.05674	29.32434	100	1	-.3314255	1.804973
UNUSEDLOC	1128	.1757949	.7128282	16.00024	0	14.36281	268.2457
QUICKRATIO	1128	4.638941	16.04608	280.9496	0	10.02789	129.3894
PROFTOINCOME	1128	.0403563	1.144274	1	-27.78788	-15.94104	337.7205
DEBTRATIO	1128	.9567783	1.519665	18.26782	.0054743	5.955071	50.91508
ZDEBTRATIO	876	.4966086	.2740079	.9988063	.0054743	-.0058015	1.9009
INVRATIO	1128	.2117687	.2432367	.9908435	0	1.16968	3.487414
CASHRATIO	1101	2.093121	8.322678	147.673	0	11.56505	174.3091
ARRATIO	1128	2.600202	11.08057	187.5	0	10.96303	142.6207
LnUNUSEDLOC	1128	.1152049	.2370365	2.833228	0	4.968755	39.65333
LnQUICKRATIO	1128	1.075312	.8621913	5.641728	0	1.671781	6.83672
LnPROFTOIN~E	1128	4.18045	.234802	4.81	1.415898	-3.849758	39.68118
LnDEBTRATIO	1128	.5502286	.4153116	2.958436	.0054594	2.09369	9.440935
LnZDEBTRATIO	876	.3858866	.1880077	.6925501	.0054594	-.2610079	1.986723
LnINVRATIO	1128	.6862517	.1149137	1.022083	.581172	.9920607	2.959688
LnCASHRATIO	1101	.5791051	.7653576	5.00175	0	2.160821	8.434396
LnARRATIO	1128	.7198298	.7458335	5.239098	0	2.107468	9.98655
wLnUNUSEDLOC	1128	.1124606	.2137275	1.593252	0	3.64321	20.08923
wLnQUICKRA~O	1128	1.072346	.8487296	4.647591	0	1.543102	5.9512
wLnPROFTOI~E	1128	4.184176	.2054848	4.803224	2.86409	-1.825475	19.17937
wLnDEBTRATIO	1128	.5501612	.4149258	2.89844	.0054594	2.084052	9.355567
wLnZDEBTRA~O	876	.3858275	.1879126	.6851684	.0054594	-.2629043	1.985174
wLnINVRATIO	1128	.6862486	.1149046	1.018577	.581172	.9916893	2.958063
wLnCASHRATIO	1101	.5769966	.7545569	4.069027	0	2.039404	7.397054
wLnARRATIO	1128	.7145487	.719143	3.970292	0	1.786104	7.524263

Figure 2.1. Sample statistics for numeric model variables from 1998 NSSBF

variable	N	mean	sd	max	min	skewness	kurtosis
PCTDISCOUNTS	1458	56.21948	44.5413	100	0	-.2244587	1.209707
OWNEXP	1458	24.16049	11.1087	65	0	.4136017	3.015918
OWNSHR	1458	68.24279	27.76535	100	8	-.0610716	1.556785
UNUSEDLOC	1458	.1768291	.536785	8.962179	0	10.22697	140.6152
QUICKRATIO	1458	5.174741	16.30614	275.2632	0	9.887714	129.4686
PROFTOINCOME	1458	.0165088	3.461267	1	-131.6735	-37.81453	1439.162
DEBTRATIO	1458	.8703825	2.02049	44.20573	.0018836	12.5927	213.0355
ZDEBTRATIO	1185	.4664344	.2797261	1	.0018836	.0769458	1.809332
INVRATIO	1458	.1955367	.2381094	.9767092	0	1.260109	3.629428
CASHRATIO	1424	2.717712	11.30043	275.2632	0	13.62333	269.4488
ARRATIO	1455	2.412904	8.242731	160	0	12.46196	205.8385
LnUNUSEDLOC	1458	.1248278	.226732	2.298796	0	4.233277	29.13614
LnQUICKRATIO	1458	1.169796	.88524	5.621354	0	1.533104	6.053156
LnPROFTOIN~E	1458	5.517657	.1737437	6.15	1.2546	-9.874296	253.5563
LnDEBTRATIO	1458	.4983387	.3961456	3.811224	.0018818	2.685634	16.0401
LnZDEBTRATIO	1185	.3642226	.1943432	.6931472	.0018818	-.1558523	1.829139
LnINVRATIO	1458	.2339434	.1703728	.7247782	.0839403	1.021851	2.911423
LnCASHRATIO	1424	.6682202	.8243844	5.621354	0	2.060212	7.988917
LnARRATIO	1455	.7567489	.7455421	5.081404	0	1.701816	7.265967
wLnUNUSEDLOC	1458	.1233656	.2147582	1.673976	0	3.543666	19.64631
wLnQUICKRA~O	1458	1.166444	.8708885	4.537961	0	1.405632	5.227356
wLnPROFTOI~E	1458	5.52023	.1321928	6.105282	4.661638	.761532	10.08383
wLnDEBTRATIO	1458	.4952821	.3767001	2.508437	.0018818	2.095397	10.22442
wLnZDEBTRA~O	1185	.3641982	.1943024	.6861819	.0018818	-.1566227	1.82826
wLnINVRATIO	1458	.2339053	.1702659	.7029824	.0839403	1.019161	2.899872
wLnCASHRATIO	1424	.6672613	.8193063	4.61512	0	2.002754	7.486651
wLnARRATIO	1455	.7539381	.7318557	3.89182	0	1.530306	5.98181

Figure 2.2. Sample statistics for numeric model variables from 2003 NSSBF (using implicate #3 only)

2.3.3 DEBTRATIO and insolvent firms. Examination of the maximum value of the variable DEBTRATIO in Figures 2.1 and 2.2 shows maxima that are considerably in excess of one. DEBTRATIO is the ratio of total liabilities over total assets for a firm. For a typical firm in sound financial health, total assets should exceed total liabilities, the difference being the shareholders' equity in the firm. For these firms, DEBTRATIO should not exceed one. However for some firms, total liabilities may exceed total assets, leading to negative equity. These firms are called balance sheet insolvent firms. Such firms will exhibit a DEBTRATIO of greater than one. These firms may continue to operate as long as they are not cash flow insolvent and can continue to meet their debt payment obligations, and as long as their DEBTRATIO value does not violate any covenants on the firm's debt that might trigger foreclosure.

In Figures 2.3 and 2.4 below, DEBTRATIO has been divided into quartiles, with the means and linearized standard errors indicted for each of the four quartiles. Note that the fourth quartile contains the firms with DEBTRATIO>1, for both samples, 1998 and 2003.

Over	Mean	Linearized Std. Err.	[95% Conf.	Interval]
DEBTRATIO				
1	.0001507	.0000386	.0000751	.0002264
2	.1500921	.0040426	.1421659	.1580184
3	.5952191	.0063615	.5827462	.6076919
4	4.107276	.3054738	3.508342	4.70621

Figure 2.3. 1998 NSSBF: Quartiles of DEBTRATIO

Over	Mean	Linearized Std. Err.	[95% Conf.	Interval]
DEBTRATIO				
1	9.27e-06	4.17e-06	1.10e-06	.0000174
2	.1212125	.0034488	.114451	.127974
3	.535353	.0068142	.5219935	.5487126
4	3.172341	.2553991	2.671618	3.673065

Figure 2. 4. 2003 NSSBF: Quartiles of DEBTRATIO

There are 767 such balance sheet insolvent firms in the 1998 NSSBF survey, and 782 balance sheet insolvent firms in implicate #3 of the 2003 NSSBF survey. After excluding observations with missing item data, 252 firms in the 1998 sample (out of a total of 1,128) are insolvent, and 273 firms in implicate #3 of the 2003 sample (out of 1458) are insolvent. It is these firms that cause the value of DEBTRATIO in figures 2.1 and 2.2 to be greater than one. Due to the NSSBF survey criteria that firms accepted for the survey sample be in operation at the time of the survey, these firms have not been dropped from the sample as they continued to be going concerns. However, an

alternative variable called "ZDEBTRATIO" has been created that is trimmed so that values above one are set to missing. Results using this variable are also presented.

2.3.4 Summary Statistics for Dummy and Categorical Variables. Tables 2.2 and 2.3 provide un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 1,129 observations of the 1998 NSSBF sample, and tables 2.4 and 2.5 provide un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 1,464 observations of the 2003 NSSBF sample.

Note that variable OFFEREDTCD = 1 for 100% of the observations used in the 1998 and 2003 samples. This variable identifies the subpopulation of firms that are actually offered trade credit discounts, all of which provided a response value for PCTDISCOUNTS in the two surveys. There are actually 1,473 firms in the 1998 sample, and 9,139 in the 2003 sample, that have OFFEREDTCD = 1. Unfortunately, missing item data for some of these observations reduces the usable observations to 1,129 and 1,464, respectively, as described earlier.

Examination of the distribution of responses for PCTDISCOUNTS in tables 2.3 and 2.5 shows a cluster of responses around zero percent discounts used, and around one-hundred percent discounts used, for both samples. This suggests that most small firms maintained a policy of either taking all discounts offered, or none of them, during the previous fiscal year.

Table 2.2

Sample statistics for dummy/categorical variables from 1998 NSSBF (n=1128)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
FEMOWN: Female owns more than 50% of the firm	No	973	86.3
	Yes	155	13.7
MINOWN: Minority owns more than 50% of the firm	No	1050	93.1
	Yes	78	6.9
OWNMGR: Firm's Manager is an owner	No	177	15.7
	Yes	951	84.3
OWNEDU: Principal owner's level of education	Less than High School	15	1.3
	High School graduate	183	16.2
	Some college but no degree	181	16.0
	Assoc Degree/occupational program	59	5.2
	Trade School/vocational program	29	2.6
	College degree	463	41.0
	Post-graduate degree	198	17.6
PCACCTNG: Firm uses PC's for accounting	No	98	8.7
	Yes	1030	91.3
MAINSUPL: Firm's main supplier offers trade credit discounts	No	574	50.9
	Yes	554	49.1
USEDCARD: Firm has used owner's or firm's credit card within most recent fiscal year	No	189	16.8
	Yes	939	83.2
DBSCORE: Dun and Bradstreet credit score	Low Risk	141	12.5
	Moderate Risk	340	30.1
	Average Risk	308	27.3
	Significant Risk	224	19.9
	High Risk	115	10.2
PAIDLATE: Firm has paid at least one invoice past due date within most recent fiscal year	No	519	46.0
	Yes	609	54.0
FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations	No	880	78.0
	Yes	248	22.0
OFFEREDTCD: Firm is offered trade credit discounts by at least one supplier	No	0	0.0
	Yes	1128	100.0

Table 2.3

Sample distribution of PCTDISCOUNTS from 1998 NSSBF (n=1128)

PCTDISCOUNTS: Percentage of discounts offered that are taken			
% Taken	% of Sample	% Taken	% of Sample
0 (n=266)	23.6	54 (n=2)	0.2
1 (n=41)	3.6	58 (n=1)	0.1
2 (n=32)	2.8	60 (n=3)	0.3
3 (n=6)	0.5	62 (n=1)	0.1
4 (n=2)	0.2	63 (n=1)	0.1
5 (n=26)	2.3	65 (n=3)	0.3
7 (n=1)	0.1	66 (n=2)	0.2
8 (n=1)	0.1	67 (n=2)	0.2
10 (n=43)	3.8	70 (n=5)	0.4
11 (n=1)	0.1	72 (n=2)	0.2
13 (n=1)	0.1	74 (n=2)	0.2
15 (n=5)	0.4	75 (n=27)	2.4
20 (n=10)	0.9	78 (n=1)	0.1
21 (n=1)	0.1	80 (n=28)	2.5
22 (n=1)	0.1	82 (n=1)	0.1
25 (n=12)	1.1	85 (n=4)	0.4
26 (n=1)	0.1	90 (n=37)	3.3
29 (n=2)	0.2	92 (n=3)	0.3
30 (n=9)	0.8	93 (n=2)	0.2
32 (n=1)	0.1	95 (n=16)	1.4
33 (n=3)	0.3	96 (n=2)	0.2
35 (n=1)	0.1	98 (n=6)	0.5
40 (n=6)	0.5	99 (n=10)	0.9
46 (n=2)	0.2	100 (n=419)	37.1
49 (n=2)	0.2	Total (n=1,128)	100.0
50 (n=71)	6.3		
53 (n=1)	0.1		

Table 2.4

Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=1458)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
FEMOWN: Female owns more than 50% of the firm	No	1284	88.1
	Yes	174	11.9
MINOWN: Minority owns more than 50% of the firm	No	1392	95.5
	Yes	66	4.5
OWNMGR: Firm's Manager is an owner	No	226	15.5
	Yes	1232	84.5
OWNEDU: Principal owner's level of education	Less than High School	12	0.8
	High School graduate	256	17.6
	Some college but no degree	257	17.6
	Assoc Degree/occupational program	136	9.3
	Trade School/vocational program	137	9.4
	College degree	450	30.9
	Post-graduate degree	210	14.4
PCACCTNG: Firm uses PC's for accounting	No	85	5.8
	Yes	1373	94.2
MAINSUPL: Firm's main supplier offers trade credit discounts	No	806	55.3
	Yes	652	44.7
USEDCARD: Firm has used owner's or firm's credit card within most recent fiscal year	No	199	13.6
	Yes	1259	86.4
DBSCORE: Dun and Bradstreet credit score	Low Risk	282	19.3
	Moderate Risk	290	19.9
	Average Risk	428	29.4
	Significant Risk	190	13.0
	High Risk	122	8.4
	Very High Risk	146	10.0
PAIDLATE: Firm has paid at least one invoice past due date within most recent fiscal year	No	764	52.4
	Yes	694	47.6
FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations	No	1402	96.2
	Yes	56	3.8
OFFEREDTCD: Firm is offered trade credit discounts by at least one supplier	No	0	0.0
	Yes	1458	100.0

Table 2.5

Sample distribution of PCTDISCOUNTS from 2003 NSSBF (using implicate #3 only, n=1458)

PCTDISCOUNTS: Percentage of discounts offered that are taken			
% Taken	% of Sample	% Taken	% of Sample
0 (n=292)	20.0	60 (n=4)	0.3
1 (n=36)	2.5	66 (n=1)	0.1
2 (n=48)	3.3	70 (n=11)	0.8
3 (n=7)	0.5	75 (n=27)	1.9
4 (n=2)	0.1	80 (n=22)	1.5
5 (n=43)	2.9	81 (n=1)	0.1
6 (n=2)	0.1	85 (n=3)	0.2
8 (n=2)	0.1	90 (n=55)	3.8
10 (n=82)	5.6	95 (n=20)	1.4
12 (n=2)	0.1	96 (n=1)	0.1
13 (n=1)	0.1	97 (n=1)	0.1
14 (n=1)	0.1	98 (n=2)	0.1
15 (n=3)	0.2	99 (n=11)	0.8
17 (n=2)	0.1	100 (n=602)	41.3
20 (n=37)	2.5	Total (n=1,458)	100.0
25 (n=14)	1.0		
26 (n=1)	0.1		
30 (n=10)	0.7		
35 (n=1)	0.1		
37 (n=1)	0.1		
40 (n=9)	0.6		
44 (n=1)	0.1		
47 (n=1)	0.1		
50 (n=99)	6.8		

2.3.5 Sample correlations. Figures 2.5 and 2.6 present the Pearson correlations between the variables in the empirical model for the 1998 and 2003 NSSBF samples, respectively. As can be seen, there are no correlations between variables with absolute values greater than 0.5.

	PCTDIS~S	FEMOWN	MINOWN	OWNEXP	OWNEDU	PCACCTNG	MAINSUPL
PCTDISCOUNTS	1.0000						
FEMOWN	0.0243	1.0000					
MINOWN	-0.1035*	0.0333	1.0000				
OWNEXP	0.1538*	-0.1503*	-0.0794*	1.0000			
OWNEDU	0.0023	-0.0547	0.1012*	-0.0784*	1.0000		
PCACCTNG	0.0264	-0.0689*	-0.0524	0.0382	-0.0082	1.0000	
MAINSUPL	0.1095*	0.0457	0.0468	-0.0521	-0.0735*	-0.0370	1.0000
OWNSHR	-0.0472	0.0215	0.0640*	-0.1679*	-0.1662*	-0.0657*	0.0406
OWNMGR	-0.0466	0.0235	0.0599*	-0.0971*	-0.0732*	-0.0638*	0.0387
USEDCARD	-0.0507	-0.0002	0.0194	-0.0108	0.0375	0.0133	-0.0578
wLnUNUSEDLOC	0.0426	-0.0507	-0.0195	0.0222	0.0190	0.0185	-0.0578
wLnQUICKRA~O	0.1492*	0.0157	0.0084	0.0030	0.0851*	0.0231	0.0305
wLnPROFTOI~E	0.0675*	0.0362	0.0158	-0.0060	-0.0491	-0.0326	-0.0244
DBSCORE	-0.2677*	0.0374	0.1146*	-0.2122*	0.0448	0.0251	-0.0610*
PAIDLATE	-0.2385*	0.0275	0.0623*	-0.0684*	0.0080	-0.0069	-0.0110
wLnDEBTRATIO	-0.1007*	0.0429	0.0337	-0.1271*	-0.0807*	-0.0350	-0.0733*
wLnINVRATIO	-0.0126	0.0568	-0.0284	0.0773*	0.0027	0.0008	0.0310
FIRMDISTRESS	-0.2713*	-0.0067	0.0916*	-0.0924*	0.0110	0.0270	0.0522

	OWNSHR	OWNMGR	USEDCARD	wLnUNU~C	wLnQUI~O	wLnPRO~E	DBSCORE
OWNSHR	1.0000						
OWNMGR	0.0019	1.0000					
USEDCARD	0.0384	0.0675*	1.0000				
wLnUNUSEDLOC	-0.0417	-0.0223	0.0730*	1.0000			
wLnQUICKRA~O	0.0046	0.0067	-0.0201	0.0547	1.0000		
wLnPROFTOI~E	0.0936*	-0.0197	0.0192	-0.0323	-0.0095	1.0000	
DBSCORE	0.0904*	0.0220	0.0078	-0.0460	-0.1260*	-0.0273	1.0000
PAIDLATE	0.0054	0.0125	0.0145	-0.1407*	-0.2062*	-0.0056	0.3108*
wLnDEBTRATIO	0.0770*	0.0222	-0.0356	0.0439	-0.4078*	0.0366	0.1816*
wLnINVRATIO	-0.0167	-0.0094	0.0604*	0.0072	-0.1711*	0.0012	0.0378
FIRMDISTRESS	0.0600*	-0.0476	0.0204	-0.0691*	-0.1906*	-0.0353	0.3490*

	PAIDLATE	wLnDEB~O	wLnINV~O	FIRMDI~S
PAIDLATE	1.0000			
wLnDEBTRATIO	0.1419*	1.0000		
wLnINVRATIO	-0.0464	-0.0166	1.0000	
FIRMDISTRESS	0.4042*	0.1802*	-0.0151	1.0000

Figure 2.5. 1998 NSSBF: Pearson Correlations of Model Variables

	PCTDIS~S	FEMOWN	MINOWN	OWNEXP	OWNEDU	PCACCTNG	MAINSUPL
PCTDISCOUNTS	1.0000						
FEMOWN	-0.0509	1.0000					
MINOWN	-0.0326	0.0623*	1.0000				
OWNEXP	0.1020*	-0.1191*	-0.0332	1.0000			
OWNEDU	0.0392	-0.0387	0.0624*	-0.0270	1.0000		
PCACCTNG	0.0232	-0.0258	-0.0021	0.0073	0.0542*	1.0000	
MAINSUPL	0.0925*	-0.0247	-0.0300	0.0151	-0.1217*	0.0236	1.0000
OWNSHR	-0.0451	0.1012*	-0.0046	0.0237	-0.0740*	-0.1021*	0.0450
OWNMGR	0.0025	-0.0469	-0.0435	-0.2210*	-0.0078	-0.0661*	-0.0036
USEDCARD	-0.0618*	0.0416	-0.0095	-0.0713*	0.0474	0.0034	-0.0683*
wLnUNUSEDLOC	0.0838*	-0.0235	-0.0222	-0.0206	0.0374	0.0211	0.0041
wLnQUICKRA~O	0.1178*	0.0092	0.0246	-0.0114	-0.0163	-0.0484	-0.0172
wLnPROFTOI~E	0.0245	-0.0242	-0.0005	-0.0181	-0.0169	-0.0952*	0.0021
DBSCORE	-0.3182*	0.0247	0.0177	-0.1407*	0.0213	0.0345	-0.0451
PAIDLATE	-0.3090*	0.0558*	0.0171	-0.0969*	0.0372	0.0261	-0.0673*
wLnDEBTRATIO	-0.1540*	0.0291	-0.0028	-0.0770*	0.0183	0.0565*	-0.0226
wLnINVRATIO	0.0334	-0.0109	-0.0608*	0.0909*	-0.0298	0.0033	0.0048
FIRMDISTRESS	-0.0741*	0.0365	-0.0264	-0.0093	0.0038	0.0497	0.0141

	OWNSHR	OWNMGR	USEDCARD	wLnUNU~C	wLnQUI~O	wLnPRO~E	DBSCORE
OWNSHR	1.0000						
OWNMGR	0.0684*	1.0000					
USEDCARD	0.0272	0.1002*	1.0000				
wLnUNUSEDLOC	0.0258	0.0108	0.0271	1.0000			
wLnQUICKRA~O	0.0429	0.0272	0.0080	-0.0265	1.0000		
wLnPROFTOI~E	0.0718*	0.0459	-0.0277	-0.0288	0.0379	1.0000	
DBSCORE	0.0435	0.0282	-0.0099	-0.1290*	-0.1992*	0.0008	1.0000
PAIDLATE	-0.0023	-0.0092	0.0309	-0.0774*	-0.1890*	-0.0629*	0.3138*
wLnDEBTRATIO	0.0112	0.0320	0.0190	0.1968*	-0.4106*	-0.1324*	0.1989*
wLnINVRATIO	0.0241	-0.0094	0.0530*	-0.0012	-0.2330*	-0.0028	0.0371
FIRMDISTRESS	0.0019	-0.0032	0.0067	0.0139	-0.0642*	0.0133	0.1174*

	PAIDLATE	wLnDEB~O	wLnINV~O	FIRMDI~S
PAIDLATE	1.0000			
wLnDEBTRATIO	0.1960*	1.0000		
wLnINVRATIO	0.0601*	0.0678*	1.0000	
FIRMDISTRESS	0.0596*	0.0799*	-0.0261	1.0000

Figure 2. 6. 2003 NSSBF: Pearson Correlations of Model Variables (using implicate #3 only)

2.3.6 Variance inflation factors. The variance inflation factors for the 1998 model estimation are provided in table 2.6 below. The variance inflation factors for the 2003 model estimation are provided in table 2.7 below. They were generated following unweighted OLS estimation of the Trade Credit model for the two survey samples. No evidence of multicollinearity is indicated by the low values in these tables.

Table 2.6

Variance Inflation Factors – 1998 NSSBF

Variable	**VIF**	**1/VIF**
FIRMDISTRESS	1.33	0.753458
wLnQUICKRA~O	1.31	0.766107
PAIDLATE	1.30	0.770636
wLnDEBTRATIO	1.28	0.779160
DBSCORE	1.27	0.785433
OWNEXP	1.15	0.872944
OWNSHR	1.10	0.911221
OWNEDU	1.10	0.913136
wLnINVRATIO	1.07	0.934430
FEMOWN	1.05	0.955273
MINOWN	1.05	0.955955
MAINSUPL	1.04	0.957346
wLnUNUSEDLOC	1.04	0.961233
OWNMGR	1.04	0.962252
USEDCARD	1.03	0.974850
wLnPROFTOI~E	1.02	0.978739
PCACCTNG	1.02	0.978806
Mean VIF	1.13	

Table 2.7

Variance Inflation Factors – 2003 NSSBF

Variable	**VIF**	**1/VIF**
wLnDEBTRATIO	1.34	0.747756
wLnQUICKRA~O	1.31	0.761148
DBSCORE	1.21	0.829069
PAIDLATE	1.16	0.859437
OWNEXP	1.12	0.893830
wLnUNUSEDLOC	1.09	0.920127
OWNMGR	1.08	0.922817
wLnINVRATIO	1.08	0.926631
OWNSHR	1.05	0.954170
FEMOWN	1.05	0.956011
wLnPROFTOI~E	1.04	0.963451
OWNEDU	1.03	0.967185
PCACCTNG	1.03	0.969284
MAINSUPL	1.03	0.970762
USEDCARD	1.03	0.972136
FIRMDISTRESS	1.03	0.975010
MINOWN	1.02	0.983610
Mean VIF	1.10	

2.4 Estimation Methodology

The model specified in the previous section is estimated using survey-weighted least squares regression or the equivalent method, WLS with robust standard errors. The sign and statistical significance of the independent variable coefficients are used to test the hypotheses. The rationale behind the use of a survey-weighted regression estimation methodology, which is common to all three essays in this dissertation, is described in Section 6.1. In addition to the nature of the survey and its impact on regression estimates, there are two additional econometric challenges that this model and data present. Those challenges are selection bias, and endogeneity of regressors. They are addressed in the following sections of this essay.

2.4.1 Potential selection bias. The fact that the response variable PCTDISCOUNTS is only recorded in the samples for those observations for which OFFEREDTCD = 1 and is missing for all other observations presents a challenge to the estimation methodology. This is similar to what is encountered in labor studies in Economics, where wages of an individual is used as the dependent variable in a regression which models the level of wages against a variety of individual and family factors to explore the determinants of wages. Typically, wages is not observed in a sample unless the individual is also employed, which causes the wages variable to be truncated in the sample. If the employment status of an individual in the sample was completely random, then model estimation could proceed using only the subpopulation of the sample for which wages was observed with no fear of bias. Unfortunately, the determinants of employment may themselves be complex and so the employed individuals do not represent a random subsample. In cases such as this, OLS regression will produce biased estimates.

As described by Breen (1996), "incidental truncation" in which the presence or absence of a response variable in the sample depends upon the value of another variable in the sample. When all of the regressor variables for the model are present for every observation in the sample (with the exception of some missing item data), but the response variable itself is only observed for the selected subset of the sample observations, and missing for all other observations, Breen describes this as a sample selection problem rather than a truncation or censorship problem. The usual full-sample regression estimation methodologies cannot be applied in this situation, as they will produce biased and inconsistent estimates of the regression parameters. Nor can estimates using only the subpopulation of firms for which OFFEREDTCD=1 be used, as the sample representing that subpopulation as in the sample is not randomly selected and the estimates thus obtained will be biased and inconsistent (Breen, 1996). Fortunately, Heckman (1976, 1979) derived a two-step estimation procedure to correct for the bias introduced by this type of selection process which is described below. Imagine the existence of an unobserved (latent) variable OFFEREDTCD* of which the observed dummy variable OFFEREDTCD is the realization in the sample. OFFEREDTCD* can be expressed as follows:

$$\text{OFFEREDTCD}^*_i = \mathbf{w_i}'\boldsymbol{\alpha_i} + \mu_i \quad , \text{ where} \qquad (1)$$

$\text{OFFEREDTCD}_i = 0$ if $\text{OFFEREDTCD}^*_i \leq 0$, and

$\text{OFFEREDTCD}_i = 1$ if $\text{OFFEREDTCD}^*_i > 0$

The $\mathbf{w_i}$ are variables that determine the decision to offer or not offer trade credit discounts, and may or may not be same as the variables $\mathbf{x_i}$ in equation (2) below. The subscript "i" varies from 1 to N, the size of the sample, even though there are only $n < N$

observations that have observed values for PCTDISCOUNTS. The errors μ are assumed to be normally distributed with zero mean and constant variance σ_μ^2. Given these assumptions, the probability that OFFEREDTCD=1 can be expressed as shown in equation (1a) below, and can be estimated using Probit regression with a suitable set of regressors $\mathbf{w_i}$

$$\Pr(\text{OFFEREDTCD}_i = 1) = \Phi(\mathbf{w_i}'\boldsymbol{\alpha_i}) \qquad (1a)$$

where $\Phi(\mathbf{w_i}'\boldsymbol{\alpha_i})$ is the cumulative distribution function (cdf) of the standard normal distribution evaluated at $\mathbf{w_i}'\boldsymbol{\alpha_i}$. Equation (1a) is estimated using ALL of the observations in the sample that pass the going concern test and are not missing any item data for the independent variables $\mathbf{w_i}$.

Now consider the existence of another latent variable PCTDISCOUNTS* of which the observed PCTDISCOUNTS is the realization in the sample. PCTDISCOUNTS* can be expressed as:

$$\text{PCTDISCOUNTS}^*_i = \mathbf{x_i}'\boldsymbol{\beta_i} + \varepsilon_i \text{ , where} \qquad (2)$$

$\text{PCTDISCOUNTS}_i = \text{PCTDISCOUNTS}^*_i$ if $\text{OFFEREDTCD}_i = 1$, but
PCTDISCOUNTS_i is not observed if $\text{OFFEREDTCD}_i = 0$

The errors ε are assumed to be normally distributed with zero mean and constant variance σ_ε^2. In this model, the errors ε and μ are assumed to have correlation ρ and have a joint bivariate normal distribution. Equation (1) models the process by which observations in the sample are selected to have observed values of PCTDISCOUNTS, and equation (2) is just the structural model for PCTDISCOUNTS, as originally presented in Section 2.3.

Estimating the expected value of equation (2) gives:

$$E(PCTDISCOUNTS_i \mid OFFEREDTCD=1, \mathbf{x_i}) = \mathbf{x_i}'\boldsymbol{\beta_i} + E(\varepsilon_i \mid OFFEREDTCD=1) \quad (3)$$

But remember from (1) that when OFFEREDTCD=1, $\mathbf{w_i}'\boldsymbol{\alpha_i} + \mu_i > 0$, or $\mu_i > \mathbf{w_i}'\boldsymbol{\alpha_i}$.

Substituting this last inequality into (3) gives:

$$E(PCTDISCOUNTS_i \mid OFFEREDTCD=1, \mathbf{x_i}) = \mathbf{x_i}'\boldsymbol{\beta_i} + E(\varepsilon_i \mid \mu_i > \mathbf{w_i}'\boldsymbol{\alpha_i})$$

Under the assumption that ε and μ are bivariate normal, Breen derives the result:

$$E(\varepsilon_i \mid \mu_i > \mathbf{w_i}'\boldsymbol{\alpha_i}) = \rho\sigma_\varepsilon\sigma_\mu[\varphi(\mathbf{w_i}'\boldsymbol{\alpha_i})/\Phi(\mathbf{w_i}'\boldsymbol{\alpha_i})]$$

$$E(PCTDISCOUNTS_i \mid OFFEREDTCD=1, \mathbf{x_i}) = \mathbf{x_i}'\boldsymbol{\beta_i} + \rho\sigma_\varepsilon\sigma_\mu[\varphi(\mathbf{w_i}'\boldsymbol{\alpha_i})/\Phi(\mathbf{w_i}'\boldsymbol{\alpha_i})] \quad (4)$$

$$E(PCTDISCOUNTS_i \mid OFFEREDTCD=1, \mathbf{x_i}) = \mathbf{x_i}'\boldsymbol{\beta_i} + \lambda[\varphi(\mathbf{w_i}'\boldsymbol{\alpha_i})/\Phi(\mathbf{w_i}'\boldsymbol{\alpha_i})] \quad (5)$$

In equation (5), $\varphi(\mathbf{w_i}'\boldsymbol{\alpha_i})$ is the probability density function (pdf) for the standard normal distribution, and $\Phi(\mathbf{w_i}'\boldsymbol{\alpha_i})$ is the cdf for the standard normal distribution. The ratio of the two as written above is the "inverse Mills Ratio". Equation (5) is only estimated for those $n < N$ observations that have OFFEREDTCD=1, unlike equation (1a) that is estimated using the full sample subject to the going concern and missing item data criteria.

Note that the first term in equation (5) is just the structural model for PCTDISCOUNTS from Section 2.3; the second term represents the correction for the selection bias. If the selection process in equation (1) and the structural process in equation (2) are totally independent of each other, then $\rho = 0$ and thus $\lambda = 0$ and so there is no bias correction. This will be observed in the model estimation as a failure to reject the null hypothesis of zero equality for the t-test on the estimated regression coefficient $\hat{\lambda}$.

In order to estimate (5), equation (1a) must first be estimated across the entire N observations of the sample an estimate of the inverse Mills Ratio for each observation can be derived using the estimated values of $\mathbf{w_i}'\boldsymbol{\alpha}_i$. Then equation (5) can be estimated, limiting "i" to range across the $n < N$ observations in the sample for which OFFEREDTCD=1, using either survey-weighted least squares or WLS with robust standard errors, as explained in section 6.1 of this document. Note that if the estimated coefficient $\hat{\lambda}$ in equation (5) is not significantly different than zero, then there is no selection bias and it can be concluded that the selection process is independent of the structural equation process. The standard errors produced by the estimation of (5) must be adjusted for the fact that an estimated value of the inverse Mills Ratio is being used from the first step regression. (This is similar to the correction that must be made to the standard errors produced by the second step of 2SLS estimation.) Fortunately, STATA does this correction automatically when using the "heckman" estimation command.

In order to determine a list of regressor variables $\mathbf{w_i}$ to estimate equation (1a), it is important to remember that the decision to offer trade credit is a *seller decision*, while the decision to take trade credit discounts is a *buyer decision*. This makes the selection process is the model unique when compared to typical examples of selection in the economics literature, which mostly involve "self-selection" wherein the selection decision is made by the same entity to whom the structural model applies. The fact that the selection decision and the decision to take discounts are made by separate entities might suggest that they are entirely independent of each other, and hence no selection bias correction need be applied.

Keeping in mind that the selection decision is a seller decision, and that the seller only has access to externally visible information about the firm and its business environment to use in its decision to offer trade credit discounts or not, the regressors $\mathbf{w_i}$ are chosen on the following basis.

Industry dummy variables are chosen because as shown by Ng, Smith and Smith (1999), the terms of trade credit, including offering of discounts, is very industry dependent.

DBSCORE is chosen as an externally visible indicator of the firm's ability to make payments in a timely manner, including the firm's ability to make early payments to take advantage of any discounts offered. A seller wishing to reduce the Days Sales Outstanding on its accounts receivable may choose to selectively offer discounts to those firms that can actually pay early. Alternatively, consistent with the signaling theory of Smith (1981), a seller looking for an early signal of distress may offer discounts to firms that are weaker and at risk of default.

LnTOTEMP and LnFIRMAGE are chosen as general measures of firm size and firm age, respectively. These can be viewed as externally visible proxies for stability, survivorship and reputation. Such factors may influence the relationship between buyer and seller and the terms on which credit is offered. They can also be viewed as control variables in the Probit regression. Note that with the addition of these variables, the selection equation contains two exogenous variables that are excluded from the outcome equation. As explained by Cameron and Trivedi (2009), doing this reduces the possibility of multicollinearity between the Mills Ratio term and the rest of the variables in the outcome equation.

Including the variables discussed above, the Probit Index from equation (1a) above can be written as:

$$\mathbf{w_i}'\boldsymbol{\alpha_i} = \alpha_{0i} + \alpha_{1i}DBSCORE + \alpha_{2i}MANUFACTURING + \alpha_{3i}TRANSPORTATION + \alpha_{4i}WHOLESALE + \alpha_{5i}RETAIL + \alpha_{6i}SERVICES + \alpha_{7i}LnTOTEMP + \alpha_{8i}LnFIRMAGE$$

Figures 2.7 (for the 1998 NSSBF) and 2.8 (for the 2003 NSSBF) below show the results of the estimation of the Probit model with OFFEREDTCD as the response variable and using the Probit Index specified above for the regressors. The full samples (minus observations with missing item data) are used for the estimation, although the 2003 survey data uses implicate #3 only. Survey weights and robust standard errors are used in the Probit regressions displayed in these tables. Maximum likelihood Probit estimation is employed.

For both the 1998 and 2003 surveys, the models are significant as indicated by the Wald Chi-square test. All regressors in the 2003 Probit estimation except WHOLESALE are significant at the 0.05 percent level, indicating that they are good candidates for the Probit estimation step of the Heckman estimation of the full model. For the 1998 Probit estimation, WHOLESALE and RETAIL are clearly not significant, and LnFIRMAGE is barely not significant at the 0.05 percent level but is comfortably significant at the 0.1 percent level. As the full model is very significant, this full set of variables will be employed for the Probit step of the Heckman estimation of the full model.

```
Probit regression                                 Number of obs   =       3441
                                                  Wald chi2(8)    =     336.78
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2040.7658                 Pseudo R2       =     0.1037

------------------------------------------------------------------------------
             |               Robust
  OFFEREDTCD |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     DBSCORE |  -.0934196   .0278781    -3.35   0.001    -.1480596   -.0387795
MANUFACTUR~G |   .2459827   .1101613     2.23   0.026     .0300705     .461895
TRANSPORTA~N |  -.6482335   .1638067    -3.96   0.000    -.9692889   -.3271782
   WHOLESALE |   .1916089   .1212776     1.58   0.114    -.0460909    .4293087
      RETAIL |  -.1137383   .0866553    -1.31   0.189    -.2835795     .056103
    SERVICES |   -.533168   .0767725    -6.94   0.000    -.6836393   -.3826966
   wLnTOTEMP |    .298207   .0233509    12.77   0.000     .2524402    .3439738
  wLnFIRMAGE |   .0711041   .0374404     1.90   0.058    -.0022777    .1444858
       _cons |  -.3967484   .1487523    -2.67   0.008    -.6882975   -.1051992
------------------------------------------------------------------------------
```

Figure 2.7. 1998 NSSBF: Probit Regression to examine determinants of OFFEREDTCD

```
Probit regression                                 Number of obs   =       4087
                                                  Wald chi2(8)    =     474.88
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2233.7238                 Pseudo R2       =     0.1360

------------------------------------------------------------------------------
             |               Robust
  OFFEREDTCD |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     DBSCORE |  -.0785546   .0203509    -3.86   0.000    -.1184417   -.0386676
MANUFACTUR~G |   .2591512   .1156958     2.24   0.025     .0323916    .4859107
TRANSPORTA~N |   -.492876   .1699273    -2.90   0.004    -.8259273   -.1598247
   WHOLESALE |   .1588798     .11916     1.33   0.182    -.0746696    .3924292
      RETAIL |  -.1924711   .0951185    -2.02   0.043    -.3788999   -.0060423
    SERVICES |  -.6594888   .0837571    -7.87   0.000    -.8236498   -.4953279
   wLnTOTEMP |   .4079067   .0274746    14.85   0.000     .3540575    .4617558
  wLnFIRMAGE |   .1326471   .0336467     3.94   0.000     .0667008    .1985935
       _cons |  -.9109546     .14547    -6.26   0.000    -1.196071   -.6258386
------------------------------------------------------------------------------
```

Figure 2.8. 2003 NSSBF: Regression to examine determinants of OFFEREDTCD (using implicate #3 only)

The original structural model from Section 2.3 is estimated using survey-weighted regression or WLS with robust standard errors, and compared to an estimation of equations (1a) and (5) using a Maximum Likelihood (ML) approach. According to Breen (1996, pg. 40), ML is to be preferred to the two-step estimation of the model as ML

produces estimates that are asymptotically normal and unbiased, and are more efficient than using the two-step estimation procedure. By comparison, OLS estimation of (5) with no Heckman correction term will produce estimates that are biased and inconsistent, while using a two-step estimation of (1a) and (5) will produce estimates that are consistent.

Sample selection models are very sensitive to heteroskedasticity and non-normality of the error terms. Sample selected estimators are neither efficient nor consistent under heteroskedasticity, and are not consistent under non-normality (Breen 1996, pgs. 58-59).

The two-step model above was derived on the assumption that ε and μ are bivariate normal and homoscedastic. As a robustness check, the results of the estimation using the Heckman ML method with other estimation methods for the same model will be compared to determine if there are significant differences that could be attributed to the violations of the assumptions of homoscedasticity and normality.

2.4.2 Endogeneity. One of the assumptions of OLS regression is that the error term is unrelated to the independent variables (regressors) of the model, That is, $E(\boldsymbol{\varepsilon} \mid \mathbf{x}) = 0$, where $\boldsymbol{\varepsilon}$ is the matrix of the residuals of the regression and $\mathbf{x}$ is the matrix of regressors. Regressors that satisfy this condition are exogenous to the model; those that do not are endogenous. The presence of endogenous regressors in the model leads to the OLS estimators being inconsistent.

When examining the structural model presented in section 2.3 and the theoretical justification for the regressors chosen for the model, the variable LnQUICKRATIO has been identified as potentially having an endogenous relationship with PCTDISCOUNTS, the dependent variable.

The endogeneity of this regressor in the model can be tested using the Durban-Wu-Hausman test described by Davidson and McKinnon (2004) and Wooldridge (2003). For a regressor that is found to be endogenous in the model, the method of instrumental variables (IV) will be used to replace the endogenous variable with a set of instrumental variables that meet three criteria: (a) they are highly correlated with the endogenous variable, (b) they are not correlated with the error term of the structural model (are exogenous), and (c) they can be legitimately excluded from the original structural model. Criteria (a) is testable and will be used along with theoretical considerations to select the instruments from the available candidates in the sample. Criteria (b) is not testable directly, though if the model is over-identified, then the test of over-identifying restrictions can be used to test the null hypothesis that all instruments are exogenous. To satisfy (c) instruments are chosen that are determinants of LnQUICKRATIO but not of PCTDISCOUNTS, which is testable.

In selecting instruments, care is taken that the set of instruments chosen to replace the endogenous variable exceeds the number of endogenous variables by at least one. This will ensure that the system of equations (structural and reduced form) is over-identified. Two-stage least squares regression (2SLS) or Generalized Method of Moments (GMM) may then be used to estimate the model, and the test of over-identifying restrictions (Cameron and Trivedi, 2009) will be performed to determine if the set of instruments is exogenous.

2.4.2.1 Instruments for LnQUICKRATIO. The selection of instruments for an endogenous variable that are both valid and not weak can be very challenging and subject the model estimation to criticism if not done carefully and with adequate justification (Murray, 2006). When weak instruments are chosen, the 2SLS estimates tend to be biased

and their standard errors are too small, resulting in misleading hypothesis tests. Using weak instruments to correct for endogeneity can introduce IV estimation errors that are as bad or worse than the OLS estimates they are intended to correct.

LnQUICKRATIO is a composite balance sheet variable created by summing cash and accounts receivable, dividing by current liabilities, performing any data transformation required as described by Section 6.2, then taking the natural log of the result. The focus of LnQUICKRATIO is on the current asset portion of the balance sheet, so to find instruments that meet the correlation criteria, the other asset accounts on the balance sheet that may be negatively correlated with LnQUICKRATIO are potential candidates for instruments. Candidate instrument variables using balance sheet data are then created for those asset accounts using data available in the 1998 and 2003 NSSBF surveys.

LnDEPRTOASSETS and LnOTRRATIO have been selected as candidate instrument variables. LnDEPRTOASSETS is the natural log of the ratio of the firm's depreciable assets to total assets, which is expected to be negatively correlated with liquidity since investments in such longer-term assets may be done at the expense of liquidity. LnOTRRATIO is the natural log of the ratio of "other current assets" to total assets, which may either be positively or negatively correlated with liquidity, depending on whether it is another substitute for liquidity (negative), or another manifestation of management's policy to invest in current assets over longer term assets (positive).

To test criteria (a), that the instruments are strongly correlated with the endogenous variable, one must examine the Pearson correlation of these variables with LnQUICKRATIO as shown in figure 2.9 below for the 1998 NSSBF and in figure 2.10 for the 2003 NSSBF.

	wLnQUI~O	wLnDEP~S	wLnOTR~O
wLnQUICKRA~O	1.0000		
wLnDEPRTOA~S	-0.1172*	1.0000	
wLnOTRRATIO	0.2760*	-0.0278	1.0000

Figure 2.9. 1998 NSSBF: Pearson correlation of LnQUICKRATIO instruments

	wLnQUI~O	wLnDEP~S	wLnOTR~O
wLnQUICKRA~O	1.0000		
wLnDEPRTOA~S	-0.1162*	1.0000	
wLnOTRRATIO	0.2516*	-0.0605*	1.0000

Figure 2.10. 2003 NSSBF: Pearson correlation of LnQUICKRATIO instruments

The weak correlation between LnQUICKRATIO the three chosen instruments suggests that these might be weak instruments. In order to ensure that the model is over-identified, both instruments are kept. Later tests will indicate if these are weak instruments. It appears that criteria (a) is not satisfied. Unfortunately, finding instruments that meet the criteria for good instruments among the variables available in the NSSBF database is a challenge that limits the selection of instruments.

Figures 2.11 and 2.12 below show the survey-weighted least squares regression of LnQUICKRATIO against the chosen instruments, using robust standard errors. All of the instruments are statistically significant at the 0.05 percent level in these regressions.

```
Linear regression                                       Number of obs =    1128
                                                        F(  2,  1125) =   31.28
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.0865
                                                        Root MSE      =  .87149
------------------------------------------------------------------------------
             |               Robust
wLnQUICKRA~O |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wLnDEPRTOA~S |  -.4582259   .1706524    -2.69   0.007    -.7930587    -.123393
 wLnOTRRATIO |    .516497    .070581     7.32   0.000     .3780118    .6549823
       _cons |   1.094835   .0588196    18.61   0.000     .9794265    1.210243
------------------------------------------------------------------------------
```

Figure 2.11. 1998 NSSBF: Regression of LnQUICKRATIO against instruments

```
Linear regression                                       Number of obs =    1458
                                                        F(  2,  1455) =   12.79
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.0628
                                                        Root MSE      =  .91588
------------------------------------------------------------------------------
             |               Robust
wLnQUICKRA~O |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wLnDEPRTOA~S |  -.6919908    .220126    -3.14   0.002    -1.123789   -.2601926
 wLnOTRRATIO |   1.022422   .2631249     3.89   0.000     .5062777    1.538567
       _cons |  -.6724175    .568996    -1.18   0.237    -1.788558    .4437226
------------------------------------------------------------------------------
```

Figure 2. 12. 2003 NSSBF: Regression of LnQUICKRATIO against instruments

To test criteria (c), that the instruments can be excluded from the structural model, the instruments are included in the structural model for PCTDISCOUNTS and estimated using robust WLS. The results for the 1998 NSSBF data are shown in figure 2.13 and for the 2003 NSSBF data in figure 2.14. In both cases, the null hypothesis that the coefficients of the instrumental variables in the estimated model are equal to zero at the 0.05 level cannot be rejected. Therefore, both instruments can legitimately be excluded from the structural model, and criteria (c) is satisfied.

```
Linear regression                                       Number of obs =    1128
                                                        F( 19,  1108) =   12.47
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.1889
                                                        Root MSE      =  40.133
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |   6.660184    4.09231     1.63   0.104    -1.369368    14.68974
      MINOWN |  -18.34047   5.768563    -3.18   0.002    -29.65901   -7.021928
      OWNEXP |   .6725405   .1397455     4.81   0.000     .3983448    .9467362
      OWNEDU |   .8064288   .8485176     0.95   0.342    -.8584538    2.471311
    PCACCTNG |   12.04226     5.1846     2.32   0.020     1.869517      22.215
    MAINSUPL |   14.16011   3.200646     4.42   0.000     7.880099    20.44012
      OWNSHR |  -.0094421   .0575969    -0.16   0.870    -.1224534    .1035692
      OWNMGR |  -3.313883   4.967217    -0.67   0.505     -13.0601     6.43233
    USEDCARD |   -2.68682   4.020778    -0.67   0.504    -10.57602    5.202378
wLnUNUSEDLOC |   5.314489   6.202395     0.86   0.392    -6.855277    17.48425
wLnQUICKRA~O |   5.728865   1.932791     2.96   0.003     1.936521    9.521208
wLnPROFTOI~E |   18.69985    7.04563     2.65   0.008     4.875566    32.52413
     DBSCORE |  -2.957854   1.511785    -1.96   0.051    -5.924138    .0084303
    PAIDLATE |  -8.586384   3.555207    -2.42   0.016    -15.56208   -1.610686
FIRMDISTRESS |   -19.0933   4.320067    -4.42   0.000    -27.56973   -10.61686
wLnDEBTRATIO |   1.800393   3.791783     0.47   0.635    -5.639492    9.240279
 wLnINVRATIO |  -2.277368   14.82494    -0.15   0.878     -31.3655    26.81076
 wLnOTRRATIO |  -1.447238   3.079151    -0.47   0.638    -7.488862    4.594387
wLnDEPRTOA~S |   10.50818    9.05983     1.16   0.246     -7.26818    28.28454
       _cons |  -43.75774   34.09466    -1.28   0.200    -110.6551    23.13965
------------------------------------------------------------------------------
```

Figure 2.13. 1998 NSSBF: structural model including three instruments

```
Linear regression                                       Number of obs =    1458
                                                        F( 19,  1438) =    9.64
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.1850
                                                        Root MSE      =  40.275
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |    2.758206   5.337174     0.52   0.605    -7.711274    13.22769
      MINOWN |   -4.914674   7.892671    -0.62   0.534    -20.39706    10.56771
      OWNEXP |    .0567438    .143492     0.40   0.693    -.2247323    .3382199
      OWNEDU |    1.348544    .932674     1.45   0.148    -.4810038    3.178091
    PCACCTNG |    .7451728   5.990711     0.12   0.901     -11.0063    12.49664
    MAINSUPL |    8.883382   3.302506     2.69   0.007     2.405136    15.36163
      OWNSHR |    .0237126   .0633593     0.37   0.708     -.100574    .1479992
      OWNMGR |   -2.651197   5.015733    -0.53   0.597    -12.49013     7.18774
    USEDCARD |   -6.620677   4.482035    -1.48   0.140     -15.4127    2.171351
wLnUNUSEDLOC |    17.12684    5.89196     2.91   0.004     5.569082    28.6846
wLnQUICKRA~O |    3.817436   2.005802     1.90   0.057    -.1171751    7.752046
wLnPROFTOI~E |   -5.531428   10.65452    -0.52   0.604    -26.43149    15.36864
     DBSCORE |   -4.236725   1.134631    -3.73   0.000    -6.462433   -2.011016
    PAIDLATE |   -20.25221   3.577767    -5.66   0.000    -27.27041     -13.234
FIRMDISTRESS |   -9.954424    10.2512    -0.97   0.332    -30.06333    10.15448
wLnDEBTRATIO |   -4.379723   4.563768    -0.96   0.337    -13.33208    4.572634
 wLnOTRRATIO |    2.335708   7.463734     0.31   0.754    -12.30526    16.97668
 wLnINVRATIO |    18.57083   10.90955     1.70   0.089    -2.829513    39.97117
wLnDEPRTOA~S |   -12.35012   11.17154    -1.11   0.269    -34.26439    9.564148
       _cons |    91.68288   63.27141     1.45   0.148    -32.43126     215.797
------------------------------------------------------------------------------
```

Figure 2.14. 2003 NSSBF: structural model including three instruments

2.4.2.2 The Durban-Wu-Hausman Test. Endogeneity of LnQUICKRATIO in the model can be tested using the Durban-Wu-Hausman test as described in Wooldridge (2003, pg 507). This test requires that one first performs a survey-weighted least squares regression of the reduced form equation for LnQUICKRATIO shown below:

$$\begin{aligned}\text{LnQUICKRATIO}_i = {} & \beta_{0i} + \beta_{1i}FEMOWN_i + \beta_{2i}MINOWN_i + \beta_{3i}OWNEXP_i + \\ & \beta_{4i}OWNEDU_i + \beta_{5i}PCACCTNG_i + \beta_{6i}MAINSUPL_i + \beta_{7i}OWNSHR_i + \\ & \beta_{8i}OWNMGR_i + \beta_{9i}USEDCARD_i + \beta_{10i}LnUNUSEDLOC_i + \\ & \beta_{11i}LnPROFTOINCOME_i + \beta_{12i}DBSCORE_i + \\ & \beta_{13i}PAIDLATE_i + \beta_{14i}LnDEBTRATIO_i + \beta_{15i}FIRMDISTRESS + \\ & \beta_{16i}LnOTRRATIO + \beta_{17i}LnINVRATIO + \beta_{18i}LnDEPRTOASSETS + \mu_i\end{aligned}$$

The residuals from this regression are then included as a regressor in the original structural model presented in Section 2.3. If the coefficient of the residual term in the model is significantly different than zero when estimated using survey-weighted least

squares regression using robust standard errors, then it can be concluded that LnQUICKRATIO is endogenous in the model; otherwise one can conclude it is not.

The results of the Durban-Wu-Hausman test for LnQUICKRATIO using the 1998 NSSBF data are shown in figures 2.15 and 2.16 below. The first figure is the results of the regression of the reduced form equation for LnQUICKRATIO from which the residuals for step 2 are derived. Included in the figure is a Wald test for the null that the coefficients of the instruments are jointly zero. That null hypothesis can be rejected with an F-value greater than 10, which according to Staiger and Stock (1997) is the minimum F-value for this test below which instruments are considered to be weak.

The second figure is the results of the regression of the original structural model including variable "quickresid" which contains the residuals from the step 1 regression. Also included in this figure is a Wald test for the null hypothesis that the estimated coefficient for the residuals is zero. The test results indicate that the null hypothesis that the coefficient is zero cannot be rejected. From this it is concluded that LnQUICKRATIO is not endogenous in the model using the 1998 NSSBF data.

```
Linear regression                                       Number of obs =    1128
                                                        F( 18,  1109) =   16.79
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.3190
                                                        Root MSE      =  .75784
------------------------------------------------------------------------------
             |               Robust
wLnQUICKRA~O |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |   .0615223    .083426     0.74   0.461    -.1021683    .2252128
      MINOWN |   .0800132   .1161038     0.69   0.491    -.1477948    .3078211
      OWNEXP |  -.0003685    .002734    -0.13   0.893     -.005733     .004996
      OWNEDU |   .0498485   .0150991     3.30   0.001     .0202224    .0794745
    PCACCTNG |    .031885   .0961034     0.33   0.740    -.1566799      .22045
    MAINSUPL |   .0233792    .061446     0.38   0.704    -.0971843    .1439428
      OWNSHR |    .001876   .0010775     1.74   0.082    -.0002382    .0039902
      OWNMGR |    .009916   .1020676     0.10   0.923    -.1903514    .2101834
    USEDCARD |   .0025243   .0682403     0.04   0.970    -.1313703     .136419
wLnUNUSEDLOC |   .2605771   .1540849     1.69   0.091    -.0417538    .5629079
wLnPROFTOI~E |  -.1568942   .1543213    -1.02   0.310    -.4596889    .1459006
     DBSCORE |  -.0048467   .0287402    -0.17   0.866    -.0612379    .0515445
    PAIDLATE |  -.1869018   .0696965    -2.68   0.007    -.3236536     -.05015
FIRMDISTRESS |  -.1963231   .0705567    -2.78   0.005    -.3347628   -.0578834
wLnDEBTRATIO |  -.6499466   .0874798    -7.43   0.000     -.821591   -.4783021
 wLnOTRRATIO |   .3252673   .0736968     4.41   0.000     .1806664    .4698682
 wLnINVRATIO |  -1.721261   .2686347    -6.41   0.000    -2.248351   -1.194172
wLnDEPRTOA~S |  -.8200753   .1665252    -4.92   0.000    -1.146815   -.4933352
       _cons |    3.14835   .7041751     4.47   0.000     1.766684    4.530015
------------------------------------------------------------------------------
      Wald test for H0: LnOTRRATIO = 0 and LnDEPRTOASSETS = 0
      F( 2,  1109) = 22.95     Prob > F = 0.0000
```

Figure 2.15. 1998 NSSBF: Regression of reduced form model for LnQUICKRATIO (step 1 of Durban-Wu-Hausman test)

```
Linear regression                                       Number of obs =    1128
                                                        F( 19,  1108) =   12.77
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.1904
                                                        Root MSE      =  40.097
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |   7.145788   4.080524     1.75   0.080     -.860637    15.15221
      MINOWN |  -17.61253   5.816917    -3.03   0.003    -29.02595   -6.199119
      OWNEXP |    .658489   .1411564     4.66   0.000     .3815251     .935453
      OWNEDU |   1.133372   .9108961     1.24   0.214    -.6539037    2.920648
    PCACCTNG |     11.955   5.161037     2.32   0.021     1.828491    22.08151
    MAINSUPL |   14.69452   3.223786     4.56   0.000     8.369106    21.01993
      OWNSHR |   .1015582   .0884806     1.15   0.251    -.0720502    .2751666
      OWNMGR |  -3.125172   4.919469    -0.64   0.525     -12.7777    6.527354
   wLnOWNERS |   4.699707   3.470138     1.35   0.176    -2.109076    11.50849
    USEDCARD |   -2.54174   4.024871    -0.63   0.528    -10.43897    5.355488
wLnUNUSEDLOC |   6.861855   6.379607     1.08   0.282    -5.655618    19.37933
wLnQUICKRA~O |    -2.9519   6.823721    -0.43   0.665    -16.34077    10.43697
wLnPROFTOI~E |   17.10475   7.239183     2.36   0.018     2.900693     31.3088
     DBSCORE |  -2.902804   1.517289    -1.91   0.056    -5.879889    .0742796
    PAIDLATE |  -10.54324   3.830702    -2.75   0.006    -18.05949   -3.026993
FIRMDISTRESS |  -20.75256    4.53254    -4.58   0.000    -29.64589   -11.85923
wLnDEBTRATIO |  -3.790301   5.682728    -0.67   0.505    -14.94042    7.359821
 wLnINVRATIO |  -19.77256   16.26048    -1.22   0.224    -51.67736    12.13224
  quickresid |   8.776312   7.068501     1.24   0.215    -5.092845    22.64547
       _cons |  -21.59876   40.21116    -0.54   0.591    -100.4974    57.29985
------------------------------------------------------------------------------
      Note: quickresid = coefficient for residuals from step 1 regression)
      Wald test for H0: quickresid = 0
      F(  1,  1108) =    1.54    Prob > F =    0.2146
```

Figure 2. 16. 1998 NSSBF: Regression of structural model for PCTDISCOUNTS

The results of the Durban-Wu-Hausman test for LnQUICKRATIO using the 2003 NSSBF data are shown in figures 2.17 and 2.18 below. The first figure is the results of the regression of the reduced form equation for LnQUICKRATIO from which the residuals for step 2 are derived. Included in the table is a Wald test for the null that the coefficients of the instruments are jointly zero. That null hypothesis can be rejected with an F-value greater than 10, which according to Staiger and Stock (1997) is the minimum F-value for this test below which instruments are considered to be weak.

The second figure is the results of the regression of the original structural model including "quickresid" as the residuals from the step 1 regression. Also included in this figure is a Wald test for the null hypothesis that the estimated coefficient for the residuals

is zero. The test results indicate that the null hypothesis that the coefficient is zero cannot be rejected. From this it is concluded that LnQUICKRATIO is not endogenous in the model using the 2003 NSSBF data.

Since LnQUICKRATIO is not endogenous in the model, the model will not be estimated using 2SLS regression, as that would not be an appropriate estimation method in this case.

```
Linear regression                                       Number of obs =    1458
                                                        F( 18,  1439) =   15.51
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.3320
                                                        Root MSE      =   .7775
------------------------------------------------------------------------------
             |               Robust
wLnQUICKRA~O |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |  -.0575275   .0726871    -0.79   0.429    -.2001114    .0850564
      MINOWN |  -.1675001   .1430627    -1.17   0.242     -.448134    .1131338
      OWNEXP |    .001042   .0030808     0.34   0.735    -.0050014    .0070853
      OWNEDU |  -.0030634   .0168186    -0.18   0.855     -.036055    .0299283
    PCACCTNG |   .1022847   .1113086     0.92   0.358    -.1160599    .3206293
    MAINSUPL |  -.0020161   .0630403    -0.03   0.974    -.1256769    .1216447
      OWNSHR |   .0015025   .0011724     1.28   0.200    -.0007974    .0038023
      OWNMGR |   .0921253   .0921342     1.00   0.318    -.0886064    .2728571
    USEDCARD |   .0859155   .0891353     0.96   0.335    -.0889336    .2607646
wLnUNUSEDLOC |   -.072471   .1096908    -0.66   0.509     -.287642       .1427
wLnPROFTOI~E |    .005521   .2375943     0.02   0.981    -.4605472    .4715893
     DBSCORE |  -.0737959   .0187978    -3.93   0.000    -.1106699   -.0369218
    PAIDLATE |  -.1154993   .0711013    -1.62   0.105    -.2549725    .0239739
FIRMDISTRESS |  -.0331077   .0993767    -0.33   0.739    -.2280463    .1618309
wLnDEBTRATIO |  -.8982158   .0786232   -11.42   0.000    -1.052444   -.7439874
 wLnINVRATIO |  -1.496067   .1872062    -7.99   0.000    -1.863293   -1.128841
 wLnOTRRATIO |    .449127   .2354571     1.91   0.057    -.0127489     .911003
wLnDEPRTOA~S |  -1.349834   .2061715    -6.55   0.000    -1.754263   -.9454047
       _cons |   1.556327   1.349264     1.15   0.249    -1.090407    4.203061
------------------------------------------------------------------------------
       Wald test for H0: LnOTRRATIO = 0 and LnDEPRTOASSETS = 0
       F(  2,  1439) =   24.49     Prob > F =    0.0000
```

Figure 2.17. 2003 NSSBF: Regression of reduced form model for LnQUICKRATIO (step 1 of Durban-Wu-Hausman test, using implicate #3 only)

```
Linear regression                                       Number of obs =    1458
                                                        F( 18,  1439) =   10.17
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.1849
                                                        Root MSE      =  40.262
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      FEMOWN |   3.251877   5.328072     0.61   0.542    -7.199742     13.7035
      MINOWN |  -3.487909    7.96128    -0.44   0.661    -19.10487    12.12905
      OWNEXP |   .0485413   .1431064     0.34   0.735    -.2321783    .3292609
      OWNEDU |   1.381428   .9281648     1.49   0.137    -.4392728    3.202129
    PCACCTNG |   -.132007   5.958247    -0.02   0.982    -11.81979    11.55577
    MAINSUPL |   8.884232   3.300053     2.69   0.007     2.410802    15.35766
      OWNSHR |    .011337   .0634957     0.18   0.858     -.113217    .1358911
      OWNMGR |  -3.369845   5.038293    -0.67   0.504    -13.25303     6.51334
    USEDCARD |  -7.391274   4.496817    -1.64   0.100    -16.21229    1.429745
wLnUNUSEDLOC |   17.73881   5.879973     3.02   0.003     6.204572    29.27305
wLnQUICKRA~O |   12.27657   6.627639     1.85   0.064    -.7243022    25.27744
wLnPROFTOI~E |  -5.524069   10.65165    -0.52   0.604    -26.41849    15.37035
     DBSCORE |   -3.61856   1.237551    -2.92   0.004    -6.046156   -1.190963
    PAIDLATE |  -19.27278   3.699261    -5.21   0.000     -26.5293   -12.01625
FIRMDISTRESS |  -9.706589    10.2632    -0.95   0.344    -29.83902    10.42584
wLnDEBTRATIO |    3.31084   7.283537     0.45   0.649    -10.97665    17.59833
 wLnINVRATIO |   31.83555   11.35008     2.80   0.005     9.571085    54.10002
  quickresid |  -8.459131   6.975378    -1.21   0.225    -22.14213    5.223867
       _cons |   74.43161   62.03761     1.20   0.230    -47.26222    196.1254
------------------------------------------------------------------------------
      Note: quickresid = coefficient for residuals from step 1 regression)
      Wald test for null: quickresid = 0
      F( 1,  1439) =   1.47     Prob > F =  0.2254
```

Figure 2.18. 2003 NSSBF: Regression of structural model for PCTDISCOUNTS (step 2 of Durban-Wu-Hausman test, using implicate #3 only)

2.4.2.3 The test of over-identifying restrictions. In order to investigate whether or not the chosen instruments are exogenous, the test of over-identifying restrictions can be used, since the model has one endogenous variable and two instruments, making it over-identified by one instrument. This test relies on the fact that under the null hypothesis that all instruments are valid, the objective function of the GMM estimator has an asymptotic chi-squared distribution with degrees of freedom equal to the number of over-identifying restrictions (Cameron and Trivedi, 2009). So the model must be estimated using GMM with robust errors instead of 2SLS, then the Hansen's J statistic produced is examined to see if one can reject the null hypothesis that the chosen set of instruments is valid.

Shown below are the results of the GMM estimation of the model and Hansen's J statistic for the 1998 NSSBF survey. For the 1998 NSSBF data, the null hypothesis that the chosen instruments for LnQUICKRATIO are valid cannot be rejected.

```
Instrumental variables (GMM) regression                Number of obs =    1128
                                                       Wald chi2(17) =  215.00
                                                       Prob > chi2   =  0.0000
                                                       R-squared     =  0.1696
GMM weight matrix: Robust                              Root MSE      =  40.248
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wLnQUICKRA~O |  -2.369528   6.880186    -0.34   0.731    -15.85444    11.11539
      FEMOWN |   6.977314   4.079691     1.71   0.087    -1.018733    14.97336
      MINOWN |  -17.93512   5.874447    -3.05   0.002    -29.44882   -6.421412
      OWNEXP |   .6659862   .1401161     4.75   0.000     .3913636    .9406088
      OWNEDU |   1.221354   .9265754     1.32   0.187    -.5947002    3.037409
    PCACCTNG |   12.15788   5.277206     2.30   0.021     1.814743    22.50101
    MAINSUPL |     14.425   3.210209     4.49   0.000      8.13311     20.7169
      OWNSHR |    .006395   .0588331     0.11   0.913    -.1089156    .1217057
      OWNMGR |  -3.414694   5.048441    -0.68   0.499    -13.30946    6.480069
    USEDCARD |  -2.691758   4.068697    -0.66   0.508    -10.66626    5.282741
wLnUNUSEDLOC |   7.355868   6.397988     1.15   0.250    -5.183959    19.89569
wLnPROFTOI~E |   17.71031   7.324319     2.42   0.016     3.354909    32.06571
     DBSCORE |  -2.949567   1.522382    -1.94   0.053    -5.933381    .0342467
    PAIDLATE |  -9.982724   3.892596    -2.56   0.010    -17.61207   -2.353375
FIRMDISTRESS |  -20.73281   4.596912    -4.51   0.000    -29.74259   -11.72302
wLnDEBTRATIO |   -3.89643   5.647557    -0.69   0.490    -14.96544    7.172579
 wLnINVRATIO |  -19.18868   16.50613    -1.16   0.245    -51.54009    13.16274
       _cons |  -15.75488   40.11458    -0.39   0.695      -94.378    62.86825
------------------------------------------------------------------------------
Instrumented:  wLnQUICKRATIO
Instruments:   FEMOWN MINOWN OWNEXP OWNEDU PCACCTNG MAINSUPL OWNSHR OWNMGR
               USEDCARD wLnUNUSEDLOC wLnPROFTOINCOME DBSCORE PAIDLATE
               FIRMDISTRESS wLnDEBTRATIO wLnINVRATIO wLnOTRRATIO
               WLnDEPRTOASSETS

       Test of endogeneity (orthogonality conditions)
         H0: variables are exogenous
         GMM C statistic chi2(1) =  1.29808  (p = 0.2546)

       Test of over-identifying restriction:
         H0: instruments are valid
         Hansen's J chi2(1) = .305599 (p = 0.5804)
```

Figure 2.19. 1998 NSSBF: GMM regression of structural model for PCTDISCOUNTS with instruments for LnQUICKRATIO

Shown below are the results of the GMM estimation of the model and Hansen's J statistic for the 2003 NSSBF survey. For the 2003 NSSBF data, the null hypothesis that the chosen instruments for LnQUICKRATIO are valid cannot be rejected.

```
Instrumental variables (GMM) regression                 Number of obs =    1458
                                                        Wald chi2(17) =  179.68
                                                        Prob > chi2   =  0.0000
                                                        R-squared     =  0.1637
GMM weight matrix: Robust                               Root MSE      =  40.516
------------------------------------------------------------------------------
             |               Robust
PCTDISCOUNTS |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wLnQUICKRA~O |   12.17409   6.642266     1.83   0.067     -.844516    25.19269
      FEMOWN |   3.311145   5.310601     0.62   0.533    -7.097442    13.71973
      MINOWN |  -3.577016   8.081336    -0.44   0.658    -19.41614    12.26211
      OWNEXP |   .0473578   .1445213     0.33   0.743    -.2358988    .3306143
      OWNEDU |   1.388471     .93151     1.49   0.136     -.437255    3.214197
    PCACCTNG |  -.1668532   5.763003    -0.03   0.977    -11.46213    11.12843
    MAINSUPL |   8.880268   3.316078     2.68   0.007     2.380874    15.37966
      OWNSHR |   .0105246   .0635932     0.17   0.869    -.1141157    .1351649
      OWNMGR |  -3.435293    5.04713    -0.68   0.496    -13.32748      6.4569
    USEDCARD |  -7.387655   4.578256    -1.61   0.107    -16.36087    1.585561
wLnUNUSEDLOC |   17.75247    5.90137     3.01   0.003     6.185995    29.31894
wLnPROFTOI~E |  -5.657274   10.78764    -0.52   0.600    -26.80065     15.4861
     DBSCORE |  -3.622708   1.254711    -2.89   0.004    -6.081896   -1.163521
    PAIDLATE |  -19.25421   3.730194    -5.16   0.000    -26.56526   -11.94316
FIRMDISTRESS |  -9.918535   10.24053    -0.97   0.333    -29.98961    10.15254
wLnDEBTRATIO |   3.250149   7.281779     0.45   0.655    -11.02188    17.52217
 wLnINVRATIO |   31.72482    11.3406     2.80   0.005      9.49766    53.95198
       _cons |   75.50177   62.30208     1.21   0.226    -46.60806    197.6116
------------------------------------------------------------------------------
Instrumented:  wLnQUICKRATIO
Instruments:   FEMOWN MINOWN OWNEXP OWNEDU PCACCTNG MAINSUPL OWNSHR OWNMGR
               USEDCARD wLnUNUSEDLOC wLnPROFTOINCOME DBSCORE PAIDLATE
               FIRMDISTRESS wLnDEBTRATIO wLnINVRATIO wLnOTRRATIO
               WLnDEPRTOASSETS

       Test of endogeneity (orthogonality conditions)
         H0: variables are exogenous
         GMM C statistic chi2(1) =  1.42435  (p = 0.2327)

       Test of over identifying restriction:
         H0: instruments are valid
         Hansen's J chi2(1) = .033377 (p = 0.8550)
```

Figure 2.20. 2003 NSSBF: GMM regression of structural model for PCTDISCOUNTS with instruments for LnQUICKRATIO

2.5 Univariate Analysis

Chapter 1 of this document provided an overview of some descriptive statistics for small U.S. firms, taken from the 2003 NSSBF survey data. That overview painted a broad picture of the characteristics of small U.S. firms in general. This section will focus on univariate analysis particular to the trade credit discounts question, in order to attempt to illuminate the characteristics of firms that are offered trade credit discounts, and those that actually take advantage of them. This analysis is preliminary to the multivariate

analysis presented in the next section in support of the hypotheses of this essay. All statistics presented in this section are survey-weighted population statistics, not unweighted sample statistics.

Figures 2.21 (for the 1998 NSSBF) and 2.22 (for the 2003 NSSBF) below present two-way tabulations of the dummy and categorical regressors used in the trade credit model, against the variable OFFEREDTCD. For each two-way tabulation presented, the Pearson Chi-square test results are presented. The null hypothesis for this test is that there is no difference between the responses of the regressor variable between firms that have been offered trade credit discounts, and those that have not been offered them. Rejection of the null hypothesis indicates that there is a significant difference in the responses between the two subpopulations.

Examination of figure 2.21 shows that for the population represented by the 1998 NSSBF survey, the null hypothesis can be rejected at the 0.05 level of significance for all regressors except OWNDISTRESS. Examination of figure 2.22 shows that for the population represented by the 2003 NSSBF survey, the null hypothesis can be rejected at the 0.05 level of significance for all regressors except OWNDISTRESS and FIRMDISTRESS. Hence, there is no significant different in the responses to the owner and firm distress questions between firms in the population that are offered trade credit discounts, and those that are not. It is interesting that all other dummy and categorical variables in the model show significant differences in responses between the two subpopulations. One possible interpretation is that OFFEREDTCD is a broad proxy for a number of other latent variables that influence the firm characteristics along the dimensions measured by the dummy and categorical variables. In fact, when OFFERETCD is modeled in the first stage of the Heckman estimation presented in the

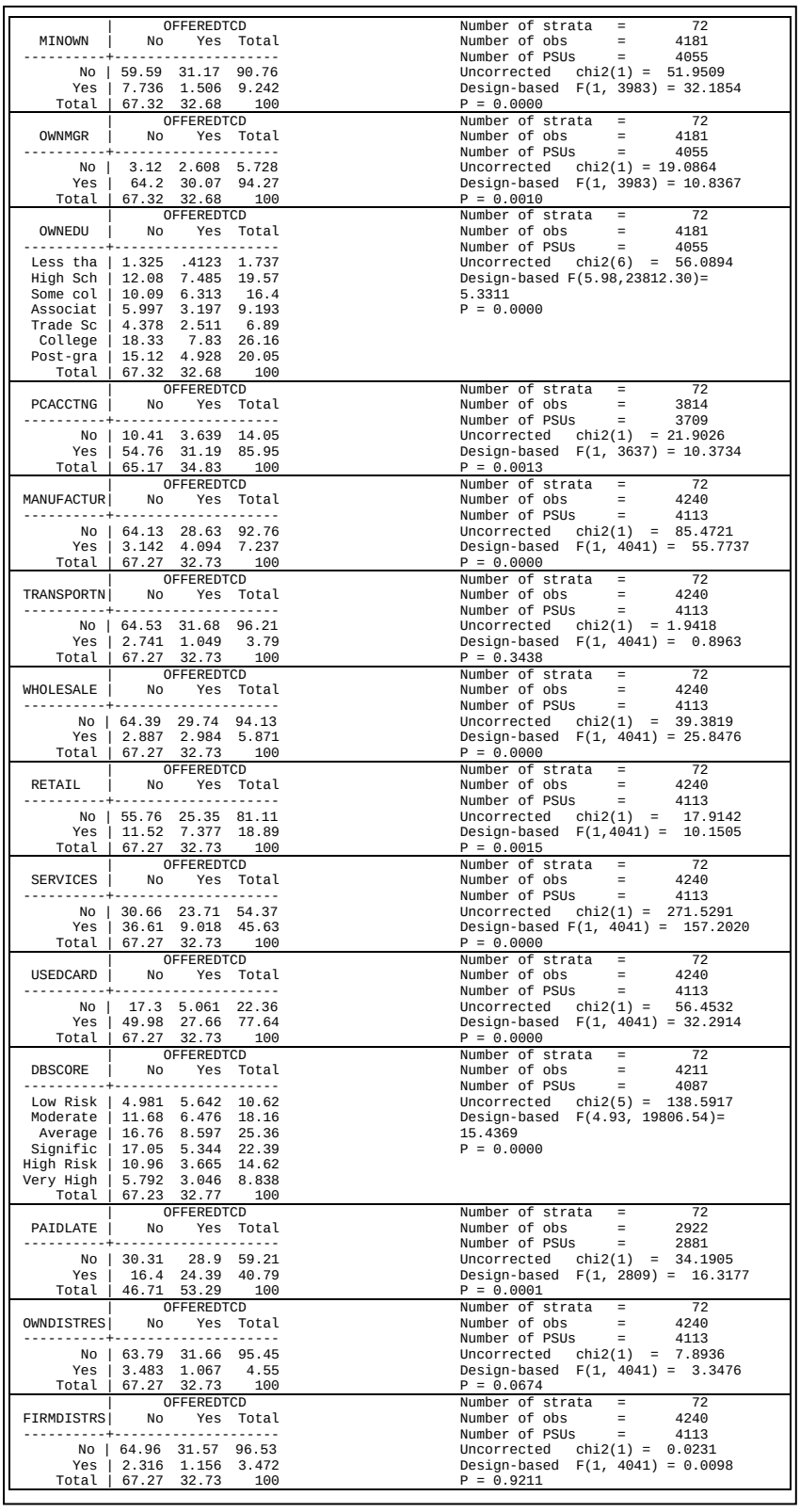
next section, it will be shown that OFFEREDTCD can in fact be significantly modeled in terms of other factors, some of which have been presented in figures 2.21 and 2.22.

```
          |      OFFEREDTCD                    Number of strata   =        78
  FAMOWN  |    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
       No | 6.075  5.113  11.19                Uncorrected   chi2(1) =   12.7985
      Yes|  56.4  32.41  88.81                Design-based F(1, 3363) =  9.0660
    Total | 62.48  37.52    100                P = 0.0026
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
  FEMOWN  |    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
       No |  44.8   31.4   76.2                Uncorrected   chi2(1) =  65.9859
      Yes | 17.68  6.123   23.8                Design-based  F(1, 3363)= 45.6961
    Total | 62.48  37.52    100                P = 0.0000
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
  MINOWN  |    No    Yes  Total                Number of obs      =      3553
----------+--------------------                Number of PSUs     =      3434
       No | 55.33  35.47  90.81                Uncorrected   chi2(1)  =  38.6452
      Yes | 7.207  1.985  9.192                Design-based  F(1, 3356) = 42.5161
    Total | 62.54  37.46    100                P = 0.0000
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
  OWNMGR  |    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
       No | 3.883  3.744  7.627                Uncorrected   chi2(1) = 16.7671
      Yes | 58.59  33.78  92.37                Design-based  F(1, 3363) = 12.3034
    Total | 62.48  37.52    100                P = 0.0005
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
  OWNEDU  |    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
 Less tha | 2.393  1.025  3.418                Uncorrected   chi2(6) = 38.9382
 High Sch | 12.25  7.953   20.2                Design-based  F(5.92,19909.34) =
 Some col | 10.61  7.565  18.18                4.225
 Associat |  3.56  1.922  5.482                P = 0.0003
 Trade Sc | 2.953  1.398  4.351
  College | 17.63  12.38  30.02
 Post-gra | 13.08  5.275  18.36
    Total | 62.48  37.52    100
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
 PCACCTNG |    No    Yes  Total                Number of obs      =      2863
----------+--------------------                Number of PSUs     =      2781
       No | 11.12  5.223  16.35                Uncorrected   chi2(1) = 19.3490
      Yes | 47.78  35.88  83.65                Design-based  F(1, 2703) = 12.0654
    Total |  58.9   41.1    100                P = 0.0005
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
MANUFACTUR|    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
       No | 59.04  32.57  91.61                Uncorrected   chi2(1) = 64.2677
      Yes |  3.44  4.953  8.394                Design-based  F(1, 3363) = 45.9396
    Total | 62.48  37.52    100                P = 0.0000
----------+--------------------------------------------------------------------
          |      OFFEREDTCD                    Number of strata   =        78
TRANSPORTN|    No    Yes  Total                Number of obs      =      3561
----------+--------------------                Number of PSUs     =      3441
       No | 59.75  36.59  96.34                Uncorrected   chi2(1) = 8.4325
      Yes | 2.728  .9303  3.658                Design-based  F(1, 3363) = 6.1604
    Total | 62.48  37.52    100                P = 0.0131
```

```
           |      OFFEREDTCD                 Number of strata   =        78
WHOLESALE  |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 59.36  33.48  92.84             Uncorrected   chi2(1) = 41.9401
      Yes  | 3.117   4.04  7.157             Design-based  F(1, 3363) =
    Total  | 62.48  37.52    100             26.3415     P = 0.0000
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
 RETAIL    |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 51.51  29.23  80.74             Uncorrected   chi2(1) = 10.9946
      Yes  | 10.97  8.288  19.26             Design-based  F(1, 3363) = 7.6143
    Total  | 62.48  37.52    100             P = 0.0058
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
 SERVICES  |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 30.15  26.69  56.84             Uncorrected   chi2(1) =  177.9980
      Yes  | 32.33  10.83  43.16             Design-based  F(1, 3363) =
    Total  | 62.48  37.52    100             121.5270     P = 0.0000
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
 USEDCARD  |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 22.68  8.397  31.07             Uncorrected   chi2(1) = 75.5107
      Yes  |  39.8  29.13  68.93             Design-based  F(1, 3363) =
    Total  | 62.48  37.52    100             49.2098     P = 0.0000
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
 DBSCORE   |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
 Low Risk  | 2.045  3.489  5.535             Uncorrected   chi2(4) =  131.4280
 Moderate  | 14.88  12.11  26.99             Design-based  F(3.99,13432.91)=
  Average  |  27.3  11.53  38.83             22.8768
 Signific  | 14.47  7.007  21.48             P = 0.0000
 High Ris  |  3.77   3.39   7.16
    Total  | 62.48  37.52    100
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
 PAIDLATE  |    No    Yes  Total             Number of obs      =      2338
-----------+--------------------             Number of PSUs     =      2310
       No  | 25.75  31.54  57.29             Uncorrected   chi2(1) = 21.8279
      Yes  |  15.1  27.62  42.71             Design-based  F(1, 2232) =
    Total  | 40.85  59.15    100             14.5044     P = 0.0001
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
OWNDISTRES |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 52.04  32.08  84.11             Uncorrected   chi2(1) = 3.0200
      Yes  | 10.44  5.446  15.89             Design-based  F(1, 3363) = 2.0256
    Total  | 62.48  37.52    100             P = 0.1548
-----------+-----------------------------------------------------------------
           |      OFFEREDTCD                 Number of strata   =        78
FIRMDISTRS |    No    Yes  Total             Number of obs      =      3561
-----------+--------------------             Number of PSUs     =      3441
       No  | 55.72  30.44  86.16             Uncorrected   chi2(1) =  45.3433
      Yes  |  6.76   7.08  13.84             Design-based  F(1, 3363) =
    Total  | 62.48  37.52    100             31.4878     P = 0.0000
```

Figure 2.21. 1998 NSSBF: Two-way tabulation of OFFEREDTCD versus firm characteristics

```
           |      OFFEREDTCD                          Number of strata   =        72
  FAMOWN   |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113 Uncorrected   chi2(1)
      No   | 5.903  4.237  10.14                      = 17.8244
      Yes  | 61.37  28.49  89.86                      Design-based  F(1, 4041) = 12.1288
    Total  | 67.27  32.73    100                      P = 0.0005

           |      OFFEREDTCD                          Number of strata   =        72
  FEMOWN   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055  Uncorrected
      No   | 50.35  27.89  78.24                      chi2(1) =  60.1335
      Yes  | 16.97  4.789  21.76                      Design-based  F(1, 3983) = 34.9288
    Total  | 67.32  32.68    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
  MINOWN   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055
      No   | 59.59  31.17  90.76                      Uncorrected   chi2(1) =  51.9509
      Yes  | 7.736  1.506  9.242                      Design-based  F(1, 3983) = 32.1854
    Total  | 67.32  32.68    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
  OWNMGR   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055
      No   |  3.12  2.608  5.728                      Uncorrected   chi2(1) = 19.0864
      Yes  |  64.2  30.07  94.27                      Design-based  F(1, 3983) = 10.8367
    Total  | 67.32  32.68    100                      P = 0.0010

           |      OFFEREDTCD                          Number of strata   =        72
  OWNEDU   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055
 Less tha  | 1.325  .4123  1.737                      Uncorrected   chi2(6)  =  56.0894
 High Sch  | 12.08  7.485  19.57                      Design-based F(5.98,23812.30)=    5.3311
 Some col  | 10.09  6.313   16.4                      P = 0.0000
 Associat  | 5.997  3.197  9.193
 Trade Sc  | 4.378  2.511   6.89
  College  | 18.33   7.83  26.16
 Post-gra  | 15.12  4.928  20.05
    Total  | 67.32  32.68    100

           |      OFFEREDTCD                          Number of strata   =        72
 PCACCTNG  |    No    Yes  Total                      Number of obs      =      3814
-----------+--------------------                      Number of PSUs     =      3709
      No   | 10.41  3.639  14.05                      Uncorrected   chi2(1)  = 21.9026
      Yes  | 54.76  31.19  85.95                      Design-based  F(1, 3637) = 10.3734
    Total  | 65.17  34.83    100                      P = 0.0013

           |      OFFEREDTCD                          Number of strata   =        72
MANUFACTUR |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   | 64.13  28.63  92.76                      Uncorrected   chi2(1)  =  85.4721
      Yes  | 3.142  4.094  7.237                      Design-based  F(1, 4041) =  55.7737
    Total  | 67.27  32.73    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
TRANSPORTN |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   | 64.53  31.68  96.21                      Uncorrected   chi2(1)  = 1.9418
      Yes  | 2.741  1.049   3.79                      Design-based  F(1, 4041) =  0.8963
    Total  | 67.27  32.73    100                      P = 0.3438

           |      OFFEREDTCD                          Number of strata   =        72
WHOLESALE  |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   | 64.39  29.74  94.13                      Uncorrected   chi2(1)  =  39.3819
      Yes  | 2.887  2.984  5.871                      Design-based  F(1, 4041) = 25.8476
    Total  | 67.27  32.73    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
 RETAIL    |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   | 55.76  25.35  81.11                      Uncorrected   chi2(1)  =   17.9142
      Yes  | 11.52  7.377  18.89                      Design-based  F(1,4041) =  10.1505
    Total  | 67.27  32.73    100                      P = 0.0015

           |      OFFEREDTCD                          Number of strata   =        72
 SERVICES  |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   | 30.66  23.71  54.37                      Uncorrected   chi2(1) =  271.5291
      Yes  | 36.61  9.018  45.63                      Design-based F(1, 4041) =  157.2020
    Total  | 67.27  32.73    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
 USEDCARD  |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113
      No   |  17.3  5.061  22.36                      Uncorrected   chi2(1) =   56.4532
      Yes  | 49.98  27.66  77.64                      Design-based  F(1, 4041) = 32.2914
    Total  | 67.27  32.73    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
  FAMOWN   |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113 Uncorrected   chi2(1)
      No   | 5.903  4.237  10.14                      = 17.8244
      Yes  | 61.37  28.49  89.86                      Design-based  F(1, 4041) = 12.1288
    Total  | 67.27  32.73    100                      P = 0.0005

           |      OFFEREDTCD                          Number of strata   =        72
  FAMOWN   |    No    Yes  Total                      Number of obs      =      4240
-----------+--------------------                      Number of PSUs     =      4113 Uncorrected   chi2(1)
      No   | 5.903  4.237  10.14                      = 17.8244
      Yes  | 61.37  28.49  89.86                      Design-based  F(1, 4041) = 12.1288
    Total  | 67.27  32.73    100                      P = 0.0005

           |      OFFEREDTCD                          Number of strata   =        72
  FEMOWN   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055  Uncorrected
      No   | 50.35  27.89  78.24                      chi2(1) =  60.1335
      Yes  | 16.97  4.789  21.76                      Design-based  F(1, 3983) = 34.9288
    Total  | 67.32  32.68    100                      P = 0.0000

           |      OFFEREDTCD                          Number of strata   =        72
  FEMOWN   |    No    Yes  Total                      Number of obs      =      4181
-----------+--------------------                      Number of PSUs     =      4055  Uncorrected
      No   | 50.35  27.89  78.24                      chi2(1) =  60.1335
      Yes  | 16.97  4.789  21.76                      Design-based  F(1, 3983) = 34.9288
    Total  | 67.32  32.68    100                      P = 0.0000
```



```
           |      OFFEREDTCD                    Number of strata   =        72
  MINOWN   |    No    Yes  Total                Number of obs      =      4181
-----------+--------------------                Number of PSUs     =      4055
        No | 59.59  31.17  90.76                Uncorrected   chi2(1) =  51.9509
       Yes | 7.736  1.506  9.242                Design-based  F(1, 3983) = 32.1854
     Total | 67.32  32.68    100                P = 0.0000
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
  OWNMGR   |    No    Yes  Total                Number of obs      =      4181
-----------+--------------------                Number of PSUs     =      4055
        No |  3.12  2.608  5.728                Uncorrected   chi2(1) = 19.0864
       Yes |  64.2  30.07  94.27                Design-based  F(1, 3983) = 10.8367
     Total | 67.32  32.68    100                P = 0.0010
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
  OWNEDU   |    No    Yes  Total                Number of obs      =      4181
-----------+--------------------                Number of PSUs     =      4055
 Less tha | 1.325  .4123  1.737                Uncorrected   chi2(6)  =  56.0894
 High Sch | 12.08  7.485  19.57                Design-based F(5.98,23812.30)=
 Some col | 10.09  6.313   16.4                5.3311
 Associat | 5.997  3.197  9.193                P = 0.0000
 Trade Sc | 4.378  2.511   6.89
  College | 18.33   7.83  26.16
 Post-gra | 15.12  4.928  20.05
    Total | 67.32  32.68    100
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 PCACCTNG  |    No    Yes  Total                Number of obs      =      3814
-----------+--------------------                Number of PSUs     =      3709
        No | 10.41  3.639  14.05                Uncorrected   chi2(1)  = 21.9026
       Yes | 54.76  31.19  85.95                Design-based  F(1, 3637) = 10.3734
     Total | 65.17  34.83    100                P = 0.0013
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
MANUFACTUR |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 64.13  28.63  92.76                Uncorrected   chi2(1)  =  85.4721
       Yes | 3.142  4.094  7.237                Design-based  F(1, 4041) =  55.7737
     Total | 67.27  32.73    100                P = 0.0000
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
TRANSPORTN |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 64.53  31.68  96.21                Uncorrected   chi2(1)  = 1.9418
       Yes | 2.741  1.049   3.79                Design-based  F(1, 4041) =  0.8963
     Total | 67.27  32.73    100                P = 0.3438
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
WHOLESALE  |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 64.39  29.74  94.13                Uncorrected   chi2(1)  =  39.3819
       Yes | 2.887  2.984  5.871                Design-based  F(1, 4041) = 25.8476
     Total | 67.27  32.73    100                P = 0.0000
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 RETAIL    |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 55.76  25.35  81.11                Uncorrected   chi2(1)  =   17.9142
       Yes | 11.52  7.377  18.89                Design-based  F(1,4041) =  10.1505
     Total | 67.27  32.73    100                P = 0.0015
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 SERVICES  |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 30.66  23.71  54.37                Uncorrected   chi2(1) =  271.5291
       Yes | 36.61  9.018  45.63                Design-based F(1, 4041) =  157.2020
     Total | 67.27  32.73    100                P = 0.0000
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 USEDCARD  |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No |  17.3  5.061  22.36                Uncorrected   chi2(1) =   56.4532
       Yes | 49.98  27.66  77.64                Design-based  F(1, 4041) = 32.2914
     Total | 67.27  32.73    100                P = 0.0000
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 DBSCORE   |    No    Yes  Total                Number of obs      =      4211
-----------+--------------------                Number of PSUs     =      4087
 Low Risk | 4.981  5.642  10.62                Uncorrected   chi2(5) =  138.5917
 Moderate | 11.68  6.476  18.16                Design-based  F(4.93, 19806.54)=
  Average | 16.76  8.597  25.36                15.4369
 Signific | 17.05  5.344  22.39                P = 0.0000
High Risk | 10.96  3.665  14.62
Very High | 5.792  3.046  8.838
    Total | 67.23  32.77    100
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
 PAIDLATE  |    No    Yes  Total                Number of obs      =      2922
-----------+--------------------                Number of PSUs     =      2881
        No | 30.31   28.9  59.21                Uncorrected   chi2(1)  =  34.1905
       Yes |  16.4  24.39  40.79                Design-based  F(1, 2809) =  16.3177
     Total | 46.71  53.29    100                P = 0.0001
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
OWNDISTRES |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 63.79  31.66  95.45                Uncorrected   chi2(1)  =  7.8936
       Yes | 3.483  1.067   4.55                Design-based  F(1, 4041) =  3.3476
     Total | 67.27  32.73    100                P = 0.0674
-----------+--------------------
           |      OFFEREDTCD                    Number of strata   =        72
FIRMDISTRS |    No    Yes  Total                Number of obs      =      4240
-----------+--------------------                Number of PSUs     =      4113
        No | 64.96  31.57  96.53                Uncorrected   chi2(1) =  0.0231
       Yes | 2.316  1.156  3.472                Design-based  F(1, 4041) = 0.0098
     Total | 67.27  32.73    100                P = 0.9211
```

Figure 2.22. 2003 NSSBF: Two-way tabulation of OFFEREDTCD versus firm characteristics (using implicate #3 only)

Tables 2.8 (for the 1998 NSSBF) and 2.9 (for the 2003 NSSBF) below present the means of a variety of numerical variables that characterize the firm across multiple dimensions. These variables are drawn from the firm's balance sheet and income statement, represent owner characteristics, or represent lender relationship characteristics. The variables are:

- SALES: Annual sales
- LOANS: Total of all outstanding loans held by the firm
- PAYABLES: Accounts Payable
- RECEIVABLES: Accounts receivable
- OCURRLIB: Other current liabilities
- OPEX: Operating expenses
- INVENTORY: Inventory
- OTRCURRENT: Other current assets
- TOTALASSETS: Total assets of the firm
- CURRLIB: Current liabilities
- INVESTMENTS: Firm's investments in non-core activities (see essay #3)
- OTRINCOME: Other income (not from Sales)
- TOTINCOME: Total income from all sources
- TOTLIABILITIES: Total liabilities of the firm
- DEPRECIABLES: Depreciable assets
- LAND: Value of firm's investment in land

- FIRMAGE: Age of the firm
- TOTEMP: Total employees
- OWNEXP: Years of primary owner experience managing a business
- OWNAGE: The age of the primary owner
- RELLENGTH: The length of the firm's relationship with its primary financial inst.
- RELNUM: The number of relationships with financial institutions.
- OWNSHR: The percentage of ownership share of the firm's primary owner
- OWNERS: The number of owners/shareholders of the firm
- OWNWORTH: Net worth of the firm's primary owner, not including the firm
- OWNEQUITY: Primary owner's equity investment in the firm

For each variable, means are calculated for the two subpopulations represented by the binary variable OFFEREDTCD. For each pair of means presented, the results of the Adjusted Wald Test for equality of means is provided. The null hypothesis for this test is that there is no difference between the means for firms that have been offered trade credit discounts (OFFEREDTCD=1), and those that have not been offered them (OFFEREDTCD=0). Rejection of the null hypothesis indicates that there is a significant difference in the means between the two subpopulations.

When examining the results in tables 2.8 and 2.9, two observations are immediately apparent. First, for all of the variables examined, the subpopulation means

are significantly different from each other at the 0.05 percent level of significance except for LAND and OWNAGE for the 1998 survey, and OWNERS, LAND and OWNAGE for the 2003 survey. Second, for all of the income statement and balance sheet variables examined (excluding LAND), the subpopulation mean for the firms for which OFFEREDTCD=1 are significantly larger than the means for the other firms, indicating that firms that are offered trade credit discounts are uniformly larger in all of the measures examined than those for which OFFEREDTCD=0. These firms also tend to be older, have wealthier and more experienced owners, have longer relationships with their primary financial institution, and have more relationships with financial institutions. Since the subpopulation with OFFEREDTCD=1 is also the subpopulation that will be examined in the multivariate analysis in the next section, it is important to keep in mind these characteristics of that subpopulation under study.

Table 2.8

1998 NSSBF: Survey-weighted means over OFFEREDTCD for firm characteristic variables

OFFEREDTCD	Mean	Linearized Std. Err.	[95% Conf.	Interval]	Adj Wald Test (H0: means are equal)
SALES					
No	503390.3	34757.28	435242.2	571538.4	
Yes	1931726	161325.6	1615417	2248035	F(1, 3291) = 73.34, Prob > F = 0.0000
LOANS					
No	89469.91	12292.38	65368.42	113571.4	
Yes	263089.2	20849.07	222210.8	303967.7	F(1, 3291) = 50.59, Prob > F = 0.0000
PAYABLES					
No	26564.5	2802.768	21069.15	32059.85	
Yes	128186	10435.14	107726	148646	F(1, 3291) = 86.99, Prob > F = 0.0000
OCURRLIB					
No	15965.86	1876.695	12286.25	19645.47	
Yes	70804.54	8228.168	54671.69	86937.38	F(1, 3291) = 41.46, Prob > F = 0.0000
RECEIVABLES					
No	41538.76	4187.543	33328.3	49749.21	
Yes	192228.4	20600.72	151836.9	232619.9	F(1, 3291) = 50.75, Prob > F = 0.0000
OPEX					
No	401671.8	31863.32	339197.9	464145.8	
Yes	1757892	154991.4	1454002	2061781	F(1, 3291) = 72.16, Prob > F = 0.0000
INVENTORY					
No	26145.02	2538.699	21167.44	31122.61	
Yes	172573.3	14034.28	145056.5	200090.1	F(1, 3291) = 104.05,Prob > F = 0.0000
CASH					
No	24741.83	2411.904	20012.85	29470.82	
Yes	78195.04	10119.73	58353.43	98036.65	F(1, 3291) = 26.23, Prob > F = 0.0000
OTRCURRENT					
No	18817.48	4048.93	10878.81	26756.16	
Yes	52998.37	8620.397	36096.49	69900.26	F(1, 3291) = 12.70, Prob > F = 0.0004
TOTALASSETS					
No	229915.2	17143.77	196301.7	263528.7	
Yes	773008.5	48252.46	678400.7	867616.4	F(1, 3291) = 108.60,Prob > F = 0.0000

CURRLIB					
No	42530.36	3852.248	34977.31	50083.4	
Yes	198990.5	14490.75	170578.7	227402.3	F(1, 3291) = 105.69,Prob > F = 0.0000
INVESTMENTS					
No	11919.78	2819.44	6391.742	17447.81	
Yes	23744.97	3402.283	17074.16	30415.77	F(1, 3291) = 7.07, Prob > F = 0.0079
OTRINCOME					
No	7922.612	1548.831	4885.841	10959.38	
Yes	24475.05	3972.597	16686.04	32264.07	F(1, 3291) = 15.01, Prob > F = 0.0001
TOTINCOME					
No	511312.9	35000.56	442687.9	579938	
Yes	1956201	162319.6	1637943	2274459	F(1, 3291) = 74.11, Prob > F = 0.0000
TOTLIABILIES					
No	134951.3	13996.19	107509.2	162393.4	
Yes	466076.6	30226.12	406812.7	525340.5	F(1, 3291) = 95.84, Prob > F = 0.0000
DEPRECIABLES					
No	77375.32	8670.814	60374.59	94376.06	
Yes	197283.5	16924.93	164099	230467.9	F(1, 3291) = 38.90, Prob > F = 0.0000
LAND					
No	25434.76	4610.499	16395.02	34474.49	
Yes	48116.06	11292.96	25974.14	70257.99	F(1, 3291) = 3.46, Prob > F = 0.0631
FIRMAGE					
No	12.83383	.2867487	12.27161	13.39606	
Yes	14.58927	.3650314	13.87356	15.30498	F(1, 3291) = 14.21, Prob > F = 0.0002
TOTEMP					
No	6.140928	.2677732	5.615909	6.665947	
Yes	13.56289	.6302133	12.32724	14.79854	F(1, 3291) = 106.69,Prob > F = 0.0000
OWNEXP					
No	17.40193	.2968669	16.81987	17.98399	
Yes	19.75739	.3727386	19.02657	20.48821	F(1, 3291) = 24.31, Prob > F = 0.0000
OWNAGE					
No	49.70782	.2965234	49.12643	50.28921	
Yes	50.50998	.354256	49.8154	51.20457	F(1, 3291) = 3.01, Prob > F = 0.0827
RELLENGTH					
No	89.54078	2.590315	84.46199	94.61957	
Yes	103.0949	3.584077	96.06767	110.1222	F(1, 3291) = 9.29, Prob > F = 0.0023

```
-------------+------------------------------------------------------------------------------
RELNUM       |
          No |   1.961133    .031434      1.899501    2.022765
         Yes |     2.3976   .0456943      2.308007    2.487192   F(1, 3291) = 61.72, Prob > F = 0.0000

OWNSHR       |
          No |    87.1163   .5988006      85.94224    88.29036
         Yes |   80.56001   .8457168      78.90183     82.2182   F(1, 3291) = 39.64, Prob > F = 0.0000
-------------+------------------------------------------------------------------------------
OWNERS       |
          No |   1.755378   .2003692      1.362517    2.148239
         Yes |   3.825297    .774444      2.306856    5.343738   F(1, 3291) = 6.66,  Prob > F = 0.0099
-------------+------------------------------------------------------------------------------
OWNWORTH     |
          No |   465884.5   25155.47      416562.6    515206.5
         Yes |   886334.7   78477.38      732465.2     1040204   F(1, 3291) = 25.93, Prob > F = 0.0000
-------------+------------------------------------------------------------------------------
OWNEQUITY    |
          No |   62442.55    11154.3      40572.49    84312.61
         Yes |   178705.2   21615.14      136324.7    221085.7   F(1, 3291) = 22.78, Prob > F = 0.0000
-------------------------------------------------------------------------------------------
Note: strata with single sampling unit treated as certainty units.
No:  OFFEREDTCD = No     Yes: OFFEREDTCD = Yes
Number of strata =      78         Number of obs    =     3489        Design df   =   3291
Number of PSUs   =    3369         Population size  =  4944450
```

Table 2.9

2003 NSSBF: Survey-weighted means over OFFEREDTCD for firm characteristic variables (using implicate #3 only)

OFFEREDTCD	Mean	Linearized Std. Err.	[95% Conf.	Interval]	Adj Wald Test (H0: means are equal)
SALES					
No	597686.4	45882.4	507730.8	687642	
Yes	2140688	99786.99	1945049	2336327	F(1,3920) = 191.20, Prob > F = 0.0000
LOANS					
No	140833.1	20195.11	101239.1	180427	
Yes	388221.4	34551.99	320479.9	455963	F(1,3920) = 37.92, Prob > F = 0.0000
PAYABLES					
No	26843.91	3292.804	20388.13	33299.68	
Yes	136181.4	12305.46	112055.7	160307.1	F(1,3920) = 72.84, Prob > F = 0.0000
OCURRLIB					
No	14478.04	2229.416	10107.11	18848.96	
Yes	83354.19	8703.192	66290.98	100417.4	F(1,3920) = 58.16, Prob > F = 0.0000
RECEIVABLES					
No	43797.64	4608.575	34762.21	52833.07	
Yes	210461.2	18034.02	175104.3	245818.2	F(1,3920) = 79.18, Prob > F = 0.0000
OPEX					
No	473656.3	40425.98	394398.4	552914.3	
Yes	1896059	89875.57	1719852	2072266	F(1,3920) = 201.77, Prob > F = 0.0000
INVENTORY					
No	28267.06	3235.963	21922.73	34611.39	
Yes	224231.9	23555.13	178050.4	270413.4	F(1,3920) = 67.74, Prob > F = 0.0000
CASH					
No	33553.44	2845.527	27974.59	39132.29	
Yes	91644.95	5875.072	80126.46	103163.4	F(1,3920) = 78.07, Prob > F = 0.0000
OTRCURRENT					
No	35393.95	10340.1	15121.46	55666.45	
Yes	91688.1	13945.87	64346.25	119029.9	F(1,3920) = 10.50, Prob > F = 0.0012
TOTALASSETS					
No	330063	33890.25	263618.8	396507.2	
Yes	1013090	63615.78	888366.9	1137813	F(1,3920) = 88.83, Prob > F = 0.0000

CURRLIB					
No	41321.94	4152.259	33181.15	49462.73	
Yes	219535.6	16594.61	187000.7	252070.5	F(1,3920) = 106.72, Prob > F = 0.0000
INVESTMENTS					
No	7643	1382.565	4932.386	10353.62	
Yes	39383.88	6656.252	26333.84	52433.93	F(1,3920) = 21.76, Prob > F = 0.0000
OTRINCOME					
No	7959.555	1611.151	4800.781	11118.33	
Yes	37058.99	7760.056	21844.86	52273.12	F(1,3920) = 13.43, Prob > F = 0.0003
TOTINCOME					
No	605646	46025.93	515408.9	695883	
Yes	2177747	101086.6	1979560	2375935	F(1,3920) = 194.00, Prob > F = 0.0000
TOTLIABILI~S					
No	182690.9	21608.87	140325.3	225056.6	
Yes	610172	44888.48	522165	698178.9	F(1,3920) = 72.70, Prob > F = 0.0000
DEPRECIABLE					
No	114580.3	16038.8	83135.14	146025.5	
Yes	294999.7	28988.37	238166	351833.4	F(1,3920) = 29.57, Prob > F = 0.0000
LAND					
No	61560.53	18647.45	25000.91	98120.15	
Yes	47229.21	6003.406	35459.11	58999.3	F(1,3920) = 0.54, Prob > F = 0.4642

```
FIRMAGE      |
          No |     13.469    .276513      12.92688    14.01112
         Yes |   16.22688   .3891675      15.46389    16.98987  F(1,3920) =  33.27,  Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
TOTEMP       |
          No |   6.030053   .1796891       5.67776    6.382346
         Yes |   14.35153   .4374823      13.49382    15.20925  F(1,3920) =  283.10, Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
OWNEXP       |
          No |   18.36057    .291261      17.78953     18.9316
         Yes |    21.5767   .4113715      20.77018    22.38322  F(1,3920) =  40.43,  Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
OWNAGE       |
          No |   51.12127   .2949782      50.54294    51.69959
         Yes |    52.0894   .3996654      51.30582    52.87297  F(1,3920) =   3.79,  Prob > F = 0.0516
-------------+------------------------------------------------------------------------------------
RELLENGTH    |
          No |   117.7714   2.708566      112.4611    123.0818
         Yes |   138.6513   4.059063      130.6932    146.6094  F(1,3920) =  18.12,  Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
RELNUM       |
          No |   2.284904   .0347736      2.216727     2.35308
         Yes |   2.866383   .0523889      2.763671    2.969095  F(1,3920) =  85.13,  Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
OWNSHR       |
          No |   83.21178   .6404027      81.95623    84.46733
         Yes |   76.89289   .8944955      75.13917    78.64661  F(1,3920) =  32.69,  Prob > F = 0.0000
-------------+------------------------------------------------------------------------------------
OWNERS       |
          No |   1.697411   .0669149       1.56622    1.828603
         Yes |   4.125812   1.719659      .7543026    7.497322  F(1,3920) =   1.99,  Prob > F = 0.1583
-------------+------------------------------------------------------------------------------------
OWNWORTH     |
          No |    826077   78024.12      673105.3    979048.7
         Yes |   1418565   213653.9      999681.2     1837448  F(1,3920) =   6.73,  Prob > F = 0.0095
-------------+------------------------------------------------------------------------------------
OWNEQUITY    |
          No |   103781.9   12247.46      79769.92    127793.9
         Yes |   271560.6   21344.07        229714    313407.1  F(1,3920) =  46.29,  Prob > F = 0.0000
------------------------------------------------------------------------------------------------------
No: OFFEREDTCD = No   Yes: OFFEREDTCD = Yes
Number of strata =      72         Number of obs    =     4119
Number of PSUs   =    3992         Population size  =  5858208        Design df   =   3920
```

Tables 2.10 (1998 NSSBF) and 2.11 (2003 NSSBF) show the mean of PCTDISCOUNTS across the four quartiles of the numeric model variables. Listed with the PCTDISCOUNTS mean for each quartile in the table is an Adjusted Wald Test that tests the null hypothesis that the PCTDISCOUNTS mean for that quartile is equal to the PCTDISCOUNTS mean of the previous quartile. An observation that the mean of PCTDISCOUNTS increases and is significantly different from one quartile of a variable to the next higher quartile would indicate that there may be a positive relationship between PCTDISCOUNTS and that variable. However, the results of the multivariate analysis that will be presented in the next section will be required to establish the relationship between the model variables and PCTDISCOUNTS.

Not all of the numeric variables could be divided into four distinct quartiles. For the 1998 NSSBF sample, the variables OWNSHR and wLnUNUSEDLOC did not exhibit sufficient variation to be divided into four distinct quartiles. For the 2003 NSSBF, only OWNSHR exhibited this phenomenon. It should be noted from the table that the order of the quartiles (1,2,3,4) corresponds to an increase in the value of the quartile variable.

The tables show that the mean of PCTDISCOUTS is highest for the highest quartile of OWNEXP and significantly different than the previous quartile, but this result only holds for the 1998 sample and not the 2003 sample. This suggests that there may be some positive relationship between PCTDISCOUNTS and OWNEXP for the 1998 sample.

The mean of PCTDISCOUNTS does not vary significantly across the quartiles of OWNSHR for either the 1998 or 2003 samples.

The mean of PCTDISCOUNTS varies significantly across all quartiles of wLnUNUSLEDLOC for both samples. However, the highest means of PCTDISCOUNTS are observed for the first and fourth quartiles of wLnUNUSEDLOC, and the lowest means of PCTDISCOUNTS are observed for the middle quartiles of wLnUNUSEDLOC, for both samples. This suggests there may be a nonlinear relationship between these variables.

The results in the tables suggest there may be positive relationship between wLnQUICKRATIO and PCTDISCOUNTS in both samples. The results also suggest there may be a positive relationship between wLnPROFTOINCOME and PCTDISCOUNTS in the 2003 sample but not the 1998 sample.

There does not appear to be a significant relationship between the mean of PCTDISCOUNTS and wLnDEBTRATIO for the 2003 sample. For the 1998 sample, the means of PCTDISCOUTS are significantly different from one quartile to the next and trend downward with rising quartile, but not in a linear fashion. This suggests that the relationship between PCTDISCOUNTS and wLnDEBTRATIO may be nonlinear.

The mean of PCTDISCOUNTS does not vary significantly across the quartiles of wLnINVRATIO for either the 1998 or 2003 samples.

Table 2.10

1998 NSSBF: Mean of PCTDISCOUNTS by quartiles of the model numeric variables

```
Number of strata =      77         Number of obs    =     1128
Number of PSUs   =    1128         Population size  =  1279594
                                  Design df        =     1051
------------------------------------------------------------------------
             |   Mean of    Linearized     Adjusted Wald Test*
    Quartile | PCTDISCOUNTS  Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------
      OWNEXP |
           1 |   45.6234    3.517784
           2 |   53.23507   3.515406  F(1,1051)=2.36, Prob > F=0.1247
           3 |   56.44546   3.212861  F(1,1051)=0.46, Prob > F=0.4996
           4 |   65.79282   3.143511  F(1,1051)=4.30, Prob > F=0.0383
------------------------------------------------------------------------
      OWNSHR |
           1 |   53.5279    2.988834
           2 |   55.69914   2.10258   F(1,1051)=0.35, Prob > F=0.5532
------------------------------------------------------------------------
wLnUNUSEDLOC |
           1 |   56.1235    2.427605
           3 |   46.88208   3.404893  F(1,1051)=4.91, Prob > F=0.0269
           4 |   59.30912   3.31286   F(1,1051)=6.80, Prob > F=0.0092
------------------------------------------------------------------------
wLnQUICKRATIO|
           1 |   46.12135   3.528986
           2 |   50.83395   3.292778  F(1,1051)=0.98, Prob > F=0.3235
           3 |   54.49172   3.389392  F(1,1051)=0.59, Prob > F=0.4424
           4 |   68.61726   3.170663  F(1,1051)=9.13, Prob > F=0.0026
------------------------------------------------------------------------
wlnPROFTOINC~|
           1 |   51.1019    3.417237
           2 |   55.12511   3.207862  F(1,1051)=0.75, Prob > F=0.3873
           3 |   53.87126   3.620621  F(1,1051)=0.07, Prob > F=0.7968
           4 |   59.95796   3.47159   F(1,1051)=1.46, Prob > F=0.2277
------------------------------------------------------------------------
wLnDEBTRATIO |
           1 |   66.18724   3.246907
           2 |   49.7661    3.465199  F(1,1051)=11.94,Prob > F=0.0006
           3 |   59.56726   3.123555  F(1,1051)=4.40, Prob > F=0.0363
           4 |   44.4085    3.59423   F(1,1051)=10.02,Prob > F=0.0016
------------------------------------------------------------------------
 wLnINVRATIO |
           1 |   58.42607   3.345904
           2 |   49.29048   3.660587  F(1,1051)=3.38, Prob > F=0.0663
           3 |   55.43444   3.271403  F(1,1051)=1.56, Prob > F=0.2119
           4 |   55.76242   3.510511  F(1,1051)=0.00, Prob > F=0.9455
------------------------------------------------------------------------
*Each Wald Test is for the difference between the preceding “quartile n-1” and
current “quartile n” mean.
```

Table 2.11

2003 NSSBF: Mean of PCTDISCOUNTS by quartiles of the model numeric variables

```
Number of strata =      72         Number of obs    =     1458
Number of PSUs   =    1458         Population size  =  1453495
                                  Design df        =     1386
------------------------------------------------------------------------
             |   Mean of    Linearized     Adjusted Wald Test*
    Quartile | PCTDISCOUNTS  Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------
      OWNEXP |
           1 |   49.60542   3.872943
           2 |   47.04653   3.436399  F(1,1386)=0.25, Prob > F=0.6192
           3 |   52.11074   3.413026  F(1,1386)=1.06, Prob > F=0.3043
           4 |   58.84394   3.933537  F(1,1386)=1.63, Prob > F=0.2017
------------------------------------------------------------------------
      OWNSHR |
           1 |   53.34279   3.202047
           2 |   49.18386   4.020549  F(1,1386)=0.65, Prob > F=0.4210
           3 |   50.95087   2.71012   F(1,1386)=0.13, Prob > F=0.7152
------------------------------------------------------------------------
wLnUNUSEDLOC |
           1 |   50.67792   2.789129
           2 |   21.16953   8.099946  F(1,1386)=11.92,Prob > F=0.0006
           3 |   44.48487   3.334438  F(1,1386)=7.06, Prob > F=0.0080
           4 |   61.72138   3.260422  F(1,1386)=13.75,Prob > F=0.0002
------------------------------------------------------------------------
wLnQUICKRATIO|
           1 |   39.22558   3.471883
           2 |    51.9559   3.359625  F(1,1386)=6.87, Prob > F=0.0089
           3 |    54.0251   3.82929   F(1,1386)=0.16, Prob > F=0.6849
           4 |   60.43858   3.584102  F(1,1386)=1.48, Prob > F=0.2245
------------------------------------------------------------------------
wlnPROFTOINC~|
           1 |   46.59505   3.610999
           2 |    57.6694   3.880586  F(1,1386)=4.27, Prob > F=0.0390
           3 |   52.11416   3.620205  F(1,1386)=1.09, Prob > F=0.2976
           4 |   49.21903   3.656134  F(1,1386)=0.32, Prob > F=0.5728
------------------------------------------------------------------------
wLnDEBTRATIO |
           1 |   59.96164   4.020407
           2 |   53.01591   3.28547   F(1,1386)=1.75, Prob > F=0.1858
           3 |   50.5953    3.664417  F(1,1386)=0.24, Prob > F=0.6269
           4 |   41.96966   3.583399  F(1,1386)=2.83, Prob > F=0.0926
------------------------------------------------------------------------
 wLnINVRATIO |
           1 |   52.45195   3.942713
           2 |   48.20614   3.793182  F(1,1386)=0.60, Prob > F=0.4399
           3 |   48.40459   3.595431  F(1,1386)=0.00, Prob > F=0.9696
           4 |    56.1615   3.349878  F(1,1386)=2.49, Prob > F=0.1150
------------------------------------------------------------------------
*Each Wald Test is for the difference between the preceding “quartile n-1” and
current “quartile n” mean.
```

2.6 Multivariate Analysis and Results

The results of the estimation of the structural model for PCTDISCOUNTS are presented in the following sections. Survey-weighted least squares estimation is used as the base estimation method. However, it was demonstrated in a previous section how selection bias could potentially be a problem for the model, and it was explained that the Heckman estimator would be a remedy for this bias. The results of the Heckman estimation of the model will be presented along with evidence confirming that selection bias is not an issue for the model and that the use of the Heckman estimator is not required.

Figures 2.23 and 2.24 show the results of the estimation of the model for the 1998 NSSBF and 2003 NSSBF surveys. The columns in the table represent coefficient estimation using: (1) OLS with robust errors, (2) survey-weighted least squares with robust errors, and (3) Heckman estimation using maximum likelihood with survey weights and robust errors. Column (4) holds the estimate of the probit selection coefficients of the Heckman model. The Probit model used to select firms with OFFEREDTCD=1 in the first stage of the estimator is described in section 2.4.

The column (1) OLS estimates using robust standard errors are included for comparison purposes only: it is understood that the estimates will be biased by failure to use survey weights. The column (2) survey-weighted least squares estimates using robust standard errors would be the chosen estimates if selection bias does not affect the model. The column (3) Heckman estimates would be chosen if selection bias affected the model.

Figures 2.23 and 2.24 include a Wald test of the null hypothesis that $\rho=0$ in equation (4) of section 2.4. Failure to reject this null hypothesis would indicate that selection bias is not an issue for this model and data, while rejection of the null would indicate that the selection step and the estimation step are not independent of one another, and the Heckman estimator is appropriate to correct for selection bias. For the Heckman estimation using the 1998 NSSBF survey, one cannot reject the null hypothesis at the 0.05 percent level, indicating that the Heckman estimator is not to be preferred over survey-weighted least squares for the subpopulation OFFEREDTCD=1. Similarly, examining the Wald test for the 2003 NSSBF survey one cannot reject the null hypothesis that $\rho=0$ at the 0.05 level. The survey-weighted estimates with robust standard errors in column (2) will be used for interpretation of both the 1998 and 2003 estimations.

(PCTDISCOUNTS is the dependent variable)
1998 NSSBF Survey - Subpopulation with OFFEREDTCD=1

VARIABLES	(1) Robust OLS	(2) Robust WLS	(4) Heckman ML	(5) Probit Est.
FEMOWN	5.847	6.833*	6.356	
	(3.675)	(4.082)	(4.050)	
MINOWN	-11.98**	-18.56***	-18.59***	
	(4.824)	(5.753)	(5.674)	
OWNEXP	0.433***	0.670***	0.708***	
	(0.109)	(0.139)	(0.140)	
OWNEDU	0.840	0.904	0.889	
	(0.696)	(0.853)	(0.845)	
PCACCTNG	5.136	11.77**	13.08**	
	(4.426)	(5.124)	(5.178)	
MAINSUPL	10.89***	14.26***	14.73***	
	(2.503)	(3.209)	(3.191)	
OWNSHR	-0.0180	-0.00436	-0.0335	
	(0.0433)	(0.0578)	(0.0599)	
OWNMGR	-4.126	-3.305	-4.487	
	(3.511)	(4.975)	(4.936)	
USEDCARD	-3.981	-2.710	-2.290	
	(3.358)	(4.038)	(3.990)	
wLnUNUSEDLOC	3.395	5.136	5.537	
	(5.387)	(6.175)	(6.082)	
wLnQUICKRATIO	4.708***	5.071***	4.822***	
	(1.623)	(1.871)	(1.847)	
wLnPROFTOINCOME	12.66**	18.51***	16.62**	
	(5.720)	(7.123)	(6.995)	
DBSCORE	-4.909***	-2.915*	-3.243**	-0.0439
	(1.171)	(1.513)	(1.521)	(0.0312)
PAIDLATE	-9.140***	-8.229**	-8.220**	
	(2.838)	(3.565)	(3.531)	
FIRMDISTRESS	-17.12***	-19.23***	-19.39***	
	(3.347)	(4.349)	(4.326)	
wLnDEBTRATIO	2.872	1.426	1.068	
	(3.425)	(3.758)	(3.721)	
wLnINVRATIO	-6.982	-8.557	-5.711	
	(11.02)	(13.44)	(13.29)	
MANUFACTURING				0.401***
				(0.121)
TRANSPORTATION				-0.618***
				(0.187)
WHOLESALE				0.427***
				(0.129)
RETAIL				-0.0673
				(0.0963)
SERVICES				-0.426***
				(0.0869)
wLnTOTEMP				0.429***
				(0.0260)
wLnFIRMAGE				-0.0201
				(0.0415)
Constant	6.502	-36.37	-35.64	-0.885***
	(26.89)	(34.03)	(33.49)	(0.168)
Observations	1133	1128	3114	3114
R-squared	0.161	0.187		
Model df	17	17	17	17
Residual df	1115	1110		
F statistic	16.12	13.91		
Wald Chi-sq			237.7	237.7
Uncensored Obs			1128	1128
Wald indep test			3.432	3.432
P >			0.0640	0.0640
Significance			0	0
Lambda			7.723	7.723
SE Lambda			4.143	4.143

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Wald test of indep. eqns. (rho = 0): chi2(1) = 3.432 Prob > chi2 = 0.0640

Figure 2.23. 1998 NSSBF: Estimation of Trade Credit Discount Model

(PCTDISCOUNTS is the dependent variable)
2003 NSSBF Survey - Subpopulation with OFFEREDTCD=1

VARIABLES	(1) Robust OLS	(2) Robust WLS	(4) Heckman ML	(5) Probit Est.
FEMOWN	-1.372	3.181	3.261	
	(3.431)	(5.346)	(5.350)	
MINOWN	-4.490	-4.300	-4.347	
	(5.651)	(7.923)	(7.883)	
OWNEXP	0.171	0.0556	0.0434	
	(0.105)	(0.144)	(0.146)	
OWNEDU	1.580***	1.406	1.398	
	(0.611)	(0.926)	(0.922)	
PCACCTNG	6.634	0.844	0.418	
	(4.965)	(6.042)	(6.113)	
MAINSUPL	6.305***	8.757***	8.805***	
	(2.147)	(3.312)	(3.286)	
OWNSHR	-0.0584	0.0253	0.0303	
	(0.0390)	(0.0634)	(0.0643)	
OWNMGR	3.307	-3.077	-2.837	
	(3.076)	(5.024)	(5.070)	
USEDCARD	-7.466**	-6.893	-6.890	
	(3.028)	(4.457)	(4.435)	
wLnUNUSEDLOC	10.89**	17.65***	17.67***	
	(5.462)	(5.949)	(5.925)	
wLnQUICKRATIO	1.432	4.538**	4.650**	
	(1.417)	(1.902)	(1.899)	
wLnPROFTOINCOME	3.116	-5.402	-5.024	
	(7.876)	(10.60)	(10.51)	
DBSCORE	-6.345***	-4.263***	-4.195***	-0.0540**
	(0.750)	(1.135)	(1.141)	(0.0229)
PAIDLATE	-18.95***	-20.43***	-20.48***	
	(2.381)	(3.589)	(3.561)	
FIRMDISTRESS	-7.000	-10.57	-10.76	
	(5.455)	(10.17)	(10.02)	
wLnDEBTRATIO	-7.705**	-3.928	-3.771	
	(3.593)	(4.507)	(4.506)	
wLnINVRATIO	16.95***	24.25**	24.20***	
	(6.373)	(9.441)	(9.374)	
MANUFACTURING				0.280**
				(0.131)
TRANSPORTATION				-0.579***
				(0.196)
WHOLESALE				0.230*
				(0.129)
RETAIL				-0.247**
				(0.107)
SERVICES				-0.712***
				(0.0964)
wLnTOTEMP				0.505***
				(0.0304)
wLnFIRMAGE				0.106***
				(0.0380)
Constant	51.81	88.41	87.44	-1.286***
	(44.75)	(61.04)	(60.56)	(0.169)
Observations	1460	1458	3741	3741
R-squared	0.178	0.183		
Model df	17	17	17	17
Residual df	1442	1440		
F statistic	22.13	10.63		
Wald Chi-sq			180.2	180.2
Uncensored Obs			1458	1458
Wald indep test			0.127	0.127
P >			0.721	0.721
Significance			0	0
Lambda			-1.469	-1.469
SE Lambda			4.122	4.122

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Wald test of indep. eqns. (rho = 0): chi2(1) = 0.127 Prob > chi2 = 0.721

Figure 2.24. 2003 NSSBF: Estimation of Trade Credit Discount Model (using implicate #3 only)

Note the similarities between the results presented in columns (2) and (3). For the purposes of testing the hypotheses of this essay, the results are almost identical, but all are different than the OLS results in column (1). It would appear that the transition from not using survey weights in the regression estimation to using them has the largest effect on the results. The survey-weighted least squares and Heckman estimation results are very similar.

Table 2.12 below provides a tabular summary of the results from the two regression tables, comparing the hypothesized results for each regressor in the model, to the estimated results. No support is observed for H1, the hypothesis that trade credit discount usage increases as agency conflict in the firm is reduced. The coefficients of OWNSHR and OWNMGR are not significant in any regression in either survey. H1 is rejected on the basis of this lack of supporting evidence.

Table 2.12

Comparison of actual results with hypothesized results

Independent Variable	Hypothesis Tested	Hypothesized Relationship to Discount Usage	Observed Relationship 1998/2003
Agency:			
OWNSHR	H1	(+)	ns/ns
OWNMGR	H1	(+)	ns/ns
Liquidity and Credit Availability:			
FEMOWN	H2	(-)	(+)*/ns
MINOWN	H2	(-)	(-)***/ns
USEDCARD	H2	(+)	ns/ns
LnUNUSEDLOC	H2	(+)	ns/(+)***
LnQUICKRATIO	H2	(+)	(+)***/(+)**
LnPROFTOINCOME	H2	(+)	(+)***/ns
DBSCORE	H2	(-)	(-)*/(-)***
PAIDLATE	H2	(-)	(-)**/(-)***
FIRMDISTRESS	H2	(-)	(-)***/ns
LnDEBTRATIO	H2	(-)	ns/ns
LnINVRATIO	H2	(+)	ns/(+)**
Mgmt Competence:			
OWNEXP	H3	(+)	(+)***/ns
OWNEDU	H3	(+)	ns/ns
Transaction Costs:			
PCACCTNG	H4	(+)	(+)**/ns
MAINSUPL	H4	(+)	(+)***/(+)***

*** p<0.01, ** p<0.05, * p<0.1, ns = ″not significant″

Some evidence supporting the hypothesis H2 is observed, that trade credit discount usage increases with firm liquidity and with availability of less expensive forms of finance. Using the 1998 survey data, it is observed that as expected, more profitable firms and firms with higher liquidity (QUICKRATIO) use more trade credit discounts. Also as expected, minority owned firms (MINOWN), firms with riskier DB credit scores (DBSCORE), firms in financial distress (FIRMDISTRESS), and firms with a history of paying bills late (PAIDLATE) all use less trade credit discounts. Scant evidence is observed that the gender of the firm's primary owner (FEMOWN) is a determinant of the firm's use of trade credit discounts.

An additional word about the significance of QUICKRATIO is in order. The QUICKRATIO is comprised of the sum of two current asset components, CASH and RECEIVABLES, divided by current liabilities CURRLIB. When QUICKRATIO is divided into two separate ratios called CASHRATIO (=CASH/CURRLIB) and ARRATIO (=RECEIVABLES/CURRLIB), and the Robust WLS estimation is repeated with these variables in place of QUICKRATIO, only the coefficient of CASHRATIO is significant and positive. The coefficient of ARRATIO is not significantly different than zero. This result holds for both the 1998 and 2003 samples. Thus, only cash is a significant determinant of the usage of trade credit discounts. Accounts receivable are apparently inadequately liquid to induce firms to take discounts offered.

USEDCARD is not significant in either the 1998 or 2003 estimations. This is an interesting result since if the pecking order theory of capital structure held, one would expect that firms would use their credit cards to make discounted purchases, because credit card financing is nominally less expensive than trade credit financing in the

presence of discounts. Since USEDCARD only indicates whether or not the firm used credit cards to make purchases, and not the types of purchases made, it may contain too little information to discern the effect of credit card usage on trade credit discount usage. Some firms may use their credit cards because they have exhausted other forms of short-term finance and are in distress. USEDCARD will not discern these firms from those that use their cards opportunistically to take discounts. This could explain the lack of significance of USEDCARD in the model.

However, there is another variable in the NSSBF database that indicates whether or not the firm pays its credit card balance in full every month, or carries the balance over to the next month. Firms that use credit cards opportunistically to take discounts will likely pay the balance in full each month or suffer a financing charge that will offset to some extent the benefit of the discount. Firms in distress will likely carry their credit card balance forward from month to month because they must. Dummy variable USEDGRACE is defined which is "1" if USEDCARD=1 and if the firm pays its credit card balance in full each month, and "0" if USEDCARD=1 and the firm carries a credit card balance from month to month. This variable is a subset of USEDCARD, being defined in the database only for those firms that have USEDCARD=1, and missing otherwise. It is highly correlated with USEDCARD. For this reason, USEDCARD and USEDGRACE are not included together in the same model estimation. Including USEDGRACE in the model in place of USEDCARD reduces the number of complete observations from 1128 to 939 in the 1998 NSSBF sample, and from 1458 to 1259 in the 2003 NSSBF sample.

Figures 2.25 and 2.26 below show the results of the 1998 and 2003 estimations using survey-weighted least squares with robust standard errors, and with USEDGRACE substituted for USEDCARD. The estimated coefficient for USEDGRACE is positive and significant at the 0.05 percent level for both estimations, and is relatively large. This is a strong indication that some firms are using their credit cards to take trade credit discounts and substituting the grace period on their credit cards for the trade credit period offered by their suppliers. This result lends support to hypothesis H2.

(PCTDISCOUNTS is the dependent variable)
1998 NSSBF Survey - Subpopulation with OFFEREDTCD=1

	(1)	(2)
	Robust WLS	Robust WLS
VARIABLES	With USEDCARD	With USEDGRACE
FEMOWN	6.833*	9.435**
	(4.082)	(4.400)
MINOWN	-18.56***	-20.92***
	(5.753)	(6.255)
OWNEXP	0.670***	0.607***
	(0.139)	(0.154)
OWNEDU	0.904	0.312
	(0.853)	(0.957)
PCACCTNG	11.77**	14.21**
	(5.124)	(5.555)
MAINSUPL	14.26***	16.14***
	(3.209)	(3.537)
OWNSHR	-0.00436	-0.0151
	(0.0578)	(0.0645)
OWNMGR	-3.305	-4.528
	(4.975)	(5.661)
USEDCARD	-2.710	
	(4.038)	
wLnUNUSEDLOC	5.136	4.503
	(6.175)	(6.403)
wLnQUICKRATIO	5.071***	4.570**
	(1.871)	(2.035)
wLnPROFTOINCOME	18.51***	22.92***
	(7.123)	(7.449)
DBSCORE	-2.915*	-3.141*
	(1.513)	(1.668)
PAIDLATE	-8.229**	-5.451
	(3.565)	(3.921)
FIRMDISTRESS	-19.23***	-19.97***
	(4.349)	(4.780)
wLnDEBTRATIO	1.426	0.709
	(3.758)	(4.185)
wLnINVRATIO	-8.557	-5.745
	(13.44)	(14.80)
USEDGRACE		10.25**
		(4.731)
Constant	-36.37	-65.09*
	(34.03)	(37.45)
Observations	1128	939
R-squared	0.187	0.208
Model df	17	17
Residual df	1110	921
F statistic	13.91	14.19

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.25. 1998 NSSBF: Estimation of Trade Credit Discount Model with USEDGRACE substituted for USEDCARD

(PCTDISCOUNTS is the dependent variable)
2003 NSSBF Survey - Subpopulation with OFFEREDTCD=1
Implicate #3 only used in estimation

VARIABLES	(1) With USEDCARD	(2) With USEDGRACE
FEMOWN	3.181	5.106
	(5.346)	(5.672)
MINOWN	-4.300	-6.407
	(7.923)	(8.959)
OWNEXP	0.0556	0.0786
	(0.144)	(0.158)
OWNEDU	1.406	0.912
	(0.926)	(0.989)
PCACCTNG	0.844	-0.575
	(6.042)	(6.420)
MAINSUPL	8.757***	8.456**
	(3.312)	(3.536)
OWNSHR	0.0253	0.0191
	(0.0634)	(0.0708)
OWNMGR	-3.077	-0.505
	(5.024)	(5.584)
USEDCARD	-6.893	
	(4.457)	
wLnUNUSEDLOC	17.65***	14.40**
	(5.949)	(6.689)
wLnQUICKRATIO	4.538**	4.822**
	(1.902)	(2.031)
wLnPROFTOINCOME	-5.402	-6.627
	(10.60)	(11.49)
DBSCORE	-4.263***	-3.645***
	(1.135)	(1.257)
PAIDLATE	-20.43***	-18.09***
	(3.589)	(3.886)
FIRMDISTRESS	-10.57	-13.65
	(10.17)	(10.76)
wLnDEBTRATIO	-3.928	0.137
	(4.507)	(4.962)
wLnINVRATIO	24.25**	22.92**
	(9.441)	(10.13)
USEDGRACE		10.42**
		(4.783)
Constant	88.41	76.42
	(61.04)	(65.68)
Observations	1458	1259
R-squared	0.183	0.175
Model df	17	17
Residual df	1440	1241
F statistic	10.63	8.976

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.26. 2003 NSSBF: Estimation of Trade Credit Discount Model with USEDGRACE substituted for USEDCARD

Regarding the hypothesis H3 that trade credit discount usage increases with management competence, only weak support is observed in the model estimation. OWNEXP is very positively significant, though small, in the 1998 survey estimation. It is not significant in the 2003 survey estimation. OWNEDU is not significant in either survey estimation. Management experience may increase trade credit discount usage slightly, but education has no observable effect.

Regarding hypothesis H4, that trade credit discount usage increases as the firm's transaction costs of taking discounts decreases, strong support is seen in the 1998 and 2003 survey estimations. PCACCTNG and MAINSUPL are significantly positive and strong in the 1998 estimation, and MAINSUPL is significantly positive and strong in the 2003 estimation.

Figures 2.27 and 2.28 present the Robust WLS regression results again, but with ZDEBTRATIO in place of DEBTRATIO. (Recall that ZDEBTRATIO has been trimmed above DEBTRATIO=1.0). The regression results with DEBTRATIO and ZDEBTRATIO are presented side by side for comparison. For the 1998 sample regression, PCACCTNG and DBSCORE become insignificant when ZDEBTRATIO is substituted for DEBTRATIO, and the total number of observations drops from 1128 to 876. For the 2003 sample regression, USEDCARD becomes negative and significant at the 0.05 level when ZDEBTRATIO is substituted for DEBTRATIO, and the number of observations drops from 1458 to 1185. In the former case, the 252 insolvent firm observations dropped from the 1998 sample must have contained information that contributed to the significance of PCACCTNG and DBSCORE. In the latter case, the 273 insolvent firm observations dropped from the 2003 sample left behind lower-debt

firms that apparently use their credit cards and trade credit as a substitute for other forms of debt.

(PCTDISCOUNTS is the dependent variable)
1998 NSSBF Survey - Subpopulation with OFFEREDTCD=1

	(1)	(2)
	Robust WLS	Robust WLS
VARIABLES	With DEBTRATIO	With ZDEBTRATIO
FEMOWN	6.833*	8.970*
	(4.082)	(4.623)
MINOWN	-18.56***	-23.19***
	(5.753)	(6.105)
OWNEXP	0.670***	0.845***
	(0.139)	(0.160)
OWNEDU	0.904	0.888
	(0.853)	(1.002)
PCACCTNG	11.77**	8.327
	(5.124)	(6.286)
MAINSUPL	14.26***	11.48***
	(3.209)	(3.719)
OWNSHR	-0.00436	0.0171
	(0.0578)	(0.0664)
OWNMGR	-3.305	-2.225
	(4.975)	(5.777)
USEDCARD	-2.710	0.195
	(4.038)	(4.879)
wLnUNUSEDLOC	5.136	11.35
	(6.175)	(8.036)
wLnQUICKRATIO	5.071***	5.104**
	(1.871)	(2.263)
wLnPROFTOINCOME	18.51***	17.02**
	(7.123)	(7.833)
DBSCORE	-2.915*	-1.595
	(1.513)	(1.767)
PAIDLATE	-8.229**	-9.252**
	(3.565)	(4.074)
FIRMDISTRESS	-19.23***	-17.27***
	(4.349)	(5.319)
wLnDEBTRATIO	1.426	
	(3.758)	
wLnINVRATIO	-8.557	4.131
	(13.44)	(16.19)
wLnZDEBTRATIO		8.215
		(11.01)
Constant	-36.37	-48.88
	(34.03)	(38.11)
Observations	1128	876
R-squared	0.187	0.169
Model df	17	17
Residual df	1110	858
F statistic	13.91	10.28

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.27. 1998 NSSBF: Robust WLS with ZDEBTRATIO in place of DEBTRATIO

(PCTDISCOUNTS is the dependent variable)
2003 NSSBF Survey - Subpopulation with OFFEREDTCD=1
Using Implicate #3 Only

VARIABLES	(1) Robust WLS With DEBTRATIO	(2) Robust WLS With ZDEBTRATIO
FEMOWN	3.181	1.614
	(5.346)	(6.235)
MINOWN	-4.300	-13.89
	(7.923)	(8.711)
OWNEXP	0.0556	0.0199
	(0.144)	(0.162)
OWNEDU	1.406	1.950*
	(0.926)	(1.049)
PCACCTNG	0.844	1.482
	(6.042)	(6.632)
MAINSUPL	8.757***	9.002**
	(3.312)	(3.639)
OWNSHR	0.0253	-0.0171
	(0.0634)	(0.0742)
OWNMGR	-3.077	-1.072
	(5.024)	(5.592)
USEDCARD	-6.893	-10.67**
	(4.457)	(4.829)
wLnUNUSEDLOC	17.65***	23.92***
	(5.949)	(6.800)
wLnQUICKRATIO	4.538**	5.999***
	(1.902)	(2.185)
wLnPROFTOINCOME	-5.402	-5.637
	(10.60)	(12.88)
DBSCORE	-4.263***	-4.480***
	(1.135)	(1.291)
PAIDLATE	-20.43***	-17.89***
	(3.589)	(4.069)
FIRMDISTRESS	-10.57	-9.758
	(10.17)	(11.51)
wLnDEBTRATIO	-3.928	
	(4.507)	
wLnINVRATIO	24.25**	29.05***
	(9.441)	(10.63)
wLnZDEBTRATIO		2.979
		(10.33)
Constant	88.41	86.72
	(61.04)	(74.73)
Observations	1458	1185
R-squared	0.183	0.190
Model df	17	17
Residual df	1440	1167
F statistic	10.63	9.579

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.28. 2003 NSSBF: Robust WLS with ZDEBTRATIO in place of DEBTRATIO

In conclusion, weak support is observed for hypotheses H1 and H3, but strong support for H2 and H4. In general, estimation of the 1998 survey led to more significant

results with larger coefficients than the estimation of the 2003 survey. It is difficult to provide a single unifying reason for this observation, but observing individual results in table 2.12 can shed some light on the reasons for the differences.

MINOWN is significantly negative and strong in the 1998 survey estimation, but insignificant in the 2003 estimation. This variable is viewed as a proxy for credit discrimination for minority-owned firms. It is possible that between 1998 and 2003, the availability of credit to minority-owned firms improved sufficiently that this variable no longer represented credit discrimination. Certainly the observed result would be consistent with and offer support to that view.

FIRMDISTRESS is another regressor that is significant (0.01) for the 1998 survey estimation, but insignificant for the 2003 survey estimation. Comparison of the two-way tabulation of FIRMDISTRESS over OFFEREDTCD in figures 2.21 and 2.22 shows that while in the 1998 survey, 13.8% of firm observations had FIRMDISTRESS=1, that number dropped to only 3.5% in 2003. This number may simply be too small to obtain a significant result in the regression. It is important to remember that this variable is backward-looking, defined as "firm declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years". The year 2003 was a mild recession year in the U.S., but previous years had seen a major financial expansionary period during which firm profits and the U.S. economy were strong. This may explain the drop in firms reporting FIRMDISTRESS=1.

OWNEXP (0.01) and PCACCTNG (0.01) were both positively significant in the 1998 survey estimation, but not in the 2003 estimation. Examining the differences in range of OWNEXP between 1998 and 2003, and the distribution of PCACCTNG

between 1998 and 2003, sheds no light on a reason for this. It is possible that in the difficult economic climate of the 2003 period, neither owner experience nor the use of computers for accounting made a difference to the decision to take trade credit discounts. Under those economic circumstances, financial constraints may have dominated that decision process. A more detailed study would be required to discern the differences between the two results.

As an additional robustness check of the results, two additional estimations were performed using two alternate dependent variables. The variable DISCOUNTS was defined to be "1" if PCTDISCOUNTS > 50, and "0" if PCTDISCOUNTS ≤ 50. The variable ALLORNONE was defined to be "1" if PCTDISCOUNTS=100, "0" if PCTDISCOUNTS=0, and missing otherwise. Survey-weighted logistic regression was performed using the model variables as regressors and these two variables as the dependents.

Tables 2.29 and 2.30 below present the survey-weighted logistic estimations of the model with DISCOUNTS and ALLORNONE as the dependent variable, and a third column containing the survey-weighted least squares estimation (with robust errors) of PCTDISCOUNTS against the model regressors, for reference purposes. Comparison of the three estimations for the 2003 sample shows that the same regressors are significant and of the same sign across all three estimations, though of course the magnitude of the coefficients is not the same and their degree of significance is also not the same.

For the 1998 sample, the results are consistent between the DISCOUNTS and PCTDISCOUNTS estimations, but the ALLORNONE estimation shows several coefficients that are not significant in that estimation but are significant in the other two

estimations. It is not immediately obvious why this is so, though it may be due to the fact that the ALLORNONE variable has discarded useful observations in the middle range of PCTDISCOUNTS without which the significant relationships observed in the other two estimations cannot be seen in the 1998 sample.

VARIABLES	(1) Svy Logit DISCOUNTS	(2) Svy Logit ALLORNONE	(3) Robust WLS PCTDISCOUNTS
FEMOWN	0.378*	0.292	6.833*
	(0.228)	(0.310)	(4.082)
MINOWN	-1.260***	-0.865	-18.56***
	(0.346)	(0.533)	(5.753)
OWNEXP	0.0352***	0.0503***	0.670***
	(0.00825)	(0.0127)	(0.139)
OWNEDU	0.0576	0.00229	0.904
	(0.0464)	(0.0633)	(0.853)
PCACCTNG	0.749***	0.400	11.77**
	(0.289)	(0.346)	(5.124)
MAINSUPL	0.729***	0.877***	14.26***
	(0.178)	(0.247)	(3.209)
OWNSHR	-0.00138	0.00316	-0.00436
	(0.00318)	(0.00472)	(0.0578)
OWNMGR	-0.238	0.00761	-3.305
	(0.268)	(0.385)	(4.975)
USEDCARD	-0.0834	-0.200	-2.710
	(0.235)	(0.321)	(4.038)
wLnUNUSEDLOC	0.127	0.615	5.136
	(0.367)	(0.493)	(6.175)
wLnQUICKRATIO	0.335***	0.183	5.071***
	(0.112)	(0.138)	(1.871)
wLnPROFTOINCOME	1.153***	1.015*	18.51***
	(0.414)	(0.600)	(7.123)
DBSCORE	-0.148*	-0.0581	-2.915*
	(0.0816)	(0.115)	(1.513)
PAIDLATE	-0.342*	-0.661**	-8.229**
	(0.190)	(0.259)	(3.565)
FIRMDISTRESS	-0.944***	-1.211***	-19.23***
	(0.236)	(0.317)	(4.349)
wLnDEBTRATIO	0.138	-0.272	1.426
	(0.234)	(0.287)	(3.758)
wLnINVRATIO	-0.351	-0.0378	-8.557
	(0.732)	(1.085)	(13.44)
Constant	-5.763***	-4.817*	-36.37
	(1.958)	(2.679)	(34.03)
Subpopulation obs	1128	685	1128
R-squared			0.187
Model df	17	17	17
Residual df	3483	3011	1110
F statistic	6.778	4.926	13.91

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.29. 1998 NSSBF: Logistic regression of DISCOUNTS and ALLORNONE

VARIABLES	(1) Svy Logit DISCOUNTS	(2) Svy Logit ALLORNONE	(3) Robust WLS PCTDISCOUNTS
FEMOWN	0.236	0.234	3.181
	(0.290)	(0.418)	(5.346)
MINOWN	-0.0463	0.721	-4.300
	(0.422)	(0.739)	(7.923)
OWNEXP	-9.78e-05	-0.00423	0.0556
	(0.00781)	(0.0118)	(0.144)
OWNEDU	0.0670	0.0674	1.406
	(0.0522)	(0.0746)	(0.926)
PCACCTNG	-0.0961	0.148	0.844
	(0.319)	(0.461)	(6.042)
MAINSUPL	0.539***	0.915***	8.757***
	(0.179)	(0.264)	(3.312)
OWNSHR	-0.000530	0.00177	0.0253
	(0.00341)	(0.00493)	(0.0634)
OWNMGR	-0.260	-0.0951	-3.077
	(0.260)	(0.378)	(5.024)
USEDCARD	-0.242	0.224	-6.893
	(0.234)	(0.359)	(4.457)
wLnUNUSEDLOC	0.628*	1.228**	17.65***
	(0.375)	(0.600)	(5.949)
wLnQUICKRATIO	0.197*	0.259*	4.538**
	(0.101)	(0.156)	(1.902)
wLnPROFTOINCOME	-0.529	-0.105	-5.402
	(0.581)	(0.792)	(10.60)
DBSCORE	-0.224***	-0.259***	-4.263***
	(0.0643)	(0.0909)	(1.135)
PAIDLATE	-0.955***	-1.555***	-20.43***
	(0.185)	(0.262)	(3.589)
FIRMDISTRESS	-0.853	-1.006	-10.57
	(0.770)	(0.848)	(10.17)
wLnDEBTRATIO	-0.238	-0.308	-3.928
	(0.268)	(0.413)	(4.507)
wLnINVRATIO	1.039*	1.466*	24.25**
	(0.530)	(0.821)	(9.441)
Constant	3.534	1.181	88.41
	(3.352)	(4.723)	(61.04)
Subpopulation obs	1458	894	1458
R-squared			0.183
Model df	17	17	17
Residual df	4168	3602	1440
F statistic	5.300	6.138	10.63

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.30. 2003 NSSBF: Logistic regression of DISCOUNTS and ALLORNONE

2.7 Contributions to the Literature

This study contributes to the literature on trade credit discount usage in a number of ways. First, this is the first study identified that examines the failure to take Trade Credit discounts as a possible agency cost to the firm (hypothesis H1).

Second, this is also the first study to examine the effect of credit card usage by small firms on the usage of trade credit discounts (hypothesis H2). This was made possible by the uniquely detailed data about firm credit card usage available in the NSSBF survey databases.

Third, this is the first study to consider the capability of the firm and its manager as an issue in the decision to accept or reject trade credit discounts (hypothesis H3).

Fourth, this is the first study to consider the transaction costs of taking trade credit as a determinant in the decision to do so (hypothesis H4).

Fifth, this study addresses potentially serious deficiencies in the econometric methodology used by previous authors who used profitability and liquidity as regressors without considering the potential endogeneity of those regressors and testing for it. Furthermore, previous papers in this area used unweighted OLS estimation (Bopaiah, also Burkart, Ellingsen and Giannetti) rather than using survey weights, for the 1998 NSSBF survey data used in those studies. The results of this study show that unweighted estimation results can differ significantly from weighted ones, and theory indicates that using weighted estimation provides unbiased estimates of the population parameters.

Sixth, this study separately utilized both the 1998 and 2003 NSSBF surveys for model estimation. The results of these separate estimations facilitated interpretation that is relevant to the macroeconomic environment in which the data was collected. The year

1998 was near the peak of a large economic expansion in the U.S., while the year 2003 was at the end of a brief recession in the U.S. One would expect that availability of credit to small firms would differ between these periods, perhaps in a way that would affect trade credit discount usage. Such comparisons between the results of the two estimations provided an additional dimension to the analysis that has not previously been undertaken.

CHAPTER III

ESSAY 2: WHAT DETERMINES THE CASH HOLDINGS OF SMALL FIRMS?

This study will examine variations in small firms' cash holdings and relate them to variables that proxy for agency costs and monitoring, variables that proxy for substitutes for cash, variables reflecting the firm's short and long-term financial obligations, variables that proxy for management/firm competency in cash management, and firm characteristic control variables.

This study will examine the relationship between agency costs and the level of cash holdings in small firms using a database of small firm financing data compiled by the Federal Reserve Board. It builds upon previous work by Ang, Cole and Lin (2000) on agency costs in small firms, as well as work by Opler, et. al (1999) on the determinants of cash holdings. This study will also draw upon the literature on bank monitoring, relationship lending and shareholder-creditor agency problems in small firms for determinants of agency costs in this sample of small firms.

3.1 Theory and Testable Hypotheses

The issue of agency costs in small closely held firms is an issue of great importance to many stakeholders. Small firms of less than 500 employees constitute the majority of firms in the U.S., and are collectively the largest employer in the U.S. These

firms tend to be owned by individuals, small groups of investors or families, with other minority equity holders represented by angel investors, extended family, friends, and venture capitalists. Most of these firms are not publicly traded and issue no public debt, but rely on financial institutions such as banks and finance companies, and even friends and family members or other shareholders for debt financing. These firms are often, but not always, managed by shareholders with a substantial equity stake in the company. These firms also tend to be informationally opaque relative to large public corporations. A lack of participation in public financial markets means that little information is publicly available regarding the firm's history, current condition or future prospects.

Jensen and Meckling (1976) distinguished between two types of agency costs; those between shareholders (owners) and managers, and those between shareholders and debt holders. Shareholder-manager agency costs arise when the objectives of management and shareholders are not perfectly aligned toward the goal of maximizing shareholder value. It is characterized by misuse of company assets for personal or professional gain by managers, to the detriment of shareholder value.

Jensen (1986) extends agency arguments to free cash flows in firms and suggests that management can alleviate this agency problem by paying out the free cash flows as dividends, using them to repurchase stock, or increasing the firm's leverage to commit cash flows to repayment of debt under a debt contract. Thus, in empirical examinations a firm's cash flows and level of cash holdings could be indicative of the magnitude of manager-owner related agency costs.

Opler et al. (1999) are among the first to put forth arguments suggesting a relationship between cash holdings and agency costs in firms. As described by Opler et

al., management that is interested in maximizing the value of the firm will adjust cash holdings until the marginal cost of holding cash just equals the marginal benefit. The cost of holding cash and liquid assets in general is the lower rate of return on them than on other forms of investment. The benefits of holding cash are the reduction in the transaction costs of raising new funds (*transaction cost motive*), and the availability of funds to invest in new projects if other sources of funding are not available or too costly (*precautionary motive*). This suggests that for each firm there exists some optimal level of cash holdings that maximizes firm value. As Opler et al. point out, however, managers and shareholders may view the costs and benefits of holding cash differently. Managers may prefer to hold cash, because it reduces firm risk and increases their ability to make discretionary investments and disbursements. Therefore, they suggest that agency theory may be required to explain the level of cash held by the firm.

It would be reasonable to expect that if cash holdings are a sign of owner-manager agency conflict, then the same determinants that have been used in previous empirical studies to model agency costs should be significant determinants of cash holdings as well, while controlling for other firm variables that can influence the level of cash holdings. Furthermore, one would expect to find a high positive correlation between measures of agency costs and measures of cash holdings in firms that have been identified as having an owner-manager agency conflict. This leads to the first testable hypothesis:

H1: Cash holdings are positively related to agency conflict in the firm.

It is common in small financially-constrained firms for the owners to provide working capital to the firm out of their personal resources. It is also common for small business owners to pay themselves dividends or bonuses when cash is available to do so.

Wealthier owners will have greater personal resources out of which to provide working capital to the firm, and will also have less need to extract dividends and bonuses from the firm than less wealthy owners. These owners will have the resources to support the liquidity of the firm, both at initial start-up and at critical periods of working capital requirement beyond the start-up period. Numerous studies documented by Parker (2004) support the notion that small firms are capital constrained and that capital provided by entrepreneurs plays an important role in the formation and survival of small firms. This suggests that a positive relationship may exist between the wealth of the firm's owners and the cash holdings of the firm. This specific relationship is a heretofore empirically unexplored subject, which leads to the second hypotheses:

H2a: Cash holdings are positively related to the personal wealth of the firm's owner

H2b: Cash holdings are lower for firms having a financially distressed owner

If it can be accepted that cash holdings (liquidity) is an important contributor to small firm survival, then there are other entrepreneur characteristics that have been identified as determinants of small firm survival that may also be determinants of small firm cash holdings. Entrepreneur education level has been identified as a positive determinant of entering self-employment by multiple studies (Parker 2004). A college educated entrepreneur has also been associated with a higher probability of small firm survival (Bates 1990). The effect of prior management experience of the entrepreneur on small firm growth has been mixed in previous studies, but mostly positive (Storey 1994). Regarding entrepreneur age, Bates (1990) found that the highest probability for survival

was found in firms with owners in the 45-54 age range, and the lowest probability of survival in firms with an owner over 55 years of age. Storey (1994) suggests that middle-aged entrepreneurs possess a successful combination of experience, credibility and energy that is lacking in the youngest and oldest entrepreneurs. These observations lead to the third set of hypotheses:

H3a: Cash holdings are positively related to owner experience

H3b: Cash holdings are higher for firms with a college educated owner

Firms that are financially constrained and cannot always obtain the required financing from external sources must use undistributed profits to fund the firm's operations. Small firms are notoriously informationally-opaque and do not have access to the debt and equity markets to which large public firms have access. It is reasonable to expect that such firms will accumulate cash from retained earnings to be used to finance the firm's operations. This leads to the fourth hypothesis:

H4: Cash holdings are positively related to the financial constraints of the firm

The use of debt can increase a firm's return on equity, but it can also increase the firm's financial risk. Such risk includes the possibility that the firm may default on an interest or principal payment for their debt, which would drive them into bankruptcy. It is reasonable to expect that firms that have higher levels of debt to be serviced will hold more cash to reduce the possibility of defaulting on an interest or principal payment. Firms with higher debt are also under increased scrutiny by their creditors who are certain to be monitoring the firm's liquidity ratios. Firms with higher current liabilities that require liquid assets to service will also likely hold more cash. This leads to the fifth hypothesis:

H5: Cash holdings are positively related to the firm's debt service requirements

Firms that have ready substitutes for cash, such as a line of credit or access to trade credit, which reduces the firm's liquidity requirement, will need to hold less cash. This leads to the fifth and final hypothesis:

H6: Cash holdings are negatively related to the firm's access to cash substitutes

3.2 Review of Empirical Studies

Using a large sample of publicly traded manufacturing firms over the period 1971 to 2000, Almeida, Campello and Weisbach (2004) show empirically that financially constrained firms tend to accumulate cash out of cash flows more readily than unconstrained firms. That is, they show a positive "cash flow sensitivity of cash" compared to unconstrained firms which show a cash flow sensitivity of cash of zero. They attribute this tendency for constrained firms to accumulate cash to the precautionary motive, by which these firms keep cash ready to invest in positive NPV projects for which cash may not be readily available from capital markets when it is needed. Constrained firms are those that have limited ability to raise sufficient funds in capital markets at an acceptable cost to fund all investment needs. Small, closely held firms generally have limited access to financial markets as they tend not to issue equity or debt publicly, but rely on banks, insider and angel finance, trade credit and venture capitalists for their funding (Berger and Udell, 1998). The results of Almeida, Campello and Weisbach suggest that small firms would tend to accumulate cash to satisfy the precautionary motive.

Dittmar, Mahrt-Smith and Servaes (2003) examine a sample of 11,000 firms across 45 countries and find that firms in countries with the lowest level of shareholder

protection hold more than twice the amount of cash on average than firms in the countries with the highest level of protection. They interpret this result as being consistent with the agency motive for cash holdings, in which managers hold cash for their own discretionary uses and will only release it to shareholders if required to do so by law. Furthermore, controlling for the development of capital markets in each country, they find that cash holdings are actually larger in countries with more developed debt markets. They attribute this finding to their agency motive interpretation of cash holdings, as firms tend to hold cash even when not constrained by underdeveloped capital markets. They also find that firms with higher net working capital hold less cash, indicating that cash and net working capital are substitutes. (In their study, net working capital excludes cash and equivalents.) Also, smaller firms, firms that are more profitable and firms with a higher market-to-book ratio (proxy for investment opportunities) tend to hold more cash. These findings indicate that when management can do so, it will hoard cash for reasons other than the precautionary motive or transaction costs motive.

Starting with the hypothesis empirically confirmed by Dittmar, Mahrt-Smith and Servaes that stronger shareholder rights will lead to smaller cash holdings, Harford, Mansi and Maxwell (2005) examine a sample of 1,442 U.S. firms over the period 1993 through 2002. They regress the cash-to-sales ratio against a governance index developed by Gompers et al. (2003). This index is constructed by measuring each firm in the sample against twenty-four governance rules. It increases in value as shareholder rights decrease (managerial power increases). They incorporate in their model a number of control variables similar to those used by Opler et al. (1999). Contrary to the results of Dittmar et al., they find that firms with weaker shareholder rights hold less cash than

those with stronger shareholder rights. In fact, cash holdings decrease monotonically with increasing index (managerial power). Granger causality tests confirm that governance leads cash, and that firms with strong management rights tend to shed more cash from one period to the next.

Limiting the examination to firms with high-cash holdings, they find that firms with weak shareholder rights tend to shed cash faster than firms with strong shareholder rights. Firms with weak shareholder rights also do not accumulate cash as fast as those with strong shareholder rights when cash flows are increasing. Strong shareholder firms issue more equity, while weak shareholder firms issue more debt. Weak shareholder firms are also much more active in making acquisitions than strong shareholder firms, which tends to support the results of Harford (1999). Harford, Mansi and Maxwell conclude that strong managers in weak shareholder firms tend to dissipate cash on value-reducing acquisitions, creating an agency conflict between shareholders and management.

Opler, Pinkowitz, Stulz and Williamson (1999) wrote the definitive work in the area of the determinants of corporate cash holdings. They performed both time series and cross-sectional empirical examinations of cash holdings and their determinants on a sample of publicly traded U.S. firms during the period 1971 through 1994. They suggest that agency theory can explain why managers hold an amount of cash that is greater than that required for maximizing shareholder wealth. They propose that managers have a preference for cash because it reduces firm risk, helps them avoid market discipline and increases their discretionary ability to pursue their own interests, including value-reducing projects. All of this can have an adverse effect on firm value.

Opler et al. propose four conditions that will reduce management discipline and thus increase the likelihood that managers will accumulate excess cash for discretionary use: (1) shareholders are highly dispersed, reducing their ability to monitor managerial behavior, (2) the firm is large, as size is a takeover deterrent so the firm can accumulate cash with less fear of being a takeover target, (3) the firm has low debt and is therefore less subject to monitoring by debt markets and banks, and (4) the firm is protected by anti-takeover charter amendments.

The authors also acknowledge that the agency costs of debt can influence the level of liquid assets held by the firm. They suggest that firms for which the agency costs of debt are high will hold more liquid assets or maintain a lower level of leverage in order to ensure that funding is available for projects when needed. They attribute the agency costs of debt to the information asymmetry that exists between the firm's management and potential creditors. The alternative to holding cash in the presence of high agency costs of debt is to reduce the level of investments, which would be very costly for firms that have valuable investment opportunities. The authors thus suggest that firms with higher market-to-book ratios (more investment opportunities) would hold more cash than an equivalent firm with a lower market-to-book ratio.

Examining a sample of firms from the Compustat database from the period 1952 through 1994, and using the cash/net assets and cash/sales ratios as their dependent variables, they found that firms with strong growth opportunities, firms with riskier cash flows and small firms tend to accumulate cash. The percentage of managerial ownership of the firm had no effect on cash holdings. Large firms and those with credit ratings tended to hold less cash. They found limited support for the argument that positive

excess cash leads firms to spend more on acquisitions. They conclude that the precautionary motive for holding cash is strong, and that management accumulates cash if it can do so. They also suggest that the failure of the proxies for agency costs to explain excess cash holdings indicates that more work needs to be done to explain why firms hold excess cash.

Harford (1999) finds that cash-rich firms are more likely to undertake value-reducing acquisitions than firms with less cash. The targets they choose are often unattractive to other bidders. The mergers result in a negative stock price reaction, and subsequent poor operating performance of the merged firm. They find some evidence that cash rich firms with lower managerial ownership are responsible for the acquisition activity, leading to an agency theory explanation for the phenomenon. Harford concludes that his results are consistent with the Free Cash Flow hypothesis.

Faulkender (2002) examines the determinants of cash holding in small firms, using the 1993 NSSBF database as his sample. He finds that cash holdings decline as the percentage of ownership of the largest shareholder increases, regardless of whether that shareholder is also the firm's manager or not. He applies an agency theory interpretation to this result, suggesting that owners remove cash from the firm so that managers cannot misuse it, and that the ability of the owner to remove cash is not affected by his role as a manager. He also finds that firms with more shareholders have more cash, which he interprets to mean that firms that are less tightly held have better access to capital and may receive more cash infusions from more shareholders. An alternative interpretation from agency theory is that more shareholders implies more diffuse ownership and less monitoring of management behavior, which allows managers to hoard cash rather than

invest it in positive NPV projects. He also finds that small firms tend to hold more cash as leverage increases, which is the opposite of the behavior of publicly traded firms. He interprets this to mean that small firms value holding cash over paying down debt, perhaps because as leverage increases, obtaining new sources of financing becomes more difficult. The availability of trade credit also reduces the amount of cash held by small firms.

3.3 Model, Variables and Data

The model chosen to test the hypotheses of this essay is shown below. It is proposed that the cash holdings for a small firm are a function of variables that proxy for agency costs and value maximizing behavior, variables that proxy for financing sources and constraints, variables that proxy for cash substitutes, variables that represent the firm's short-term financial obligations and debt, and firm characteristic control variables.

$$\begin{aligned}LnCASHTOSALES_i = {} & \beta_{0i} + \beta_{1i}PASSTHRU_i + \beta_{2i}LnSALES_i + \beta_{3i}FAMOWN_i + \\ & \beta_{4i}OWNSHR_i + \beta_{5i}OWNMGR_i + \beta_{6i}LnOWNERS_i + \beta_{7i}PURCHASED_i + \\ & \beta_{8i}INHERITED_i + \beta_{9i}OWNDISTRESS_i + \beta_{10i}FIRMDISTRESS_i + \beta_{11i}FEARDENIAL_i + \\ & \beta_{12i}LnOTRINCTOSALES_i + \beta_{13i}LnOWNWORTHTOSALES_i + \beta_{14i}LnPROFTOINCOME_i \\ & + \beta_{15i}TRADECREDIT_i + \beta_{16i}LnUNUSEDLOC_i + \beta_{17i}LnCURLIBTOSALES_i + \\ & \beta_{18i}LnDEBTRATIO_i + \beta_{19i}COLLEGEGRAD_i + \beta_{20i}SPECIALED_i + \beta_{21i}OWNEXP_i + \varepsilon_i\end{aligned}$$

The specific variables chosen in each category are summarized in table 3.1, along with their hypothesized relationship (+ or -) to LnCASHTOSALES. These variables are defined the same in both the 1998 and 2003 NSSBF surveys, which are used as the source of data for the study. Those variables that are not directly defined in the database were derived from other variables that are. Based on correlation between the variables, it may be necessary to run several regressions, each excluding variables highly correlated with others in the model.

Table 3.1

Independent variables and their hypothesized relationship to LnCASHTOSALES

Independent Variable	Description	Hypothesized Relationship to Cash Holdings	Hypothesis Tested	Comments
Firm Characteristics (Controls):				
PASSTHRU	Dummy, 1 = firm is structured as a pass-through entity for tax purposes	(-)		Firms will hold less cash if owners are personally taxed on firm profits.
LnSALES	Natural log of annual sales	(-)		Larger firms hold less cash because they have access to alternate forms of finance
PURCHASED	Dummy, 1 = firm was purchased by current owner(s)	(-)		Firm that is purchased may be viewed as an investment rather than a family legacy and will not hold excess cash
INHERITED	Dummy, 1 = firm was inherited by current owner(s)	(+)		Firm that is a family legacy will hold accumulated cash
Industry Dummies	Dummy variables for: Wholesale, Retail, Manufacturing, Transportation, Services	n/a		Control for industry-specific factors
Agency and Value Maximization:				
FAMOWN	Dummy, 1 = greater than 50% family ownership	(+)	H1	Family firms are concerned with survival and risk reduction over value maximization; will hold cash to reduce firm risk
OWNSHR	Percentage of business owned by principal owner	(-)	H1	Increasing firm ownership share reduces agency conflict (Jensen and Meckling 1976)
OWNMGR	Dummy, 1 = firm is managed by an owner	(-)	H1	Having firm managed by owner reduces agency conflict (Jensen and Meckling 1976)
LnOWNERS	Natural log of the total number of firm owners	(+)	H1	Increasingly diffuse firm ownership promotes agency conflict
Owner Characteristics				
LnOWNWORTHTOSALES	Natural log of the ratio of the primary owner's personal wealth (net of her share of firm ownership), to Sales	(+)	H2a	Wealthier owners are less likely to extract cash from firm and more able to provide cash infusion to firm than less wealthy owners

OWNDISTRESS	Dummy, 1 = primary owner declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years	(-)	H2b	Distressed owners more likely to extract cash from firm to cover personal obligations, and less able to make cash infusions to firm
OWNEXP	Number of years of experience of principal owner managing this or other business	(+)	H3a	More experienced owners have experience with working capital management
COLLEGEGRAD	Dummy, 1 = primary owner of firm is a college grad (or higher)	(+)	H3b	Owners with a college degree or higher may have business training and understand working capital management
SPECIALED	Dummy, 1 = primary owner of firm is a trade school grad or has associate degree	(-)	H3b	Owners who started firm to leverage their specialized skill or training may not have business training in working capital management
Financing Sources and Constraints:				
FIRMDISTRESS	Dummy, 1 = firm declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years	(-)	H4	Distressed firms cannot accumulate cash and will deplete cash to meet obligations
FEARDENIAL	Dummy, 1 = firm declined to apply for a loan within the past 3 years, even though they needed the funds	(-)	H4	Failure to apply for credit when needed is an indicator of firm's poor financial condition, including liquidity condition
LnOTRINCTOSALES	Natural log of the ratio of "other income" to sales	(+)	H4	Firms with income from non-operating sources will use this as "windfall" to accumulate cash.
LnPROFTOINCOME	Natural log of the ratio of profit to total income from all sources for current or previous fiscal year	(+)	H4	Profitable firms can more easily accumulate cash; unprofitable ones drain cash reserves.
Financial Obligations and Debt:				
LnCURLIBTOSALES	Natural log of the ratio of the firm's current liabilities to sales	(+)	H5	Firms with higher short-term liabilities will hold more cash to meet obligations
LnDEBTRATIO	Natural log of the ratio of Total Liabilities to Total Assets.	(-)	H5	Firms with higher outstanding debt will need cash to service debt to avoid default .
Cash Substitutes:				
TRADECREDIT	Dummy, 1 = if firm uses trade credit	(-)	H6	Availability of trade credit relaxes firm's liquidity requirements
LnUNUSEDLOC	Natural log of the ratio of unused balance on all Lines of Credit to Sales	(-)	H6	Availability of a Line of credit relaxes firm's liquidity requirements

3.3.1 Sample size and summary statistics for numeric variables. Sections 6.2 and 6.3 of this document describe the transformation and clean-up applied to the 1998 and 2003 NSSBF sample data prior to analysis. In that section it was indicated that 120 observations (out of 3561 total) in the 1998 NSSBF are excluded, and 627 observations (out of 21200 total) in the 2003 NSSBF are excluded, due to failure to meet the "going concern" criteria.

An additional 103 observations are excluded from the 1998 NSSBF sample data due to missing item data for the cash regression model independent variables, leaving 3338 complete observations for analysis from the 1998 NSSBF. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3.

An additional 899 observations are excluded from the 2003 NSSBF sample data due to missing item data for the cash regression model independent variables, leaving 19674 complete observations for analysis. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3. Finally, selection of implicate #3 only as described in section 6.4 results in 3934 complete observations for analysis from the 2003 NSSBF.

Note that some of the variables in the model have been transformed to their natural log form and Winsorized. This has been done to reduce the rather large skewness and kurtosis typical of the untransformed numeric variables in the 1998 and 2003 NSSBF samples. Sections 6.2 and 6.3 describe the rationale behind this and the transformation methodology used. Figures 3.1 and 3.2 below provide sample statistics for the numeric variables in the model, including mean, standard deviation, skewness and kurtosis. The

untransformed and transformed variables are included in the table for comparison, and to show how the logarithmic transformation and Winsorization of the variables have reduced skewness and kurtosis.

variable	N	mean	sd	max	min	skewness	kurtosis
OWNSHR	3338	80.23158	27.29921	100	1	-.9307972	2.467675
OWNEXP	3338	19.2867	11.76435	72	0	.8046414	3.570297
CASHTOSALES	3338	.112028	.4056525	13.92928	0	17.7049	486.5553
LnCASHTOSA~S	3338	.0841031	.171444	2.703324	0	5.708642	50.82512
wLnCASHTOS~S	3338	.080505	.1431948	.924841	0	3.741395	19.14796
SALES	3338	3508420	1.53e+07	6.24e+08	75	22.92307	836.3026
LnSALES	3338	12.70107	2.28872	20.25166	4.330733	.040026	2.972415
wLnSALES	3338	12.69599	2.276372	17.74784	4.330733	.0073093	2.904989
OWNERS	3338	6.379868	72.00058	2500	1	24.68248	693.9601
LnOWNERS	3338	.471144	.8291453	7.824046	0	3.276864	19.09508
wLnOWNERS	3338	.4570813	.7469981	3.912023	0	2.315092	9.419795
OTRINCTOSA~S	3338	.037509	.7689369	43.54243	-.281078	54.3781	3071.917
LnOTRINCTO~S	3338	.2636814	.0997177	3.802733	0	17.74462	513.7332
wLnOTRINCT~S	3338	.2612101	.0620167	.7800731	.2477019	6.81772	53.01461
OWNWORTHTO~S	3338	9.864433	97.03174	2948.288	-66.66666	23.52095	632.4018
LnOWNWORTH~S	3338	8.658729	.0142825	9.070996	8.645469	21.9008	554.645
wLnOWNWORT~S	3338	8.658056	.0030956	8.682423	8.657129	6.226323	45.17571
PROFTOINCOME	3338	.0809244	2.017273	1	-99	-37.26497	1761.583
LnPROFTOIN~E	3338	4.225523	.2832803	4.81	.1948795	-3.204925	30.86424
wLnPROFTOI~E	3338	4.229775	.2530558	4.803224	2.86409	-1.483425	11.4712
UNUSEDLOC	3338	.3495936	6.4175	335	0	45.34706	2269.892
LnUNUSEDLOC	3338	.0992033	.316021	5.817111	0	7.485123	85.2514
wLnUNUSEDLOC	3338	.0902894	.2369373	1.593252	0	4.14085	22.50825
CURLIBTOSA~S	3338	.1001296	.203248	2	0	3.921697	23.36026
LnCURLIBTO~S	3338	.0830916	.1457479	1.098612	0	2.928233	13.02207
wLnCURLIBT~S	3338	.0817219	.1385666	.6876656	0	2.564781	9.549197
DEBTRATIO	3338	1.114961	3.932861	97.98157	0	13.39175	253.0054
LnDEBTRATIO	3338	.4677874	.5558724	4.594934	0	2.504338	12.02956
wLnDEBTRATIO	3338	.4634161	.5325272	2.89844	0	2.126647	8.707107

Figure 3.1. Sample statistics for numeric model variables from 1998 NSSBF

variable	N	mean	sd	max	min	skewness	kurtosis
OWNSHR	3934	76.10473	27.11274	100	8	-.4843441	1.657802
OWNEXP	3934	21.41129	11.51455	65	0	.4905398	2.982965
CASHTOSALES	3934	.1710573	2.032707	112.5	0	46.391	2440.01
LnCASHTOSA~S	3934	.0929259	.2138032	4.731803	0	8.667614	123.721
wLnCASHTOS~S	3934	.0869004	.1552212	1.049822	0	3.908554	21.07929
SALES	3934	4487467	1.27e+07	2.11e+08	54	6.79327	70.8331
LnSALES	3934	13.21141	2.233077	19.16672	7.845808	.042676	2.427398
wLnSALES	3934	13.20777	2.224785	17.94269	7.845808	.0224686	2.385637
OWNERS	3934	4.116929	51.93903	2800	1	44.38326	2231.763
LnOWNERS	3934	.5576774	.7247152	7.937375	0	2.400917	14.47109
wLnOWNERS	3934	.5517263	.6871977	3.912023	0	1.703539	7.173829
OTRINCTOSA~S	3934	.0565075	1.449223	87.64276	-.2831222	56.80069	3401.191
LnOTRINCTO~S	3934	.2670402	.1247206	4.487803	0	17.11748	440.332
wLnOTRINCT~S	3934	.2636256	.0716142	.8255439	.2492946	6.737445	49.86473
OWNWORTHTO~S	3934	13.4169	101.1204	2643.478	-50	16.52721	333.5803
LnOWNWORTH~S	3934	4.035012	.3247742	7.89896	0	5.727057	58.25106
wLnOWNWORT~S	3934	4.028175	.253703	5.735924	3.931826	4.79431	28.41714
PROFTOINCOME	3934	.0004738	7.535976	1	-467.9074	-60.9512	3780.293
LnPROFTOIN~E	3934	5.551858	.2394028	6.15	-.0025357	-5.188544	97.60703
wLnPROFTOI~E	3934	5.556506	.1966246	6.105282	4.661638	-.2386307	7.014546
UNUSEDLOC	3934	.3286982	4.92221	284.5529	0	50.7541	2854.338
LnUNUSEDLOC	3934	.1247809	.3220724	5.654427	0	5.93584	58.26441
wLnUNUSEDLOC	3934	.1178517	.2661966	1.673976	0	3.607886	17.86258
CURLIBTOSA~S	3934	.0720034	.1461095	2	0	5.303388	43.2911
LnCURLIBTO~S	3934	.0628008	.1078748	1.098612	0	3.759318	22.50921
wLnCURLIBT~S	3934	.0612741	.098286	.5781896	0	2.937075	13.38436
DEBTRATIO	3934	.8662447	2.602223	53.56457	0	11.15924	167.8626
LnDEBTRATIO	3934	.4243869	.485192	3.999385	0	2.492532	12.69059
wLnDEBTRATIO	3934	.4194727	.4587623	2.508437	0	1.979796	8.287826

Figure 3.2. Sample statistics for numeric model variables from 2003 NSSBF (using implicate #3 only)

3.3.2 Summary statistics for dummy and categorical variables. Table 3.2 provides un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 3435 observations of the 1998 NSSBF sample, and table 3.3 provides un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 4052 observations of the 2003 NSSBF sample.

Table 3.2

Sample statistics for dummy/categorical variables from 1998 NSSBF (n=3338)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
PASSTHRU: Firm is structured as a pass-thru	No	3127	93.7
entity for tax purposes	Yes	211	6.3
FAMOWN: One Family owns more than 50% of	No	499	14.9
the firm	Yes	2839	85.1
OWNMGR: Firm's Manager is an owner	No	346	10.4
	Yes	2992	89.6
PURCHASED: Firm was purchased by its current	No	2682	80.3
owners	Yes	656	19.7
INHERITED: Firm was inherited by its current	No	3152	94.4
owners	Yes	186	5.6
OWNDISTRESS: Principal owner has been	No	2847	85.3
bankrupt or delinquent on personal obligations	Yes	491	14.7
COLLEGEGRAD: Primary owner is a college grad	No	1595	47.8
or better	Yes	1743	52.2
SPECIALED: Primary owner is a trade school or	No	3022	90.5
assoc degree grad	Yes	316	9.5
FIRMDISTRESS: Firm has been	No	2858	85.6
bankrupt/delinquent on business obligations	Yes	480	14.4
FEARDENIAL: Firm has not applied for credit	No	2609	78.2
due to fear of denial	Yes	729	21.8
TRADECREDIT: Firm has used trade credit within	No	1108	33.2
most recent fiscal year	Yes	2230	66.8

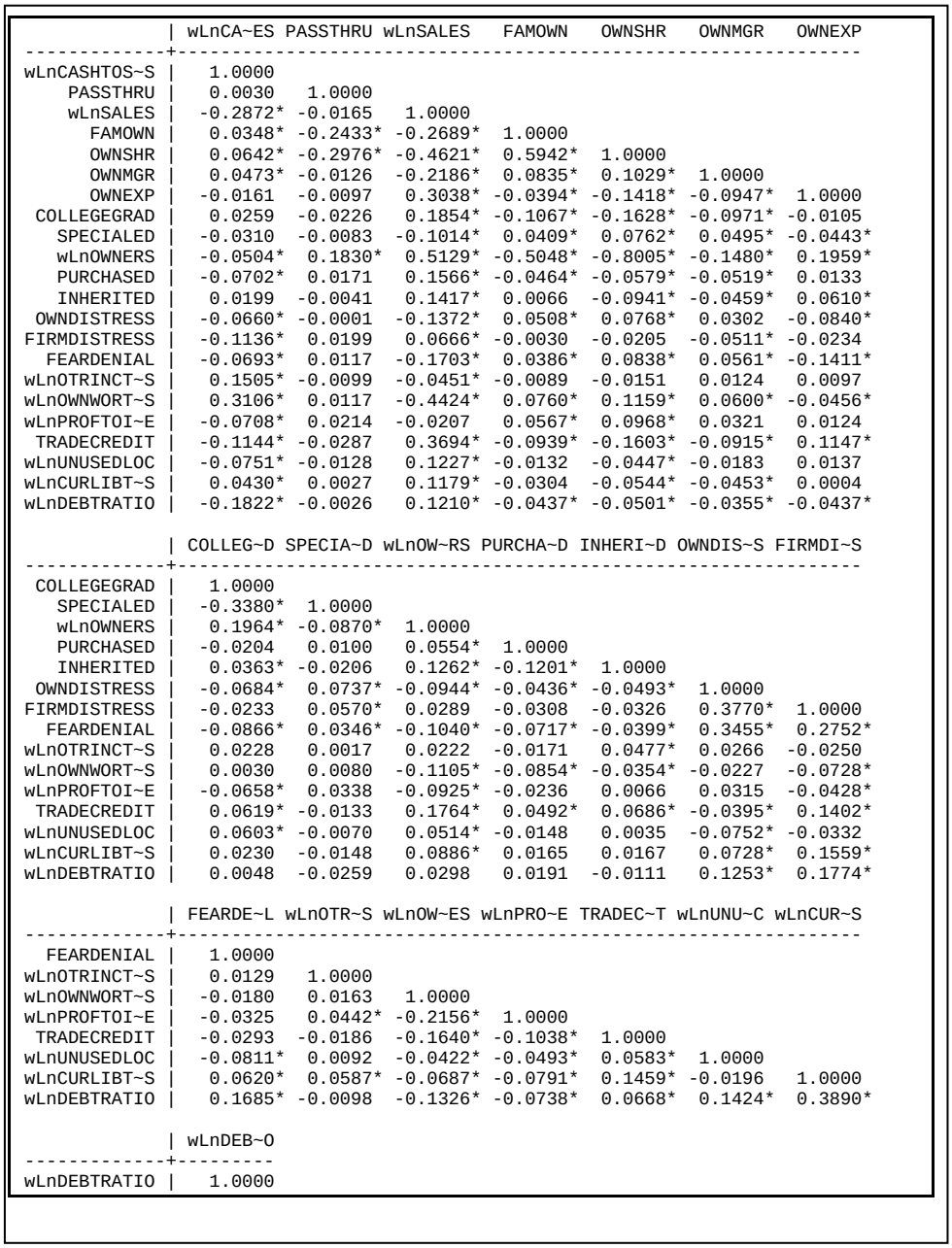
Table 3.3

Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=3934)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
PASSTHRU: Firm is structured as a pass-thru entity for tax purposes	No	3631	92.3
	Yes	303	7.7
FAMOWN: One Family owns more than 50% of the firm	No	613	15.6
	Yes	3321	84.4
OWNMGR: Firm's Manager is an owner	No	364	9.3
	Yes	3570	90.7
PURCHASED: Firm was purchased by its current owners	No	3088	78.5
	Yes	846	21.5
INHERITED: Firm was inherited by its current owners	No	3678	93.5
	Yes	256	6.5
OWNDISTRESS: Principal owner has been bankrupt or delinquent on personal obligations	No	3797	96.5
	Yes	137	3.5
COLLEGEGRAD: Primary owner is a college grad or better	No	2015	51.2
	Yes	1919	48.8
SPECIALED: Primary owner is a trade school or assoc degree grad	No	3284	83.5
	Yes	650	16.5
FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations	No	3804	96.7
	Yes	130	3.3
FEARDENIAL: Firm has not applied for credit due to fear of denial	No	3376	85.8
	Yes	558	14.2
TRADECREDIT: Firm has used trade credit within most recent fiscal year	No	1189	30.2
	Yes	2745	69.8

3.3.3 Sample correlations. Figures 3.3 and 3.4 present the Pearson correlations between the variables in the model for the 1998 and 2003 NSSBF samples, respectively. Examining correlations that are close to 0.500 or higher (-0.500 or lower) it can be seen that the variables OWNSHR and LnOWNERS are correlated with several other variables in both the 1998 and 2003 NSSBF samples. In addition to the full model, regressions will be run that drop these two variables to observe the effect on the estimated coefficients.

It can also be observed that COLLEGEGRAD and SPECIALED are negatively correlated, which is a natural result of their definition. The model is estimated with each of these variables removed to observe the effect on the significance of the other.



	wLnCA~ES	PASSTHRU	wLnSALES	FAMOWN	OWNSHR	OWNMGR	OWNEXP
wLnCASHTOS~S	1.0000						
PASSTHRU	0.0030	1.0000					
wLnSALES	-0.2872*	-0.0165	1.0000				
FAMOWN	0.0348*	-0.2433*	-0.2689*	1.0000			
OWNSHR	0.0642*	-0.2976*	-0.4621*	0.5942*	1.0000		
OWNMGR	0.0473*	-0.0126	-0.2186*	0.0835*	0.1029*	1.0000	
OWNEXP	-0.0161	-0.0097	0.3038*	-0.0394*	-0.1418*	-0.0947*	1.0000
COLLEGEGRAD	0.0259	-0.0226	0.1854*	-0.1067*	-0.1628*	-0.0971*	-0.0105
SPECIALED	-0.0310	-0.0083	-0.1014*	0.0409*	0.0762*	0.0495*	-0.0443*
wLnOWNERS	-0.0504*	0.1830*	0.5129*	-0.5048*	-0.8005*	-0.1480*	0.1959*
PURCHASED	-0.0702*	0.0171	0.1566*	-0.0464*	-0.0579*	-0.0519*	0.0133
INHERITED	0.0199	-0.0041	0.1417*	0.0066	-0.0941*	-0.0459*	0.0610*
OWNDISTRESS	-0.0660*	-0.0001	-0.1372*	0.0508*	0.0768*	0.0302	-0.0840*
FIRMDISTRESS	-0.1136*	0.0199	0.0666*	-0.0030	-0.0205	-0.0511*	-0.0234
FEARDENIAL	-0.0693*	0.0117	-0.1703*	0.0386*	0.0838*	0.0561*	-0.1411*
wLnOTRINCT~S	0.1505*	-0.0099	-0.0451*	-0.0089	-0.0151	0.0124	0.0097
wLnOWNWORT~S	0.3106*	0.0117	-0.4424*	0.0760*	0.1159*	0.0600*	-0.0456*
wLnPROFTOI~E	-0.0708*	0.0214	-0.0207	0.0567*	0.0968*	0.0321	0.0124
TRADECREDIT	-0.1144*	-0.0287	0.3694*	-0.0939*	-0.1603*	-0.0915*	0.1147*
wLnUNUSEDLOC	-0.0751*	-0.0128	0.1227*	-0.0132	-0.0447*	-0.0183	0.0137
wLnCURLIBT~S	0.0430*	0.0027	0.1179*	-0.0304	-0.0544*	-0.0453*	0.0004
wLnDEBTRATIO	-0.1822*	-0.0026	0.1210*	-0.0437*	-0.0501*	-0.0355*	-0.0437*

	COLLEG~D	SPECIA~D	wLnOW~RS	PURCHA~D	INHERI~D	OWNDIS~S	FIRMDI~S
COLLEGEGRAD	1.0000						
SPECIALED	-0.3380*	1.0000					
wLnOWNERS	0.1964*	-0.0870*	1.0000				
PURCHASED	-0.0204	0.0100	0.0554*	1.0000			
INHERITED	0.0363*	-0.0206	0.1262*	-0.1201*	1.0000		
OWNDISTRESS	-0.0684*	0.0737*	-0.0944*	-0.0436*	-0.0493*	1.0000	
FIRMDISTRESS	-0.0233	0.0570*	0.0289	-0.0308	-0.0326	0.3770*	1.0000
FEARDENIAL	-0.0866*	0.0346*	-0.1040*	-0.0717*	-0.0399*	0.3455*	0.2752*
wLnOTRINCT~S	0.0228	0.0017	0.0222	-0.0171	0.0477*	0.0266	-0.0250
wLnOWNWORT~S	0.0030	0.0080	-0.1105*	-0.0854*	-0.0354*	-0.0227	-0.0728*
wLnPROFTOI~E	-0.0658*	0.0338	-0.0925*	-0.0236	0.0066	0.0315	-0.0428*
TRADECREDIT	0.0619*	-0.0133	0.1764*	0.0492*	0.0686*	-0.0395*	0.1402*
wLnUNUSEDLOC	0.0603*	-0.0070	0.0514*	-0.0148	0.0035	-0.0752*	-0.0332
wLnCURLIBT~S	0.0230	-0.0148	0.0886*	0.0165	0.0167	0.0728*	0.1559*
wLnDEBTRATIO	0.0048	-0.0259	0.0298	0.0191	-0.0111	0.1253*	0.1774*

	FEARDE~L	wLnOTR~S	wLnOW~ES	wLnPRO~E	TRADEC~T	wLnUNU~C	wLnCUR~S
FEARDENIAL	1.0000						
wLnOTRINCT~S	0.0129	1.0000					
wLnOWNWORT~S	-0.0180	0.0163	1.0000				
wLnPROFTOI~E	-0.0325	0.0442*	-0.2156*	1.0000			
TRADECREDIT	-0.0293	-0.0186	-0.1640*	-0.1038*	1.0000		
wLnUNUSEDLOC	-0.0811*	0.0092	-0.0422*	-0.0493*	0.0583*	1.0000	
wLnCURLIBT~S	0.0620*	0.0587*	-0.0687*	-0.0791*	0.1459*	-0.0196	1.0000
wLnDEBTRATIO	0.1685*	-0.0098	-0.1326*	-0.0738*	0.0668*	0.1424*	0.3890*

	wLnDEB~O
wLnDEBTRATIO	1.0000

Figure 3.3. 1998 NSSBF: Pearson Correlations of Model Variables

	wLnCA~ES	PASSTHRU	wLnSALES	FAMOWN	OWNSHR	OWNMGR	OWNEXP
wLnCASHTOS~S	1.0000						
PASSTHRU	-0.0109	1.0000					
wLnSALES	-0.3069*	-0.0052	1.0000				
FAMOWN	0.0665*	-0.1992*	-0.2764*	1.0000			
OWNSHR	0.0745*	-0.2603*	-0.3700*	0.4467*	1.0000		
OWNMGR	0.0239	-0.0229	-0.2238*	0.0829*	0.1147*	1.0000	
OWNEXP	0.0153	-0.0383*	0.2894*	0.0223	-0.0484*	-0.1744*	1.0000
COLLEGEGRAD	0.0327*	-0.0187	0.0848*	-0.0799*	0.0848*	-0.0306	-0.0181
SPECIALED	-0.0244	0.0512*	0.0135	-0.0693*	-0.2409*	0.0405*	-0.0560*
wLnOWNERS	-0.0752*	0.1755*	0.4596*	-0.5041*	-0.7852*	-0.1980*	0.1248*
PURCHASED	-0.0763*	0.0066	0.1881*	-0.0685*	-0.0841*	-0.0720*	0.0171
INHERITED	-0.0068	-0.0298	0.1847*	0.0423*	-0.0920*	-0.0545*	0.0876*
OWNDISTRESS	-0.0200	0.0075	-0.1048*	0.0243	0.0389*	0.0319*	-0.0558*
FIRMDISTRESS	-0.0410*	-0.0107	0.0483*	-0.0147	-0.0142	-0.0097	0.0137
FEARDENIAL	-0.0598*	-0.0218	-0.1293*	0.0260	0.0820*	0.0569*	-0.1368*
wLnOTRINCT~S	0.1486*	-0.0136	-0.0868*	0.0098	0.0112	-0.0007	0.0015
wLnOWNWORT~S	0.3950*	0.0331*	-0.4902*	0.0828*	0.1188*	0.0617*	-0.0552*
wLnPROFTOI~E	-0.0023	-0.0202	-0.0855*	0.1017*	0.1207*	0.0544*	-0.0001
TRADECREDIT	-0.1560*	-0.0154	0.4159*	-0.0905*	-0.1601*	-0.1070*	0.1652*
wLnUNUSEDLOC	-0.0589*	-0.0039	0.0663*	-0.0295	-0.0332*	0.0074	0.0166
wLnCURLIBT~S	0.0156	-0.0067	0.1920*	-0.1157*	-0.1038*	-0.0926*	0.0670*
wLnDEBTRATIO	-0.2080*	0.0232	0.1429*	-0.0690*	-0.0686*	-0.0131	-0.0332*

	COLLEG~D	SPECIA~D	wLnOW~RS	PURCHA~D	INHERI~D	OWNDIS~S	FIRMDI~S
COLLEGEGRAD	1.0000						
SPECIALED	-0.4342*	1.0000					
wLnOWNERS	-0.0034	0.1477*	1.0000				
PURCHASED	-0.0008	0.0353*	0.0657*	1.0000			
INHERITED	-0.0121	0.0075	0.1292*	-0.1381*	1.0000		
OWNDISTRESS	-0.0411*	0.0014	-0.0417*	-0.0252	-0.0220	1.0000	
FIRMDISTRESS	-0.0069	-0.0172	0.0217	0.0175	0.0089	0.2829*	1.0000
FEARDENIAL	-0.0688*	-0.0043	-0.0699*	-0.0408*	-0.0689*	0.2288*	0.1327*
wLnOTRINCT~S	-0.0082	-0.0066	0.0037	-0.0290	-0.0201	0.0325*	0.0246
wLnOWNWORT~S	0.0409*	-0.0293	-0.1329*	-0.1167*	-0.0597*	-0.0287	-0.0505*
wLnPROFTOI~E	0.0076	-0.0180	-0.1289*	-0.0285	-0.0528*	0.0010	-0.0088
TRADECREDIT	-0.0366*	0.0186	0.1807*	0.1168*	0.0973*	-0.0471*	0.0164
wLnUNUSEDLOC	0.0603*	-0.0129	0.0320*	-0.0045	-0.0091	-0.0433*	-0.0184
wLnCURLIBT~S	0.0125	0.0261	0.1653*	0.0062	0.0663*	-0.0186	0.0579*
wLnDEBTRATIO	0.0107	-0.0093	0.0717*	0.0673*	-0.0043	0.0154	0.0607*

	FEARDE~L	wLnOTR~S	wLnOW~ES	wLnPRO~E	TRADEC~T	wLnUNU~C	wLnCUR~S
FEARDENIAL	1.0000						
wLnOTRINCT~S	0.0166	1.0000					
wLnOWNWORT~S	-0.0655*	0.0788*	1.0000				
wLnPROFTOI~E	-0.0380*	0.0807*	-0.0916*	1.0000			
TRADECREDIT	-0.0148	-0.0591*	-0.2537*	-0.1282*	1.0000		
wLnUNUSEDLOC	-0.0885*	-0.0106	-0.0078	-0.0476*	0.0453*	1.0000	
wLnCURLIBT~S	0.0534*	0.0393*	-0.0488*	-0.1124*	0.1594*	-0.0350*	1.0000
wLnDEBTRATIO	0.1609*	-0.0299	-0.1470*	-0.1352*	0.1260*	0.1683*	0.2812*

	wLnDEB~O
wLnDEBTRATIO	1.0000

Figure 3.4. 2003 NSSBF: Pearson Correlations of Model Variables (using implicate #3 only)

3.3.4 Variance inflation factors. The variance inflation factors for the 1998 model estimation are provided in figure 3.5 below. The variance inflation factors for the 2003 model estimation are provided in figure 3.6 below. They were generated following unweighted OLS estimation of the Cash model for the two survey samples. The observed variance inflation factors for OWNSHR and wLnOWNERS are consistent with the observation of relatively high correlation between these variables in figures 3.3 and 3.4 above. This confirms the earlier conclusion that estimating the model multiple times with one or both of these variables dropped would be advisable.

Variable	VIF	1/VIF
OWNSHR	3.46	0.288965
wLnOWNERS	3.13	0.319469
wLnSALES	2.29	0.435780
FAMOWN	1.59	0.630623
wLnOWNWORT~S	1.40	0.712601
OWNDISTRESS	1.30	0.770281
wLnDEBTRATIO	1.30	0.772068
FIRMDISTRESS	1.28	0.780571
FEARDENIAL	1.25	0.802446
wLnCURLIBT~S	1.23	0.809805
COLLEGEGRAD	1.21	0.828375
TRADECREDIT	1.21	0.829834
PASSTHRU	1.16	0.863688
OWNEXP	1.15	0.868683
SPECIALED	1.14	0.875993
wLnPROFTOI~E	1.11	0.897288
OWNMGR	1.06	0.939183
wLnUNUSEDLOC	1.06	0.941908
INHERITED	1.06	0.942335
PURCHASED	1.06	0.942415
wLnOTRINCT~S	1.02	0.980685
Mean VIF	1.45	

Figure 3.5. Variance Inflation Factors – 1998 NSSBF

Variable	VIF	1/VIF
wLnOWNERS	3.19	0.313221
OWNSHR	2.91	0.343326
wLnSALES	2.24	0.446703
wLnOWNWORT~S	1.46	0.684776
FAMOWN	1.44	0.696156
SPECIALED	1.32	0.758980
COLLEGEGRAD	1.30	0.770496
TRADECREDIT	1.26	0.794676
wLnDEBTRATIO	1.21	0.827382
OWNEXP	1.17	0.853627
wLnCURLIBT~S	1.17	0.855869
FEARDENIAL	1.16	0.860790
OWNDISTRESS	1.15	0.868501
PASSTHRU	1.11	0.903015
FIRMDISTRESS	1.11	0.903694
INHERITED	1.10	0.909138
OWNMGR	1.09	0.913340
wLnPROFTOI~E	1.09	0.916234
PURCHASED	1.09	0.920781
wLnUNUSEDLOC	1.06	0.942120
wLnOTRINCT~S	1.03	0.974696
Mean VIF	1.41	

Figure 3.6. Variance Inflation Factors – 2003 NSSBF

3.4 Estimation Methodology

The model specified in the previous section is estimated using survey-weighted least squares regression or the equivalent method, WLS with robust standard errors. The sign and statistical significance of the independent variable coefficients is used to test the hypotheses. The methodology and rationale behind the use of a survey-weighted regression estimation methodology is described in detail in section 6.1 of this document and will not be repeated here. An estimation of the model using OLS with robust standard errors is included in order to show the effect of the use of survey weights in the estimation of the model.

3.5 Univariate Analysis

Before estimating the multivariate regression model, it would be useful to examine how the small firms' CASHTOSALES ratio is related in a univariate sense to the firm characteristics embodied in the model variables. Tables 3.4 (for the 1998 NSSBF) and 3.5 (for the 2003 NSSBF) show how the mean of CASHTOSALES differs for the two states of each binary variable in the model. Included for each set of means is an Adjusted Wald test whose null hypothesis is that the two means are not significantly different from each other.

For the 1998 NSSBF sample, the means of CASHTOSALES for PASSTHRU, FAMOWN, OWNMGR, SPECIALED, and INHERITED are not significantly different for the two states (Yes and No) of these binary variables. However, the means of COLLEGEGRAD, PURCHASED, OWNDISTRESS, FIRMDISTRESS, FEARDENIAL and TRADECREDIT are significantly different for the two states of these binary variables. Furthermore, for these variables, the differences are supportive of the hypothesized (+) or (-) relationship indicated in table 3.1. Firms with a primary owner who is a college grad have a significantly higher CASHTOSALES ratio, while purchased firms, firms in distress or with a primary owner in distress, firms that fear denial of a loan application, and firms that use trade credit all have significantly lower CASHTOSALES ratios.

For the 2003 NSSBF sample, the means of CASHTOSALES for PASSTHRU, FAMOWN, OWNMGR, COLLEGEGRAD, SPECIALED, PURCHASED and INHERITED are not significantly different for the two states (Yes and No) of these binary variables. However, the means of OWNDISTRESS, FIRMDISTRESS,

FEARDENIAL and TRADECREDIT are significantly different for the two states of these binary variables. Furthermore, for these variables, the differences are supportive of the hypothesized (+) or (-) relationship indicated in table 3.1. Firms in distress or with a primary owner in distress, firms that fear denial of a loan application, and firms that use trade credit all have significantly lower CASHTOSALES ratios.

For the 1998 NSSBF, the only industry that showed a significant difference in the CASHTOSALES ratio was WHOLESALE, which had a significantly lower ratio for firms in that industry than those who were not.

For the 2003 NSSBF, firms in the TRANSPORTATION, WHOLESALE and RETAIL industries all had a significantly lower CASHTOSALES ratio than other firms, while firms in the SERVICES industry had a very much higher ratio, by two orders of magnitude, than firms in other industries. The significantly lower CASHTOSALES ratios for TRANSPORTATION, WHOLESALE and RETAIL industries for 2003 could be the result of the poor U.S. economic conditions at that period compared to 1998. Firms in these three industries may have been particularly hard-hit by the recession of 2001-2002, and may have been cash depleted as a result. The SERVICES sector on the other hand appears to have been booming in 2003, if their very high CASHTOSALES ratio is any indication.

Table 3.6 shows the means and standard deviations for selected numeric variables from the cash holdings model, for both the 1998 NSSBF and 2003 NSSBF samples. T-tests were performed of the differences between the 1998 and 2003 variable means, assuming unequal variances and using a significance level of 0.05, with the following result:

- CASHTOSALES: firms held significantly less cash on average in 1998 than 2003.
- OTRINCTOSALES: no significant difference between 1998 and 2003.
- OWNWORTHTOSALES: no significant difference between 1998 and 2003.
- PROFTOINCOME: no significant difference between 1998 and 2003.
- UNUSEDLOC: no significant difference between 1998 and 2003.
- CURLIBTOSALES: firms maintained a significantly higher ratio in 1998 than 2003.
- DEBTTOASSETS: firms maintained a significantly higher ratio in 1998 than 2003.

In summary, from 1998 to 2003, as the economy transitioned from a period of strong growth to a period of relative contraction, small firms shed debt and accumulated cash.

Tables 3.7 (for the 1998 NSSBF) and 3.8 (for the 2003 NSSBF) show how the mean of the model independent variable wLnCASHTOSALES differs across four quartiles of each numeric variable from the regression model. Included for each set of means are Adjusted Wald tests whose null hypothesis is that the two quartile means are not significantly different from each other. There is a Wald test for each pair of adjacent quartile means (1^{st}-2^{nd} quartile, 2^{nd}-3^{rd} quartile, 3^{rd}-4^{th} quartile). Note that for some of the numeric variables, less than four quartiles are listed in the table. That is because that particular variable had a large number of missing or zero values, such that four unique quartiles could not be created.

Consistent with the results of other researchers, larger firms (measured by SALES) maintain a lower wLnCASHTOSALES ratio than smaller firms. This result is supported by both the 1998 and 2003 samples.

Firms whose primary owner holds a larger share (OWNSHR) of the firm maintain a higher wLnCASHTOSALES ratio, contrary to hypothesis H1 in table 3.1. This result is supported by the 1998 but not the 2003 sample. This observation would be consistent with the idea that increasing ownership in a small firm gives the primary owner greater control over the firm's resources and allows her to accumulate cash in the firm for their own purposes. The values of OWNSHR observed in the NSSBF are frequently in the 50 to 100 percent range, giving the primary owner complete control. It would appear that either (a) increasing ownership share in the small firm does not decrease agency, or (b) cash accumulation is not motivated by agency issues.

For the both samples, firms with the most experienced owners (OWNEXP) maintain the highest level of wLnCASHTOSALES, consistent with hypothesis H3a.

For the 1998 sample, firms with the lowest and highest quartiles of wLnOWNERS maintain the highest levels of wLnCASHTOSALES, which offers partial support for hypothesis H1 and suggests a nonlinear relationship between wLnOWNERS and wLnCASHTOSALES. For the 2003 sample, the wLnCASHTOSALES means across wLnOWNERSquartiles are not significantly different.

No significant difference is observed in the mean of wLnCASHTOSALES across quartiles of wLnOTRINCTOSALES in either sample.

The wLnCASHTOSALES ratio rises with each quartile of owners wealth, with the fourth quartile of wealth having a wLnCASHTOSALES ratio of more than twice that

for the third quartile. This suggests that the very wealthiest of owners have the greatest impact on the firm's cash holdings and provides support for hypothesis H2a. This result is observed for both the 1998 and 2003 samples.

The wLnCASHTOSALES ratio is highest for the lowest and highest quartiles of wLnPROFTOINCOME in both the 1998 and 2003 samples. The least profitable and the most profitable firms maintain the highest ratio, with the intermediate quartiles maintaining a lower ratio. This result offers partial support for hypothesis H4. The most profitable firms maintain higher wLnCASHTOSALES because they can (H4). It may be that the least profitable firms accumulate cash because they must; they cannot rely on a steady stream of profits to fund operations.

For the 2003 sample it is observed that firms with a higher unused line of credit balance (wLnUNUSEDLOC) maintain a lower wLnCASHTOSALES ratio, consistent with hypothesis H6. This is not supported for the 1998 sample. It may be that the poorer economic conditions in 2003 caused small firms to rely more on their available lines of credit and hold less cash than they did during the more economically robust 1998 period.

For both the 1998 and 2003 samples, it is observed that firms in the highest and lowest quartiles of wLnCURLIBTOSALES maintain the highest levels of the wLnCASHTOSALES ratio, with the middle quartiles maintaining lower ratios. The presence of a high wLnCASHTOSALES ratio for the highest wLnCURLIBTOSALES quartile is consistent with hypothesis H5 that firms with a higher wLnCASHTOSALES ratio will maintain more cash to service that debt. The firms in the highest quartile of current liabilities are at the highest risk of default and are motivated to maintain enough cash to avoid that event. On the other hand, firms in the lowest wLnCURLIBTOSALES

quartile have the lowest demands on their cash and can more easily accumulate and maintain cash holdings.

For both the 1998 and 2003 samples, firms in the lower quartiles of DEBTTOASSETS hold more cash than firms in the higher quartiles. This is contrary to hypothesis H5. This is consistent however with the observation that firms in the lowest quartile of current liabilities hold more cash than the middle quartiles. Cash and debt appear to be substitutes, at least at the low to mid quartiles of debt.

Table 3.4

1998 NSSBF: Two-way tabulation of CASHTOSALES versus firm characteristics from model

Number of strata = 78 Number of obs = 3485 Design df = 3260
Number of PSUs = 3338 Population size = 4928579

		CASHTOSALES Mean	Linearized Std. Err.	[95% Conf.	Interval]	Adjusted Wald test for equality of means (H0: Means are equal)
PASSTHRU	No	.1238899	.0073141	.1095492	.1382305	
	Yes	.1182436	.0353204	.0489911	.1874961	F(1,3260) = 0.02, Prob > F = 0.8756
FAMOWN	No	.1057194	.0196122	.0672659	.1441729	
	Yes	.1257347	.0077606	.1105185	.1409509	F(1,3260) = 0.90, Prob > F = 0.3426
OWNMGR	No	.1033897	.0273082	.0498468	.1569326	
	Yes	.1251374	.0075053	.1104218	.139853	F(1,3260) = 0.59, Prob > F = 0.4427
COLLEGEGRAD	No	.1119641	.0094133	.0935075	.1304208	
	Yes	.1359166	.0110816	.114189	.1576443	F(1,3260) = 2.71, Prob > F = 0.0997
SPECIALED	No	.1262602	.0077331	.1110981	.1414224	
	Yes	.0982608	.019639	.0597547	.1367668	F(1,3260) = 1.76, Prob > F = 0.1847
PURCHASED	No	.1348239	.0087004	.1177652	.1518826	
	Yes	.0709265	.0053222	.0604912	.0813618	F(1,3260) = 39.35, Prob > F = 0.0000
INHERITED	No	.1213924	.007345	.1069912	.1357937	
	Yes	.1719555	.0400117	.0935049	.2504061	F(1,3260) = 1.54, Prob > F = 0.2140
OWNDISTRESS	No	.1313728	.0082459	.1152051	.1475406	
	Yes	.08042	.0121697	.056559	.104281	F(1,3260) = 12.05, Prob > F = 0.0005
FIRMDISTRESS	No	.1333888	.0081399	.1174291	.1493485	
	Yes	.0596149	.0114798	.0371066	.0821233	F(1,3260) = 27.52, Prob > F = 0.0000
FEARDENIAL	No	.1365887	.0089284	.1190829	.1540945	
	Yes	.0794269	.0094224	.0609525	.0979014	F(1,3260) = 19.39, Prob > F = 0.0000
TRADECREDIT	No	.164669	.0158017	.1336867	.1956513	

```
                 Yes |   .0994337   .0067297      .0862389    .1126285      F(1,3260) = 14.43, Prob > F = 0.0001
---------------------+-------------------------------------------------------------------------------------------
 MANUFACTURING    No |   .1250085    .007765      .1097836    .1402334
                 Yes |   .1066493   .0151257      .0769924    .1363062      F(1,3260) = 1.17,  Prob > F = 0.2800
---------------------+-------------------------------------------------------------------------------------------
 TRANSPORTATION   No |   .1227286    .007212      .1085881    .1368692
                 Yes |   .1444302   .0562909       .034061    .2547994      F(1,3260) = 0.15,  Prob > F = 0.7022
---------------------+-------------------------------------------------------------------------------------------
 WHOLESALE        No |   .1273447   .0077487      .1121518    .1425375
                 Yes |   .073229    .0097438      .0541245    .0923336      F(1,3260) = 18.88, Prob > F = 0.0000
---------------------+-------------------------------------------------------------------------------------------
 RETAIL           No |   .1243231    .007853      .1089259    .1397203
                 Yes |   .1200839   .0180496      .0846943    .1554735      F(1,3260) = 0.05,  Prob > F = 0.8295
---------------------+-------------------------------------------------------------------------------------------
 SERVICES         No |   .1157728   .0092411      .0976539    .1338917
                 Yes |   .1335871   .0115073      .1110248    .1561494      F(1,3260) = 1.46,  Prob > F = 0.2274
---------------------+-------------------------------------------------------------------------------------------
```

Table 3.5

2003 NSSBF: Two-way tabulation of CASHTOSALES versus firm characteristics from model

```
Number of strata =      72         Number of obs    =     4145      Design df  =  3862
Number of PSUs   =    3934         Population size  =  5806122
---------------------------------------------------------------------------------------------------------
                     | CASHTOSALES  Linearized                              Adjusted Wald test for equality of means
                     |     Mean     Std. Err.     [95% Conf. Interval]            (H0: Means are equal)
---------------------+-----------------------------------------------------------------------------------
 PASSTHRU         No |   .203309    .0390685      .1267122    .2799059
                 Yes |   .1938529   .0556456      .0847554    .3029505      F(1,3862) = 0.02,  Prob > F = 0.8895
---------------------+-----------------------------------------------------------------------------------
 FAMOWN           No |   .1349699   .0328682      .0705292    .1994107
                 Yes |   .2098064     .03982      .1317363    .2878765      F(1,3862) = 2.10,  Prob > F = 0.1478
---------------------+-----------------------------------------------------------------------------------
 OWNMGR           No |    .094739   .0134023      .0684627    .1210153
                 Yes |   .2087913   .0381627      .1339703    .2836123      F(1,3862) = 7.95,  Prob > F = 0.0048
---------------------+-----------------------------------------------------------------------------------
 COLLEGEGRAD      No |   .1976732   .0574065      .0851232    .3102231
```

	Yes	.2082209	.0398777	.1300376	.2864043	F(1,3862) = 0.02, Prob > F = 0.8800
SPECIALED	No	.1805653	.0238626	.1337808	.2273498	
	Yes	.3170111	.1864446	-.0485281	.6825503	F(1,3862) = 0.53, Prob > F = 0.4679
PURCHASED	No	.1903496	.0245422	.1422327	.2384666	
	Yes	.2590566	.1687582	-.0718071	.5899202	F(1,3862) = 0.16, Prob > F = 0.6870
INHERITED	No	.2024179	.0373298	.12923	.2756058	
	Yes	.2049188	.0822487	.0436639	.3661738	F(1,3862) = 0.00, Prob > F = 0.9779
OWNDISTRESS	No	.2065174	.0377634	.1324793	.2805554	
	Yes	.1191806	.0354973	.0495854	.1887757	F(1,3862) = 2.84, Prob > F = 0.0919
FIRMDISTRESS	No	.2064703	.037316	.1333092	.2796313	
	Yes	.0892426	.0291843	.0320245	.1464608	F(1,3862) = 6.13, Prob > F = 0.0133
FEARDENIAL	No	.2236478	.0435634	.1382383	.3090573	
	Yes	.1027884	.0163773	.0706794	.1348974	F(1,3862) = 6.74, Prob > F = 0.0094
TRADECREDIT	No	.3371961	.0898548	.1610288	.5133634	
	Yes	.1160866	.0132825	.0900453	.1421279	F(1,3862) = 5.93, Prob > F = 0.0150
MANUFACTURING	No	.2052015	.0387926	.1291456	.2812573	
	Yes	.1681732	.037614	.0944281	.2419184	F(1,3862) = 0.47, Prob > F = 0.4936
TRANSPORTATION	No	.2062226	.0374535	.132792	.2796532	
	Yes	.1079871	.0388388	.0318406	.1841336	F(1,3862) = 3.32, Prob > F = 0.0686
WHOLESALE	No	.2088943	.0382797	.1338439	.2839448	
	Yes	.0989043	.015455	.0686036	.129205	F(1,3862) = 7.10, Prob > F = 0.0078
RETAIL	No	.2206422	.044238	.1339102	.3073743	
	Yes	.1240289	.0168535	.0909862	.1570716	F(1,3862) = 4.16, Prob > F = 0.0415
SERVICES	No	.1296883	.0104645	.1091717	.1502048	
	Yes	.2900168	.0784036	.1363003	.4437333	F(1,3862) = 4.11, Prob > F = 0.0428

Table 3.6

Means of selected model variables from 1998 and 2003 NSSBF samples

Number of strata = 78	Number of obs = 3485		Number of strata = 72	Number of obs = 4145	
Number of PSUs = 3338	Population size = 4928579		Number of PSUs = 3934	Population size = 5806122	
Design df = 3260			Design df = 3862		
	***** 1998 NSSBF *****			***** 2003 NSSBF *****	
	Mean	Std. Dev.	[95% Conf. Interval]	Mean	Std. Dev.	[95% Conf. Interval]
CASHTOSALES	.112028	.4056525	.0982617 .1257943	.1710573	2.032707	.1075184 .2345962
OTRINCTOSALES	.037509	.7689369	.0114142 .0636038	.0565075	1.449223	.0112073 .1018077
OWNWORTHTOSALES	9.864433	97.03174	6.57155 13.15732	13.4169	101.1204	10.25605 16.57775
PROFTOINCOME	.0809244	2.017273	.0124659 .1493829	.0004738	7.535976	-.2350876 .2360352
UNUSEDLOC	.3495936	6.4175	.1318084 .5673788	.3286982	4.92221	.1748386 .4825578
CURLIBTOSALES	.1001296	.203248	.0932321 .1070271	.0720034	.1461095	.0674363 .0765705
DEBTRATIO	1.114961	3.932861	.9814949 1.248427	.8662447	2.602223	.7849038 .9475856

Note: strata with single sampling unit treated as certainty

Table 3.7

1998 NSSBF: Mean of wLnCASHTOSALES across quartiles of model variables

```
Number of strata =      77         Number of obs    =     1128
Number of PSUs   =    1128         Population size  =  1279594
                                  Design df        =     1051
------------------------------------------------------------------------
             |   Mean of     Linearized     Adjusted Wald Test*
    Quartile |wLnCASHTOSALES  Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------
    wLnSALES |
           1 |   .1588675   .0095929
           2 |   .0850707   .0054981   F(1,3260)=44.55, Prob>F=0.0000
           3 |   .0640306   .0041537   F(1,3260)=9.30,  Prob>F=0.0023
           4 |   .0501867   .0033539   F(1,3260)=6.72,  Prob>F=0.0096
------------------------------------------------------------------------
      OWNSHR |
           1 |   .0757363   .0051084
           2 |   .0942224   .0038913   F(1,3260)=8.33,  Prob>F=0.0039
------------------------------------------------------------------------
      OWNEXP |
           1 |   .0955543   .0059894
           2 |   .0844074   .0060759   F(1,3260)=1.71,  Prob>F=0.1917
           3 |   .0799057   .0055747   F(1,3260)=0.30,  Prob>F=0.5845
           4 |   .098225    .0078646   F(1,3260)=3.61,  Prob>F=0.0574
------------------------------------------------------------------------
   wLnOWNERS |
           1 |   .0946834   .004072
           3 |   .0681329   .0045808   F(1,3260)=18.87, Prob>F=0.0000
           4 |   .0972173   .0108209   F(1,3260)=6.13,  Prob>F=0.0133
------------------------------------------------------------------------
wLnOTRINCTOS~|
           1 |   .0883401   .0036337
           4 |   .0937333   .0066935   F(1,3260)=0.50,  Prob>F=0.4788
------------------------------------------------------------------------
wLnOWNWORTHT~|
           1 |   .0414717   .0025786
           2 |   .0577249   .0029911   F(1,3260)=16.94, Prob>F=0.0000
           3 |   .0873327   .0055687   F(1,3260)=21.99, Prob>F=0.0000
           4 |   .172296    .0099677   F(1,3260)=55.53, Prob>F=0.0000
------------------------------------------------------------------------
wLnPROFTOINC~|
           1 |   .0967847   .0079938
           2 |   .0637847   .0040214   F(1,3260)=13.59, Prob>F=0.0002
           3 |   .0893499   .0058791   F(1,3260)=12.91, Prob>F=0.0003
           4 |   .1084445   .0068046   F(1,3260)=4.52,  Prob>F=0.0336
------------------------------------------------------------------------
wLnUNUSEDLOC |
           1 |   .0988177   .0039959
           3 |   .1217171   .0477461   F(1,3260)=0.23,  Prob>F=0.6328
           4 |   .0606633   .0040505   F(1,3260)=1.62,  Prob>F=0.2027
------------------------------------------------------------------------
wLnCURLIBTOS~|
           1 |   .11265     .0060975
           2 |   .0590927   .0055972   F(1,3260)=41.88, Prob>F=0.0000
           3 |   .0630934   .0044646   F(1,3260)=0.31,  Prob>F=0.5775
           4 |   .088905    .0059709   F(1,3260)=12.02, Prob>F=0.0005
------------------------------------------------------------------------
wLnDEBTRATIO |
           1 |   .1352571   .0090247
           2 |   .1125734   .0066452   F(1,3260)=4.10,  Prob>F=0.0429
           3 |   .0634925   .0039664   F(1,3260)=40.28, Prob>F=0.0000
           4 |   .0469627   .0034927   F(1,3260)=9.77,  Prob>F=0.0018
```

(Wald test is for equality of quartile mean on previous row to quartile mean on current row of table.)

Table 3.8

2003 NSSBF: Mean of wLnCASHTOSALES across quartiles of model variables

```
Number of strata =      72         Number of obs    =     3934
Number of PSUs   =    3934         Population size  =  5806122
                                  Design df        =     3862
------------------------------------------------------------------------
             |   Mean of     Linearized     Adjusted Wald Test*
    Quartile |wLnCASHTOSALES  Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------
    wLnSALES |
           1 |   .188117    .0116205
           2 |   .0925807   .005965    F(1,3862)=53.42, Prob>F=0.0000
           3 |   .0675532   .0054448   F(1,3862)=9.61,  Prob>F=0.0019
           4 |   .0531834   .0032688   F(1,3862)=5.11,  Prob>F=0.0238
------------------------------------------------------------------------
      OWNSHR |
           1 |   .0922093   .0062976
           2 |   .1041788   .0047354   F(1,3862)=2.31,  Prob>F=0.1289
------------------------------------------------------------------------
      OWNEXP |
           1 |   .107642    .0077331
           2 |   .080271    .0063303   F(1,3862)=7.49,  Prob>F=0.0062
           3 |   .0952326   .0064237   F(1,3862)=2.75,  Prob>F=0.0973
           4 |   .1188295   .0095661   F(1,3862)=4.20,  Prob>F=0.0404
------------------------------------------------------------------------
   wLnOWNERS |
           1 |   .10534     .0052571
           3 |   .0942637   .0061028   F(1,3862)=1.89,  Prob>F=0.1695
           4 |   .0931823   .0118272   F(1,3862)=0.01,  Prob>F=0.9352
------------------------------------------------------------------------
wLnOTRINCTOS~|
           1 |   .0981763   .0041731
           4 |   .1103931   .0092776   F(1,3862)=1.44,  Prob>F=0.2304
------------------------------------------------------------------------
wLnOWNWORTHT~|
           1 |   .0469822   .0039244
           2 |   .0666949   .0047752   F(1,3862)=10.17, Prob>F=0.0014
           3 |   .0917232   .0058634   F(1,3862)=10.94, Prob>F=0.0009
           4 |   .1968215   .0116104   F(1,3862)=65.37, Prob>F=0.0000
------------------------------------------------------------------------
wLnPROFTOINC~|
           1 |   .1091862   .0085835
           2 |   .0685365   .0044894   F(1,3862)=17.58, Prob>F=0.0000
           3 |   .0936901   .0073523   F(1,3862)=8.54,  Prob>F=0.0035
           4 |   .1307438   .0089647   F(1,3862)=10.24, Prob>F=0.0014
------------------------------------------------------------------------
wLnUNUSEDLOC |
           1 |   .1138215   .0049281
           3 |   .0533232   .0101824   F(1,3862)=28.63, Prob>F=0.0000
           4 |   .080213    .006756    F(1,3862)=4.86,  Prob>F=0.0276
------------------------------------------------------------------------
wLnCURLIBTOS~|
           1 |    .134519   .0072202
           2 |   .0578231   .0082289   F(1,3862)=48.94, Prob>F=0.0000
           3 |   .0677758   .0046992   F(1,3862)=1.10,  Prob>F=0.2945
           4 |   .0971076   .0079052   F(1,3862)=10.19, Prob>F=0.0014
------------------------------------------------------------------------
wLnDEBTRATIO |
           1 |   .1551567   .0098617
           2 |   .1210796   .0090545   F(1,3862)=6.48,  Prob>F=0.0109
           3 |   .069137    .00426     F(1,3862)=26.96, Prob>F=0.0000
           4 |   .0563535   .0049781   F(1,3862)=3.81,  Prob>F=0.0511
```

(Wald test is for equality of quartile mean on previous row to quartile mean on current row of table.)

3.6 Multivariate Analysis and Results

In this section the results of the multivariate analysis of the Cash Holdings model are summarized and discussed. The results from the estimation of the model using both the 1998 and 2003 NSSBF samples are presented and an analysis of the results is offered. Table 3.9 presents a tabular summary of the results of the estimations, indicating which hypothesis is being tested by each variable, the sign of the coefficient estimated for that variable, and the level of significance of the t-test for that variable. The expected sign of the variable based on the hypothesis being tested is also indicated in that figure.

Figure 3.7 shows (for the 1998 NSSBF) the estimation of the full Cash Holdings model using OLS with robust standard errors in column 1, weighted least-squares with robust standard errors in column 2, and survey-weighted regression in column 3. As expected and as shown in section 4, the results in columns 2 and 3 are virtually identical. This confirms that weighted least squares with robust standard errors can be used to estimate the Cash Holdings model, confident that the estimates will be unbiased and consistent. Figure 3.10 shows the three comparative estimations for the 2003 NSSBF sample, and confirms that the estimations in columns 2 and 3 of that table are virtually identical for that sample as well.

Figure 3.8 for the 1998 NSSBF (3.11 for the 2003 NSSBF) duplicates the full model estimation using robust WLS in column 1, then in columns 2 through 5 it repeats the estimation with selected variables being dropped from the model due to the high correlation between those variables, as explained in section 3.3.3. Figure 3.9 for the 1998 NSSBF (3.12 for the 2003 NSSBF) adds five industry dummy variables to the model.

They are MANUFACTURING, TRANSPORTATION, WHOLESALE, RETAIL, SERVICES.

Table 3.9

Summary of observed results compared to hypothesized results

Independent Variable	Hypothesis Tested	Hypothesized Relationship to Cash Holdings	Observed Relationship 1998/2003
Firm Characteristics (Controls):			
PASSTHRU		(-)	(-)**/ns
LnSALES		(-)	(-)***/(-)***
PURCHASED		(-)	(-)**/ns
INHERITED		(+)	(+)*/ns
Agency and Value Maximization:			
FAMOWN	H1	(+)	ns/ns
OWNSHR	H1	(-)	(-)**/(-)**
OWNMGR	H1	(-)	ns/ns
LnOWNERS	H1	(+)	(+)***/(+)**
Owner Characteristics			
LnOWNWORTHTOSALES	H2a	(+)	(+)***/(+)***
OWNDISTRESS	H2b	(-)	(-)*/ns
OWNEXP	H3a	(+)	(+)*/(+)***
COLLEGEGRAD	H3b	(+)	(+)**/(+)**
SPECIALED	H3b	(-)	(-)**/ns
Financing Sources and Constraints:			
FIRMDISTRESS	H4	(-)	ns/ns
FEARDENIAL	H4	(-)	(-)***/ns
LnOTRINCTOSALES	H4	(+)	(+)***/(+)**
LnPROFTOINCOME	H4	(+)	ns/ns
Financial Obligations and Debt:			
LnCURLIBTOSALES	H5	(+)	(+)***/(+)***
LnDEBTRATIO	H5	(+)	(-)***/(-)***
Cash Substitutes:			
TRADECREDIT	H6	(-)	ns/ns
LnUNUSEDLOC	H6	(-)	(-)**/ns

*** p<0.01, ** p<0.05, * p<0.1, ns = ”not significant”

Examining the firm characteristic variables in table 3.9 first, it is observed that firms organized as PASSTHRU entities hold less cash due to the personal tax liability of the firm's owners for any profits earned by the firm. This result is supported by the 1998 sample but not the 2003 sample. Examining table 3.6 and related discussion in the previous section of this paper, it is observed that firms maintained a significantly higher CASHTOSALES ratio in 2003 than in 1998, probably as a precaution due to the relatively weak economy in 2003. In that environment, the tax liability of the owners may have been less of an issue than the need to maintain liquidity in uncertain times, leading to the insignificance of the coefficient for PASSTHRU in 2003.

It is also observed that larger firms (measured by LnSALES) hold significantly less cash than smaller firms, a result that is supported by both the 1998 and 2003 data. This is consistent with the findings of other researchers. Larger firms have better access to alternative sources of capital than smaller firms, which allows them to maintain less cash.

Some indication is observed that PURCHASED firms hold less cash, and a weaker indication (significant at the 0.1 level) that INHERITED firms hold more cash, consistent with the predictions for the signs of the coefficients of these variables. INHERITED firms are family legacies and may hold cash to reduce the financial risk of the firm and promote its survival. PURCHASED firms on the other hand may be viewed as investments by their purchaser and lack the emotional attachment of the owners of INHERITED firms. The new owners may desire to extract cash from the firm to get an immediate return on their investment, or they may be less risk-averse than the inheritor of a family firm and be willing to accept more financial risk by operating with less cash on

hand. It is observed that these results hold for the 1998 data but not the 2003 data. This is consistent with the observation from tables 3.4 and 3.5 that the difference in means of CASHTOSALES between PURCHASED and other firms is significant for the 1998 sample but not the 2003 sample.

In support of hypothesis H1, cash holdings decrease with increasing owner share in the firm (OWNSHR). This observed result is consistent with the Jensen and Meckling hypothesis that increasing ownership share in the firm reduces agency, and with the hypothesis of Opler et al. that excess cash holdings represent an agency cost to the firm. Additional support to hypothesis H1 is provided by the observation that cash holdings increase with the number of firm owners (LnOWNERS). Increasingly diffuse ownership reduces monitoring of management and allows agency issues, including accumulation of cash, to flourish. The observed results for OWNSHR and LnOWNERS are supported by both the 1998 and 2003 samples. Note that Faulkender (2002) also observed a significant negative relationship between cash holdings and owner share, and a significant positive relationship with number of owners, though he used the 1993 NSSBF survey data.

One of the most statistically significant and economically strongest relationships to cash holdings is the positive relationship observed between owner wealth (LnOWNWORTHTOSALES) and cash holdings, in support of hypothesis H2a. The observation is upheld by both the 1998 and 2003 samples. The personal wealth of the principal owner of the firm is one of the main determinants in the model of cash holdings. This is consistent with the body of research that positively relates owner wealth to firm success, since the ability to provide liquidity at critical periods of need is essential to the

success of the firm and may help to explain the empirical observation in other studies that firms with wealthier owners enjoy greater longevity.

Only weak support is observed in the 1998 sample for hypothesis H2b, that the previous financial distress of the primary owner (OWNDISTRESS) is negatively related to cash holdings, and no support in the 2003 sample. The variable OWNDISTRESS is "1" if the primary owner has declared bankruptcy within seven years prior to the survey date, or defaulted on a personal obligation within three years prior to the survey date. It may be that the contemporary cash holdings in the cross-sectional NSSBF samples are not affected by owner distress from so far into the past, or it may be that a single negative credit event from the owner's past is not enough to influence the current cash holdings of the firm. Also, the number of primary owners reporting distress dropped from 14.7% in the 1998 sample to 3.5% in the 2003 sample, and the Adjusted Wald test for difference of CASHTOSALES means between firms with OWNDISTRESS=1 and other firms dropped from F=12.05 in the 1998 sample to F=2.84 in the 2003 sample. One cannot rule out the possibility that the 2003 sample lacks adequate observations with OWNDISTRESS=1 to achieve a statistically significant coefficient in the model estimation.

A very interesting result is the strong support observed in the 2003 sample (but weak in the 1998 sample) for hypothesis H3a, that cash holdings are positively related to owner experience (OWNEXP). The interpretation that presents itself is that owner experience is more important in a time of weak economy (2003) than in a time when the economy is expanding and firms are highly profitable (1998). When times are bad, experienced owners accumulate cash as a precaution to maintain firm liquidity and to

finance firm operations since credit may be difficult to obtain. A significantly higher mean of CASHTOSALES was observed in 2003 than 1998 when comparing means in table 3.6.

Support is found for hypothesis H3b, that firms with college educated owners maintain higher cash ratios than firms whose primary owners have a trade school or associate degree education. A significant positive result is observed for both samples. It is observed that owners with a trade school or associate degree education maintain significantly lower cash ratios with the 1998 sample, though the coefficient was insignificant in the 2003 sample. These results suggest that firms with college educated owners maintain higher cash balances regardless of the economic climate, though less educated owners maintain lower cash balances during strong economic times. Combining this with the previous observation for OWNEXP, it would appear that owner experience and education level are both significant determinants of the firms cash holdings.

Mixed support is seen for hypothesis H4 that Cash holdings are positively related to the financial constraints of the firm. No support is found in either sample that the previous financial distress of the firm (FIRMDISTRESS) is negatively related to cash holdings. The variable FIRMDISTRESS is "1" if the firm has declared bankruptcy within seven years prior to the survey date, or defaulted on an obligation within three years prior to the survey date. It may be that the contemporary cash holdings in the cross-sectional NSSBF samples are not affected by firm distress from so far into the past, or it may be that a single negative credit event from the firm's past is not enough to influence the current cash holdings of the firm. Also, the number of firms reporting

distress dropped from 14.4% in the 1998 sample to 3.3% in the 2003 sample, and the Adjusted Wald test for difference of CASHTOSALES means between firms with FIRMDISTRESS=1 and other firms dropped from F=27.52 in the 1998 sample to F=6.13 in the 2003 sample. One cannot rule out the possibility that the 2003 sample lacks adequate observations with FIRMDISTRESS=1 to achieve a statistically significant coefficient in the model estimation.

It is also noted that profitability (LnPROFTOINCOME) is not a significant determinant of cash holdings in either the 1998 or 2003 samples, contrary to hypothesis H4. However, "other income" (LnOTRINCTOSALES) is a significant positive determinant of cash holdings in both samples. This latter observation supports the hypothesis H4. The NSSBF samples include "other income" in the calculation of firm profits, though the variables LnPROFTOINCOME and LnOTRINCTOSALES are not highly correlated. (Removing LnOTRINCTOSALES from the model does not change the significance of the coefficient for LnPROFTOINCOME.) Apparently, although higher total profits of the firm may make it more possible for a firm to accumulate cash, they are not a sufficient motivator for the small firm to accumulate cash. Contributions from other sources of income however, such as those from financial investments, are apparently viewed as a windfall and are saved.

Also in support of hypothesis H4, a significant negative relationship is found between FEARDENIAL and cash holdings using the 1998 sample, though the relationship is not significant when using the 2003 sample. Firms that have not applied for a loan within the past three years even though they need the funds hold less cash than other firms. FEARDENIAL is assumed to be a proxy for financial distress. Such firms

are aware that they are too financially unfit to approach a lender for financing, and their lower cash holdings (liquidity) are one indicator of this lack of fitness. The number of firms reporting FEARDENIAL=1 dropped from 21.8% in the 1998 sample to 14.2% in the 2003 sample, and the Adjusted Wald test for difference of CASHTOSALES means between firms with FEARDENIAL=1 and other firms dropped from F=19.39 in the 1998 sample to F=6.74 in the 2003 sample.

It has been assumed for hypothesis H4 that FEARDENIAL is a proxy for firm financial distress and thus would be negatively related to cash holdings (liquidity). In the three year period preceding 1998, which was a period of financial expansion and prosperity, that may a good assumption and it is upheld by the empirical results. However, the three years preceding 2003 were a period of recession and financial contraction, during which firms may have feared denial of a loan application due to credit rationing by financial institutions rather than due to their own financial status. In this situation, FEARDENIAL would no longer be an unambiguous proxy for distress and its relationship to cash holdings would be difficult to predict. This could explain the lack of significant relationship between FEARDENIAL and cash holdings using the 2003 sample data.

Mixed support is found for hypothesis H5. Current liabilities (LnCURLIBTOSALES) are significantly positively related to cash holdings using both the 1998 and 2003 samples. This is consistent with the prediction for hypothesis H5. However, a significant negative relationship between total debt (LnDEBTTOASSETS) and cash holdings is found using both the 1998 and 2003 samples, in contradiction to the hypothesized result and in contradiction to the positive relationship observed by

Faulkender (2002) using the 1993 NSSBF survey data. However, the result of this study is consistent with the Free Cash Flow theory of Jensen (1986) who suggests that a higher level of firm debt will reduce the free cash flows available to managers to spend on non-value maximizing activities. Although free cash flow and cash holding are not exactly the same thing, higher free cash flows can lead to higher cash holdings if they are accumulated rather than paid out to investors. A higher level of total debt will force managers to pay more of their free cash flow to creditors, reducing their ability to accumulate cash holdings, which would support the empirical result.

No support is observed for hypothesis H6 using TRADECREDIT as a proxy for cash substitute. Faulkender observed a significant negative relationship between the use of trade credit and the cash holdings of the firm using the 1993 NSSBF data, which would support H6. No significant relationship is found between trade credit and cash holdings in the 1998 and 2003 NSSBF samples. These results suggest that small firms do not view trade credit and lines of credit as substitutes for cash.

A significant negative relationship between LnUNUSEDLOC and cash holdings is observed using the 1998 sample, but no significant relationship with the 2003 sample. The 1998 sample results supports the hypothesis H6, that lines of credit and cash are substitutes for each other. Although the value of UNUSEDLOC did not decrease much from 1998 to 2003, indicating that firms still had access to unused lines of credit during the 2003 period, small firms apparently did not use their lines of credit as substitutes for cash during this period. This hesitancy to draw upon their lines of credit instead of using cash is consistent with their reduction in current liabilities and other debt from 1998 to

2003. During difficult financial times, it would appear that small firms reduce their dependence upon debt.

(wLnCASHTOSALES is the dependent variable)

	(1)	(2)	(3)
VARIABLES	Robust OLS	Robust WLS	Survey-weighted
PASSTHRU	-0.00899	-0.0224**	-0.0224**
	(0.00927)	(0.0107)	(0.0107)
wLnSALES	-0.0168***	-0.0185***	-0.0185***
	(0.00173)	(0.00257)	(0.00256)
FAMOWN	-0.00525	-0.00715	-0.00715
	(0.00651)	(0.00948)	(0.00945)
OWNMGR	-0.000491	-0.00269	-0.00269
	(0.00638)	(0.00968)	(0.00967)
OWNSHR	-1.88e-05	0.000334	0.000334
	(0.000121)	(0.000207)	(0.000207)
OWNEXP	0.000477**	0.000520*	0.000520*
	(0.000224)	(0.000303)	(0.000302)
COLLEGEGRAD	0.00983**	0.0121**	0.0121**
	(0.00498)	(0.00614)	(0.00613)
SPECIALED	-0.0162**	-0.0144	-0.0144
	(0.00709)	(0.00912)	(0.00910)
wLnOWNERS	0.0113***	0.0349***	0.0349***
	(0.00410)	(0.0106)	(0.0105)
PURCHASED	-0.00640	-0.0120**	-0.0120**
	(0.00427)	(0.00505)	(0.00503)
INHERITED	0.0221*	0.0324*	0.0324*
	(0.0118)	(0.0173)	(0.0173)
OWNDISTRESS	-0.0178**	-0.0160*	-0.0160*
	(0.00727)	(0.00927)	(0.00923)
FIRMDISTRESS	-0.0164***	-0.0138	-0.0138
	(0.00628)	(0.00870)	(0.00867)
FEARDENIAL	-0.0195***	-0.0225***	-0.0225***
	(0.00601)	(0.00697)	(0.00696)
wLnOTRINCTOSALES	0.285***	0.295***	0.295***
	(0.0787)	(0.0934)	(0.0931)
wLnOWNWORTHTOSALES	7.907***	8.498***	8.498***
	(2.024)	(2.338)	(2.333)
wLnPROFTOINCOME	-0.0235	-0.00731	-0.00731
	(0.0165)	(0.0201)	(0.0200)
TRADECREDIT	-0.00537	-0.00293	-0.00293
	(0.00566)	(0.00675)	(0.00672)
wLnUNUSEDLOC	-0.0167**	-0.0203**	-0.0203**
	(0.00654)	(0.00859)	(0.00858)
wLnCURLIBTOSALES	0.150***	0.133***	0.133***
	(0.0225)	(0.0248)	(0.0248)
wLnDEBTRATIO	-0.0429***	-0.0398***	-0.0398***
	(0.00410)	(0.00436)	(0.00434)
Constant	-68.13***	-73.34***	-73.34***
	(17.54)	(20.27)	(20.23)
Observations	3338	3338	3561
R-squared	0.202	0.206	0.206
Adjusted R2	0.197	0.201	
Model SS	13.80	16.23	
Residual SS	54.62	62.43	
Model df	21	21	21
Residual df	3316	3316	3483
F statistic	17.52	12.89	12.88
Number of strata			78
Population size			4.929e+06

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

(1) OLS with robust std errors (2) Weighted OLS with robust std errors
(3) Survey-weighted LS with std errors calculated using Taylor Linearization

Figure 3.7. 1998 NSSBF – Comparison of Model Estimation Methods for Cash Holdings Model

(wLnCASHTOSALES is the dependent variable)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Full Model	Minus LnOWNERS	Minus OWNSHR	Minus SPECIALED	Minus COLLEGEGRAD
PASSTHRU	-0.0224**	-0.0242**	-0.0264**	-0.0220**	-0.0237**
	(0.0107)	(0.0110)	(0.0109)	(0.0107)	(0.0107)
wLnSALES	-0.0185***	-0.0173***	-0.0188***	-0.0184***	-0.0181***
	(0.00257)	(0.00247)	(0.00259)	(0.00256)	(0.00255)
FAMOWN	-0.00715	-0.00830	-0.00242	-0.00696	-0.00789
	(0.00948)	(0.00966)	(0.00918)	(0.00947)	(0.00948)
OWNMGR	-0.00269	-0.00433	-0.00371	-0.00265	-0.00328
	(0.00968)	(0.00985)	(0.00974)	(0.00969)	(0.00968)
OWNSHR	0.000334	-0.000284**		0.000324	0.000344*
	(0.000207)	(0.000125)		(0.000207)	(0.000209)
OWNEXP	0.000520*	0.000568*	0.000532*	0.000531*	0.000472
	(0.000303)	(0.000304)	(0.000303)	(0.000301)	(0.000301)
COLLEGEGRAD	0.0121**	0.0134**	0.0123**	0.0148**	
	(0.00614)	(0.00619)	(0.00616)	(0.00582)	
SPECIALED	-0.0144	-0.0137	-0.0140		-0.0205**
	(0.00912)	(0.00916)	(0.00913)		(0.00864)
wLnOWNERS	0.0349***		0.0244***	0.0347***	0.0362***
	(0.0106)		(0.00655)	(0.0106)	(0.0107)
PURCHASED	-0.0120**	-0.0130***	-0.0123**	-0.0122**	-0.0128**
	(0.00505)	(0.00505)	(0.00506)	(0.00504)	(0.00505)
INHERITED	0.0324*	0.0358**	0.0331*	0.0327*	0.0319*
	(0.0173)	(0.0178)	(0.0174)	(0.0173)	(0.0173)
OWNDISTRESS	-0.0160*	-0.0168*	-0.0163*	-0.0163*	-0.0162*
	(0.00927)	(0.00924)	(0.00926)	(0.00926)	(0.00931)
FIRMDISTRESS	-0.0138	-0.0126	-0.0134	-0.0144*	-0.0137
	(0.00870)	(0.00865)	(0.00867)	(0.00866)	(0.00869)

FEARDENIAL	-0.0225***	-0.0221***	-0.0224***	-0.0222***	-0.0230***
	(0.00697)	(0.00696)	(0.00697)	(0.00695)	(0.00698)
wLnOTRINCTOSALES	0.295***	0.301***	0.296***	0.295***	0.299***
	(0.0934)	(0.0938)	(0.0937)	(0.0933)	(0.0939)
wLnOWNWORTHTOSALES	8.498***	8.761***	8.503***	8.509***	8.648***
	(2.338)	(2.339)	(2.340)	(2.344)	(2.322)
wLnPROFTOINCOME	-0.00731	-0.00686	-0.00638	-0.00761	-0.00805
	(0.0201)	(0.0201)	(0.0201)	(0.0201)	(0.0201)
TRADECREDIT	-0.00293	-0.00296	-0.00291	-0.00305	-0.00327
	(0.00675)	(0.00676)	(0.00675)	(0.00675)	(0.00676)
wLnUNUSEDLOC	-0.0203**	-0.0193**	-0.0198**	-0.0208**	-0.0195**
	(0.00859)	(0.00880)	(0.00865)	(0.00856)	(0.00850)
wLnCURLIBTOSALES	0.133***	0.136***	0.135***	0.134***	0.133***
	(0.0248)	(0.0249)	(0.0248)	(0.0248)	(0.0247)
wLnDEBTRATIO	-0.0398***	-0.0405***	-0.0401***	-0.0396***	-0.0401***
	(0.00436)	(0.00437)	(0.00436)	(0.00437)	(0.00437)
Constant	-73.34***	-75.56***	-73.35***	-73.44***	-74.62***
	(20.27)	(20.28)	(20.29)	(20.33)	(20.13)
Observations	3338	3338	3338	3338	3338
R-squared	0.206	0.202	0.206	0.206	0.205
Adjusted R2	0.201	0.198	0.201	0.201	0.200
Model SS	16.23	15.92	16.18	16.17	16.12
Residual SS	62.43	62.74	62.48	62.49	62.54
Model df	21	20	20	20	20
Residual df	3316	3317	3317	3317	3317
F statistic	12.89	13.45	13.49	13.49	13.27

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All columns estimated using Robust WLS

Figure 3.8. 1998 NSSBF – Estimations of Cash Holdings Model with Selected Variables Dropped

(wLnCASHTOSALES is the dependent variable)

VARIABLES	(1) Full Model	(2) Industries
PASSTHRU	-0.0224**	-0.0226**
	(0.0107)	(0.0108)
wLnSALES	-0.0185***	-0.0186***
	(0.00257)	(0.00268)
FAMOWN	-0.00715	-0.00663
	(0.00948)	(0.00952)
OWNMGR	-0.00269	-0.00247
	(0.00968)	(0.00960)
OWNSHR	0.000334	0.000345*
	(0.000207)	(0.000208)
OWNEXP	0.000520*	0.000502*
	(0.000303)	(0.000304)
COLLEGEGRAD	0.0121**	0.0133**
	(0.00614)	(0.00629)
SPECIALED	-0.0144	-0.0137
	(0.00912)	(0.00919)
wLnOWNERS	0.0349***	0.0354***
	(0.0106)	(0.0105)
PURCHASED	-0.0120**	-0.00996*
	(0.00505)	(0.00527)
INHERITED	0.0324*	0.0315*
	(0.0173)	(0.0173)
OWNDISTRESS	-0.0160*	-0.0163*
	(0.00927)	(0.00929)
FIRMDISTRESS	-0.0138	-0.0135
	(0.00870)	(0.00869)
FEARDENIAL	-0.0225***	-0.0224***
	(0.00697)	(0.00704)
wLnOTRINCTOSALES	0.295***	0.296***
	(0.0934)	(0.0931)
wLnOWNWORTHTOSALES	8.498***	8.519***
	(2.338)	(2.342)
wLnPROFTOINCOME	-0.00731	-0.00881
	(0.0201)	(0.0202)
TRADECREDIT	-0.00293	-0.00202
	(0.00675)	(0.00686)
wLnUNUSEDLOC	-0.0203**	-0.0214**
	(0.00859)	(0.00869)
wLnCURLIBTOSALES	0.133***	0.134***
	(0.0248)	(0.0250)
wLnDEBTRATIO	-0.0398***	-0.0408***
	(0.00436)	(0.00443)
MANUFACTURING		-0.0159
		(0.0130)
TRANSPORTATION		0.00313
		(0.0166)
WHOLESALE		-0.0149
		(0.0105)
RETAIL		-0.0138
		(0.00969)
SERVICES		-0.0118
		(0.00827)
Constant	-73.34***	-73.50***
	(20.27)	(20.30)
Observations	3338	3338
R-squared	0.206	0.208
Adjusted R2	0.201	0.201
Model SS	16.23	16.33
Residual SS	62.43	62.33
Model df	21	26
Residual df	3316	3311
F statistic	12.89	10.63

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3.9. 1998 NSSBF – Estimations of Cash Holdings Model with Industry dummies added

(wLnCASHTOSALES is the dependent variable)

VARIABLES	(1) Robust OLS	(2) Robust WLS	(3) Survey-weighted
PASSTHRU	-0.0121	-0.000176	-0.000176
	(0.00878)	(0.0171)	(0.0170)
wLnSALES	-0.0149***	-0.0200***	-0.0200***
	(0.00175)	(0.00329)	(0.00329)
FAMOWN	0.00248	0.00346	0.00346
	(0.00583)	(0.0134)	(0.0134)
OWNMGR	-0.00493	0.00378	0.00378
	(0.00694)	(0.0110)	(0.0110)
OWNSHR	-8.64e-05	-4.47e-05	-4.47e-05
	(0.000128)	(0.000229)	(0.000228)
OWNEXP	0.000919***	0.00111***	0.00111***
	(0.000242)	(0.000375)	(0.000375)
COLLEGEGRAD	0.0126**	0.0146*	0.0146*
	(0.00521)	(0.00793)	(0.00792)
SPECIALED	-0.00131	-0.00205	-0.00205
	(0.00616)	(0.00938)	(0.00937)
wLnOWNERS	0.00746	0.0193	0.0193
	(0.00472)	(0.0128)	(0.0128)
PURCHASED	0.00271	0.00146	0.00146
	(0.00421)	(0.00740)	(0.00738)
INHERITED	0.0191**	0.0236	0.0236
	(0.00915)	(0.0146)	(0.0146)
OWNDISTRESS	-0.0144	-0.0154	-0.0154
	(0.0129)	(0.0166)	(0.0165)
FIRMDISTRESS	-0.00823	-0.000882	-0.000882
	(0.00988)	(0.0182)	(0.0181)
FEARDENIAL	-0.0139**	-0.0121	-0.0121
	(0.00660)	(0.00859)	(0.00857)
wLnOTRINCTOSALES	0.222***	0.218**	0.218**
	(0.0619)	(0.0883)	(0.0883)
wLnOWNWORTHTOSALES	0.164***	0.147***	0.147***
	(0.0261)	(0.0303)	(0.0302)
wLnPROFTOINCOME	-0.00875	0.00321	0.00321
	(0.0213)	(0.0264)	(0.0263)
TRADECREDIT	-0.00446	-0.00274	-0.00274
	(0.00574)	(0.00792)	(0.00792)
wLnUNUSEDLOC	-0.0120*	0.000183	0.000183
	(0.00712)	(0.0124)	(0.0123)
wLnCURLIBTOSALES	0.152***	0.169***	0.169***
	(0.0352)	(0.0512)	(0.0512)
wLnDEBTRATIO	-0.0520***	-0.0520***	-0.0520***
	(0.00434)	(0.00598)	(0.00598)
Constant	-0.389**	-0.350	-0.350
	(0.177)	(0.232)	(0.231)
Observations	3934	3934	4240
R-squared	0.225	0.209	0.209
Adjusted R2	0.221	0.204	
Model SS	21.29	25.12	
Residual SS	73.47	95.31	
Model df	21	21	21
Residual df	3912	3912	4168
F statistic	20.30	11.98	11.93
Number of strata			72
Population size			5.806e+06

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(1) OLS with robust std errors (2) Weighted OLS with robust std errors
(3) Survey-weighted LS with std errors calculated using Taylor Linearization

Figure 3.10. 2003 NSSBF – Comparison of Model Estimation Methods for Cash Holdings Model

(wLnCASHTOSALES is the dependent variable)

VARIABLES	(1) Full Model	(2) Minus LnOWNERS	(3) Minus OWNSHR	(4) Minus SPECIALED	(5) Minus COLLEGEGRAD
PASSTHRU	-0.000176	-0.000191	0.000288	-8.07e-05	-0.000492
	(0.0171)	(0.0172)	(0.0170)	(0.0171)	(0.0170)
wLnSALES	-0.0200***	-0.0196***	-0.0200***	-0.0200***	-0.0193***
	(0.00329)	(0.00326)	(0.00329)	(0.00328)	(0.00325)
FAMOWN	0.00346	-0.00103	0.00336	0.00351	0.00112
	(0.0134)	(0.0127)	(0.0134)	(0.0134)	(0.0135)
OWNMGR	0.00378	0.00160	0.00392	0.00369	0.00416
	(0.0110)	(0.0110)	(0.0110)	(0.0109)	(0.0109)
OWNSHR	-4.47e-05	-0.000330**		-3.86e-05	-2.34e-05
	(0.000229)	(0.000159)		(0.000230)	(0.000228)
OWNEXP	0.00111***	0.00115***	0.00110***	0.00111***	0.00107***
	(0.000375)	(0.000377)	(0.000375)	(0.000377)	(0.000375)
COLLEGEGRAD	0.0146*	0.0146*	0.0146*	0.0152**	
	(0.00793)	(0.00795)	(0.00789)	(0.00730)	
SPECIALED	-0.00205	-0.00208	-0.00181		-0.00975
	(0.00938)	(0.00939)	(0.00946)		(0.00864)
wLnOWNERS	0.0193		0.0209**	0.0193	0.0192
	(0.0128)		(0.00883)	(0.0128)	(0.0128)
PURCHASED	0.00146	0.00125	0.00153	0.00142	0.00133
	(0.00740)	(0.00741)	(0.00739)	(0.00740)	(0.00743)
INHERITED	0.0236	0.0244*	0.0235	0.0236	0.0214
	(0.0146)	(0.0145)	(0.0146)	(0.0146)	(0.0146)
OWNDISTRESS	-0.0154	-0.0153	-0.0154	-0.0154	-0.0158
	(0.0166)	(0.0165)	(0.0166)	(0.0165)	(0.0165)
FIRMDISTRESS	-0.000882	-0.000923	-0.000842	-0.000785	-0.00180
	(0.0182)	(0.0182)	(0.0182)	(0.0183)	(0.0182)
FEARDENIAL	-0.0121	-0.0119	-0.0122	-0.0120	-0.0135
	(0.00859)	(0.00863)	(0.00865)	(0.00858)	(0.00858)
wLnOTRINCTOSALES	0.218**	0.218**	0.218**	0.218**	0.217**
	(0.0883)	(0.0883)	(0.0883)	(0.0883)	(0.0884)
wLnOWNWORTHTOSALES	0.147***	0.148***	0.147***	0.147***	0.150***
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0298)
wLnPROFTOINCOME	0.00321	0.00218	0.00317	0.00320	0.00403
	(0.0264)	(0.0265)	(0.0264)	(0.0264)	(0.0264)

TRADECREDIT	-0.00274	-0.00267	-0.00274	-0.00273	-0.00378
	(0.00792)	(0.00794)	(0.00792)	(0.00792)	(0.00802)
wLnUNUSEDLOC	0.000183	0.000233	0.000205	0.000162	0.00156
	(0.0124)	(0.0124)	(0.0124)	(0.0124)	(0.0123)
wLnCURLIBTOSALES	0.169***	0.172***	0.168***	0.168***	0.169***
	(0.0512)	(0.0514)	(0.0512)	(0.0511)	(0.0511)
wLnDEBTRATIO	-0.0520***	-0.0517***	-0.0520***	-0.0519***	-0.0520***
	(0.00598)	(0.00596)	(0.00597)	(0.00595)	(0.00598)
Constant	-0.350	-0.317	-0.355	-0.352	-0.366
	(0.232)	(0.233)	(0.233)	(0.232)	(0.230)
Observations	3934	3934	3934	3934	3934
R-squared	0.209	0.208	0.209	0.209	0.207
Adjusted R2	0.204	0.204	0.205	0.205	0.203
Model SS	25.12	25.01	25.12	25.12	24.96
Residual SS	95.31	95.42	95.31	95.31	95.47
Model df	21	20	20	20	20
Residual df	3912	3913	3913	3913	3913
F statistic	11.98	12.44	12.57	12.45	12.06

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All columns estimated using Robust WLS

Figure 3.11. 2003 NSSBF – Estimations of Cash Holdings Model with Selected Variables Dropped

(wLnCASHTOSALES is the dependent variable)

VARIABLES	(1) Full Model	(2) Industries
PASSTHRU	-0.000176	-0.000691
	(0.0171)	(0.0169)
wLnSALES	-0.0200***	-0.0205***
	(0.00329)	(0.00335)
FAMOWN	0.00346	0.00311
	(0.0134)	(0.0135)
OWNMGR	0.00378	0.00268
	(0.0110)	(0.0109)
OWNSHR	-4.47e-05	-5.25e-05
	(0.000229)	(0.000228)
OWNEXP	0.00111***	0.00108***
	(0.000375)	(0.000369)
COLLEGEGRAD	0.0146*	0.0169**
	(0.00793)	(0.00746)
SPECIALED	-0.00205	-0.000969
	(0.00938)	(0.00929)
wLnOWNERS	0.0193	0.0192
	(0.0128)	(0.0128)
PURCHASED	0.00146	0.00418
	(0.00740)	(0.00780)
INHERITED	0.0236	0.0249*
	(0.0146)	(0.0146)
OWNDISTRESS	-0.0154	-0.0151
	(0.0166)	(0.0166)
FIRMDISTRESS	-0.000882	-0.000894
	(0.0182)	(0.0185)
FEARDENIAL	-0.0121	-0.0116
	(0.00859)	(0.00861)
wLnOTRINCTOSALES	0.218**	0.218**
	(0.0883)	(0.0884)
wLnOWNWORTHTOSALES	0.147***	0.146***
	(0.0303)	(0.0302)
wLnPROFTOINCOME	0.00321	0.00222
	(0.0264)	(0.0265)
TRADECREDIT	-0.00274	-0.00380
	(0.00792)	(0.00793)
wLnUNUSEDLOC	0.000183	-0.000558
	(0.0124)	(0.0124)
wLnCURLIBTOSALES	0.169***	0.168***
	(0.0512)	(0.0513)
wLnDEBTRATIO	-0.0520***	-0.0525***
	(0.00598)	(0.00605)
MANUFACTURING		-0.00783
		(0.0148)
TRANSPORTATION		-0.00852
		(0.0162)
WHOLESALE		-0.0192
		(0.0131)
RETAIL		-0.0184*
		(0.0112)
SERVICES		-0.0176*
		(0.0100)
Constant	-0.350	-0.320
	(0.232)	(0.234)
Observations	3934	3934
R-squared	0.209	0.210
Adjusted R2	0.204	0.205
Model SS	25.12	25.32
Residual SS	95.31	95.12
Model df	21	26
Residual df	3912	3907
F statistic	11.98	9.714

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 3.12. 2003 NSSBF – Estimations of Cash Holdings Model with Industry dummies added

3.7 Contributions to the Literature

This study contributes to the literature on cash holdings in small firms in a number of ways. First, this study builds on the work of Faulkender (2002) to examine for small firms the hypotheses that accumulation of cash is a form of non-value-maximizing behavior for the small firm owner, and may represent an agency cost to the firm in the presence of other shareholders. In addition, the consideration of the impact of family ownership and the inherited/purchased status of the firm on cash holdings is apparently unique to this paper.

Second, this is also the first study to consider the wealth, past credit history and human capital characteristics of the entrepreneur on the cash holdings of the small firm. This is a relevant issue since for many small firms, the entrepreneur's wealth and ability to obtain credit have been shown to have a positive relationship on both the probability of founding the firm, and on the longevity of the firm. The human capital characteristics of the entrepreneur have been shown in other studies to be positively related to the success of the firm. However, the link between these entrepreneurial characteristics and specific capital structure components of the small firm has not been completely and unambiguously determined. This paper has presented additional evidence in this area.

Third, this study separately utilized both the 1998 and 2003 NSSBF surveys for model estimation. The results of these separate estimations have made it possible to interpret some of the observed results in the context of the very different macroeconomic environments in which the two datasets were collected. Such comparisons between the results of the two estimations provided an additional dimension to the analysis that had not previously been undertaken.

CHAPTER IV

ESSAY 3: WHY DO SMALL FIRMS MAKE INVESTMENTS UNRELATED TO THEIR CORE BUSINESS?

This study focuses on the "other investments" made by small firms in financial or real assets that do not support their core business operations, such as loans or mortgages issued to shareholders or partners, investments in other companies, or artwork. There are two reasons why a small firm might make such investments that readily present themselves. First, if the small firm cannot identify enough positive NPV projects supporting their core business to consume their available funds, they may choose to invest in other financial or real assets that they believe will bring a positive return to the firm.

Second, the management, shareholders or partners in a small firm who value personal pecuniary and non-pecuniary rewards over firm value maximization may choose to divert firm funds to more personal uses, such as personal loans or mortgages at favorable rates, or artwork, fine wines and other collectables that are expected to appreciate with time but also provide a non-pecuniary satisfaction to the collector while held.

This study investigates the characteristics of small firms that act as determinants of the book value of these non-core investments. The study takes advantage of unique data available in the NSSBF surveys that reports the "other investments" made by the respondent firms in investments which are intended to bring a positive return to the firm, but which are not supportive of the firm's core operations. The 2003 NSSBF survey questionnaire specifically describes the question posed to the small firm owner as follows:

> *"As of [DATE]), what was the total dollar amount of other investments held by the business, such as (all loans to shareholders/partners, and) real estate loans (mortgages) owed to the business? Remember, these are amounts owed **to** the firm, not owed **by** the firm. IF R ASKS WHAT "OTHER INVESTMENTS" MEANS, SAY: **Other investments** are any items not yet discussed that were purchased by the firm with the intent to generate a return on the invested capital. Examples are investments in other companies, or artwork owned by the firm."*

This study illuminates the motives of small firm management and owners that lead to the diversion of funds away from the growth of the core business, and into non-core investments. Note that these investments do not necessarily represent negative NPV investments to the firm; they are just not supportive of firm growth in its core business area, and may or may not contribute to the maximization of firm value.

4.1 Theory and Testable Hypotheses

Two Finance theories that can be examined to explain the motivations of small firm owners and managers in the area of firm investments are the Agency Theory of Jensen and Meckling (1976) and the Free Cash Flow Theory of Jensen (1986). Jensen and Meckling started with the proposition that in a firm that was 100% owned by its manager (a description which applies to almost half of the population of small U.S.

firms), the owner would extract value-reducing pecuniary and non-pecuniary benefits from the firm consistent with maximization of her personal utility. As the manager's fractional share of the firm's ownership falls, her fractional claim on the firm's value falls, and this will encourage her to appropriate more benefits from the firm, causing a "residual loss" in firm value. It may also encourage her to apply less effort to the management of the firm, with the consequence of an additional reduction of firm value due to lost opportunities. In the limit of a professional manager that held no share of the firm's ownership, the appropriation and shirking behavior by the manager would be at a maximum. The reduction in firm value caused by appropriation and shirking were referred to as the "residual loss" by Jensen and Meckling, and were identified by them as an agency cost to the firm, along with the monitoring and bonding costs expended by shareholders and lenders to ensure that management's behavior was in alignment with their interests.

If the "other investments" of the small firm incur a residual loss to the firm and thus represent an agency cost, then it would be expected that such investments would increase with decreasing ownership share of the firm's primary owner, be higher if the firm's manager is not an owner, increase with the number of firm shareholders (reduced monitoring of management), and increase as monitoring by the firm's lenders decreases. This leads to the first set of related hypothesis:

> *H1a: Non-core investments are negatively related to the primary manager's ownership share in the firm.*
>
> *H1b: Non-core investments are positively related to the number of owners of the firm.*
>
> *H1c: Non-core investments are greater in firms in which the manager is not an owner.*

H1d: Non-core investments are negatively related the degree of monitoring by lenders.

The Free Cash Flow Theory of Jensen asserts that firms having excess cash flows (above the level required to fund all positive NPV projects available) will tend to invest the excess cash in value-reducing investments or waste it on "organizational inefficiencies". They suggest that payment of the excess cash flows to shareholders as dividends is one way to reduce this problem, but suffers from the fact that future dividend payments are not a commitment by management and may be revoked. However, they point out that debt payments are a commitment, and they suggest that firms with excess cash flows should borrow to repurchase stock, then use the excess cash flows to service the debt. This will discipline management and reduce the shareholder-manager agency costs associated with the free cash flows, but will potentially create shareholder-creditor agency issues, which can be controlled by selecting a level of debt at which the marginal costs of debt just equals the marginal benefits. Jensen points out that the agency costs associated with free cash flow will be the greatest for firms with little or no growth opportunities or those which must shrink; firms with growth opportunities will use the free cash flows to fund growth through investment in positive NPV projects.

This theory suggests that small firms with lower growth opportunities and closely-held "lifestyle" firms will have higher "other investments", while small growing firms and those that are carrying a higher level of external debt (from financial institutions, as opposed to shareholder loans) will have less such investments due to the disciplinary nature of debt and the necessity to use the firm's cash flows to service the debt. This leads to the following set of hypotheses:

H2a: Non-core investments are negatively related to the firm's growth opportunities.

H2b: Non-core investments are negatively related to the firm's level of external debt.

H2c: Non-core investments are positively related to the level of cash available to the owners.

Another factor that could influence the degree to which the firm directs resources to non-core investments is the diversification of the primary owner's investment portfolio. The primary owner of a small firm generally owns a large or majority equity share, and can direct or at least strongly influence the disposition of the firm's assets. If the wealth of the primary owner of the firm is not well diversified outside of the firm, she may seek to diversify her risk by directing the firm to diversify its investments into areas outside of its core business. The goal of this firm diversification would be to reduce the business risk of the firm, and thus protect the owner's equity investment in the firm. The higher the fraction of the owner's total wealth invested in the firm, the greater the degree of firm diversification that would be expected in the form of "other investments". This leads to the last hypothesis:

H3: Non-core investments are positively related to the fraction of total owner wealth invested in the firm.

4.2 Review of Empirical Studies

There is a remarkable lack of empirical papers that address the small firm decision to invest in non-core investments. This is most likely due to the lack of availability of data for small firms that record this particular item of data together with other variables that might be used to create a reasonably complete model for this investment decision.

One recent paper that does address the overall small firm investment decision from an Agency perspective is Danielson and Scott (2007). They use data from the 2003 National Federation of Independent Business (NFIB) "Reinvesting in the Business" survey, which supplies survey data for a sample of U.S. firms with 250 or less employees. Among the questions posed to small business owners in this survey was the question: "Is the greatest long-term concern about re-investing in your business possible overinvestment, possible underinvestment, or possible investment in the wrong things?". Limiting their analysis to firms reporting overinvestment or underinvestment as their greatest concern, they model this response using logistic regression against a set of regressors that include firm structure variables, variables that proxy for more or less concentration of firm ownership and control, firms representing the firm's financing intentions and real growth.

They find that underinvestment concerns are more common in small firms with concentrated ownership and control structures and in firms pursuing growth strategies. Overinvestment concerns are more common in small firms with less concentrated ownership and control structures; and those firms are also more likely to use planning tools such as business plans. Following the theory of Fama and Jensen (1983) that firms that have separated ownership and control have done so to control agency costs, the authors conclude that the owners of small firms recognize that agency costs can arise as the result of free cash flows, and will use planning tools to reduce those agency costs. The authors also acknowledge that the lack of actual balance sheet data on firm investments and use of debt for their sample firms does not allow them to directly test the firm's actual performance, but only the beliefs of the survey respondents. This study uses

balance sheet and income statement data from the NSSBF surveys to provide a more direct examination of the overinvestment issue and how it relates to the firm's ownership structure, debt usage and other control variables.

Martin and Sayrak (2003) in a review paper cite a large body of finance literature supporting the generally-accepted idea that diversification is value-destroying for the firm, though they also cite cases where diversification built value for the firm rather than destroyed it. They suggest that many of the previous empirical papers that showed value destruction were suffering from measurement problems in their empirical methodology that when corrected would show that there is in many cases a diversification premium rather than a diversification discount.

4.3 Model, Variables and Data

The model chosen to test the hypotheses is shown below. It is proposed that the "other investments" for a small U.S. firm are a function of variables that proxy for agency costs and value maximizing behavior, a variable that proxies for growth, variables that represent cash and external debt, a variable that measures the fraction of owner wealth invested in the firm, and dummy industry variables. Other investments are scaled by the firm's annual sales to remove the firm size effect. Sales rather than total assets is chosen as the scaling variable because many of the firms in the sample are services firms which have few assets and would produce abnormally large values for the ratio when divided by total assets.

$$\text{LnINVESTOSALES}_i = \beta_{0i} + \beta_{1i}OWNSHR_i + \beta_{2i}OWNMGR_i + \beta_{3i}LnOWNERS_i + \beta_{4i}RELLENGTH_i + \beta_{5i}RELNUM_i + \beta_{6i}GROWTH_i + \beta_{7i}LnCASHTOSALES_i + \beta_{8i}LnEXTDEBTRATIO_i + \beta_{9i}LnDIVERSE_i + \beta_{10i}LnWHOLESALE_i + \beta_{11i}RETAIL_i + \beta_{12i}MANUFACTURING_i + \beta_{13i}TRANSPORTATION_i + \beta_{14i}SERVICES_i + \varepsilon_i$$

The specific variables chosen in each category are summarized in table 4.1, along with their hypothesized relationship (+ or -) to LnINVESTOSALES. These variables are defined the same in both the 1998 and 2003 NSSBF surveys, which are used as the source of data for the study. Those variables that are not directly defined in the database were derived from other variables that are. Based on correlation between the variables, it may be necessary to run several regressions, each excluding variables highly correlated with others in the model.

Table 4.1

Independent variables and their hypothesized relationship to LnINVESTOSALES

Independent Variable	Description	Hypothesized Relationship to Other Investments	Hypothesis Tested	Comments
Firm Characteristics:				
GROWTH	Dummy, 1 = firm's sales have grown over the past 2 years	(-)	H2a	Firms that are growing will not divert cash flows to other investments
Industry dummies	Dummy variables for: Wholesale, Retail, Manufacturing, Transportation, Services	n/a	n/a	Control for industry-specific factors
Agency and Monitoring:				
OWNSHR	Percentage of business owned by principal owner	(-)	H1a	Increasing primary owner's firm ownership share reduces agency (Jensen and Meckling 1976)
OWNMGR	Dummy, 1 = firm is managed by an owner	(-)	H1c	Having firm managed by an owner reduces agency (Jensen and Meckling 1976)
LnOWNERS	Natural log of the total number of firm owners	(+)	H1b	Increasingly diffuse firm ownership promotes agency costs
RELLENGTH	Length of the longest relationship (months) firm has had with its primary financial institution	(-)	H1d	Relationship length is a proxy for monitoring by creditors. Longer relationship→more monitoring→lower agency costs
RELNUM	Number of financial institutions with which the firm does business	(+)	H1d	Relationship number is a proxy for monitoring by creditors. More relationships→more diffuse monitoring→higher agency costs
Sources and uses of cash flows:				
LnCASHTOSALES	Natural log of the ratio of the firm's cash to sales	(+)	H2c	Firms that can accumulate free cash flows can divert cash to other investment purposes
LnEXTDEBTRATIO	Natural log of the ratio of total amount of all loans, mortgages, notes and bonds, less loans from owners, to Total Assets. Does not include current liabilities such as Accounts Payable and accruals.	(-)	H2b	Firms with higher outstanding debt will need to service debt rather than make other investments, to avoid default . Loans from owners are removed since owners are unlikely to foreclose if debt interest or principal payment is missed.
Owner diversification:				
LnDIVERSE	Natural log of the ratio of the primary owner's equity share in the firm to the primary owner's total wealth.	(+)	H3	Higher concentration of owner wealth in the firm leads to more diversification of firm investments.

4.3.1 Sample size and summary statistics for numeric variables. Sections 6.2 and 6.3 of this document describe the transformation and clean-up applied to the 1998 and 2003 NSSBF sample data prior to analysis. In that section it is indicated that 120 observations (out of 3561 total) in the 1998 NSSBF are excluded, and 627 observations (out of 21200 total) in the 2003 NSSBF are excluded, due to failure to meet the "going concern" criteria.

An additional 316 observations are excluded from the 1998 NSSBF sample data due to missing item data for the regression model independent variables, leaving 3125 complete observations for analysis from the 1998 NSSBF. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3.

An additional 1170 observations are excluded from the 2003 NSSBF sample data due to missing item data for the regression model independent variables, leaving 19403 complete observations for analysis. Observations are excluded by setting FIN_WGT to zero, but the observations are not actually dropped from the sample, as described in Section 6.3. Finally, selection of implicate #3 only as described in section 6.4, results in 3879 complete observations for analysis from the 2003 NSSBF.

Note that some of the variables in the model have been transformed to their natural log form and Winsorized. This has been done to reduce the rather large skewness and kurtosis typical of the untransformed numeric variables in the 1998 and 2003 NSSBF samples. Sections 6.2 and 6.3 describe the rationale behind this and the transformation methodology used. Figures 4.1 and 4.2 below provide sample statistics for the numeric variables in the model, including mean, standard deviation, skewness and kurtosis. The

untransformed and transformed variables are included in the table for comparison, and to show how the logarithmic transformation and Winsorization of the variables have reduced skewness and kurtosis.

variable	N	mean	sd	max	min	skewness	kurtosis
OWNSHR	3125	79.76352	27.55503	100	1	-.9071642	2.429518
RELLENGTH	3125	99.15488	100.0857	780	0	2.199216	9.310322
RELNUM	3125	2.46048	1.731715	20	1	2.309636	13.36609
INVESTOSALES	3125	.0285819	.3733183	13.7106	0	29.05554	931.9876
LnINVESTOS~S	3125	.0164366	.1061151	2.688568	0	15.76392	325.5557
wLnINVESTO~S	3125	.0115683	.0451002	.3257309	0	5.213302	32.35524
OWNERS	3125	6.72672	74.40251	2500	1	23.87974	649.6574
LnOWNERS	3125	.4885592	.8494088	7.824046	0	3.206902	18.27018
wLnOWNERS	3125	.473538	.7640031	3.912023	0	2.263117	9.024026
CASHTOSALES	3125	.1114595	.413744	13.92928	0	17.76343	480.1738
LnCASHTOSA~S	3125	.0833305	.17121	2.703324	0	5.91051	53.71599
wLnCASHTOS~S	3125	.0795693	.1413111	.924841	0	3.847125	20.20089
EXTDEBTRATIO	3125	1.929716	23.38897	908.7333	0	30.49599	1052.505
LnEXTDEBTR~O	3125	.4498331	.5913779	6.813151	0	3.64331	25.03899
wLnEXTDEBT~O	3125	.4400807	.5276574	2.963397	0	2.356749	10.06683
DIVERSE	3125	.2104821	.4264058	17.60281	-7.888889	19.83745	928.6261
LnDIVERSE	3125	2.20726	.0516503	3.276873	.0011105	-21.89088	1125.089
wLnDIVERSE	3125	2.207584	.0267629	2.290436	2.184927	1.280482	3.791576

Figure 4.1. Sample statistics for numeric model variables from 1998 NSSBF

variable	N	mean	sd	max	min	skewness	kurtosis
OWNSHR	3879	75.69244	27.18865	100	8	-.46084	1.643467
RELLENGTH	3879	136.0601	124.6776	1156	0	1.864232	8.218664
RELNUM	3879	2.875226	1.86894	20	1	1.815375	9.012228
INVESTOSALES	3879	.0588938	1.888621	116.1667	0	60.00532	3684.733
LnINVESTOS~S	3879	.0185786	.1351291	4.763597	0	18.3402	486.8254
wLnINVESTO~S	3879	.0125552	.0550959	.4373658	0	6.128323	43.43106
OWNERS	3879	4.219386	52.35496	2800	1	43.94635	2192.012
LnOWNERS	3879	.5691709	.7335857	7.937375	0	2.403492	14.33836
wLnOWNERS	3879	.5627534	.6940606	3.912023	0	1.703049	7.178518
CASHTOSALES	3879	.182197	2.117181	112.5	0	42.60581	2117.007
LnCASHTOSA~S	3879	.0942589	.2238784	4.731803	0	8.762491	120.2103
wLnCASHTOS~S	3879	.0871595	.1562337	1.049822	0	3.942901	21.31316
EXTDEBTRATIO	3879	.8921209	8.035268	460.7895	0	50.05026	2795.19
LnEXTDEBTR~O	3879	.3879964	.4628377	6.135109	0	3.055842	20.52422
wLnEXTDEBT~O	3879	.3817796	.4243423	2.353991	0	2.014922	8.598249
DIVERSE	3879	.2017751	.2422352	1	-.8095238	1.311646	4.055273
LnDIVERSE	3879	.6921549	.1131565	1.033042	.0000762	1.074643	3.689375
wLnDIVERSE	3879	.6923113	.1122877	1.023183	.5931059	1.146038	3.341442

Figure 4.2. Sample statistics for numeric model variables from 2003 NSSBF (using implicate #3 only)

4.3.2 Summary statistics for dummy and categorical variables. Table 4.2 provides un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 3125 observations of the 1998 NSSBF sample, and table 4.3 provides

un-weighted one-way tabulations of the dummy and categorical variables in the model for the final 3879 observations of the 2003 NSSBF sample.

Table 4.2

Sample statistics for dummy/categorical variables from 1998 NSSBF (n=3125)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
INVESTS: Firm makes other investments	No	2574	82.4
	Yes	551	17.6
GROWTH: Firm has experienced sales growth	No	1081	34.6
from previous to current fiscal year	Yes	2044	65.4
OWNMGR: Firm's Manager is an owner	No	340	10.9
	Yes	2785	89.1
MANUFACTURING: Firm is in the	No	2775	88.8
Manufacturing sector (SIC 20-39)	Yes	350	11.2
TRANSPORTATION: Firm is in the	No	3002	96.1
Transportation sector (SIC 40-49)	Yes	123	3.9
WHOLESALE: Firm is in the Wholesale sector	No	2907	93.0
(SIC 50-51)	Yes	218	7.0
RETAIL: Firm is in the Retail sector (SIC 52-59)	No	2502	80.1
	Yes	623	19.9
SERVICES: Firm is in the Services sector (SIC 70-	No	1837	58.8
89)	Yes	1288	41.2

Table 4.3

Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=3879)

Dummy/Categorical Vars	Response	Number of Responses	Percent of Sample
INVESTS: Firm makes other investments	No	3232	83.3
	Yes	647	16.7
GROWTH: Firm has experienced sales growth	No	2176	56.1
from previous to current fiscal year	Yes	1703	43.9
OWNMGR: Firm's Manager is an owner	No	367	9.5
	Yes	3512	90.5
MANUFACTURING: Firm is in the	No	3413	88.0
Manufacturing sector (SIC 20-39)	Yes	466	12.0
TRANSPORTATION: Firm is in the	No	3718	95.8
Transportation sector (SIC 40-49)	Yes	161	4.2
WHOLESALE: Firm is in the Wholesale sector	No	3608	93.0
(SIC 50-51)	Yes	271	7.0
RETAIL: Firm is in the Retail sector (SIC 52-59)	No	3108	80.1
	Yes	771	19.9
SERVICES: Firm is in the Services sector (SIC 70-	No	2314	59.7
89)	Yes	1565	40.3

4.3.3 Sample correlations. Figures 4.3 and 4.4 present the Pearson correlations between the variables in the model for the 1998 and 2003 NSSBF samples, respectively. Looking for correlations between variables that are higher than 0.500 (or lower than -0.500), it is noted that in both the 1998 and 2003 samples, there is a high correlation between OWNSHR and LnOWNERS. (This was observed in the second essay on cash

holdings as well.) Separate estimations of the model will be executed that exclude one of these variables at a time, to avoid problems with multicollinearity.

	wLnINV~S	GROWTH	OWNSHR	OWNMGR	wLnOW~RS	RELLEN~H	RELNUM
wLnINVESTO~S	1.0000						
GROWTH	-0.0538*	1.0000					
OWNSHR	-0.0598*	-0.0374*	1.0000				
OWNMGR	-0.0294	0.0289	0.1014*	1.0000			
wLnOWNERS	0.0797*	0.0395*	-0.7990*	-0.1476*	1.0000		
RELLENGTH	0.0241	-0.0979*	-0.0162	-0.0227	0.0467*	1.0000	
RELNUM	0.0856*	0.0357*	-0.2127*	-0.0869*	0.2383*	-0.0304	1.0000
wLnCASHTOS~S	0.0769*	-0.0691*	0.0627*	0.0326	-0.0453*	0.0183	-0.1038*
wLnEXTDEBT~O	-0.0367*	0.0376*	-0.0270	-0.0340	0.0162	-0.0561*	0.1751*
wLnDIVERSE	0.0845*	0.0019	-0.0070	-0.0272	0.0925*	0.0413*	0.0939*
MANUFACTUR~G	0.0203	-0.0212	-0.1207*	-0.0160	0.1722*	-0.0068	0.1066*
TRANSPORTA~N	0.0540*	0.0054	-0.0648*	-0.0297	0.0552*	0.0162	0.0811*
WHOLESALE	-0.0054	-0.0306	-0.0351*	-0.0173	0.0267	0.0329	0.0302
RETAIL	-0.0504*	-0.0025	0.0027	-0.0391*	-0.0369*	0.0440*	-0.0189
SERVICES	-0.0138	0.0212	0.1018*	0.0379*	-0.0858*	-0.0635*	-0.0781*

	wLnCA~ES	wLnEXT~O	wLnDIV~E	MANUFA~G	TRANSP~N	WHOLES~E	RETAIL
wLnCASHTOS~S	1.0000						
wLnEXTDEBT~O	-0.1711*	1.0000					
wLnDIVERSE	0.0073	-0.3108*	1.0000				
MANUFACTUR~G	-0.0332	-0.0212	0.1082*	1.0000			
TRANSPORTA~N	-0.0058	0.0824*	-0.0012	-0.0719*	1.0000		
WHOLESALE	-0.0408*	-0.0168	0.0843*	-0.0973*	-0.0554*	1.0000	
RETAIL	-0.0409*	-0.0204	0.0446*	-0.1772*	-0.1010*	-0.1366*	1.0000
SERVICES	0.0621*	-0.0420*	-0.1291*	-0.2974*	-0.1695*	-0.2293*	-0.4178*

	SERVICES
SERVICES	1.0000

Figure 4.3. 1998 NSSBF: Pearson Correlations of Model Variables

	wLnINV~S	GROWTH	OWNSHR	OWNMGR	wLnOW~RS	RELLEN~H	RELNUM
wLnINVESTO~S	1.0000						
GROWTH	-0.0148	1.0000					
OWNSHR	-0.0470*	-0.0575*	1.0000				
OWNMGR	-0.0775*	-0.0371*	0.1169*	1.0000			
wLnOWNERS	0.0677*	0.0649*	-0.7834*	-0.2012*	1.0000		
RELLENGTH	0.0126	-0.1062*	-0.0129	-0.0310	0.0215	1.0000	
RELNUM	0.0528*	0.1227*	-0.1819*	-0.0852*	0.2412*	-0.0128	1.0000
wLnCASHTOS~S	0.0924*	-0.1022*	0.0666*	0.0232	-0.0608*	0.0496*	-0.1470*
wLnEXTDEBT~O	-0.0272	0.0535*	-0.0653*	-0.0205	0.0682*	-0.0870*	0.1936*
wLnDIVERSE	0.0602*	0.0305	0.0300	-0.0638*	0.0698*	0.0612*	0.1401*
MANUFACTUR~G	-0.0221	-0.0009	-0.1004*	-0.0729*	0.1686*	0.0004	0.0671*
TRANSPORTA~N	0.0301	0.0217	-0.0028	-0.0122	0.0125	0.0056	0.0976*
WHOLESALE	0.0069	0.0184	-0.0281	-0.0254	0.0379*	0.0251	0.0432*
RETAIL	-0.0259	-0.0032	-0.0524*	-0.0001	0.0167	0.0164	0.0613*
SERVICES	-0.0019	-0.0255	0.1013*	0.0360*	-0.1110*	-0.0775*	-0.1338*

	wLnCA~ES	wLnEXT~O	wLnDIV~E	MANUFA~G	TRANSP~N	WHOLES~E	RETAIL
wLnCASHTOS~S	1.0000						
wLnEXTDEBT~O	-0.2167*	1.0000					
wLnDIVERSE	0.0261	-0.2801*	1.0000				
MANUFACTUR~G	-0.0258	0.0183	0.1205*	1.0000			
TRANSPORTA~N	-0.0292	0.0480*	0.0217	-0.0769*	1.0000		
WHOLESALE	-0.0214	-0.0078	0.0541*	-0.1013*	-0.0570*	1.0000	
RETAIL	-0.0601*	0.0087	0.0295	-0.1840*	-0.1036*	-0.1365*	1.0000
SERVICES	0.0823*	-0.0444*	-0.1394*	-0.3039*	-0.1711*	-0.2254*	-0.4096*

	SERVICES
SERVICES	1.0000

Figure 4.4. 2003 NSSBF: Pearson Correlations of Model Variables

4.3.4 Variance inflation factors. The variance inflation factors for the 1998 model estimation are provided in figure 4.5 below. The variance inflation factors for the 2003 model estimation are provided in figure 4.6 below. They were generated following unweighted OLS estimation of the Investments model for the two survey samples. The observed variance inflation factors for OWNSHR and wLnOWNERS are consistent with the observation of relatively high correlation between these variables in figures 4.3 and 4.4 above. This confirms the earlier conclusion that estimating the model multiple times with one or both of these variables dropped would be advisable.

Variable	VIF	1/VIF
wLnOWNERS	2.94	0.339709
OWNSHR	2.84	0.352067
SERVICES	2.06	0.485768
RETAIL	1.77	0.564818
MANUFACTUR~G	1.54	0.649433
WHOLESALE	1.34	0.748294
wLnEXTDEBT~O	1.21	0.826102
TRANSPORTA~N	1.20	0.832621
wLnDIVERSE	1.19	0.840907
RELNUM	1.14	0.880407
wLnCASHTOS~S	1.05	0.952085
OWNMGR	1.03	0.968788
RELLENGTH	1.02	0.976908
GROWTH	1.02	0.979701
Mean VIF	1.53	

Figure 4.5. Variance Inflation Factors – 1998 NSSBF

Variable	VIF	1/VIF
wLnOWNERS	2.83	0.353796
OWNSHR	2.67	0.374921
SERVICES	2.07	0.481956
RETAIL	1.78	0.563283
MANUFACTUR~G	1.57	0.636169
WHOLESALE	1.33	0.751196
TRANSPORTA~N	1.21	0.825439
wLnEXTDEBT~O	1.21	0.826519
wLnDIVERSE	1.19	0.839865
RELNUM	1.18	0.850200
wLnCASHTOS~S	1.08	0.928735
OWNMGR	1.05	0.949171
GROWTH	1.04	0.963606
RELLENGTH	1.03	0.969573
Mean VIF	1.52	

Figure 4.6. Variance Inflation Factors – 2003 NSSBF

4.3.5 LnDIVERSE and insolvent firms. The value of DIVERSE in this study is calculated as:

DIVERSE = OWNEQUITY / (OWNWORTH + OWNEQUITY)

where OWNEQUITY is the value of the primary owner's equity share in the firm, and OWNWORTH is the net worth of the primary owner, not including her share in the firm.

As the primary owner's equity investment in the firm increases relative to her external wealth, this ratio will increase. For an owner with great outside wealth relative to her investment in the firm, this value may be much less than one. For an owner whose wealth consists primarily of her investment in the firm, this ratio will be close to one.

It is possible that the value of OWNEQUITY can be negative. There are in fact 767 firms in the 1998 sample with negative OWNEQUITY, and 775 such firms in implicate #3 of the 2003 sample. Negative OWNEQUITY occurs when total liabilities exceed total assets on the firm's balance sheet, and is indicative of a firm in distress. In this condition, it is very possible that the firm will eventually cease operations and liquidate if it does not have adequate cash flow to meet its obligations to creditors. Even if the firm can continue operations in this state, the firm's cash flows will be prioritized to serving the firm's debt and there will be little or no excess cash flow to increase the wealth of shareholders. As residual claimants, shareholders of an insolvent firm can expect to receive little or no value for their shares in the firm. For this reason the negative values of OWNEQUITY are set to zero when calculating the value of DIVERSE.

4.4 Estimation Methodology

The model specified in the previous section is estimated using survey-weighted least squares regression. The sign and statistical significance of the independent variable coefficients is used to test the hypotheses. The methodology and rationale behind the use of a survey-weighted regression estimation methodology is described in detail in section 6.1 of this document and will not be repeated here. An estimation of the model using

OLS with robust standard errors will be included in order to highlight the effect of the use of survey weights in the estimation of the model.

It is important to note that most small firms do not make "other investments". In the 1998 NSSBF survey, 2914 firm observations have INVESTOSALES=0, and only 647 have INVESTOSALES>0. In implicate #3 of the 2003 NSSBF survey, 3462 firm observations have INVESTOSALES=0, and only 778 have INVESTOSALES>0. According to Wooldridge (2003), a dependent variable distributed in this manner is called a "corner solution response", and using the Tobit model with Maximum Likelihood (ML) estimation is appropriate. Estimation with OLS using only the observations having non-zero values of the dependent variable is not appropriate as it will produce estimated coefficients that are biased and inconsistent (Gujarati, 2003). Estimation with OLS using the entire sample will produce biased coefficients that will predict negative values for the dependent variable. The model is estimated using a survey-weighted Tobit method with ML estimation in addition to the survey-weighted least squares method. The winsorized variable wLnINVESTOSALES is the independent variable for these estimations. As a result of the logarithmic transformation method used (see section 4), wLnINVESTOSALES is zero whenever INVESTOSALES=0.

As a robustness check, a binary response variable called INVESTS has been created that takes the value "0" if INVESTOSALES=0, and "1" if INVESTOSALES>0. The model is then estimated using survey-weighed Logit and Probit regression, where the dependent variable is INVESTS. Logit and Probit both model the probability that the response variable will be "1", though Logit uses the logistic function to model the response variable while Probit uses the cumulative distribution function of the standard

normal distribution. STATA supports the estimation of both model types using the method of Maximum Likelihood, which is employed. The justification for using Logit and Probit estimation as robustness checks for the estimation results of the main model is as follows.

The model and hypotheses are written in such a way as to posit a positive or negative relationship between constructs such as growth, agency and diversification, and the magnitude of "other investments". The model relates these constructs to the amount of other investments made by the firm, not to the decision whether or not to make such investments. In survey-weighted least squares and Tobit estimation, significant coefficients of positive sign will suggest that the corresponding variable contributes to an increase in the magnitude of other investments, while significant coefficients of negative sign will suggest that the corresponding variable contributes to a decrease in that magnitude. In Logit and Probit estimation on the other hand, significant coefficients of positive sign have a positive effect on the *probability* that the firm has made other investments, while significant coefficients of negative sign will have a negative effect on that probability. The Logit and Probit coefficients have a different interpretation and will have a different magnitude than the least squares and Tobit coefficients. However, it can be anticipated that the sign and statistical significance of the coefficients of each of the model variables will be preserved across all four estimation methods.

The rationale for this assumption is to consider a contradiction. If a particular variable has a significant positive coefficient in the least-squares or Tobit estimation, indicating that it contributes to an increase in the amount of other investments made (above the level of zero), how can that same variable have a significant negative

coefficient or an insignificant coefficient in the Logit or Probit models? In other words, how can a variable be a significant and positive determinant of the growth of other investments, and not positively contribute to the probability that such investments are made at all? A similar argument can be made in the case where the coefficient in the least squares and Tobit estimations are significantly negative, and the same coefficients in the Logit and Probit estimations are significantly positive.

The results of the four methods of estimation are compared; survey-weighted least squares, Logit, Probit, and Tobit. Due to differences in the estimation methods, it is not reasonable to expect the values of the estimated coefficients to be the same in magnitude across the four estimation methods. However, as explained above, it can be expected that the signs of the coefficients and their significance will be preserved across the four models. Since the hypotheses all depend upon the signs of the regression coefficients in the model and not the magnitude, it should be possible to use all four estimation methods to test the hypotheses without complication.

4.5 Univariate Analysis

Before estimating the multivariate regression model, it would be useful to examine how the small firms' INVESTOSALES ratio is related in a univariate sense to the firm characteristics embodied in the model variables. Figure 4.7 (for the 1998 NSSBF) and figure 4.8 (for the 2003 NSSBF) show how the mean of INVESTOSALES differs for the two states of each binary variable in the model. Included for each set of means is an Adjusted Wald test whose null hypothesis is that the two means are not significantly different from each other. For variables GROWTH and OWNMGR, no significant difference in the means of INVESTOSALES is observed between the "1" and

"0" state of these variables, for either the 1998 or 2003 NSSBF data. For the 1998 data only, it is observed that firms in MANUFACTURING, WHOLESALE and RETAIL have significantly lower levels of INVESTOSALES than other firms.

```
-------------------------------------------------------------------------------------------------------
                 |INVESTOSALES  Linearized                          Adjusted Wald Test for Equality of Means
        Over     |    Mean      Std. Err.     [95% Conf. Interval]          (H0: Means are equal)
-----------------+-------------------------------------------------------------------------------------
 GROWTH        No |   .0468399   .0168339      .0138336    .0798461
              Yes |   .0208442   .0080901      .0049819    .0367065    F(1,3201) = 1.94, Prob > F = 0.1639
-----------------+-------------------------------------------------------------------------------------
 OWNMGR        No |   .1015321   .0675729     -.030956     .2340202
              Yes |   .0226251   .0058552      .011145     .0341051    F(1,3362) = 1.35, Prob > F = 0.2447
-----------------+-------------------------------------------------------------------------------------
 MANUFACTURING No |   .0303044   .0081702      .0142853    .0463234
              Yes |   .010538    .0025585      .0055217    .0155543    F(1,3362) = 5.33, Prob > F = 0.0210
-----------------+-------------------------------------------------------------------------------------
TRANSPORTATION  No|   .0287633   .0077466      .0135747    .0439519
              Yes |   .0255243   .0162742     -.0063841    .0574327    F(1,3362) = 0.03, Prob > F = 0.8573
-----------------+-------------------------------------------------------------------------------------
 WHOLESALE     No |   .0301745   .0080623      .0143669    .0459821
              Yes |   .008806    .0022549      .0043848    .0132272    F(1,3362) = 6.51, Prob > F = 0.0107
-----------------+-------------------------------------------------------------------------------------
 RETAIL        No |   .0335098   .0092623      .0153494    .0516702
              Yes |   .008257    .0017347      .0048558    .0116582    F(1,3362) = 7.18, Prob > F = 0.0074
-----------------+-------------------------------------------------------------------------------------
 SERVICES      No |   .0306161   .0119603      .0071658    .0540663
              Yes |   .026047    .0072675      .0117977    .0402962    F(1,3362) = 0.11, Prob > F = 0.7441
```

Figure 4.7. 1998 NSSBF: Two-way tabulation of INVESTOSALES versus firm characteristics from model

```
                |INVESTOSALES  Linearized                          Adjusted Wald Test for Equality of Means
       Over     |    Mean      Std. Err.     [95% Conf. Interval]          (H0: Means are equal)
-----------------+-------------------------------------------------------------------------------------
 GROWTH       No |   .0346107    .010182      .0146483    .0545731
             Yes |   .1139773   .0932606      -.068865    .2968196    F(1,4038) = 0.72, Prob > F = 0.3976
-----------------+-------------------------------------------------------------------------------------
 OWNMGR       No |    .1485354   .0704835     .0103482    .2867226
             Yes |    .0628976   .0416221    -.018705     .1445003    F(1,3980) = 1.10, Prob > F = 0.2953
-----------------+-------------------------------------------------------------------------------------
 MANUFACTURING No |    .0722937  .0423922     -.0108184    .1554058
             Yes |    .0086116  .0024329      .0038417    .0133815    F(1,4038) = 2.25, Prob > F = 0.1338
-----------------+-------------------------------------------------------------------------------------
 TRANSPORTATION No|    .0696845  .0408775     -.010458     .149827
             Yes |    .0171194  .0068294      .00373      .0305087    F(1,4038) = 1.61, Prob > F = 0.2047
-----------------+-------------------------------------------------------------------------------------
 WHOLESALE    No |    .0704617  .0417779     -.0114461    .1523696
             Yes |    .0232953  .0096495      .004377     .0422136    F(1,4038) = 1.21, Prob > F = 0.2713
-----------------+-------------------------------------------------------------------------------------
 RETAIL       No |    .0808965  .0484818     -.0141545    .1759475
             Yes |    .0110237  .0039522      .0032753    .0187721    F(1,4038) = 2.06, Prob > F = 0.1509
-----------------+-------------------------------------------------------------------------------------
 SERVICES     No |    .0231467  .0077579      .0079369    .0383565
             Yes |    .1207833  .0856839     -.0472044    .288771     F(1,4038) = 1.29, Prob > F = 0.2565
```

Figure 4.8. 2003 NSSBF: Two-way tabulation of INVESTOSALES versus firm characteristics from model

Figures 4.9 (for the 1998 NSSBF) and 4.10 (for the 2003 NSSBF) show how the mean of wLnINVESTTOSALES differs across four quartiles of each numeric variable from the regression model. Included for each set of means are Adjusted Wald tests whose null hypothesis is that the two quartile means are not significantly different from each other. There is a Wald test for each pair of adjacent quartile means (1^{st}-2^{nd} quartile, 2^{nd}-3^{rd} quartile, 3^{rd}-4^{th} quartile). Note that for some of the numeric variables, less than four quartiles are listed in the table. That is because that particular variable had a large number of missing or zero values, such that four unique quartiles could not be created.

Evidence is observed in both surveys that wLnINVESTOSALES decreases with increasing OWNSHR, in support of hypothesis H1a. It is also observed in both surveys that as wLnOWNERS increases, so does wLnINVESTOSALES in support of hypothesis H1b. No evidence is observed of a relationship between RELLENGTH or RELNUM and wLnINVESTOSALES, which shows lack of support for hypothesis H1d in these univariate results.

Some evidence is seen in both surveys that as wLnCASHTOSALES increases, so does wLnINVESTOSALES, which supports hypothesis H2c. In both surveys, wLnEXTDEBTRATIO is positively related to wLnINVESTOSALES at low levels of debt (lower quartiles) which disagrees with hypothesis H2b. However, in the 1998 survey is it observed that wLnINVESTOSALES decreases with increasing wLnEXTDEBTRATIO at high debt levels (higher quartiles) which does support H2b.. The multivariate analysis in the next section will be needed to resolve the true nature of this relationship.

Using the 2003 survey data it is observed that wLnINVESTOSALES increases with wLnDIVERSE, in support of hypothesis H3. No such support is observed with the 1998 survey data.

In addition to the results above, the means of INVESTOSALES, CASHTOSALES, EXTDEBTRATIO, and DIVERSE were compared between 1998 and 2003, performing t-tests of the differences between the 1998 and 2003 variable means, assuming unequal variances and using a significance level of 0.05. The following results were obtained:

- CASHTOSALES: firms held significantly less cash on average in 1998 than 2003.
- INVESTOSALES: no significant difference between 1998 and 2003.
- DIVERSE: no significant difference between 1998 and 2003.
- EXTDEBTRATIO: firms maintained a higher debt ratio in 1998 than 2003.

These results support the observation that firms shed debt and accumulated cash between 1998 and 2003, when the economy went from a state of expansion to one of relative weakness.

(Wald test is for equality of quartile mean on previous row to quartile mean on current row of table.)

```
Number of strata =      78          Number of obs    =     3125
Number of PSUs   =    3125          Population size  =  4569651
                                    Design df        =     3047
------------------------------------------------------------------------
             |   Mean of     Linearized     Adjusted Wald Test*
    Quartile |wLnINVESTOSALES Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------
      OWNSHR |
           1 |   .0149181   .0023408
           2 |   .0089814   .0010297    F(1,3047)=5.39, Prob>F=0.0204
------------------------------------------------------------------------
   wLnOWNERS |
           1 |   .0083313   .0010519
           3 |   .0132628   .0022917    F(1,3047)=3.82, Prob>F=0.0508
           4 |   .0188881   .0041062    F(1,3047)=1.43, Prob>F=0.2322
------------------------------------------------------------------------
   RELLENGTH |
           1 |   .0116641   .0018417
           2 |    .008362   .0019279    F(1,3047)=1.54, Prob>F=0.2152
           3 |   .0093226   .0018233    F(1,3047)=0.13, Prob>F=0.7173
           4 |   .0116874   .0020712    F(1,3047)=0.74, Prob>F=0.3910
------------------------------------------------------------------------
      RELNUM |
           1 |    .007699   .0014791
           2 |   .0115075   .0018808    F(1,3047)=2.54, Prob>F=0.1111
           3 |   .0131959   .0025707    F(1,3047)=0.28, Prob>F=0.5963
           4 |   .0136673   .0023688    F(1,3047)=0.02, Prob>F=0.8927
------------------------------------------------------------------------
wLnCASHTOSAL~|
           1 |   .0092312   .0017657
           2 |   .0082664   .0016621    F(1,3047)=0.16, Prob>F=0.6909
           3 |   .0084689   .0014884    F(1,3047)=0.01, Prob>F=0.9276
           4 |   .0159592   .0026318    F(1,3047)=6.13, Prob>F=0.0133
------------------------------------------------------------------------
wLnEXTDEBTRA~|
           1 |   .0063539   .0019197
           2 |   .0148109   .0022684    F(1,3047)=8.11, Prob>F=0.0044
           3 |   .0133858   .0021164    F(1,3047)=0.21, Prob>F=0.6463
           4 |   .0073915   .0013034    F(1,3047)=5.82, Prob>F=0.0159
------------------------------------------------------------------------
  wLnDIVERSE |
           1 |   .0058831   .0012667
           2 |    .008553   .0017633    F(1,3047)=1.51, Prob>F=0.2185
           3 |   .0115508   .0022167    F(1,3047)=1.12, Prob>F=0.2900
           4 |   .0159438   .0023285    F(1,3047)=1.87, Prob>F=0.1718
------------------------------------------------------------------------
```

Figure 4. 9. 1998 NSSBF: Mean of wLnINVESTOSALES across quartiles of model variables

(Wald test is for equality of quartile mean on previous row to quartile mean on current row of table.)

```
Number of strata =      72          Number of obs    =     3879
Number of PSUs   =    3879          Population size  =  5669336
                                    Design df        =     3807
------------------------------------------------------------------------------
             |   Mean of     Linearized     Adjusted Wald Test*
    Quartile |wLnINVESTOSALES Std. Err.   (H0 = means are equal)
-------------+----------------------------------------------------------------
      OWNSHR |
           1 |   .0147088   .0027455
           2 |   .0087881   .0011577    F(1,3807)=3.95, Prob>F=0.0469
------------------------------------------------------------------------------
   wLnOWNERS |
           1 |   .0074193   .0012638
           3 |   .0102807   .0017199    F(1,3807)=1.80, Prob>F=0.1794
           4 |   .0246562   .0055681    F(1,3807)=6.09, Prob>F=0.0137
------------------------------------------------------------------------------
   RELLENGTH |
           1 |   .0078775    .002093
           2 |   .0115609   .0023422    F(1,3807)=1.38, Prob>F=0.2408
           3 |   .0106129   .0019044    F(1,3807)=0.10, Prob>F=0.7534
           4 |   .0112536   .0026706    F(1,3807)=0.04, Prob>F=0.8449
------------------------------------------------------------------------------
      RELNUM |
           1 |   .0072048   .0017969
           2 |   .0085253   .0015121    F(1,3807)=0.32, Prob>F=0.5741
           3 |   .0112844   .0027931    F(1,3807)=0.76, Prob>F=0.3847
           4 |    .016773   .0033169    F(1,3807)=1.60, Prob>F=0.2058
------------------------------------------------------------------------------
wLnCASHTOSAL~|
           1 |    .007885   .0016414
           2 |   .0069097   .0015854    F(1,3807)=0.18, Prob>F=0.6688
           3 |   .0130238   .0028575    F(1,3807)=3.51, Prob>F=0.0612
           4 |     .01337   .0025243    F(1,3807)=0.01, Prob>F=0.9276
------------------------------------------------------------------------------
wLnEXTDEBTRA~|
           1 |   .0066342   .0017191
           2 |   .012783    .0021885    F(1,3807)=4.88, Prob>F=0.0272
           3 |   .0120548   .0026725    F(1,3807)=0.04, Prob>F=0.8330
           4 |   .0101316   .0022637    F(1,3807)=0.30, Prob>F=0.5834
------------------------------------------------------------------------------
  wLnDIVERSE |
           1 |   .0080016   .0017971
           2 |   .0090906   .0021744    F(1,3807)=0.15, Prob>F=0.6995
           3 |   .0092089   .0018607    F(1,3807)=0.00, Prob>F=0.9670
           4 |   .0148902   .0028987    F(1,3807)=2.72, Prob>F=0.0990
------------------------------------------------------------------------------
```

Figure 4. 10. 2003 NSSBF: Mean of wLnINVESTOSALES across quartiles of model variables

4.6 Multivariate Analysis and Results

In this section the results of the multivariate analysis for the investments model are summarized and discussed. The results from the estimations of the model are presented using both the 1998 and 2003 NSSBF surveys and an analysis of the results is

offered. Table 4.4 presents a tabular summary of the results of the estimations, indicating which hypothesis is being tested by each model variable, the sign of the coefficient that is expected for that variable based on the hypothesis, the observed sign of the estimated coefficient, and the level of significance of the t-test for that coefficient. The observed relationships shown in the last column of table 4.4 are based on the survey-weighted estimations in figures 4.13 and 4.14, especially on the survey-weighed Tobit estimates.

Table 4.4

Summary of observed results compared to hypothesized results

Independent Variable	Hypothesis Tested	Hypothesized Relationship to Other Investments	Observed Relationship 1998/2003
Firm Characteristics:			
GROWTH	H2a	(-)	ns/ns
Agency and Monitoring:			
OWNSHR	H1a	(-)	(-)***/(-)***
OWNMGR	H1c	(-)	(-)**/(-)*
LnOWNERS	H1b	(+)	(+)***/(+)***
RELLENGTH	H1d	(-)	ns/(+)***
RELNUM	H1d	(+)	(+)***/(+)***
Sources and uses of cash flows:			
LnCASHTOSALES	H2c	(+)	ns/ns
LnEXTDEBTRATIO	H2b	(-)	(-)***/na
Owner diversification:			
LnDIVERSE	H3	(+)	(+)***/(+)**

*** p<0.01, ** p<0.05, * p<0.1, ns=not significant

Figures 4.11 (for the 1998 NSSBF) and 4.12 (for the 2003 NSSBF) present five estimations of the model in columns 1 through 5. Column 1 contains the OLS estimation

with robust standard errors, which is provided for comparison and will not be used in the analysis for reasons described in section 4 of this document. Column 2 contains the survey-weighted least squares estimation using wLnINVESTOSALES as the dependent variable. Column 3 contains the survey-weighted Logit estimation using the binary variable INVESTS as the dependent variable. Column 4 contains the survey-weighted Probit estimation, which also uses INVESTS as the dependent variable. Column 5 contains the survey-weighted Tobit estimation using wLnINVESTOSALES as the dependent variable.

In section 4.4 above, it was suggested that the signs and significance of the coefficient estimates in columns 2, 3, 4 and 5 in figures 4.11 and 4.12 would be the same, through the magnitudes of the coefficient estimates would not be the same. Examining figure 4.11 for the 1998 NSSBF data, a great degree of similarity is observed across the four sets of estimates. The signs of the significant coefficients are the same across the four estimations, and the degree of coefficient significance though not identical, is very close. Examining figure 4.12 for the 2003 NSSBF data, one can see a comparable pattern of similarity across the four estimations of the table. This would lead one to draw similar conclusions about the support for the hypotheses from all four estimations, though the strength of that support would differ in a few instances. For example, in figure 4.11 the coefficient of OWNMGR is significant at the 0.1% level in the Tobit estimation, but significant at the 0.05% level in the Logit and Probit estimations. Examining the Tobit estimation alone would lead one to conclude that hypothesis H1a enjoyed only weak support in the results. When combined with results from the Logit and Probit

estimations, one would be comfortable making a stronger claim about the degree of support for H1a in the results.

Figures 4.13 and 4.14 below reprise the Probit and Tobit estimations, but with OWNSHR and LnOWNERS dropped from the model due to their high correlation as described in section 4.3 above. Column 1 of these tables contains the survey-weighted Probit estimation with OWNSHR dropped, while column 2 contains the Probit estimation with LnOWNERS dropped. Column 3 of these tables contains the survey-weighted Tobit estimation with OWNSHR dropped, while column 4 contains the Tobit estimation with LnOWNERS dropped. These are the estimates that are used to complete the summary of observed results in table 4.4, particularly the Tobit results, since the Tobit method estimates the original model from section 4.3 which was derived from the hypotheses.

No support is evident in either the 1998 or 2003 surveys for hypothesis H2a, that growth firms would have significantly lower other investments than non-growth firm. It is possible that the failure to observe a significant result here could be due to a weak proxy for growth. The variable GROWTH is a dummy variable that takes the value "1" if the firm has experienced a growth in sales over the past two fiscal years, and "0" otherwise. A one-year growth pattern may not be adequate to separate the true growth firms from other firms, which would reduce the ability to find a significant relationship between growth and other investments.

Strong support is observed for hypotheses H1a and H1b in both surveys. Other investments decrease with increasing ownership share of the primary owner and increase with the number of owners, in support of the assertion that non-core investments represent an agency cost to the firm. Support for hypothesis H1c is observed in the 1998

survey but only weak support (0.1% level) is observed in the 2003 survey. Firms whose manager is also an owner hold less other investments than firms whose manager is not an owner, consistent with the agency cost interpretation of other investments. Strong support for hypothesis H1d is observed through the positive sign and significance at the 0.01% level of the estimated coefficient of RELNUM, the number of relationships between the firm and financial institutions, which is a proxy for increasingly diffuse monitoring by creditors. Taken together, the results described above lend support to the interpretation that other investments represent a residual loss agency cost to the firm, as originally described by Jensen and Meckling.

It is observed that the estimated coefficient of RELLENGTH is positive and highly significant in the 2003 survey, though not significant in the 1998 survey. This result is the opposite of the negative relationship between RELLENGTH and other investments that was predicted in hypothesis H1d based on agency arguments. This result can be explained if RELLENGTH is interpreted as a proxy for the age of the firm. (Only long-lived firms can have long relationships with their financial institution.) Older firms that have not grown beyond the small firm stage and thus are included in the NSSBF survey are likely to be "lifestyle" firms or firms in which growth and value maximization are not necessarily the primary goals of the owners. Such firms would be more likely to accumulate other investments, leading to a strong positive relationship between RELLENGTH and other investments. If RELLENGTH is replaced with LnFIRMAGE in the model and the model is re-estimated using the Tobit method and the 2003 survey data, it is observed that the coefficient of LnFIRMAGE is positive and significant at the 0.01% level. (Doing the same with the 1998 survey data does not

produce a significant coefficient for LnFIRMAGE.) This would indicate that RELLENGTH is functioning as a proxy for firm age in the model.

No support is seen for hypothesis H2c that firms whose managers have more cash available to them will have more other investments. However strong support is observed for hypothesis H2b in the 1998 survey, but no support for it in the 2003 survey. The level of external debt (not shareholder provided) held by the firm is negatively related to other investments, lending support to Jensen's assertion that the need to service debt would be a disciplining mechanism for management that would reduce their ability to expend the firm's cash flows on non-value maximizing uses.

Last of all, strong support is seen in both surveys for hypothesis H3 that the higher the commitment of the primary owner's wealth to the firm, the more other investments the firm will have. The interpretation of this result is that owners whose wealth is relatively undiversified and concentrated in the firm will achieve diversification by directing the firm to diversify its investments instead. The owner's motivation for doing this is to reduce the risk associated with having all of her wealth committed to one investment. Diversification of firm activities and investments is a recognized strategy for reducing the business risk of the firm, and is frequently undertaken by large firms. The argument generally advanced against such firm diversification is that diversification is best left to the shareholders, who are in a better position to diversify their portfolios and reduce their risk than is the firm.

For an entrepreneur whose wealth is heavily invested in one small firm, portfolio diversification outside of the firm may not be feasible. Therefore, such diversification of the firm's resources into other investments as has been observed in this study would have

to serve the same risk-reduction purpose. The unique advantage of this study is that it can actually determine the degree of commitment of the primary owner's wealth to the firm from the data available in the NSSBF surveys. The observation that firms with primary owners whose wealth is more committed to the firm have more other investments supports the diversification argument that has been proposed.

Looking for similarities and differences in the results between the 1998 survey data and the 2003 survey data, one of the most notable differences was the significant positive contribution of RELLENGTH to other investments in 2003 that was not observed in the 1998 data. Considering RELLENGTH as a proxy for firm age, and recognizing that 1998 was a period of strong economic expansion in the U.S. while 2003 was a period of relative economic weakness, one can interpret this result to indicate that older firms were more likely than younger firms to hold other investments on their balance sheets in 2003 that were accumulated in previous more prosperous years. The economic climate in 2003 would make it difficult for firms to acquire other investments and might compel younger and less established firm to divest themselves of those assets. The model would detect this as a significant contribution of firm age to the level of other investments, which was indeed observed. The economic climate in 1998 was one of prosperity and expansion for all firms, and firm age would be less likely to determine the level of other investments in that climate, leading to the observation that it was insignificant.

The other notable difference was the lack of significance of the coefficient of wLnEXTDEBTRATIO in the model estimation using the 2003 survey data, though the coefficient was highly significant and negative using the 1998 data. As noted in the

univariate analysis section of this essay, firms on average significantly reduced their EXTDEBTRATIO between 1998 and 2003 as the economy weakened, though their average value of INVESTOSALES did not significantly change between 1998 and 2003. It is possible that in this reduced debt state, the discipline of debt was longer effective in reducing the firm's other investments, making the relationship between debt and other investments insignificant.

VARIABLES	(1) Robust OLS	(2) Svy Regress	(3) Svy Logit	(4) Svy Probit	(5) Svy Tobit
GROWTH	-0.00494***	-0.00887	-0.0853	-0.0500	-0.0190
	(0.00186)	(0.0142)	(0.136)	(0.0727)	(0.0133)
OWNSHR	-1.03e-05	0.000426	-0.00193	-0.000581	-0.000309
	(6.08e-05)	(0.000570)	(0.00386)	(0.00217)	(0.000349)
OWNMGR	-0.00227	-0.0513*	-0.411**	-0.221**	-0.0301*
	(0.00264)	(0.0281)	(0.198)	(0.111)	(0.0174)
wLnOWNERS	0.00305	0.108***	0.577***	0.346***	0.0443***
	(0.00244)	(0.0270)	(0.148)	(0.0855)	(0.0126)
RELLENGTH	6.37e-06	7.59e-05	0.000619	0.000319	5.09e-05
	(8.99e-06)	(7.27e-05)	(0.000597)	(0.000330)	(5.98e-05)
RELNUM	0.00197***	0.0274***	0.207***	0.117***	0.0176***
	(0.000503)	(0.00515)	(0.0360)	(0.0205)	(0.00337)
wLnCASHTOSALES	0.0247**	-0.00453	-0.0543	-0.0724	0.0555
	(0.0102)	(0.0432)	(0.433)	(0.234)	(0.0497)
wLnEXTDEBTRATIO	-0.00177*	-0.0193**	-0.211**	-0.116**	-0.0211**
	(0.000993)	(0.00841)	(0.106)	(0.0572)	(0.0105)
wLnDIVERSE	0.116***	1.099***	9.058***	4.953***	0.860***
	(0.0339)	(0.301)	(2.326)	(1.313)	(0.236)
MANUFACTURING	-0.00427	-0.00520	-0.0470	-0.0231	-0.0181
	(0.00341)	(0.0300)	(0.259)	(0.140)	(0.0244)
TRANSPORTATION	0.00658	-0.0322	-0.282	-0.131	-0.0185
	(0.00669)	(0.0384)	(0.365)	(0.196)	(0.0388)
WHOLESALE	-0.00617*	0.0503	0.363	0.194	0.00411
	(0.00320)	(0.0345)	(0.247)	(0.139)	(0.0226)
RETAIL	-0.00816***	-0.0343	-0.320	-0.167	-0.0413**
	(0.00268)	(0.0220)	(0.217)	(0.115)	(0.0208)
SERVICES	-0.00360	-0.0163	-0.169	-0.0747	-0.0196
	(0.00265)	(0.0194)	(0.185)	(0.0989)	(0.0184)
Constant	-0.243***	-2.359***	-21.91***	-12.12***	-2.082***
	(0.0746)	(0.661)	(5.120)	(2.889)	(0.524)
Observations	3125	3561	3561	3561	3561
R-squared	0.032	0.060			
Adjusted R2	0.0281				
F statistic	4.414	9.088	10.25	10.43	8.235
Prob > F	6.89e-08	0	0	0	0
Model df	14	14	14	14	14
Uncensored obs					551
Left censored obs					2574

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) OLS with robust std errors, wLnINVESTOSALES is dependent variable
(2) Survey-weighted least squares regression, wLnINVESTOSALES is dependent variable
(3) Survey-weighted logit regression, INVESTS is dependent variable
(4) Survey-weighted Probit regression, INVESTS is dependent variable
(5) Survey-weighted Tobit regression, wLnINVESTOSALES is dependent variable

Figure 4.11. 1998 NSSBF: Comparative Regressions across OLS, SWLS, Logit, Probit and Tobit estimation

VARIABLES	(1) Robust OLS	(2) Svy Regress	(3) Svy Logit	(4) Svy Probit	(5) Svy Tobit
GROWTH	-0.00210	-0.0121	-0.143	-0.0846	-0.0211
	(0.00175)	(0.0120)	(0.145)	(0.0750)	(0.0179)
OWNSHR	-1.43e-05	-0.000246	-0.00745*	-0.00361*	-0.000846*
	(6.30e-05)	(0.000445)	(0.00383)	(0.00207)	(0.000489)
OWNMGR	-0.0125***	-0.0274	-0.260	-0.144	-0.0520
	(0.00443)	(0.0294)	(0.240)	(0.129)	(0.0350)
wLnOWNERS	0.00398	0.0766***	0.519***	0.299***	0.0630***
	(0.00281)	(0.0220)	(0.151)	(0.0865)	(0.0206)
RELLENGTH	-6.79e-07	0.000125**	0.00132***	0.000743***	0.000133**
	(6.93e-06)	(4.95e-05)	(0.000496)	(0.000274)	(6.49e-05)
RELNUM	0.00142**	0.0324***	0.296***	0.163***	0.0324***
	(0.000611)	(0.00455)	(0.0364)	(0.0202)	(0.00491)
wLnCASHTOSALES	0.0344***	-0.00782	-0.216	-0.135	0.0570
	(0.0109)	(0.0302)	(0.444)	(0.219)	(0.0587)
wLnEXTDEBTRATIO	-0.000891	0.00178	0.0604	0.0444	0.00981
	(0.00186)	(0.0107)	(0.140)	(0.0755)	(0.0193)
wLnDIVERSE	0.0233***	0.151**	1.761***	0.974***	0.240***
	(0.00851)	(0.0646)	(0.659)	(0.347)	(0.0830)
MANUFACTURING	-0.0107***	-0.0206	-0.241	-0.125	-0.0460
	(0.00308)	(0.0285)	(0.310)	(0.164)	(0.0358)
TRANSPORTATION	0.00268	-0.00334	-0.0324	-0.0206	0.00256
	(0.00595)	(0.0358)	(0.358)	(0.189)	(0.0452)
WHOLESALE	-0.00416	0.0300	0.234	0.144	0.0200
	(0.00435)	(0.0310)	(0.271)	(0.147)	(0.0325)
RETAIL	-0.00717**	-0.0403**	-0.456**	-0.247**	-0.0605**
	(0.00301)	(0.0197)	(0.228)	(0.118)	(0.0273)
SERVICES	-0.00361	-0.0211	-0.260	-0.139	-0.0263
	(0.00276)	(0.0174)	(0.198)	(0.102)	(0.0239)
Constant	0.00518	-0.0599	-3.591***	-2.086***	-0.477***
	(0.00939)	(0.0661)	(0.627)	(0.336)	(0.0890)
Observations	3879	4240	4240	4240	4240
R-squared	0.027	0.065			
Adjusted R2	0.0232				
F statistic	3.537	11.86	15.52	15.24	8.833
Prob > F	8.04e-06	0	0	0	0
Model df	14	14	14	14	14
Uncensored obs					647
Left censored obs					3232

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) OLS with robust std errors, wLnINVESTOSALES is dependent variable
(2) Survey-weighted least squares regression, wLnINVESTOSALES is dependent variable
(3) Survey-weighted logit regression, INVESTS is dependent variable
(4) Survey-weighted Probit regression, INVESTS is dependent variable
(5) Survey-weighted Tobit regression, wLnINVESTOSALES is dependent variable

Figure 4.12. 2003 NSSBF: Comparative Regressions across OLS, SWLS, Logit, Probit and Tobit estimation

	(1)	(2)	(3)	(4)
VARIABLES	Svy Probit	Svy Probit	Svy Tobit	Svy Tobit
GROWTH	-0.0498	-0.0435	-0.0189	-0.0182
	(0.0727)	(0.0726)	(0.0133)	(0.0133)
OWNMGR	-0.220**	-0.255**	-0.0293*	-0.0350**
	(0.110)	(0.108)	(0.0174)	(0.0173)
wLnOWNERS	0.366***		0.0545***	
	(0.0512)		(0.00887)	
RELLENGTH	0.000315	0.000405	4.78e-05	6.61e-05
	(0.000330)	(0.000332)	(5.99e-05)	(6.00e-05)
RELNUM	0.117***	0.121***	0.0177***	0.0182***
	(0.0205)	(0.0204)	(0.00337)	(0.00336)
wLnCASHTOSALES	-0.0777	0.00819	0.0525	0.0663
	(0.234)	(0.237)	(0.0497)	(0.0509)
wLnEXTDEBTRATIO	-0.117**	-0.107*	-0.0214**	-0.0197*
	(0.0574)	(0.0568)	(0.0105)	(0.0104)
wLnDIVERSE	4.913***	5.302***	0.836***	0.914***
	(1.304)	(1.299)	(0.235)	(0.234)
MANUFACTURING	-0.0242	0.0103	-0.0186	-0.0135
	(0.140)	(0.139)	(0.0245)	(0.0242)
TRANSPORTATION	-0.130	-0.129	-0.0180	-0.0182
	(0.196)	(0.193)	(0.0387)	(0.0386)
WHOLESALE	0.194	0.194	0.00404	0.00527
	(0.139)	(0.139)	(0.0226)	(0.0225)
RETAIL	-0.167	-0.167	-0.0413**	-0.0415**
	(0.115)	(0.114)	(0.0208)	(0.0208)
SERVICES	-0.0758	-0.0707	-0.0202	-0.0190
	(0.0990)	(0.0985)	(0.0185)	(0.0184)
OWNSHR		-0.00734***		-0.00119***
		(0.00128)		(0.000237)
Constant	-12.08***	-12.21***	-2.060***	-2.115***
	(2.886)	(2.869)	(0.525)	(0.521)
Observations	3561	3561	3561	3561
F statistic	11.14	9.136	8.748	7.312
Prob > F	0	0	0	0
Model df	13	13	13	13

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) Survey-weighted Probit regression, minus OWNSHR
(2) Survey-weighted Probit regression, minus LnOWNERS
(3) Survey-weighted TOBIT regression, minus OWNSHR
(4) Survey-weighted Tobit regression, minus LnOWNERS

Figure 4.13. 1998 NSSBF: Probit and Tobit estimations with selected variables dropped

VARIABLES	(1) Svy Probit	(2) Svy Probit	(3) Svy Tobit	(4) Svy Tobit
GROWTH	-0.0818	-0.0840	-0.0205	-0.0209
	(0.0750)	(0.0744)	(0.0179)	(0.0178)
OWNMGR	-0.132	-0.206	-0.0486	-0.0660*
	(0.130)	(0.127)	(0.0350)	(0.0348)
wLnOWNERS	0.427***		0.0925***	
	(0.0601)		(0.0150)	
RELLENGTH	0.000728***	0.000775***	0.000128**	0.000143**
	(0.000274)	(0.000272)	(6.46e-05)	(6.52e-05)
RELNUM	0.163***	0.166***	0.0324***	0.0333***
	(0.0202)	(0.0201)	(0.00493)	(0.00492)
wLnCASHTOSALES	-0.140	-0.111	0.0556	0.0617
	(0.220)	(0.218)	(0.0589)	(0.0589)
wLnEXTDEBTRATIO	0.0313	0.0690	0.00663	0.0153
	(0.0766)	(0.0733)	(0.0195)	(0.0191)
wLnDIVERSE	0.899***	1.042***	0.222***	0.256***
	(0.342)	(0.342)	(0.0816)	(0.0823)
MANUFACTURING	-0.129	-0.0927	-0.0472	-0.0386
	(0.164)	(0.160)	(0.0360)	(0.0349)
TRANSPORTATION	-0.0253	-0.0108	0.00201	0.00364
	(0.190)	(0.186)	(0.0454)	(0.0448)
WHOLESALE	0.144	0.153	0.0201	0.0218
	(0.146)	(0.146)	(0.0324)	(0.0327)
RETAIL	-0.240**	-0.246**	-0.0588**	-0.0611**
	(0.118)	(0.117)	(0.0272)	(0.0272)
SERVICES	-0.141	-0.137	-0.0267	-0.0262
	(0.102)	(0.102)	(0.0240)	(0.0239)
OWNSHR		-0.00873***		-0.00195***
		(0.00140)		(0.000355)
Constant	-2.377***	-1.567***	-0.545***	-0.368***
	(0.295)	(0.309)	(0.0795)	(0.0804)
Observations	4240	4240	4240	4240
F statistic	16.51	14.74	9.595	8.794
Prob > F	0	0	0	0
Model df	13	13	13	13

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) Survey-weighted Probit regression, minus OWNSHR
(2) Survey-weighted Probit regression, minus LnOWNERS
(3) Survey-weighted TOBIT regression, minus OWNSHR
(4) Survey-weighted Tobit regression, minus LnOWNERS

Figure 4. 14. 2003 NSSBF: Probit and Tobit estimations with selected variables dropped

4.7 Contributions to the Literature

This study has contributed to the literature on small firm capital structure and investment in a number of ways. First, this study has taken advantage of unique data available in the NSSBF survey databases that reports the specific non-core investments made by a small firm, along with balance sheet and income statement data, and data on firm organization, structure and management. This provided a unique opportunity to model the small firm investment decision as a function of variables that typically proxy for agency costs and their moderation, and to test empirical hypothesis implied by the Jensen and Meckling agency theory, and by the Free Cash Flow theory of Jensen.

Second, this study extends the results of Danielson and Scott (2007) on the small firm overinvestment decision through the use of quantitative investment data from balance sheets of small U.S. firms. The lack of data on the small firm's use of debt and the author's requirement to model the overinvestment decision of the firm using management's belief as the dependent variable rather than financial data on actual firm investments were limitations acknowledged by those authors. In this study, balance sheet data on other investments is used to study the determinants of overinvestment and address the limitations of the Danielson and Scott paper.

Third, the NSSBF surveys used for this study provide a unique opportunity to relate the degree of the primary owner's commitment of wealth to the firm, to the firm's other investments. This presented an opportunity to investigate a personal diversification motive as the reason for the small firm's investment in non-core investments. It appears that this approach is unique to this study.

Fourth, this study separately utilized both the 1998 and 2003 NSSBF surveys for model estimation. The results of these separate estimations lent themselves to interpretation of some of the results in the context of the macroeconomic environment in which the data was collected. The year 1998 was near the peak of a large economic expansion in the U.S., while the year 2003 was at the end of a brief recession in the U.S. Comparisons between the results of the two survey estimations provided an additional dimension to the analysis that has not previously been undertaken.

CHAPTER V

DATA: THE NATIONAL SURVEYS OF SMALL BUSINESS FINANCE

The 1998 and 2003 National Survey of Small Business Finance (NSSBF) databases are the two samples used for each of the three essays in this dissertation. These databases represent surveys of U.S. small businesses, obtained during 1998 and 2003, and which include financial statement data for those years, as well as answers to questions about sources of firm finance, firm structure and organization, management characteristics, and firm demographic data. The potential advantage of using these two databases is that they sample the state of small U.S. businesses during two very different economic climates; during an economic expansion (1998) and at the end of a recession (2003). This may facilitate comparisons between firm capital structure during different macroeconomic climates.

5.1 1998 NSSBF Database

The 1998 NSSBF database is a two-stage stratified, non-proportional random sample of the approximately 5.3 million small firms in operation as of year-end 1998. To quote the 1998 NSSBF codebook[4],

[4] Available at: http://www.federalreserve.gov/pubs/oss/oss3/ssbf98/codebook98.pdf .

> *"The target population is the population of all for-profit, nonfinancial, nonfarm, non-subsidiary business enterprises that had fewer than 500 employees and were in operation as of year-end 1998"*

The initial sample frame is divided into 91 strata along the dimensions of owner race, geographic region, urban/rural MSA and total employees.[5] The sample contains 3,561 firm observations, each of which is assigned a weight that reflects that firm's representation in the population of small firms, taking into account sample design, firm eligibility and survey non-response. The variable FIN_WGT is used for observation weights and the variable NEWSTRAT is used for the stratum identifier.

Characteristic of survey data, there were some missing data items in some of the survey responses (observations) in 1998 NSSBF database. Quoting the 1998 NSSBF codebook:

> *"About 0.78% of all values collected were missing. Fifty-four percent of the observations had no missing values; 90 percent of all observations had less than one percent of the values missing, and 95 percent of the observations had less than 3 percent missing."*

Single imputation methods were used to create values for missing variables in the survey database. Missing numeric variables and variables that could be characterized by Yes/No responses were imputed using a linear regression procedure. Missing categorical variables were imputed using a randomized hot-deck procedure. Note that the imputation procedure did not address those questions for which the response was coded ".S", which means the question was legitimately skipped or not applicable.

[5] For a complete description of the sampling methodologies for the 1998 and 2003 NSSBF surveys, refer to their Methodology Reports which are available at http://www.federalreserve.gov/pubs/oss/oss3/nssbftoc.htm .

5.2 2003 NSSBF Database

The 2003 NSSBF database is a two-stage stratified, non-proportional random sample of the approximately 6.3 million small firms in operation in December 2003. To quote the NSSBF 2003 codebook:

> *"The target population is the population of all for-profit, nonfinancial, nonfarm, non-subsidiary business enterprises that had fewer than 500 employees and were in operation as of year-end 2003 and on the date of the interview."*

Stratification of the 2003 database is done along the dimensions of census region, urban/rural MSA and total employment size. The sampling frame is divided into 72 strata by these dimensions. The sample contains 4,240 firm observations, each of which is assigned a weight that reflects that firm's representation in the population of small firms, taking into account sample design, firm eligibility and survey non-response. The variable FIN_WGT is used for the observation weights, and the variable A0_STRATUM is used for the stratum identifier.

Characteristic of survey data, there were some missing data items in some of the survey responses (observations) in the 2003 NSSBF database. Quoting the 2003 NSSBF codebook:

> *"About 1.8% of all values collected were missing. Thirty percent of the observations had no missing values; 65 percent of all observations had less than one percent of the values missing, and 79 percent of the observations had less than 3 percent missing."*

Unlike the 1998 NSSBF database where single imputation methods were used to create values for missing variables, the 2003 NSSBF database uses multiple imputation methods to create five "implicates" for each of the 4,240 respondent firms in the sample, for a total of 21,200 observations in the database. Across each of the five implicates for any firm, the values of all non-missing variables for that firm are identical, though the imputed

values for the missing variables will differ slightly. The differences reflect the uncertainty introduced by the imputation methodology that uses statistical modeling to "predict" the missing values using non-missing data as input to the models.

Both the 2003 NSSBF Codebook and Little and Rubin (2002, pg 85) recommend estimating each of the five sets of implicates separately, then combining the resulting parameter estimates and their standard errors into one estimate for each parameter, using the procedure described in Little and Rubin, and available in SAS and STATA.

5.3 Mapping Study Variables to Database Variables

Table 5.1 below provides the mapping between the variables in the 1998 and 2003 NSSBF databases, and the variables used in the analyses performed in the three essays. Where a study variable is actually calculated as combination of database variables, the expression by which it is calculated is given.

Table 5.1

Variable Mapping

Study Variable	1998 NSSBF Variable(s)	2003 NSSBF Variable(s)
CASHTOASSETS	R1 / R12	R1 / R12
CASHTOSALES	R1 / P2	R1 / P2
CURLIBTOSALES	(S2 + S3) / P2	(S2 + S3) / P2
DBSCORE	DB_SCORE	A0_DB_CREDRK (scale reversed to match 1998 order)
DEBTRATIO	S8 / R12	S8 / R12
EXTDEBTRATIO	(S8 - F41) / R12	(S8 - F41) / R12
DEBTTOASSETS	(S1 + S2 + S3) / R12	(S1 + S2 + S3) / R12
DENIEDCREDIT	L13=1	L13=1
DIVERSE	OWNEQUITY/(OWNWORTH+OWNEQUITY)	OWNEQUITY/(OWNWORTH+OWNEQUITY)
EXTDEBTTOASSETS	(S1 – F41 + S2 + S3) / R12	(S1 – F41 + S2 + S3) / R12
FAMOWN	C_FAM=1	CF_FAMILY=1
FEARDENIAL	MRL31=1	MRL31=1
FEMOWN	C_SEX=1	CF_FEMALE > 50
FIRMAGE	C_FAGE	CF_FAGE
FIRMDISTRESS	U1_1 = 1 or U1_1 = 3 or U3 > 1	U1 = 1 or U3 = 1

GROWPROB	D6=14	A0_FIRMPROB=13
GROWTH	P2 > P3	P3=1
INHERITED	C_ESTR=3	CF_ESTAB=3
INVRATIO	R3/R12	R3/R12
MAININST	HLR_1	H1
MAINSUPL	L8=1	L8=1
MINOWN	C_MINOR=1	CF_MINOR > 50
OFFEREDTCD	L4 > 0	L6 > 0
OPEXTOSALES	P5 / P2	P5 / P2
OTRINCTOSALES	P4 / P2	P4 / P2
OWNDISTRESS	U1_1 = 2 or U1_1 = 3 or U2 > 1 or U4 = 1	U4 = 1 or U6 = 1
OWNEDU	C_EDUC	CF_EDUC
OWNEQUITY	EQUITY x (OWNSHR/100)	EQUITY x (OWNSHR/100)
OWNERS	C_NOW	CF_OWNERS
OWNEXP	C_EXP	CF_EXPER
OWNMGR	C_MGR=1	CF_MANAGE=1
OWNSHR	C_OWNSH	C_SHARE_1
OWNWORTH	U_NETW + U_HEQ	U_NETW + U_HEQ
OWNWORTHTOSALES	(U_NETW + U_HEQ) / P2	(U_NETW + U_HEQ) / P2
PAIDLATE	L6=1	L4=1
PASSTHRU	B3=2 or B3=3 or B3=7	B3=2 or B3=3 or B3=7
PCACCTNG	D5_7=1	D5T8=1
PCTDISCOUNTS	L5	L7
PROFITABLE	PROFIT > 0	PROFIT > 0
PROFTOINCOME	PROFIT / (P2 + P4)	PROFIT / (P2 + P4)
PROFTOSALES	PROFIT / P2	PROFIT / P2
PURCHASED	C_ESTR=2	CF_ESTAB=2
QUICKRATIO	(R1 + R2) / (S2 + S3)	(R1 + R2) / (S2 + S3)
CASHRATIO	R1 / (S2 + S3)	R1 / (S2 + S3)
ARRATIO	R2 / (S2 + S3)	R2 / (S2 + S3)
RELDIST	Value of IDIST1-20 for MAININST	Value of IH7_1=20 for MAININST
RELLENGTH	Max of IMONS1-20 for MAININST	Max of IH4_1-20 for MAININST
RELNUM	Sum of "1" for each non-missing IMONS1-20	Sum of "1" for each non-missing IH4_1-20
SALES	P2	P2
TOTEMP	TOTEMP	TOTEMP
TRADECREDIT	L1=1	L1=1
USEDCARD	F1=1 or F4=1	F1=1 or F4=1
USEDGRACE	F3=1 or F6=1	F3=1 or F6=1
UNUSEDLOC	((f10_1 - f11_1) + (f10_2 - f11_2) + (f10_3 - f11_3)) / R12	((f10_1 - f11_1) + (f10_2 - f11_2) + (f10_3 - f11_3)) / R12

CHAPTER VI

EMPIRICAL METHODOLOGY

This chapter describes the common empirical methodology that is used for all three essays. Additions to or deviations from this methodology are described in the individual essays.

6.1 Implications of Survey Design

The fact that both the 1998 and 2003 NSSBF databases are stratified samples rather than simple random samples requires that special consideration be made of the impact of the sample design on statistical estimation, in order to ensure that inferences made regarding the population from which the sample was drawn are correct. In a simple random sample (SRS), every observation of every sample is drawn with equal probability from an infinite population (or one that is very large relative to the sample) and shares the same selection probability. However, complex survey designs utilize clustering and stratification schemes to guide the creation of samples, motivated by a desire to reduce the cost of gathering survey data and to facilitate the calculation of descriptive statistics for specific subgroups of the population (Kish 1965). Observations in survey samples do not share the same selection probability, but have probabilities that are functions of the sample design, adjusted for eligibility and non-response. Each observation in a survey

sample is assigned a *survey weight*, which represents the number of units in the population that the sample observation represents, and is proportional to the inverse of the observation's selection probability (Korn and Graubard, 1995).

That the use of survey weights and consideration of sample design are essential to obtain unbiased estimates of descriptive statistics such as totals, means, and frequencies for a population from a survey sample is well-understood and universally accepted. Excellent treatments of the statistical analysis methods required for estimating these values for complex survey designs can be found in Cochran (1977) and Kish (1965).

The same unanimity of opinion does not exist with regard to the use of survey weights in the estimation of a linear regression model, however. The fundamental question that has been debated by statisticians can be summarized as: under what circumstances does the sample design strategy impact the assumptions of the classical linear model underlying Ordinary Least Squares (OLS) regression such that unweighted OLS estimators are no longer BLUE, requiring that other estimation methods be used that incorporate survey weights to estimate unbiased and consistent regression coefficients? A brief exposition of the core issues will serve to illuminate this debate.

Assume that the population-generating model to be estimated from the stratified sample data is of the form

$$\mathbf{Y} = \boldsymbol{\beta}\mathbf{X} + \boldsymbol{\varepsilon} \qquad \textbf{(1)}$$

where $\mathbf{Y}$ is a vector of responses, $\mathbf{X}$ is an array of predictors, $\boldsymbol{\beta}$ is a vector of regression coefficients and $\boldsymbol{\varepsilon}$ is an array of random errors. Also assume that there exists an array of stratification variables $\mathbf{J}$ that define the strata and may or may not be included in the

model. The ongoing debate is over which estimator will provide unbiased and efficient estimates of the regression coefficients, the unweighted OLS estimator given by

$$\boldsymbol{\beta_{OLS} = (X'X)^{-1}X'Y} \quad \textbf{(2)}$$

or the weighed OLS estimator given by

$$\boldsymbol{\beta_{WGT} = (X'WX)^{-1}X'WY} \quad \textbf{(3)}$$

where **W** is an array containing the survey weights for each observation along the diagonal. In general, when the sample under consideration has non-constant survey weights then β_{OLS} for model (1) above can be shown to be biased and inconsistent while β_{WGT} is unbiased and consistent, under certain circumstances.

According to DuMouchel and Duncan (1983), the conditions that must be met in order for the unweighted OLS estimators to be BLUE are that the mean and variance of **ε**, conditional upon **X** and **J**, must be independent of **X** and **J**. (The other assumptions of the classical linear model must also hold.) Note that the conditions above imply that both the independent model variables and the stratification variables must be exogenous to the model being estimated, a condition which Wooldridge (2003) has also indicated is, along with the other classical assumptions, sufficient to ensure that the unweighted OLS estimators are BLUE.

Carrington, Eltinge and McCue (2000) show that if the survey weights are a simple linear combination of the stratification variables, and if all stratification variables are included in the model and if all other classical assumptions hold, then the unweighted OLS estimators are preferred. Including the stratification variables in the model provides insurance against omitted variable bias that would be caused if the stratification variables were correlated with any of the other independent variables of the model. However, if

the stratification variables are unknown, are unavailable or if the relationship between the survey weights and stratification variables is complex, then weighted OLS estimators are preferred. Furthermore, one of the properties of $\boldsymbol{\beta}_{\mathbf{WGT}}$ that may make it preferable over $\boldsymbol{\beta}_{\mathbf{OLS}}$ is that it is consistent in the face of misspecification of the model, while $\boldsymbol{\beta}_{\mathbf{OLS}}$ may not be. Since omitted variables and model misspecification are problems that are difficult to avoid in practice, using the weighted OLS estimator can be viewed as the "safe" alternative, although at a cost of higher standard errors of the estimated coefficients than would be obtained with the unweighted OLS estimator.

After several decades of debate among knowledgeable statisticians and practitioners over which approach is best, the world had divided into two camps on this subject: the *model-based* strategy camp and the *design-based* strategy camp.

The adherents of the model-based strategy insist that as long as the regression model is not seriously misspecified, then OLS will produce BLUE estimators of regression coefficients and their standard errors and should not be forsaken for other estimation methods. They point out that the cost of using survey weights in the estimation of regression coefficients and their standard errors is higher standard errors than one would obtain with OLS, which will impact hypothesis testing using those standard errors and may cause Type II errors when using t-tests to test the significance of regression coefficients. Followers of this strategy focus upon the model, ensuring that stratification variables are included if necessary to avoid omitted variable bias.

On the other hand, the adherents of the design-based strategy advocate specifying a model based only on the economic theory underlying the process that generates the population under study then apply statistical methods that incorporate the survey weights

into the calculation of the coefficient estimates and their standard errors. They point out the difficulty of perfectly specifying any model and insist that only regression estimation techniques that take into account the sample design will produce unbiased and consistent estimators of regression coefficients for the population. Statistical software packages readily available on personal computers today contain routines for calculating statistics for complex survey samples.

Reiter, Zanutto and Hunter (2005) provide an informative overview of these two strategies and apply both strategies to the estimation of two econometric models, highlighting the advantages and disadvantages of both approaches to the practitioner. In a frequently-cited paper on the subject, DuMouchel and Duncan (1983) provide guidance to practitioners regarding the conditions under which one strategy would be favored over another.

This dissertation utilizes the design-based approach to model specification and estimation. Survey-weighted linear regression routines are available in the current versions of SAS and STATA, among other software packages, making this type of analysis straightforward. Furthermore, as suggested by Winship and Radbill (1994), using weighted OLS with robust standard errors can be used in place of survey-weighted regression routines if necessary.

Tables 6.1 and 6.2 contain comparison regressions between OLS, OLS with robust errors, weighted OLS with robust errors and survey-weighted least-squares with standard errors calculated using the Taylor linearization algorithm, for the Trade Credit Discounts model of the first essay using the 1998 and 2003 surveys respectively. For the 2003 survey, only implicate #3 is used in the regressions in table 4.1.2, rather than the

full multiple imputation method using all five implicates for each firm, as it is not necessary to have the full imputation to obtain the comparison between regression methods.

In both tables, it is very clear that both OLS (column 1) and OLS with robust errors (column 2) provide almost identical results, which are much different than the results for weighted OLS with robust errors (column 3) and survey-weighted least squares (column 4), which are almost identical. Clearly, use of survey weights has a profound effect on the magnitude of the point estimates for the regression coefficients, which suggests that they survey design is not ignorable. Furthermore, in most cases, the signs and degree of significance of the estimated coefficients are the same across all regressions, though the coefficient magnitudes change from non-weighted to weighted regression. What is clear from these tables is that (a) using survey weights in the regression estimation matters, and (b) weighted OLS (WLS) with robust errors (column 3) is a satisfactory substitute for survey-weighted LS (column 4).

Table 6.1

Comparative regressions for Trade Credit Discounts model: 1998 NSSBF sample

(PCTDISCOUNTS is the dependent variable)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	Robust OLS	Robust WLS	Survey-weighted
FEMOWN	7.194**	7.194*	8.648**	8.648**
	(3.651)	(3.778)	(4.109)	(4.070)
MINOWN	-12.53**	-12.53**	-16.34***	-16.34***
	(4.942)	(4.938)	(5.881)	(5.819)
OWNEXP	0.350***	0.350***	0.626***	0.626***
	(0.118)	(0.113)	(0.142)	(0.140)
OWNEDU	1.090	1.090	0.811	0.811
	(0.704)	(0.711)	(0.873)	(0.860)
PCACCTNG	5.306	5.306	12.14**	12.14**
	(4.426)	(4.496)	(5.115)	(5.070)
MAINSUPL	9.723***	9.723***	13.47***	13.47***
	(2.535)	(2.564)	(3.320)	(3.279)
MANUFACTURING	-17.47***	-17.47***	-7.877	-7.877
	(4.094)	(4.075)	(5.256)	(5.192)

TRANSPORTATION	2.915	2.915	-0.0958	-0.0958
	(7.361)	(7.514)	(10.43)	(10.31)
WHOLESALE	-1.622	-1.622	-2.421	-2.421
	(4.618)	(4.564)	(5.525)	(5.469)
RETAIL	-0.702	-0.702	1.299	1.299
	(4.050)	(3.929)	(4.880)	(4.816)
SERVICES	-6.193	-6.193	-1.512	-1.512
	(3.924)	(3.999)	(4.736)	(4.691)
OWNSHR	0.0333	0.0333	0.0837	0.0837
	(0.0590)	(0.0568)	(0.0784)	(0.0776)
OWNMGR	-1.238	-1.238	-1.745	-1.745
	(3.416)	(3.489)	(4.793)	(4.747)
LnOWNERS	2.304	2.304	4.533*	4.533*
	(1.652)	(1.529)	(2.480)	(2.457)
USEDCARD	-13.07***	-13.07***	-12.98**	-12.98**
	(4.965)	(4.883)	(5.493)	(5.418)
USEDGRACE	11.95***	11.95***	13.34***	13.34***
	(4.215)	(4.045)	(4.668)	(4.607)
LnUNUSEDLOC	3.523	3.523	4.739	4.739
	(5.155)	(4.624)	(4.728)	(4.666)
LnQUICKRATIO	8.994*	8.994	17.11***	17.11***
	(5.407)	(6.759)	(6.547)	(6.472)
LnPROFTOINCOME	9.607*	9.607**	16.92***	16.92***
	(5.276)	(4.805)	(5.623)	(5.562)
RELLENGTH	0.0134	0.0134	0.00830	0.00830
	(0.0123)	(0.0120)	(0.0150)	(0.0148)
RELNUM	-0.922	-0.922	-2.313**	-2.313**
	(0.649)	(0.644)	(1.013)	(1.001)
LnRELDIST	-1.151	-1.151	-1.424	-1.424
	(0.926)	(0.974)	(1.239)	(1.224)
DBSCORE	-6.326***	-6.326***	-4.102***	-4.102***
	(1.143)	(1.133)	(1.472)	(1.457)
PAIDLATE	-12.76***	-12.76***	-12.90***	-12.90***
	(2.669)	(2.780)	(3.453)	(3.411)
LnDEBTRATIO	-1.066	-1.066	2.759	2.759
	(3.583)	(3.722)	(4.005)	(3.963)
Constant	-7.027	-7.027	-88.73**	-88.73***
	(30.92)	(32.66)	(34.74)	(34.34)
Observations	1138	1138	1138	3243
R-squared	0.169	0.169	0.183	0.183
Adjusted R2	0.150	0.150	0.165	
Model SS	381804	381804	406595	
Residual SS	1.877e+06	1.877e+06	1.811e+06	
Model df	25	25	25	25
Residual df	1112	1112	1112	3166
F statistic	9.048	13.50	10.27	10.43
Number of strata				77
Population size				4.462e+06
Subpopulation size				1138

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) OLS regression
(2) OLS with robust std errors
(3) Weighted OLS(WLS)with robust std errors
(4) survey-weighted least squares with std errors calculated using Taylor Linearization algorithm

Table 6.2

Comparative regressions for Trade Credit Discounts model: 2003 NSSBF sample

(PCTDISCOUNTS is the dependent variable)
(using Implicate # 3 only)

VARIABLES	(1) OLS	(2) Robust OLS	(3) Robust WLS	(4) Survey-weighted
FEMOWN	-1.738	-1.738	0.361	0.361
	(3.348)	(3.473)	(5.315)	(5.257)
MINOWN	-7.477	-7.477	-7.698	-7.698
	(5.081)	(5.502)	(7.535)	(7.468)
OWNEXP	0.108	0.108	-0.0612	-0.0612
	(0.105)	(0.108)	(0.149)	(0.148)
OWNEDU	1.462**	1.462**	1.183	1.183
	(0.610)	(0.613)	(0.914)	(0.905)
PCACCTNG	6.414	6.414	1.472	1.472
	(4.642)	(5.031)	(6.144)	(6.103)
MAINSUPL	6.046***	6.046***	7.032**	7.032**
	(2.177)	(2.174)	(3.287)	(3.267)
MANUFACTURING	-5.917*	-5.917*	-8.021	-8.021*
	(3.438)	(3.352)	(4.879)	(4.838)
TRANSPORTATION	-5.762	-5.762	-9.860	-9.860
	(5.626)	(5.651)	(9.253)	(9.188)
WHOLESALE	3.146	3.146	1.516	1.516
	(4.108)	(4.015)	(5.902)	(5.857)
RETAIL	8.272**	8.272**	10.14**	10.14**
	(3.407)	(3.360)	(4.973)	(4.955)
SERVICES	0.772	0.772	3.009	3.009
	(3.358)	(3.382)	(4.926)	(4.897)
OWNSHR	-0.0346	-0.0346	0.0265	0.0265
	(0.0560)	(0.0569)	(0.0898)	(0.0891)
OWNMGR	2.673	2.673	-4.885	-4.885
	(3.084)	(3.111)	(5.148)	(5.090)
LnOWNERS	0.547	0.547	-1.218	-1.218
	(1.884)	(1.860)	(2.847)	(2.817)
USEDCARD	-15.28***	-15.28***	-13.76**	-13.76**
	(4.519)	(4.407)	(5.643)	(5.594)
USEDGRACE	8.947**	8.947**	9.840**	9.840**
	(3.662)	(3.622)	(4.590)	(4.548)
LnUNUSEDLOC	4.755	4.755	6.258	6.258
	(4.600)	(5.360)	(6.309)	(6.253)
LnQUICKRATIO	-2.394	-2.394	7.621	7.621
	(4.500)	(4.495)	(5.682)	(5.622)
LnPROFTOINCOME	1.911	1.911	-9.144	-9.144
	(6.180)	(4.852)	(8.677)	(8.611)
RELLENGTH	0.0198**	0.0198***	0.0368***	0.0368***
	(0.00820)	(0.00762)	(0.0127)	(0.0126)
RELNUM	-0.0435	-0.0435	-0.603	-0.603
	(0.522)	(0.534)	(0.850)	(0.844)
LnRELDIST	-0.0609	-0.0609	-0.617	-0.617
	(0.772)	(0.768)	(1.106)	(1.098)
DBSCORE	-6.391***	-6.391***	-4.514***	-4.514***
	(0.759)	(0.745)	(1.101)	(1.092)

PAIDLATE	-17.54***	-17.54***	-19.71***	-19.71***
	(2.299)	(2.389)	(3.634)	(3.603)
LnDEBTRATIO	-4.827*	-4.827	0.611	0.611
	(2.835)	(3.177)	(4.105)	(4.073)
Constant	70.15*	70.15**	86.73	86.73
	(40.22)	(34.22)	(54.70)	(54.28)
Observations	1478	1478	1478	3905
R-squared	0.188	0.188	0.195	0.195
Adjusted R2	0.174	0.174	0.181	
Model SS	552690	552690	566084	
Residual SS	2.384e+06	2.384e+06	2.340e+06	
Model df	25	25	25	25
Residual df	1452	1452	1452	3833
F statistic	13.47	16.45	8.922	8.957
Number of strata				72
Population size				5.524e+06
Subpopulation size				1478

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(1) OLS regression
(2) OLS with robust std errors
(3) Weighted OLS (WLS) with robust std errors
(4) SWLS with std errors calculated using Taylor Linearization algorithm

6.2 Data Transformation

The distributions for most of the numeric variables in the 1998 and 2003 NSSBF databases show a high degree of skewness and kurtosis. This asymmetry can be caused by outliers, can be a symptom of heteroskedasticity or can be a natural characteristic of the data. For stratified survey data, the non-random design of the sample can induce heteroskedasticity in the residuals of an OLS regression. In any case, such an extreme departure from normality among the independent variables used in an OLS regression can have a detrimental effect on the normality of the OLS residuals and the tests of significance for the regression coefficients. In order to remedy this and bring the distribution for each independent variable closer to normal, a natural logarithmic transformation will be applied to each independent variable that exhibits excessive skewness and kurtosis. This transform is of the form

$$\mathbf{x_T = \ln(x_U - \min(x_U) + 1)}$$

where $\mathbf{x_T}$ is the transformed variable and $\mathbf{x_U}$ is the untransformed variable, first shifted to be zero-based before being transformed. A "1" is added to each shifted but untransformed variable to ensure that the base value of the transformed variable is zero, since natural log is not defined for real numbers of zero or less, and is identically zero when x=1.

This logarithmic transform is effective on distributions with positive skewness. Since most of the independent variables in this study exhibit positive skewness, the transformation can be applied directly without first reflecting the variable through the origin. Variables that exhibit negative skewness will first be reflected through the origin, transformed as described above, the re-reflected to restore their original order. The logarithmic transform has a powerful effect on converting asymmetric data distributions with positive skewness to near normality (Osborne 2002).

Application of this data transformation will have little effect on the interpretation of the regression analysis results. Transforming the independent variables from levels to logs will mean that one will have to interpret the regression coefficients as the effect of unit changes in the log of the independent variable rather than unit changes in the level of the independent variable; in other words, as elasticities. However, since all hypotheses are related to the sign of the relationship between the predictors and the response variable, only the sign of the regression coefficients, their statistical significance and their relative economic significance (magnitude) will be examined. No attempt will be made to interpret the absolute values of the coefficients themselves.

6.3 Data Cleanup and Winsorization

The authors of the codebooks for the 1998 and 2003 NSSBF databases caution that despite their best attempts to screen the data and ensure its accuracy, it is likely that there are influential data points that escaped their scrutiny. They suggest that users of these databases carefully examine the variables selected for analysis to ensure that no such points contaminate their analysis.

Before performing any other analysis of the data, the variables will be screened to detect data that is obviously not consistent with the values expected for a going concern. In particular, firms with zero or negative total income for the most recent fiscal year, zero or negative total assets, and zero or negative sales for the most recent fiscal year will be excluded from analysis. This will be done by setting the survey weight (FIN_WGT) to zero for those firm observations, but the observations themselves will not actually be dropped from the sample. This is consistent with Lee and Forthofer (2006, pg. 41) who explain that the entire survey sample is required to calculate the variance of the point estimates correctly, though the point estimates themselves will not include the zeroed observations. Note that 120 observations (out of 3561 total) in the 1998 NSSBF are excluded, and 627 observations (out of 21200 total) in the 2003 NSSBF are excluded, due to failure to meet the going concern criteria specified above.

Table 6.3 shows descriptive statistics for the numeric variables from the 1998 NSSBF that are used in the three essays of this paper. Comparing the untransformed variables with their logarithmically transformed versions shows that the logarithmic transform does reduce skewness and kurtosis of the variables and brings them closer to normality. Unfortunately, the transform alone is not enough. When examining the

transformed data, it is clear that outliers in the distribution tails are contributing to the non-normality. In order to correct this, each transformed variable that has skewness or kurtosis in double-digits or higher has its high and low tails Winsorized at 1 percent. (That is to say, values that fall within the 1st through 99th percentiles of the variable's range are NOT Winsorized.) The results of this are shown in table 6.4. Note that Winsorizing at 1 percent is successful in reducing the skewness and kurtosis of each variable to substantially less than 100.

Table 6.3

1998 NSSBF - Descriptive statistics for numeric variables

variable	N	mean	sd	min	max	skewness	kurtosis
PCTDISCOUNTS	1455	57.0646	44.43622	0	100	-.2864114	1.251038
OWNEXP	3441	19.3034	11.7323	0	72	.7947106	3.563414
OWNSHR	3441	80.14356	27.3181	1	100	-.9245613	2.458574
OWNERS	3441	6.293229	70.96166	1	2500	25.01649	713.5992
UNUSEDLOC	3435	.4351921	7.701558	0	335	35.53861	1384.729
QUICKRATIO	2303	8.447221	67.82369	-16	2844.954	33.45103	1346.478
RELLENGTH	3369	96.49688	99.89383	0	780	2.237469	9.51499
RELNUM	3441	2.405987	1.73606	0	20	2.184701	12.61181
PROFTOSALES	3441	.03585	2.736796	-101.5784	3.166757	-30.00113	1063.251
PROFTOINCOME	3441	.0614868	2.090686	-99	1	-33.61023	1494.567
DEBTRATIO	3441	1.183149	10.65533	0	300	21.04348	495.4953
LnOWNWORTH~S	3441	8.658844	.0159623	8.645469	9.099521	21.32176	513.3404
LnUNUSEDLOC	3435	.1019281	.3348003	0	5.817111	7.906081	92.15885
LnTOTEMP	3441	1.938578	1.554581	0	6.177944	.6387706	2.426204
LnEXTDEBTT~S	3441	2.573864	.2219167	0	6.825388	9.116327	140.4944
LnFIRMAGE	3441	2.463372	.7817523	0	4.65396	-.191188	2.423435
LnOWNERS	3441	.4722863	.8270663	0	7.824046	3.262901	18.99913
LnRELDIST	3369	1.480081	1.355391	0	8.087641	1.803016	7.523452
LnSALES	3441	12.70946	2.297985	4.330733	20.25166	.0187466	2.999641
LnDEBTTOAS~S	3441	.4877584	.6184787	0	6.813151	3.311555	21.14484
LnDEBTRATIO	3441	.3210239	.5405812	0	5.70711	4.0402	27.30575
LnCASHTOSA~S	3441	2.901952	.0201152	2.572988	3.466804	10.56124	267.2516
LnCASHTOAS~S	3441	2.255416	.0486456	0	2.335375	-28.74287	1344.681
LnINVESTOS~S	3441	.025532	.1040132	0	2.689221	15.5671	320.8143
LnCURLIBTO~S	3441	.0900608	.17666	0	2.397895	4.676205	38.39858
LnOPEXTOSA~S	3441	.59829	.3086261	0	4.670663	3.997602	38.93404
LnQUICKRATIO	2303	3.48847	.316317	2.518233	7.963237	5.570422	46.38817
LnARRATIO	2303	1.153385	.6988189	0	7.951091	3.314146	18.92151
LnOTRINCTO~S	3441	.2644093	.102872	0	3.802733	16.4784	447.9679
LnPROFTOSA~S	3441	3.605113	.1313835	.8238181	4.203495	-9.603667	153.8676
LnPROFTOIN~E	3441	4.221302	.2910459	.1948795	4.81	-3.406163	31.71786
LnCASHRATIO	2303	3.434758	.2076993	2.449088	5.93695	5.744133	46.6338
LnOTRRATIO	2303	.2975787	.6000102	0	5.194795	4.075874	22.31822
LnTAXTOSALES	868	1.627487	.0706025	0	2.713252	-9.324826	395.0312
LnDEPRTOAS~S	3441	.2671958	.216661	0	.9358733	.5389856	1.978895

Table 6.4

1998 NSSBF - Descriptive statistics for Winsorized numeric variables

variable	N	mean	sd	min	max	skewness	kurtosis
wLnOWNWORT~S	3441	8.658068	.0031335	8.657129	8.682423	6.142843	43.99415
wLnUNUSEDLOC	3435	.0912827	.2392581	0	1.593252	4.137629	22.40677
wLnTOTEMP	3441	1.936577	1.549513	0	5.710427	.6239943	2.376852
wLnEXTDEBT~S	3441	2.567428	.1324595	2.501447	3.419816	4.451676	25.51915
wLnFIRMAGE	3441	2.460981	.7753841	.6931472	4.025352	-.232061	2.323419
wLnOWNERS	3441	.4583253	.7456003	0	3.912023	2.305593	9.392093
wLnRELDIST	3369	1.475613	1.336221	0	6.887553	1.704202	6.902379
wLnSALES	3441	12.70437	2.285698	4.330733	17.74784	-.0136965	2.935072
wLnDEBTTOA~S	3441	.4775423	.5558988	0	2.991288	2.174199	8.849728
wLnDEBTRATIO	3441	.3115793	.4777023	0	2.735449	2.78372	12.32654
wLnCASHTOS~S	3441	2.901404	.0114051	2.895275	2.975781	4.604558	26.90122
wLnCASHTOA~S	3441	2.256423	.0286967	2.227999	2.335375	1.530851	4.368904
wLnINVESTO~S	3441	.0207043	.0443221	.0095695	.3326493	5.322893	33.57129
wLnCURLIBT~S	3441	.0852877	.145184	0	.7048291	2.552149	9.394778
wLnOPEXTOS~S	3441	.5917811	.2614346	.0088079	1.94591	1.598297	11.34206
wLnQUICKRA~O	2303	3.482648	.2657355	3.34639	5.065166	3.964441	20.62408
wLnARRATIO	2303	1.143966	.6409164	.6904141	4.322351	2.540878	10.82637
wLnOTRINCT~S	3441	.2616718	.0641877	.2477019	.7800731	6.66265	50.24466
wLnPROFTOS~S	3441	3.608726	.0859346	3.036829	3.743695	-3.719563	24.87899
wLnPROFTOI~E	3441	4.226249	.2562412	2.86409	4.803224	-1.565253	11.61904
wLnCASHRATIO	2303	3.430628	.1686729	3.344837	4.45467	4.193367	22.32254
wLnOTRRATIO	2303	.2914463	.5614324	.062538	3.322558	3.606508	16.75012
wLnTAXTOSA~S	868	1.627357	.0090998	1.608733	1.695674	5.342303	37.91701
wLnDEPRTOA~S	3441	.2671046	.2163937	.0351113	.7108569	.5339541	1.96084

Tables 6.5 and 6.6 are the equivalents of 6.3 and 6.4, but for the 2003 NSSBF database. Note that the Winsorization of the transformed variables at 1 percent is successful in reducing skewness and kurtosis to substantially below 100. Note also that the Winsorized variables are all prefixed with a lower-case “w” to distinguish them from their non-Winsorized counterparts. Only implicate #3 of the five implicates in the 2003 NSSBF were Winsorized, for reasons described in section 6.4 below.

Table 6.5

2003 NSSBF - Descriptive statistics for numeric variables (implicate #3 only)

variable	N	mean	sd	min	max	skewness	kurtosis
PCTDISCOUNTS	1813	57.07612	44.24405	0	100	-.2598099	1.236721
OWNEXP	4055	21.418	11.46508	0	65	.4877799	2.985365
OWNSHR	4064	75.82259	27.25953	8	100	-.4787184	1.665685
OWNERS	4113	6.296377	75.43168	1	3000	31.45647	1124.18
UNUSEDLOC	4110	.3314932	4.828495	0	284.5529	51.47675	2950.333
QUICKRATIO	2920	40.16197	1446.122	-60.37349	77527	52.79333	2825.396
RELLENGTH	4050	136.3719	125.5911	0	1156	1.882428	8.258336
RELNUM	4113	2.852905	1.892542	0	20	1.711853	8.514778
PROFTOSALES	4113	-.0540128	8.113041	-467.9074	79.61104	-49.65651	2765.75
PROFTOINCOME	4113	-.056179	7.705224	-467.9074	1	-55.79717	3327.759
DEBTRATIO	4113	.9717951	9.904458	0	455.0789	32.67862	1285.669
LnOWNWORTH~S	4064	4.038784	.3513856	0	10.75278	6.709923	79.46949
LnUNUSEDLOC	4110	.1271379	.3252341	0	5.654427	5.85456	56.0604
LnTOTEMP	4113	2.427571	1.429925	0	6.188264	.5625388	2.148041
LnEXTDEBTT~S	4113	4.439389	.0825246	0	6.300493	-34.45253	2112.083
LnFIRMAGE	4113	2.482136	.8973857	0	4.634729	-.701151	3.067271
LnOWNERS	4113	.6083013	.8348358	0	8.006368	2.719066	15.27118
LnRELDIST	4050	1.502711	1.358869	0	8.02388	1.673633	7.190012
LnSALES	4113	13.26238	2.248684	7.845808	19.16672	.0249303	2.41746
LnDEBTTOAS~S	4113	.436103	.5236238	0	6.135109	3.246911	21.43607
LnDEBTRATIO	4113	.309201	.4946478	0	6.122666	3.968073	28.46316
LnCASHTOSA~S	4113	1.626419	.1029663	0	4.766133	14.53024	369.4341
LnCASHTOAS~S	4113	2.388514	.190256	.0024007	2.95	1.085783	11.20998
LnINVESTOS~S	4113	.0224749	.1325627	0	4.763629	18.33222	494.0478
LnCURLIBTO~S	4113	.1993719	.1502584	0	3.55246	9.879758	155.6819
LnOPEXTOSA~S	4113	.6153885	.2844496	0	6.152535	6.35001	90.49075
LnQUICKRATIO	2920	4.542464	.2518728	3.293698	11.25951	12.80813	252.5891
LnARRATIO	2920	2.843612	.3550259	0	11.22544	8.56013	142.4297
LnOTRINCTO~S	4113	.269143	.1438436	0	4.715734	18.13917	462.067
LnPROFTOSA~S	4113	1.9219	.0786964	.002781	6.311035	37.62682	2454.155
LnPROFTOIN~E	4113	5.546012	.2620957	-.0025357	6.15	-5.935544	94.16668
LnCASHRATIO	2920	6.076206	.1460437	0	9.134718	-19.09024	1120.567
LnOTRRATIO	2920	2.170354	.332077	0	7.564558	7.301879	77.57334
LnTAXTOSALES	987	.0077109	.0216044	0	.2674794	5.84322	48.75999
LnDEPRTOAS~S	4113	.438048	.1827241	0	1.280474	.591268	2.213468

Table 6.6

2003 NSSBF - Descriptive statistics for Winsorized numeric variables (implicate #3 only)

variable	N	mean	sd	min	max	skewness	kurtosis
wLnOWNWORT~S	4064	4.029828	.2607592	3.931826	5.735924	4.754253	27.73706
wLnUNUSEDLOC	4110	.1198957	.2680319	0	1.673976	3.594836	17.77041
wLnTOTEMP	4113	2.425732	1.424221	.6931472	5.673323	.5483114	2.097713
wLnEXTDEBT~S	4113	4.439125	.0146717	4.427287	4.538799	4.69352	28.88445
wLnFIRMAGE	4113	2.479929	.893218	0	3.988984	-.7303285	3.049192
wLnOWNERS	4113	.5960671	.7674966	0	3.912023	1.899047	7.634695
wLnRELDIST	4050	1.497759	1.337892	0	6.862758	1.562103	6.517399
wLnSALES	4113	13.25816	2.23922	7.845808	17.94269	.0022758	2.372292
wLnDEBTTOA~S	4113	.4277022	.4717202	0	2.621039	2.084373	8.881183
wLnDEBTRATIO	4113	.3002441	.4346188	0	2.508437	2.537433	11.20486
wLnCASHTOS~S	4113	1.622469	.0430507	1.599098	1.9063	4.59232	27.07929
wLnCASHTOA~S	4113	2.390367	.1840355	2.219317	2.95	1.805196	5.409188
wLnINVESTO~S	4113	.0166691	.055908	.0036699	.4397372	6.005202	41.7637
wLnCURLIBT~S	4113	.1941493	.0976863	.1368559	.740347	3.327257	16.29101
wLnOPEXTOS~S	4113	.6069046	.2096193	.0559298	1.603168	.8174081	8.772673
wLnQUICKRA~O	2920	4.533491	.1395273	4.46875	5.438605	4.470691	25.6513
wLnARRATIO	2920	2.833581	.2498849	2.707808	4.248443	3.692331	18.14218
wLnOTRINCT~S	4113	.2646724	.0742596	.2492946	.8255439	6.460516	46.01996
wLnPROFTOS~S	4113	1.922202	.0054989	1.887055	1.93286	-2.890482	20.23552
wLnPROFTOI~E	4113	5.553151	.2002153	4.661638	6.105282	-.3686744	7.203466
wLnCASHRATIO	2920	6.073819	.0230732	6.06399	6.237202	5.326069	34.18732
wLnOTRRATIO	2920	2.161295	.2431877	2.080483	3.735702	4.665117	26.68125
wLnTAXTOSA~S	987	.0071982	.0175825	0	.1145185	3.884959	19.7271
wLnDEPRTOA~S	4113	.4377332	.1814546	.2405618	.8171616	.5541507	2.016935

6.4 Multiple Imputation

In addition to requiring the same consideration to sample design and observation weights that the 1998 NSSBF databases requires, the 2003 database adds the complication of combining multiple implicates for each observation when estimating means and standard errors. The 2003 database contains survey data for 4,240 firms. However, it uses a multiple-imputation methodology to produce estimates of missing variables that produces five implicates for each selected missing variable, resulting in five sample observations for each firm in the data set. Therefore, the total size of the sample is 21,240 observations. Each of the five implicates for each firm observation has identical values for each of the non-imputed variables, but different values for each of the imputed variables. The presence of five copies of each firm observation that differ only

in their imputed variable values complicates statistical analysis. If the regression model did not include any of the imputed variables, then one could simply choose any one of the five implicates for each firm and discard the rest.

Available statistical software packages contain routines to combine estimated regression coefficients and their standard errors obtained from estimating multiple imputations, into single estimates and standard errors for each firm, so that valid statistical inferences may be made. A description of the application of these procedures to a multiply-imputed database is presented in section 5 of the NSSBF 2003 Codebook.[6]

Table 6.7 shows the results of the survey-weighted least squares regression for the Trade Credit Discounts model, using the 2003 NSSBF database. Columns 1 through 5 shows the estimates and standard errors using only implicates 1 through 5 of the sample. Column 6 shows the estimates and standard errors that have been combined using the method described in Little and Rubin (2002). It can be seen that there is a high degree of consistency across the regressions regarding the approximate magnitude, sign and statistical significance of the regression coefficients. Since all of the hypotheses tested in the three essays require interpretation of only the sign and statistical significance of the regression coefficients, this suggests that the regression analysis for the 2003 NSSBF database can be carried out by choosing only one implicate, and avoiding the added complexity induced by the multiple imputation of missing values. Implicate #3 was chosen for the analysis throughout this dissertation, simply because it has the highest F-value and R-squared of all of the five regressions listed in table 6.7.

[6] The 2003 NSSBF Codebook can be obtained at http://www.federalreserve.gov/PUBS/oss/oss3/nssbftoc.htm

Table 6.7

Individual implicate and combined regressions, for Trade Credit Discounts model using 2003 NSSBF data

Implicates drawn from the 2003 NSSBF database
(PCTDISCOUNTS is the dependent variable)

VARIABLES	(1) Implicate 1	(2) Implicate 2	(3) Implicate 3	(4) Implicate 4	(5) Implicate 5	(6) Combined
FEMOWN	0.990	-0.468	0.463	-0.236	0.434	0.237
	(5.240)	(5.272)	(5.264)	(5.254)	(5.273)	(5.300)
MINOWN	-7.596	-6.612	-7.725	-7.639	-7.685	-7.452
	(7.455)	(7.352)	(7.511)	(7.452)	(7.524)	(7.477)
OWNEXP	-0.0896	-0.0844	-0.0596	-0.0761	-0.0314	-0.0682
	(0.149)	(0.151)	(0.148)	(0.150)	(0.149)	(0.151)
OWNEDU	0.988	1.164	1.149	1.105	1.208	1.123
	(0.901)	(0.903)	(0.904)	(0.908)	(0.898)	(0.907)
PCACCTNG	1.603	1.350	1.478	1.215	1.583	1.446
	(6.156)	(6.199)	(6.117)	(6.187)	(6.090)	(6.153)
MAINSUPL	6.730**	7.116**	7.053**	6.929**	7.222**	7.010**
	(3.281)	(3.285)	(3.267)	(3.275)	(3.275)	(3.283)
MANUFACTURING	-8.424*	-7.906	-8.038*	-7.905	-8.413*	-8.137*
	(4.860)	(4.858)	(4.848)	(4.850)	(4.846)	(4.861)
TRANSPORTATION	-9.924	-7.082	-9.868	-8.006	-11.65	-9.306
	(9.155)	(10.11)	(9.165)	(9.730)	(8.930)	(9.630)
WHOLESALE	1.302	1.630	1.506	1.602	1.396	1.487
	(5.900)	(5.872)	(5.857)	(5.870)	(5.870)	(5.876)
RETAIL	9.557*	9.954**	10.23**	10.20**	10.17**	10.02**
	(4.989)	(4.988)	(4.971)	(4.980)	(4.975)	(4.990)
SERVICES	3.156	3.245	3.064	3.204	3.021	3.138
	(4.909)	(4.914)	(4.895)	(4.916)	(4.897)	(4.907)
OWNSHR	0.0115	0.0208	0.0244	0.0167	0.0101	0.0167
	(0.0898)	(0.0899)	(0.0892)	(0.0899)	(0.0898)	(0.0900)
OWNMGR	-5.598	-4.980	-4.957	-5.377	-4.553	-5.093
	(5.074)	(5.087)	(5.087)	(5.092)	(5.054)	(5.098)
LnOWNERS	-1.831	-1.707	-1.375	-1.776	-1.804	-1.699
	(2.856)	(2.835)	(2.818)	(2.832)	(2.838)	(2.843)

USEDCARD	-13.89**	-13.16**	-13.73**	-13.48**	-13.82**	-13.62**
	(5.604)	(5.634)	(5.607)	(5.621)	(5.615)	(5.626)
USEDGRACE	9.827**	9.050**	9.751**	9.447**	9.831**	9.581**
	(4.538)	(4.610)	(4.543)	(4.588)	(4.536)	(4.578)
	(5.880)	(5.629)	(5.659)	(5.551)	(5.555)	(5.665)
LnPROFTOINCOME	-7.875	-7.462	-9.323	-8.260	-6.257	-7.836
	(8.497)	(8.527)	(8.596)	(8.527)	(8.458)	(8.609)
RELLENGTH	0.0397***	0.0392***	0.0377***	0.0394***	0.0365***	0.0385***
	(0.0123)	(0.0123)	(0.0123)	(0.0123)	(0.0123)	(0.0124)
RELNUM	-0.629	-0.607	-0.653	-0.630	-0.713	-0.646
	(0.835)	(0.844)	(0.835)	(0.840)	(0.834)	(0.839)
DBSCORE	-4.708***	-4.749***	-4.563***	-4.614***	-4.568***	-4.640***
	(1.094)	(1.106)	(1.095)	(1.103)	(1.098)	(1.103)
PAIDLATE	-19.46***	-18.82***	-19.72***	-19.17***	-19.39***	-19.31***
	(3.615)	(3.624)	(3.606)	(3.611)	(3.615)	(3.633)
LnDEBTRATIO	0.988	0.393	0.741	0.553	0.825	0.700
	(4.075)	(4.098)	(4.078)	(4.112)	(4.125)	(4.105)
Constant	80.45	77.93	87.21	83.87	71.76	80.24
	(54.55)	(54.45)	(54.47)	(54.37)	(53.94)	(54.74)
Observations	3906	3905	3905	3905	3904	3904
R-squared	0.194	0.189	0.194	0.191	0.194	
Model df	24	24	24	24	24	
Residual df	3834	3833	3833	3833	3832	
F statistic	9.256	8.944	9.277	9.002	9.186	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Regressions use survey-weighted least squares with std errors calculated using Taylor Linearization algorithm

REFERENCES

Almeida, Heitor, Campello, Murillo and Michael S.Weisbach, "The Cash Flow Sensitivity of Cash", Journal of Finance, 59(4), 2004.

Anderson, Ronald C., and David M. Reeb, "Founding-Family Ownership and Firm Performance: Evidence from the S&P 500", Journal of Finance, 58(3), 2003.

Anderson, Ronald C., Mansi, Sattar A. and David M. Reeb, "Founding family ownership and the agency cost of debt", Journal of Financial Economics, 68, 2003.

Ang, James S., Cole, Rebel A., and James Wuh Lin, "Agency Costs and Ownership Structure", Journal of Finance, 55(1), 2000.

Bates, T., "Entrepreneur Human Capital Inputs and Small Business Longevity", Review of Economics & Statistics, 72(4), 1990.

Berger, Allen N. and Gregory F. Udell, "The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle", Journal of Banking & Finance, 22, 1998.

Biais, Bruno and Christian Gollier, "Trade Credit and Credit Rationing", The Review of Financial Studies, 10(4), 1997

Bopaiah, Cavery, "Availability of Credit to Family Businesses", Small Business Economics, 11, 1998.

Bosma, Niels, von Praag, Mirjam, Thurik, Roy and Gerrit de Wit, "The Value of Human and Social Capital Investments for the Business Performance of Startups", Small Business Economics, 23, 2004.

Brau, James C., "Do Banks Price Owner-Manager Agency Costs? An Examination of Small Business Borrowing", Journal of Small Business Management, 40(4), 2002.

Breen, Richard, "Regression Models: Censored, Sample Selected or Truncated Data", Thousand Oaks, SAGE Publications, 1996.

Burkart, Mike, Ellingsen, Tore and Mariassunta Giannetti, "What You Sell is What You Lend? Explaining Trade Credit Contracts", The Review of Financial Studies, 24(4), 2011.

Cameron, A. Colin and Pravin K. Trivedi, "Microeconometrics Using Stata", College Station, Stata Press, 2009.

Carrington, William J., Eltinge, John L. and Kristin McCue, “An Economist’s Primer on Survey Samples”, Discussion Paper CES 00-15, Center for Economic Studies, October 2000.

Cochran, William G., “Sampling Techniques”, 3rd Edition, New York, John Wiley & Sons, 1977.

Coleman, Susan, “The Role of Human and Financial Capital in the Profitability and Growth of Women-Owned Small Firms”, Journal of Small Business Management, 45(3), 2007.

Copeland, Thomas E., Weston, J. Fred and Kuldeep Shastri, “Financial Theory and Corporate Policy”, New York, Pearson Addison Wesley, 2005.

Danielson, Morris G. and Jonathan A. Scott, “Additional Evidence on the Use of Trade Credit by Small Firms: The Role of Trade Credit Discounts”, draft paper, July 2000.

Danielson, Morris G. and Jonathan A. Scott, “A Note on Agency Conflicts and the Small Firm Investment Decision”, Journal of Small Business Management, 45(1), 2007.

Davidson, Russell and James G. McKinnon, “Econometric Theory and Methods”, New York, Oxford University Press, 2004.

Dittmar, Amy, Mahrt-Smith, Jan and Henri Servaes, “International Corporate Governance and Corporate Cash Holdings”, Journal of Financial and Quantitative Analysis, 38(1), 2003.

DuMouchel, William H. and Greg J. Duncan, “Using Sample Survey Weights in Multiple Regression Analyses of Stratified Samples”, Journal of the American Statistical Association, 78(383), 1983.

Elyasiani, Elyas and Lawrence G. Goldberg, “Relationship Lending: a survey of the literature”, Journal of Economics and Business, 56, 2004.

Fama, Eugene F. and Michael C. Jensen, “Separation of Ownership and Control”, The Journal of Law and Economics, XXVI, 1983.

Faulkender, M. W. (2002). "Cash Holdings Among Small Businesses." SSRN eLibrary.

Ferris, J. Stephen, “A Transactions Theory of Trade Credit Use”, Quarterly Journal of Economics, 96(2),1981.

Gompers, P., Ishii, J. and A. Metrick, “Corporate governance and equity prices”, Quarterly Journal of Economics, 118, 2003.

Gujarati, Damodar N., “Basic Econometrics, Fourth Edition”, New York, McGraw-Hill, 2003.

Haggerty, Catherine C,. Karen H. Grigorian, Rachel Harter, Amy K. Stewart, “The 1998 Survey of Small Business Finance Methodology Report”, The National Opinion Research Center, April 2001

Harford, Jarrad. “Corporate Cash Reserves and Acquisitions”, Journal of Finance, 54(6), 1999.

Harford, Jarrad, Mansi, Sattar A., and William F. Maxwell, “Corporate Governance and Firm Cash Holdings”, working paper, 2005.

Heckman, J.J., “The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models”, Annals of Economic and Social Measurement, 5, 1976.

Heckman, J.J., “Sample selection bias as a specification error”, Econometrica, 47, 1979.

Huyghebaert, Nancy, Van de Gucht, Linda and Cynthia Van Hulle, “The Choice between Bank Debt and Trade Credit in Business Start-ups”, Small Business Economics, 29(4), 2007.

Jensen, Michael C., “Agency Cost of Free Cash Flow, Corporate Finance, and Takeovers”, American Economic Review, 76(2), 1986.

Jensen, Michael C. and William H. Meckling, “Theory of the Firm: Managerial behavior, agency costs and capital structure”, Journal of Financial Economics, 3, 1976.

Kish, Leslie, “Survey Sampling”, New York, John Wiley & Sons, 1965.

Korn, Edward L. and Barry I. Graubard, “Examples of Differing Weighted and Unweighted Estimates from a Sample Survey”, The American Statistician, 49(3), 1995.

Lee, Eun Sul and Ronald N. Forthofer, “Analyzing Complex Survey Data”, second edition, Thousand Oaks, SAGE Publications, 2006.

Leland, Hayne E. and David H. Pyle, “Informational Asymmetries, Financial Structure and Financial Intermediation”, Journal of Finance, 32(2), 1977.

Little, Roderick J.A. and Donald B. Rubin, “Statistical Analysis with Missing Data”, second edition, Hoboken, John Wiley & Sons, 2002.

Martin, John D. and Akin Sayrak, “Corporate diversification and shareholder value: a survey of recent literature”, Journal of Corporate Finance, 9, 2003.

Murray, Michael P., "Avoiding Invalid Instruments and Coping with Weak Instruments", Journal of Economic Perspectives, 20(4), 2006.

Myers, S.C. and N.S. Majluf, "Corporate financing and investment decisions when firms have information that investors do not have", Journal of Financial Economics, 13, 1984.

Ng, Chee K., Smith, Janet Kiholm and Richard L. Smith, "Evidence on the Determinants of Credit Terms Used in Interfirm Trade", Journal of Finance, 54(3), 1999.

Nilsen, Jeffrey H., "Trade Credit and the Bank Lending Channel", Journal of Money, Credit and Banking, 34(1), 2002.

Opler, Tim, Pinkowitz, Lee, Stulz, Rene, and Rohan Williamson, "The determinants and implications of corporate cash holdings", Journal of Financial Economics, 52, 1999.

Osborne, Jason, "Notes on the use of data transformations", Practical Assessment, Research & Evaluation, 8(6), 2002.

Parker, S. C., The Economics of Self-Employment and Entrepreneurship. Cambridge, Cambridge University Press, 2004.

Peterson, Michell A. and Raghuram G. Rajan, "Trade Credit: Theories and Evidence", Review of Financial Studies, 10(3), 1997.

Potok, Nancy, Robert Bailey, Bill Sherman, Rachel Harter, Michael Yang, Janella Chapline, Jake Bartolone, "The 2003 Survey of Small Business Finance Methodology Report", The National Opinion Research Center, April 2005

Reiter, Jerome P., Zanutto, Elaine L. and Larry W. Hunter, "Analytical Modeling in Complex Surveys of Work Practices", Industrial and Labor Relations Review, 59(1), 2005.

Smith, Janet Kiholm, "Trade Credit and Informational Asymmetry", Journal of Finance, 42(4), 1987.

Staiger, Douglas and James H. Stock, "Instrumental Variables Regression with Weak Instruments", Econometrica, 65(3), 1997.

Stiglitz, Joseph E. and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information", The American Economic Review", 71(3), 1981.

Storey, D. J. (1994). Understanding the Small Business Sector. New York, Routledge.

Survey of Small Business Finances Group, "2003 Survey of Small Business Finance Technical Codebook", Division of Research and Statistics, Board of Governors of the Federal Reserve System, October 2006.

Tirole, Jean, “The Theory of Corporate Finance”, Princeton, Princeton University Press, 2006.

Vos, Ed, Yeh, Andy Jia-Yuh, Carter, Sara and Stephen Tagg, “The happy story of small business financing”, Journal of Banking and Finance, 31(9), 2007.

Walker, Elizabeth and Alan Brown, “What Success Factors are Important to Small Business Owners?”, International Small Business Journal, 22(6), 2004.

Winship, Christopher and Larry Radbill, “Sampling Weights and Regression Analysis”, Sociological Methods & Research, 23(2), 1994.

Wooldridge, Jeffrey M., “Introductory Econometrics”, 2nd Edition, Thomson South-Western, 2003.