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

F. Blaise Roncagli

Cleveland State University

Follow this and additional works at: https://engagedscholarship.csuohio.edu/etdarchive

Part of the Business Commons

How does access to this work benefit you? Let us know!

Recommended Citation

https://engagedscholarship.csuohio.edu/etdarchive/258
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 ............................................................................................................. ix

LIST OF FIGURES .......................................................................................................... xii

CHAPTER

I. INTRODUCTION ...................................................................................................1

1.1 Ownership and Structure of Small Firms ...........................................................2

1.2 Financing Sources for Small Firms ....................................................................4

1.3 Value Maximization, Agency Costs and Small Firms .......................................8

1.4 Information Asymmetry and Financial Constraints in Small Firms ..............16

1.5 Pecking Order Theory and Small Firms ..........................................................18

1.6 The Three Essays .............................................................................................26

II. ESSAY 1: WHY DON’T SMALL FIRMS TAKE EVERY TRADE CREDIT DISCOUNT OFFERED TO THEM? .................................................................27

2.1 Theory and Testable Hypotheses .....................................................................28

2.2 Review of Empirical Studies ...........................................................................34

2.3 Model, Variables and Data ..............................................................................37

2.3.1 The relationship between discounts, profitability and liquidity ..........38

2.3.2 Sample size and summary statistics for numeric variables ....................43

2.3.3 DEBTRATIO and insolvent firms ............................................................45

2.3.4 Summary Statistics for Dummy and Categorical Variables ....................47

2.3.6 Variance inflation factors ........................................................................53

2.4 Estimation Methodology ..................................................................................56

2.4.1 Potential selection bias .............................................................................56

2.4.2 Endogeneity .............................................................................................64
2.4.2.1 Instruments for LnQUICKRATIO .............................................. 65
2.4.2.2 The Durban-Wu-Hausman Test .................................................. 70
2.4.2.3 The test of over-identifying restrictions ...................................... 75
2.5 Univariate Analysis ............................................................................. 77
2.6 Multivariate Analysis and Results ....................................................... 96
2.7 Contributions to the Literature ............................................................. 114

III. ESSAY 2: WHAT DETERMINES THE CASH HOLDINGS OF SMALL
FIRMS? ........................................................................................................ 116
3.1 Theory and Testable Hypotheses ......................................................... 116
3.2 Review of Empirical Studies ................................................................. 121
3.3 Model, Variables and Data ................................................................. 126
   3.3.1 Sample size and summary statistics for numeric variables .......... 129
   3.3.2 Summary statistics for dummy and categorical variables ............ 131
   3.3.3 Sample correlations ................................................................. 134
   3.3.4 Variance inflation factors ......................................................... 137
3.4 Estimation Methodology ................................................................. 138
3.5 Univariate Analysis ........................................................................... 139
3.6 Multivariate Analysis and Results ....................................................... 151
3.7 Contributions to the Literature ............................................................. 168

IV. ESSAY 3: WHY DO SMALL FIRMS MAKE INVESTMENTS
UNRELATED TO THEIR CORE BUSINESS? ........................................... 169
4.1 Theory and Testable Hypotheses ......................................................... 170
4.2 Review of Empirical Studies ............................................................... 173
LIST OF TABLES

2.1 Independent Variables and Their Hypothesized Relationship to PCTDISCOUNTS .................................................................41

2.2 Sample statistics for dummy/categorical variables from 1998 NSSBF (n=1128) .................................................................................48

2.3 Sample distribution of PCTDISCOUNTS from 1998 NSSBF (n=1128) ..........49

2.4 Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=1458) .......................................................50

2.5 Sample distribution of PCTDISCOUNTS from 2003 NSSBF (using implicate #3 only, n=1458) .................................................................51

2.6 Variance Inflation Factors – 1998 NSSBF .........................................................54

2.7 Variance Inflation Factors – 2003 NSSBF .........................................................55

2.8 1998 NSSBF: Survey-weighted means over OFFEREDTCD for firm characteristic variables ...........................................................................86

2.9 2003 NSSBF: Survey-weighted means over OFFEREDTCD for firm characteristic variables (using implicate #3 only) .........................................89

2.10 1998 NSSBF: Mean of PCTDISCOUNTS by quartiles of the model numeric variables ..................................................................................94

2.11 2003 NSSBF: Mean of PCTDISCOUNTS by quartiles of the model numeric variables ..................................................................................95

2.12 Comparison of actual results with hypothesized results .............................101

3.1 Independent variables and their hypothesized relationship to LnCASHTOSALES .............................................................................127
3.2 Sample statistics for dummy/categorical variables from 1998 NSSBF (n=3338) ...............................................................................................................132
3.3 Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=3934) ..................................................................................133
3.4 1998 NSSBF: Two-way tabulation of CASHTOSALES versus firm characteristics from model ............................................................................145
3.5 2003 NSSBF: Two-way tabulation of CASHTOSALES versus firm characteristics from model ............................................................................146
3.6 Means of selected model variables from 1998 and 2003 NSSBF samples........148
3.7 1998 NSSBF: Mean of wLnCASHTOSALES across quartiles of model variables ...............................................................................................................149
3.8 2003 NSSBF: Mean of wLnCASHTOSALES across quartiles of model variables ...............................................................................................................150
3.9 Summary of observed results compared to hypothesized results ........................152
4.1 Independent variables and their hypothesized relationship to LnINVESTOSALES ...............................................................................................................177
4.2 Sample statistics for dummy/categorical variables from 1998 NSSBF (n=3125)...............................................................................................................180
4.3 Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=3879) ..................................................................................181
4.4 Summary of observed results compared to hypothesized results .....................196
5.1 Variable Mapping ................................................................................................212
6.1 Comparative regressions for Trade Credit Discounts model: 1998 NSSBF sample ...............................................................................................................219
6.2 Comparative regressions for Trade Credit Discounts model: 2003 NSSBF sample .................................................................221

6.3 1998 NSSBF - Descriptive statistics for numeric variables.................................225

6.4 1998 NSSBF - Descriptive statistics for Winsorized numeric variables ..........226

6.5 2003 NSSBF - Descriptive statistics for numeric variables (implicate #3 only) .....................................................................................................................227

6.6 2003 NSSBF - Descriptive statistics for Winsorized numeric variables (implicate #3 only)..................................................................................................................228

6.7 Individual implicate and combined regressions, for Trade Credit Discounts model using 2003 NSSBF data ........................................................................ 230
LIST OF FIGURES

Figure 2.1  Sample statistics for numeric model variables from 1998 NSSBF.........44
Figure 2.2  Sample statistics for numeric model variables from 2003 NSSBF
  (using implicate #3 only)..............................................................................45
Figure 2.3  1998 NSSBF: Quartiles of DEBTRATIO.....................................................46
Figure 2.4  2003 NSSBF: Quartiles of DEBTRATIO.....................................................46
Figure 2.5  1998 NSSBF: Pearson Correlations of Model Variables.......................52
Figure 2.6  2003 NSSBF: Pearson Correlations of Model Variables (using
  implicate #3 only)..........................................................................................53
Figure 2.7  1998 NSSBF: Probit Regression to examine determinants of
  OFFEREDTCD..............................................................................................63
Figure 2.8  2003 NSSBF: Regression to examine determinants of OFFEREDTCD
  (using implicate #3 only)................................................................................63
Figure 2.9  1998 NSSBF: Pearson correlation of LnQUICKRATIO instruments......67
Figure 2.10 2003 NSSBF: Pearson correlation of LnQUICKRATIO instruments.......67
Figure 2.11 1998 NSSBF: Regression of LnQUICKRATIO against instruments........68
Figure 2.12 2003 NSSBF: Regression of LnQUICKRATIO against instruments........68
Figure 2.13 1998 NSSBF: structural model including three instruments .................69
Figure 2.14 2003 NSSBF: structural model including three instruments ..................70
Figure 2.15 1998 NSSBF: Regression of reduced form model for
  LnQUICKRATIO (step 1 of Durban-Wu-Hausman test)..................................72
Figure 2.16 1998 NSSBF: Regression of structural model for PCTDISCOUNTS.......73
Figure 2.17 2003 NSSBF: Regression of reduced form model for LnQUICKRATIO (step 1 of Durban-Wu-Hausman test, using implicate #3 only).................................74

Figure 2.18 2003 NSSBF: Regression of structural model for PCTDISCOUNTS (step 2 of Durban-Wu-Hausman test, using implicate #3 only).........................75

Figure 2.19 1998 NSSBF: GMM regression of structural model for PCTDISCOUNTS with instruments for LnQUICKRATIO..................76

Figure 2.20 2003 NSSBF: GMM regression of structural model for PCTDISCOUNTS with instruments for LnQUICKRATIO..................77

Figure 2.21 1998 NSSBF: Two-way tabulation of OFFEREDTCD versus firm characteristics..............................................................80

Figure 2.22 2003 NSSBF: Two-way tabulation of OFFEREDTCD versus firm characteristics (using implicate #3 only)..................................................82

Figure 2.23 1998 NSSBF: Estimation of Trade Credit Discount Model ...............98

Figure 2.24 2003 NSSBF: Estimation of Trade Credit Discount Model (using implicate #3 only)..............................................................99

Figure 2.25 1998 NSSBF: Estimation of Trade Credit Discount Model with USEDGRACE substituted for USEDCARD.................................105

Figure 2.26 2003 NSSBF: Estimation of Trade Credit Discount Model with USEDGRACE substituted for USEDCARD.................................106

Figure 2.27 1998 NSSBF: Robust WLS with ZDEBTRATIO in place of DEBTRATIO.................................................................108

Figure 2.28 2003 NSSBF: Robust WLS with ZDEBTRATIO in place of DEBTRATIO.................................................................109
Figure 2.29 1998 NSSBF: Logistic regression of DISCOUNTS and ALLORNONE...112
Figure 2.30 2003 NSSBF: Logistic regression of DISCOUNTS and ALLORNONE...113
Figure 3.1 Sample statistics for numeric model variables from 1998 NSSBF............ 130
Figure 3.2 Sample statistics for numeric model variables from 2003 NSSBF (using imlicate #3 only)........................................................................................................131
Figure 3.3 1998 NSSBF: Pearson Correlations of Model Variables...................... 135
Figure 3.4 2003 NSSBF: Pearson Correlations of Model Variables (using imlicate #3 only)........................................................................................................136
Figure 3.5 Variance Inflation Factors – 1998 NSSBF ........................................... 137
Figure 3.6 Variance Inflation Factors – 2003 NSSBF ........................................... 138
Figure 3.7 1998 NSSBF – Comparison of Model Estimation Methods for Cash Holdings Model .....................................................................................................160
Figure 3.8 1998 NSSBF – Estimations of Cash Holdings Model with Selected Variables Dropped ..........................................................162
Figure 3.9 1998 NSSBF – Estimations of Cash Holdings Model with Industry dummies added ..........................................................163
Figure 3.10 2003 NSSBF – Comparison of Model Estimation Methods for Cash Holdings Model .....................................................................................................164
Figure 3.11 2003 NSSBF – Estimations of Cash Holdings Model with Selected Variables Dropped ..........................................................166
Figure 3.12 2003 NSSBF – Estimations of Cash Holdings Model with Industry dummies added ..........................................................167
Figure 4.1 Sample statistics for numeric model variables from 1998 NSSBF.............179
Figure 4.2  Sample statistics for numeric model variables from 2003 NSSBF  
(using implicate #3 only) .............................................................................179

Figure 4.3  1998 NSSBF: Pearson Correlations of Model Variables ......................182

Figure 4.4  2003 NSSBF: Pearson Correlations of Model Variables ......................183

Figure 4.5  Variance Inflation Factors – 1998 NSSBF ........................................184

Figure 4.6  Variance Inflation Factors – 2003 NSSBF ........................................184

Figure 4.7  1998 NSSBF: Two-way tabulation of INVESTOSALES versus firm  
characteristics from model ........................................................................190

Figure 4.8  2003 NSSBF: Two-way tabulation of INVESTOSALES versus firm  
characteristics from model ........................................................................191

Figure 4.9  1998 NSSBF: Mean of wLnINVESTOSALES across quartiles of  
model variables .......................................................................................194

Figure 4.10  2003 NSSBF: Mean of wLnINVESTOSALES across quartiles of  
model variables .......................................................................................195

Figure 4.11  1998 NSSBF: Comparative Regressions across OLS, SWLS, Logit,  
Probit and Tobit estimation .....................................................................203

Figure 4.12  2003 NSSBF: Comparative Regressions across OLS, SWLS, Logit,  
Probit and Tobit estimation .....................................................................204

Figure 4.13  1998 NSSBF: Probit and Tobit estimations with selected variables  
dropped ......................................................................................................205

Figure 4.14  2003 NSSBF: Probit and Tobit estimations with selected variables  
dropped ......................................................................................................206
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
cconcerned 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
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 information¹, 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 first², 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. 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:

\[ H1: \text{Trade Credit discount usage is negatively related to agency conflict in the firm.} \]

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:

\[ H2: \text{Trade Credit discount usage is positively related to firm liquidity and to availability of less expensive forms of finance.} \]

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:

\[ H3: \text{Trade Credit discount usage is positively related to management competence as measured by education and experience.} \]

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:

\[ H4: \text{Trade Credit discount usage is negatively related to the firm’s transaction costs of taking discounts.} \]

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.

Borkart, 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:

\[
PCTDISCOUNTS_i = \beta_0i + \beta_{11}FEMOWN_i + \beta_{21}MINOWN_i + \beta_{31}OWNEXP_i + \beta_{41}OWNEDU_i + \beta_{51}PCACCTNG_i + \beta_{61}MAINSUPL_i + \beta_{71}OWNSHR_i + \beta_{81}OWNMGR_i + \\
\beta_{91}USEDCARD_i + \beta_{101}LnUNUSEDLOC_i + \beta_{111}LnQUICKRATIO_i + \\
\beta_{121}LnPROFTOINCOME_i + \beta_{131}DBSCORE_i + \beta_{141}PAIDLATE_i + \\
\beta_{151}FIRMDISTRESS_i + \beta_{161}LnDEBTRATIO_i + \beta_{171}LnINVRATIO_i + \epsilon_i
\]

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 ($\beta=0.0003$, $t=1.98$, $P>|t|=0.048$, $F=3.92$, 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 LnQUICKRATIO 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

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Description</th>
<th>Hypothesized Relationship to Discount Usage</th>
<th>Hypothesis Tested</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agency:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>Percentage of business owned by principal owner</td>
<td>(+)</td>
<td>H1</td>
<td>Increasing firm ownership share reduces agency conflict (Jensen and Meckling 1976)</td>
</tr>
<tr>
<td>OWMGR</td>
<td>Dummy, 1 = firm is managed by an owner</td>
<td>(+)</td>
<td>H1</td>
<td>Having firm managed by owner reduces agency conflict (Jensen and Meckling 1976)</td>
</tr>
<tr>
<td><strong>Liquidity and Credit Availability:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEMOWN</td>
<td>Dummy, 1 = greater than 50% female ownership</td>
<td>(-)</td>
<td>H2</td>
<td>Proxy for credit discrimination = less likely to take TC discounts</td>
</tr>
<tr>
<td>MINOWN</td>
<td>Dummy, 1 = greater than 50% minority ownership (African-American, Asian, Pacific Islander, American Indian, Alaska Native)</td>
<td>(-)</td>
<td>H2</td>
<td>Proxy for credit discrimination = less likely to take TC discounts</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>Dummy, 1 = firm has used owner’s or businesses’ credit card for purchases during 1998 or most recent fiscal year</td>
<td>(+)</td>
<td>H2</td>
<td>Credit cards are nominally less expensive than TC with discounts</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>Natural log of the ratio of unused balance on all Lines of Credit, to Total Assets</td>
<td>(+)</td>
<td>H2</td>
<td>Line of credit is nominally less expensive than TC with discounts. Firm should tap line of credit to take discounts.</td>
</tr>
<tr>
<td>LnQUICKRATIO</td>
<td>Natural log of the ratio of Cash plus Accounts Receivable to Current Liabilities</td>
<td>(+)</td>
<td>H2</td>
<td>Firms with more liquid internal working capital will take more discounts</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>Natural log of the ratio of Profit to Total Income</td>
<td>(+)</td>
<td>H2</td>
<td>More profitable firms may have more retained earnings to support taking more discounts</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>Dun &amp; Bradstreet Credit Score (higher score = greater risk)</td>
<td>(-)</td>
<td>H2</td>
<td>Firms with poor credit scores are credit constrained and cannot take discounts</td>
</tr>
<tr>
<td>PAIDLATE</td>
<td>Dummy, 1 = if firm paid any invoice beyond end of the credit period during 1998 (2003) or most recent fiscal year</td>
<td>(-)</td>
<td>H2</td>
<td>Firms with history of late payments may be in distress and cannot take discounts</td>
</tr>
<tr>
<td>Independent Variable</td>
<td>Description</td>
<td>Hypothesized Relationship to Discount Usage</td>
<td>Hypothesis Tested</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
<td>--------------------------------------------</td>
<td>------------------</td>
<td>----------</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>Dummy, 1 = firm declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years</td>
<td>(-)</td>
<td>H2</td>
<td>Distressed firms lack access to internal or external sources of funding and must make use of trade credit financing</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>Natural log of the ratio of Total Liabilities to Total Assets.</td>
<td>(-)</td>
<td>H2</td>
<td>Firms with higher debt ratio will need to service debt rather than take discounts, to avoid default.</td>
</tr>
<tr>
<td><strong>Mgmt Competence:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>Number of years of experience of principal owner managing this or other business</td>
<td>(+)</td>
<td>H3</td>
<td>More experience = more likely to know when to take TC discounts</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>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</td>
<td>(+)</td>
<td>H3</td>
<td>More education = more likely to know when to take TC discounts</td>
</tr>
<tr>
<td><strong>Transaction Costs:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>Natural log of the ratio of Inventory to Total Assets</td>
<td>(+)</td>
<td>H4</td>
<td>Firms that maintain higher inventory levels use TC discounts to reduce cost of inventory.</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>Dummy, 1 = firm uses PC’s to automate accounting</td>
<td>(+)</td>
<td>H4</td>
<td>Automation of accounting lowers the cost of taking discounts = more likely to take TC discounts</td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>Dummy, 1 = firm’s main supplier offers TC discounts</td>
<td>(+)</td>
<td>H4</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>max</th>
<th>min</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCTDISCOUNTS</td>
<td>1128</td>
<td>54.27482</td>
<td>44.57126</td>
<td>100</td>
<td>0</td>
<td>-.173667</td>
<td>1.203019</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>1128</td>
<td>21.67819</td>
<td>11.40308</td>
<td>72</td>
<td>0</td>
<td>.6536732</td>
<td>3.37928</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>1128</td>
<td>70.05674</td>
<td>29.32434</td>
<td>100</td>
<td>1</td>
<td>-.331425</td>
<td>1.804973</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>1128</td>
<td>.1757994</td>
<td>.7182822</td>
<td>16.00024</td>
<td>0</td>
<td>14.36281</td>
<td>268.2457</td>
</tr>
<tr>
<td>QUICKRATIO</td>
<td>1128</td>
<td>4.635941</td>
<td>16.04608</td>
<td>280.9496</td>
<td>0</td>
<td>10.02789</td>
<td>129.3894</td>
</tr>
<tr>
<td>PROFTOINCOME</td>
<td>1128</td>
<td>.0403563</td>
<td>1.144274</td>
<td>1</td>
<td>-27.78788</td>
<td>-15.94104</td>
<td>33.7205</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>1128</td>
<td>.957783</td>
<td>1.519665</td>
<td>18.26782</td>
<td>.0054743</td>
<td>5.955071</td>
<td>50.91508</td>
</tr>
<tr>
<td>ZDEBTRATIO</td>
<td>876</td>
<td>.4966086</td>
<td>.2740079</td>
<td>5.955071</td>
<td>0</td>
<td>.0058015</td>
<td>1.9009</td>
</tr>
<tr>
<td>INVATIO</td>
<td>1128</td>
<td>.2117687</td>
<td>.2432367</td>
<td>147.673</td>
<td>0</td>
<td>1.16968</td>
<td>3.487414</td>
</tr>
<tr>
<td>CASHRATIO</td>
<td>1101</td>
<td>2.093121</td>
<td>8.322678</td>
<td>147.673</td>
<td>0</td>
<td>11.6505</td>
<td>174.3091</td>
</tr>
<tr>
<td>LNPCTDISCOUNTS</td>
<td>1128</td>
<td>.1152049</td>
<td>.2370365</td>
<td>2.833228</td>
<td>0</td>
<td>4.968755</td>
<td>39.6533</td>
</tr>
<tr>
<td>LNPCTDISCOUNTS</td>
<td>1128</td>
<td>.1152049</td>
<td>.2370365</td>
<td>2.833228</td>
<td>0</td>
<td>4.968755</td>
<td>39.6533</td>
</tr>
<tr>
<td>LNPCTDISCOUNTS</td>
<td>1128</td>
<td>.1152049</td>
<td>.2370365</td>
<td>2.833228</td>
<td>0</td>
<td>4.968755</td>
<td>39.6533</td>
</tr>
<tr>
<td>LNPCTDISCOUNTS</td>
<td>1128</td>
<td>.1152049</td>
<td>.2370365</td>
<td>2.833228</td>
<td>0</td>
<td>4.968755</td>
<td>39.6533</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>1128</td>
<td>4.18045</td>
<td>.234802</td>
<td>4.81</td>
<td>1.415898</td>
<td>-3.849758</td>
<td>39.68118</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>1128</td>
<td>.5502286</td>
<td>.1880077</td>
<td>1.022083</td>
<td>.581172</td>
<td>.9920607</td>
<td>2.958063</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>1128</td>
<td>.5502286</td>
<td>.1880077</td>
<td>1.022083</td>
<td>.581172</td>
<td>.9920607</td>
<td>2.958063</td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>1128</td>
<td>4.184176</td>
<td>.2054484</td>
<td>4.803224</td>
<td>2.86409</td>
<td>-1.825475</td>
<td>19.17937</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1101</td>
<td>.3858866</td>
<td>.1880077</td>
<td>6925501</td>
<td>.0054594</td>
<td>-.2610079</td>
<td>1.985174</td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>1128</td>
<td>.682517</td>
<td>.1149137</td>
<td>1.022083</td>
<td>.581172</td>
<td>.9920607</td>
<td>2.958063</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1101</td>
<td>4.181476</td>
<td>.2054484</td>
<td>4.803224</td>
<td>2.86409</td>
<td>-1.825475</td>
<td>19.17937</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1128</td>
<td>.5501612</td>
<td>.1849258</td>
<td>2.89944</td>
<td>.0054594</td>
<td>2.084052</td>
<td>9.355567</td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>1128</td>
<td>.682517</td>
<td>.1149137</td>
<td>1.022083</td>
<td>.581172</td>
<td>.9920607</td>
<td>2.958063</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1128</td>
<td>4.184176</td>
<td>.2054484</td>
<td>4.803224</td>
<td>2.86409</td>
<td>-1.825475</td>
<td>19.17937</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1128</td>
<td>.5501612</td>
<td>.1849258</td>
<td>2.89944</td>
<td>.0054594</td>
<td>2.084052</td>
<td>9.355567</td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>1128</td>
<td>.682517</td>
<td>.1149137</td>
<td>1.022083</td>
<td>.581172</td>
<td>.9920607</td>
<td>2.958063</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1128</td>
<td>4.184176</td>
<td>.2054484</td>
<td>4.803224</td>
<td>2.86409</td>
<td>-1.825475</td>
<td>19.17937</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>max</th>
<th>min</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCTDISCOUNTS</td>
<td>1458</td>
<td>56.21948</td>
<td>44.6431</td>
<td>100</td>
<td>0</td>
<td>-22.44587</td>
<td>1.209707</td>
</tr>
<tr>
<td>OWEXP</td>
<td>1458</td>
<td>24.16049</td>
<td>11.1087</td>
<td>65</td>
<td>0</td>
<td>4136017</td>
<td>3.015918</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>1458</td>
<td>68.24279</td>
<td>27.76535</td>
<td>100</td>
<td>8</td>
<td>-0.610716</td>
<td>1.556785</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>1458</td>
<td>0.165088</td>
<td>3.461267</td>
<td>1</td>
<td>131.6735</td>
<td>-37.81453</td>
<td>1439.162</td>
</tr>
<tr>
<td>QUICKRATIO</td>
<td>1458</td>
<td>5.174741</td>
<td>16.30614</td>
<td>275.2632</td>
<td>0</td>
<td>10.22697</td>
<td>140.6152</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>1458</td>
<td>0.8703825</td>
<td>2.02049</td>
<td>44.20573</td>
<td>0.0018836</td>
<td>12.5927</td>
<td>213.0355</td>
</tr>
<tr>
<td>ZDEBTRATIO</td>
<td>1185</td>
<td>0.4664344</td>
<td>2.797261</td>
<td>1</td>
<td>0.0018836</td>
<td>0.079458</td>
<td>1.809332</td>
</tr>
<tr>
<td>INVRATIO</td>
<td>1458</td>
<td>0.1955367</td>
<td>0.9767092</td>
<td>1</td>
<td>0</td>
<td>1.260109</td>
<td>3.629428</td>
</tr>
<tr>
<td>CASHRATIO</td>
<td>1424</td>
<td>2.717712</td>
<td>11.30403</td>
<td>275.2632</td>
<td>0</td>
<td>13.62333</td>
<td>269.4488</td>
</tr>
<tr>
<td>ARRATIO</td>
<td>1455</td>
<td>2.412904</td>
<td>8.242731</td>
<td>160</td>
<td>0</td>
<td>12.46196</td>
<td>205.8385</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>1458</td>
<td>0.1248278</td>
<td>0.226732</td>
<td>2.298796</td>
<td>0</td>
<td>4.233277</td>
<td>29.13614</td>
</tr>
<tr>
<td>LnQUICKRATIO</td>
<td>1458</td>
<td>0.1169796</td>
<td>0.88524</td>
<td>5.621354</td>
<td>0</td>
<td>1.533104</td>
<td>6.053156</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>1458</td>
<td>0.517657</td>
<td>0.1237437</td>
<td>6.15</td>
<td>1.2546</td>
<td>-9.874296</td>
<td>253.5563</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>1458</td>
<td>0.4983387</td>
<td>3.811224</td>
<td>2.685634</td>
<td>16.0401</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnZDEBTRATIO</td>
<td>1185</td>
<td>0.3642226</td>
<td>0.1831472</td>
<td>1.558523</td>
<td>1.829139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnINVRATIO</td>
<td>1458</td>
<td>0.239434</td>
<td>0.7247782</td>
<td>1.021851</td>
<td>2.911423</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>1424</td>
<td>0.682202</td>
<td>0.5621354</td>
<td>7.989917</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnARRATIO</td>
<td>1455</td>
<td>0.7567489</td>
<td>0.5081404</td>
<td>7.265967</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>1458</td>
<td>0.1236356</td>
<td>1.673976</td>
<td>3.543666</td>
<td>19.64631</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnQUICKRATIO</td>
<td>1458</td>
<td>0.1166444</td>
<td>0.4537961</td>
<td>1.405632</td>
<td>5.227356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>1458</td>
<td>0.552023</td>
<td>0.661638</td>
<td>0.761532</td>
<td>10.03833</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>1458</td>
<td>0.4952821</td>
<td>2.508437</td>
<td>2.095397</td>
<td>10.22442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnZDEBTRATIO</td>
<td>1185</td>
<td>0.3641982</td>
<td>0.156627</td>
<td>1.82826</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>1458</td>
<td>0.2339053</td>
<td>0.089403</td>
<td>2.899872</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnCASHRATIO</td>
<td>1424</td>
<td>0.6672613</td>
<td>4.61512</td>
<td>0</td>
<td>2.002754</td>
<td>4.88651</td>
<td></td>
</tr>
<tr>
<td>wLnARRATIO</td>
<td>1455</td>
<td>0.7539381</td>
<td>3.89182</td>
<td>1</td>
<td>5.98181</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Linearized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over</td>
<td>Mean</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0001507</td>
</tr>
<tr>
<td>2</td>
<td>.1500921</td>
</tr>
<tr>
<td>3</td>
<td>.5952191</td>
</tr>
<tr>
<td>4</td>
<td>4.107276</td>
</tr>
</tbody>
</table>

Figure 2.3. 1998 NSSBF: Quartiles of DEBTRATIO

<table>
<thead>
<tr>
<th></th>
<th>Linearized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over</td>
<td>Mean</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9.27e-06</td>
</tr>
<tr>
<td>2</td>
<td>.1212125</td>
</tr>
<tr>
<td>3</td>
<td>.535353</td>
</tr>
<tr>
<td>4</td>
<td>3.172341</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Dummy/Categorical Vars</th>
<th>Response</th>
<th>Number of Responses</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN: Female owns more than 50% of the firm</td>
<td>No</td>
<td>973</td>
<td>86.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>155</td>
<td>13.7</td>
</tr>
<tr>
<td>MINOWN: Minority owns more than 50% of the firm</td>
<td>No</td>
<td>1050</td>
<td>93.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>78</td>
<td>6.9</td>
</tr>
<tr>
<td>OWNMGR: Firm's Manager is an owner</td>
<td>No</td>
<td>177</td>
<td>15.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>951</td>
<td>84.3</td>
</tr>
<tr>
<td>OWNEDU: Principal owner's level of education</td>
<td>Less than High School</td>
<td>15</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>High School graduate</td>
<td>183</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>Some college but no degree</td>
<td>181</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>Assoc Degree/occupational program</td>
<td>59</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Trade School/vocational program</td>
<td>29</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>College degree</td>
<td>463</td>
<td>41.0</td>
</tr>
<tr>
<td></td>
<td>Post-graduate degree</td>
<td>198</td>
<td>17.6</td>
</tr>
<tr>
<td>PCACCTNG: Firm uses PC's for accounting</td>
<td>No</td>
<td>98</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1030</td>
<td>91.3</td>
</tr>
<tr>
<td>MAINSUP: Firm's main supplier offers trade credit discounts</td>
<td>No</td>
<td>574</td>
<td>50.9</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>554</td>
<td>49.1</td>
</tr>
<tr>
<td>USEDCARD: Firm has used owner's or firm's credit card within most recent fiscal year</td>
<td>No</td>
<td>189</td>
<td>16.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>939</td>
<td>83.2</td>
</tr>
<tr>
<td>DBSCORE: Dun and Bradstreet credit score</td>
<td>Low Risk</td>
<td>141</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>Moderate Risk</td>
<td>340</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td>Average Risk</td>
<td>308</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
<td>Significant Risk</td>
<td>224</td>
<td>19.9</td>
</tr>
<tr>
<td></td>
<td>High Risk</td>
<td>115</td>
<td>10.2</td>
</tr>
<tr>
<td>PAIDLATE: Firm has paid at least one invoice past due date within most recent fiscal year</td>
<td>No</td>
<td>519</td>
<td>46.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>609</td>
<td>54.0</td>
</tr>
<tr>
<td>FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations</td>
<td>No</td>
<td>880</td>
<td>78.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>248</td>
<td>22.0</td>
</tr>
<tr>
<td>OFFEREDTCD: Firm is offered trade credit discounts by at least one supplier</td>
<td>No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1128</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 2.3

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

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

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

<table>
<thead>
<tr>
<th>Dummy/Categorical Vars</th>
<th>Response</th>
<th>Number of Responses</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN: Female owns more than 50% of the firm</td>
<td>No</td>
<td>1284</td>
<td>88.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>174</td>
<td>11.9</td>
</tr>
<tr>
<td>MINOWN: Minority owns more than 50% of the firm</td>
<td>No</td>
<td>1392</td>
<td>95.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>66</td>
<td>4.5</td>
</tr>
<tr>
<td>OWNMGR: Firm's Manager is an owner</td>
<td>No</td>
<td>226</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1232</td>
<td>84.5</td>
</tr>
<tr>
<td>OWNEDU: Principal owner's level of education</td>
<td>Less than High School</td>
<td>12</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>High School graduate</td>
<td>256</td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>Some college but no degree</td>
<td>257</td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>Assoc Degree/occupational program</td>
<td>136</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>Trade School/vocational program</td>
<td>137</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>College degree</td>
<td>450</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>Post-graduate degree</td>
<td>210</td>
<td>14.4</td>
</tr>
<tr>
<td>PCACCTNG: Firm uses PC's for accounting</td>
<td>No</td>
<td>85</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1373</td>
<td>94.2</td>
</tr>
<tr>
<td>MAINSUPPL: Firm's main supplier offers trade credit discounts</td>
<td>No</td>
<td>806</td>
<td>55.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>652</td>
<td>44.7</td>
</tr>
<tr>
<td>USEDCARD: Firm has used owner's or firm's credit card within most recent fiscal year</td>
<td>No</td>
<td>199</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1259</td>
<td>86.4</td>
</tr>
<tr>
<td>DBSCORE: Dun and Bradstreet credit score</td>
<td>Low Risk</td>
<td>282</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>Moderate Risk</td>
<td>290</td>
<td>19.9</td>
</tr>
<tr>
<td></td>
<td>Average Risk</td>
<td>428</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>Significant Risk</td>
<td>190</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>High Risk</td>
<td>122</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>Very High Risk</td>
<td>146</td>
<td>10.0</td>
</tr>
<tr>
<td>PAIDLATE: Firm has paid at least one invoice past due date within most recent fiscal year</td>
<td>No</td>
<td>764</td>
<td>52.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>694</td>
<td>47.6</td>
</tr>
<tr>
<td>FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations</td>
<td>No</td>
<td>1402</td>
<td>96.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>56</td>
<td>3.8</td>
</tr>
<tr>
<td>OFFEREDTCD: Firm is offered trade credit discounts by at least one supplier</td>
<td>No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1458</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 2.5

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

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

Figure 2.5. 1998 NSSBF: Pearson Correlations of Model Variables
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

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

Mean VIF 1.13
<table>
<thead>
<tr>
<th>Variable</th>
<th>VIF</th>
<th>1/VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>wLnDEBTRATIO</td>
<td>1.34</td>
<td>0.747756</td>
</tr>
<tr>
<td>wLnQUICKRA−O</td>
<td>1.31</td>
<td>0.761148</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>1.21</td>
<td>0.829069</td>
</tr>
<tr>
<td>PAIDLATE</td>
<td>1.16</td>
<td>0.859437</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>1.12</td>
<td>0.893830</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>1.09</td>
<td>0.920127</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>1.08</td>
<td>0.922817</td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>1.08</td>
<td>0.926631</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>1.05</td>
<td>0.954170</td>
</tr>
<tr>
<td>FEMOWN</td>
<td>1.05</td>
<td>0.956011</td>
</tr>
<tr>
<td>wLnPROFTOI−E</td>
<td>1.04</td>
<td>0.963451</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.03</td>
<td>0.967185</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>1.03</td>
<td>0.969284</td>
</tr>
<tr>
<td>MAINSUPPL</td>
<td>1.03</td>
<td>0.970762</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>1.03</td>
<td>0.972136</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>1.03</td>
<td>0.975010</td>
</tr>
<tr>
<td>MINOWN</td>
<td>1.02</td>
<td>0.983610</td>
</tr>
</tbody>
</table>

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:

\[
\text{OFFEREDTCD}^*_i = \mathbf{w}_i' \alpha_i + \mu_i, \quad \text{where}
\]

\[
(1) \quad \text{OFFEREDTCD}_i = 0 \text{ if } \text{OFFEREDTCD}^*_i \leq 0, \text{ and}
\]

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

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 $\mu$ are assumed to be normally distributed with zero mean and constant variance $\sigma_{\mu}^2$. 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 $w_i$:

$$Pr(OFFEREDTCD_i = 1) = \Phi(w_i'\alpha_i) \quad (1a)$$

where $\Phi(w_i'\alpha_i)$ is the cumulative distribution function (cdf) of the standard normal distribution evaluated at $w_i'\alpha_i$. 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 $w_i$.

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:

$$PCTDISCOUNTS^*_i = x_i'\beta_i + \epsilon_i \quad (2)$$

where $PCTDISCOUNTS_i = PCTDISCOUNTS^*_i$ if OFFEREDTCD$_i = 1$, but $PCTDISCOUNTS_i$ is not observed if OFFEREDTCD$_i = 0$.

The errors $\epsilon$ are assumed to be normally distributed with zero mean and constant variance $\sigma_{\epsilon}^2$. In this model, the errors $\epsilon$ and $\mu$ are assumed to have correlation $\rho$ 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:
\[ E(\text{PCTDISCOUNTS}_i \mid \text{OFFEREDTCD}=1, \mathbf{x}_i) = \mathbf{x}_i' \mathbf{\beta}_i + E(\varepsilon_i \mid \text{OFFEREDTCD}=1) \] (3)

But remember from (1) that when \( \text{OFFEREDTCD}=1 \), \( \mathbf{w}_i' \mathbf{a}_i + \mu_i > 0 \), or \( \mu_i > \mathbf{w}_i' \mathbf{a}_i \).

Substituting this last inequality into (3) gives:
\[ E(\text{PCTDISCOUNTS}_i \mid \text{OFFEREDTCD}=1, \mathbf{x}_i) = \mathbf{x}_i' \mathbf{\beta}_i + E(\varepsilon_i \mid \mu_i > \mathbf{w}_i' \mathbf{a}_i) \]

Under the assumption that \( \varepsilon \) and \( \mu \) are bivariate normal, Breen derives the result:
\[ E(\varepsilon_i \mid \mu_i > \mathbf{w}_i' \mathbf{a}_i) = \rho \sigma_\varepsilon \sigma_\mu \left[ \frac{\varphi(\mathbf{w}_i' \mathbf{a}_i)}{\Phi(\mathbf{w}_i' \mathbf{a}_i)} \right] \]

In equation (5), \( \varphi(\mathbf{w}_i' \mathbf{a}_i) \) is the probability density function (pdf) for the standard normal distribution, and \( \Phi(\mathbf{w}_i' \mathbf{a}_i) \) 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 \( \text{OFFEREDTCD}=1 \), 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 \( \text{PCTDISCOUNTS} \) 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 and an estimate of the inverse Mills Ratio for each observation can be derived using the estimated values of \( w_i' a_i \). 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 \( w_i \) 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 $w_i$ 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:

$$w_i' \alpha_i = \alpha_0 + \alpha_1 DBSCORE + \alpha_2 MANUFACTURING + \alpha_3 TRANSPORTATION + \alpha_4 WHOLESALE + \alpha_5 RETAIL + \alpha_6 SERVICES + \alpha_7 LnTOTEMP + \alpha_8 LnFIRMAGE$$

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, WHOLESAL 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.
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 \( \varepsilon \) and \( \mu \) 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, \( E(\varepsilon \mid x) = 0 \), where \( \varepsilon \) is the matrix of the residuals of the regression and \( x \) 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.
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.
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.
Figure 2.13. 1998 NSSBF: structural model including three instruments

| Variable       | 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         | 0.6725405 | 0.1397455 | 4.81| 0.000| 0.3983448 - 0.9467362 |
| OWNEDU         | 0.8064288 | 0.8485176 | 0.95| 0.342| -0.8584538 - 2.471311 |
| PCACCTNG       | 12.04226  | 5.1846    | 2.32| 0.020| 1.888099 - 20.44012 |
| MAINSUL        | 14.16011  | 3.200646  | 4.42| 0.000| 7.980099 | 20.44012 |
| OWNSHR         | -0.0094421| 0.057969  | -0.16| 0.870| -1.224534 - 0.1035692 |
| 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 |
| wLnQUICKRATIO-O| 5.728865  | 1.932791  | 2.96| 0.003| 1.936521 - 9.521208 |
| wLnPROFTOE     | 18.69985  | 7.04563   | 2.65| 0.008| 4.875566  | 32.52413 |
| DBSCORE        | -2.957854 | 1.511785  | -1.96| 0.051| -5.924138 | 0.0084303 |
| 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 |
| wLnDEBT_RATIO  | 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 |
| wLnDEPRTOAS    | 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 |
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:

\[
\text{LnQUICKRATIO}_i = \beta_0 + \beta_1FEMOWN_i + \beta_2MINOWN_i + \beta_3OWNEXP_i + \beta_4OWNEDU_i + \beta_5PCACCTNG_i + \beta_6MAINSUPL_i + \beta_7OWNSHR_i + \beta_8OWNMGR_i + \beta_9USEDCARD_i + \beta_{10i}\text{LnUNUSEDLOC}_i + \beta_{11i}\text{LnPROFTOINCOME}_i + \beta_{12i}\text{DBSCORE}_i + \beta_{13i}\text{PAIDLATE}_i + \beta_{14i}\text{LnDEBTRATIO}_i + \beta_{15i}\text{FIRMDISTRESS}_i + \beta_{16i}\text{LnOTRRATIO}_i + \beta_{17i}\text{LnINVRATIO}_i + \beta_{18i}\text{LnDEPRTOASSETS}_i + \mu_i
\]

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

|                      | Coef.   | Std. Err. |    t  | P>|t|  |      [95% Conf. Interval] |
|----------------------|---------|-----------|------|-----|---------------------------|
| wLnQUICKRATIO-O      |         |           |      |     |                           |
| 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 | .0961038  | 0.33 | 0.740| -.1566799               | .22045   |
| MAINSULF             | .0233792| .061446   | 0.38 | 0.704| -.0971843               | .1439428 |
| OWNSHR               | .001876 | .0010775  | 1.74 | 0.082| -.0002382               | .0039902 |
| OWNMGR               | .009916 | .0102675  | 0.10 | 0.923| -.1903514               | .2101834 |
| USEDCARD             | .0025243| .0682403  | 0.04 | 0.970| -.1313703               | .136419  |
| wLnUNUSEDLOC         | .2605771| .150849   | 1.69 | 0.091| -.0417538               | .5629079 |
| wLnPROFTOIEI         | -.1568942| .153213 | -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 |
| wLnDEBT_RATIO        | -.6499466| .0874798 | -7.43| 0.000| -.821591                | -.4783021 |
| wLnOFRATIO           | .3252673| .0736968  | 4.41 | 0.000| .1806664                | .4698682 |
| wLnINVRATIO          | -.8200753| .1665252 | -4.92| 0.000| -.1.1.46815              | -.4933352 |
| _cons                | 3.14835 | .7041751  | 4.47 | 0.000| 1.766684                | 4.530015 |

Wald test for H0: LnOFRATIO = 0 and LnDEPRTOASSETS = 0
F(2, 1109) = 22.95 Prob > F = 0.0000
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.

Figure 2.17. 2003 NSSBF: Regression of reduced form model for LnQUICKRATIO (step 1 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.

![Regression Table]

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

![Table](image)

Test of endogeneity (orthogonality conditions)
H0: variables are exogenous
GMM C statistic chi2(1) = 1.298008 (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.
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

```
Instrumental variables (GMM) regression

| PCTDISCOUNTS          | Robust Coef. | Std. Err. | z     | P>|z| [95% Conf. Interval]
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>wLnQUICKRATIO</td>
<td>12.17409</td>
<td>6.642266</td>
<td>1.83</td>
<td>0.067</td>
<td>-8.84516  25.19269</td>
</tr>
<tr>
<td>FEMOWN</td>
<td>3.311145</td>
<td>5.310601</td>
<td>0.62</td>
<td>0.533</td>
<td>-9.097442 13.71973</td>
</tr>
<tr>
<td>MINOWN</td>
<td>-3.577016</td>
<td>8.081336</td>
<td>-0.44</td>
<td>0.658</td>
<td>-19.41614 12.26211</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.473578</td>
<td>0.1445213</td>
<td>0.33</td>
<td>0.743</td>
<td>-0.2358988 3.306143</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.388471</td>
<td>0.93151</td>
<td>1.49</td>
<td>0.136</td>
<td>-0.437255  3.214197</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>-1.668532</td>
<td>5.763003</td>
<td>-0.03</td>
<td>0.977</td>
<td>-11.46213 11.12843</td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>8.880268</td>
<td>3.316078</td>
<td>2.68</td>
<td>0.007</td>
<td>2.380874  15.37966</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.1050246</td>
<td>0.0635932</td>
<td>0.17</td>
<td>0.869</td>
<td>-0.114115 0.135164</td>
</tr>
<tr>
<td>OWNMGRR</td>
<td>3.435293</td>
<td>5.04713</td>
<td>-0.68</td>
<td>0.496</td>
<td>-13.32748 6.4569</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>7.387655</td>
<td>4.578256</td>
<td>-1.61</td>
<td>0.107</td>
<td>-16.36087 1.585561</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>17.75247</td>
<td>5.90137</td>
<td>3.01</td>
<td>0.003</td>
<td>6.185995  29.31894</td>
</tr>
<tr>
<td>wLnPROPTOINC</td>
<td>-5.657274</td>
<td>10.78676</td>
<td>-0.52</td>
<td>0.600</td>
<td>-26.80065 15.4861</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>3.622708</td>
<td>1.254711</td>
<td>-2.89</td>
<td>0.004</td>
<td>-6.081896 -1.163521</td>
</tr>
<tr>
<td>PAIDDATE</td>
<td>19.25421</td>
<td>3.730194</td>
<td>-5.16</td>
<td>0.000</td>
<td>-26.56526 -11.94316</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>9.18535</td>
<td>10.24053</td>
<td>-0.07</td>
<td>0.333</td>
<td>-29.98961 10.15254</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>3.251014</td>
<td>7.281779</td>
<td>0.45</td>
<td>0.655</td>
<td>-11.02188 17.52217</td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>31.72482</td>
<td>11.3406</td>
<td>2.80</td>
<td>0.005</td>
<td>9.49766  53.95198</td>
</tr>
<tr>
<td>_cons</td>
<td>75.50177</td>
<td>62.30208</td>
<td>1.21</td>
<td>0.226</td>
<td>46.60806  197.6116</td>
</tr>
</tbody>
</table>

Instrumented: wLnQUICKRATIO
Instruments: FEMOWN MINOWN OWNEXP OWNEDU PCACCTNG MAINSUPL OWNSHR OWNMGRR USEDCARD wLnUNUSEDLOC wLnPROPTOINC DBSCORE PAIDDATE FIRMDISTRESS wLnDEBTRATIO wLnINVRATIO wLnOTTRATIO 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.
<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>WHOLESALE</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 41.9401</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 26.3415</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>59.36</td>
<td>33.48</td>
<td>92.84</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3.117</td>
<td>4.04</td>
<td>7.157</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>NUMBER</td>
<td>3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMBER</td>
<td>3441</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>RETAIL</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 10.9946</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 7.6143</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0058</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>51.51</td>
<td>29.23</td>
<td>80.74</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10.97</td>
<td>8.288</td>
<td>19.26</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>SERVICES</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 177.9980</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 121.5270</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>30.15</td>
<td>26.69</td>
<td>56.84</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>32.33</td>
<td>10.83</td>
<td>43.16</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>USEDCARD</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 75.5107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 49.2098</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>22.68</td>
<td>8.397</td>
<td>31.07</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39.8</td>
<td>29.13</td>
<td>68.93</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>DBSCORE</th>
<th>Low Risk</th>
<th>Moderate</th>
<th>Average</th>
<th>Signific</th>
<th>High Ris</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(4) = 131.4280</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(3.99,13432.91) = 22.8768</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.045</td>
<td>3.489</td>
<td>5.535</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14.88</td>
<td>12.11</td>
<td>26.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27.3</td>
<td>11.53</td>
<td>38.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>PAIDLATE</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 2338</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 2310</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 21.8279</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 2232) = 14.5044</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>25.75</td>
<td>31.54</td>
<td>57.29</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15.1</td>
<td>27.62</td>
<td>42.71</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40.85</td>
<td>59.15</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>OWNDISTRES</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 3.0200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 2.0256</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.1548</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>52.04</td>
<td>32.08</td>
<td>84.11</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10.44</td>
<td>5.446</td>
<td>15.89</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>FIRMDISTRS</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of strata = 78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of obs = 3561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of PSUs = 3441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncorrected chi2(1) = 45.3433</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design-based F(1, 3363) = 31.4878</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>55.72</td>
<td>30.44</td>
<td>86.16</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6.76</td>
<td>7.08</td>
<td>13.84</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62.48</td>
<td>37.52</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.21. 1998 NSSBF: Two-way tabulation of OFFEREDTCD versus firm characteristics
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGNER</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>TEST</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>MANUFACTURER</td>
<td>55.76</td>
<td>25.35</td>
<td>81.11</td>
</tr>
<tr>
<td>TRANSPORTER</td>
<td>55.76</td>
<td>25.35</td>
<td>81.11</td>
</tr>
<tr>
<td>SERVICES</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>ALCOHOL</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>MANUFACTURER</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>RETAIL</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>SERVICES</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>MANUFACTURER</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>TRANSPORTER</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>SERVICES</td>
<td>3.12</td>
<td>2.608</td>
<td>5.728</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
<tr>
<td>MANUFACTURER</td>
<td>39.266</td>
<td>19.203</td>
<td>58.469</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>OFFEREDTCD</th>
<th>Linearized</th>
<th></th>
<th>[95% Conf. Interval]</th>
<th>Adj Wald Test (H0: means are equal)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Std. Err.</td>
<td></td>
</tr>
<tr>
<td>SALES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>503390.3</td>
<td>34757.28</td>
<td>435242.2</td>
<td>571538.4</td>
</tr>
<tr>
<td>Yes</td>
<td>1931726</td>
<td>161325.6</td>
<td>1615417</td>
<td>2248035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F(1, 3291) = 73.34, Prob &gt; F = 0.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receivables</td>
<td>No</td>
<td>89469.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>263089.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12192.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11595.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Payables</td>
<td>No</td>
<td>26564.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>128186</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10435.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>117261</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>148646</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 86.99, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receivables</td>
<td>No</td>
<td>15965.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>70804.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1876.695</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12286.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19645.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 41.46, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receivables</td>
<td>No</td>
<td>41538.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>192228.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4187.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>49749.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 50.75, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPEX</td>
<td>No</td>
<td>401671.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>1757992</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31863.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>339197.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>464145.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 72.16, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INVENTORY</td>
<td>No</td>
<td>26145.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>172973.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2538.699</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21167.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31122.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 104.05, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CASH</td>
<td>No</td>
<td>24741.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>78195.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2411.904</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20012.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29470.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 26.23, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OTRCURRENT</td>
<td>No</td>
<td>18817.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>522998.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4048.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10878.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26756.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 12.70, Prob &gt; F = 0.0004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTALASSETS</td>
<td>No</td>
<td>229915.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>773008.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17143.77</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>196301.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>263528.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(1, 3291) = 108.60, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>F(1, 3291) = 105.69, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
<td>--------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>CURRLIB</td>
<td>42530.36</td>
<td>198990.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INVESTMENTS</td>
<td>11919.78</td>
<td>23744.97</td>
<td>F(1, 3291) = 7.07, Prob &gt; F = 0.0079</td>
<td></td>
</tr>
<tr>
<td>OTRINCOME</td>
<td>7922.612</td>
<td>24475.05</td>
<td>F(1, 3291) = 15.01, Prob &gt; F = 0.0001</td>
<td></td>
</tr>
<tr>
<td>TOTINCOME</td>
<td>511312.9</td>
<td>1956201</td>
<td>F(1, 3291) = 74.11, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>TOTLIABILITIES</td>
<td>134951.3</td>
<td>466076.6</td>
<td>F(1, 3291) = 95.84, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>DEPRECIABLES</td>
<td>77375.32</td>
<td>197283.5</td>
<td>F(1, 3291) = 38.90, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>LAND</td>
<td>25434.76</td>
<td>48116.06</td>
<td>F(1, 3291) = 3.46, Prob &gt; F = 0.0631</td>
<td></td>
</tr>
<tr>
<td>FIRMAGE</td>
<td>12.83383</td>
<td>14.58927</td>
<td>F(1, 3291) = 14.21, Prob &gt; F = 0.0002</td>
<td></td>
</tr>
<tr>
<td>TOTEMP</td>
<td>6.140928</td>
<td>13.56289</td>
<td>F(1, 3291) = 106.69, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>17.40193</td>
<td>19.75739</td>
<td>F(1, 3291) = 24.31, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
<tr>
<td>OWNAGE</td>
<td>49.70782</td>
<td>50.50998</td>
<td>F(1, 3291) = 3.01, Prob &gt; F = 0.0827</td>
<td></td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>89.54078</td>
<td>103.0949</td>
<td>F(1, 3291) = 9.29, Prob &gt; F = 0.0023</td>
<td></td>
</tr>
<tr>
<td>RELNUM</td>
<td>No</td>
<td>1.961133</td>
<td>.031434</td>
<td>1.899501</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>No</td>
<td>87.1163</td>
<td>.5988006</td>
<td>85.94224</td>
</tr>
<tr>
<td>OWNERS</td>
<td>No</td>
<td>1.755378</td>
<td>.2003692</td>
<td>1.362517</td>
</tr>
<tr>
<td>OWNWORTH</td>
<td>No</td>
<td>465884.5</td>
<td>25155.47</td>
<td>416562.6</td>
</tr>
<tr>
<td>OWNEQUITY</td>
<td>No</td>
<td>62442.55</td>
<td>11154.3</td>
<td>40572.49</td>
</tr>
</tbody>
</table>

Note: strata with single sampling unit treated as certainty units.

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)

<table>
<thead>
<tr>
<th></th>
<th>Linearized OFFEREDTCD</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>[95% Conf. Interval]</th>
<th>Adj Wald Test (H0: means are equal)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SALES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>597686.4</td>
<td>45882.4</td>
<td>507730.8</td>
<td>687642</td>
<td>F(1,3920) = 191.20, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>Yes</td>
<td>2140688</td>
<td>99786.99</td>
<td>1945049</td>
<td>2336327</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOANS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>140833.1</td>
<td>20195.11</td>
<td>101239.1</td>
<td>180427</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>318221.4</td>
<td>34551.99</td>
<td>320479.9</td>
<td>455963</td>
<td>F(1,3920) = 37.92, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAYABLES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>26843.91</td>
<td>3292.804</td>
<td>20388.13</td>
<td>33299.68</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>136181.4</td>
<td>12305.46</td>
<td>112055.7</td>
<td>160307.1</td>
<td>F(1,3920) = 72.84, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OCURRLIB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>14478.04</td>
<td>2229.416</td>
<td>10107.11</td>
<td>18848.96</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>83354.19</td>
<td>8703.192</td>
<td>66290.98</td>
<td>100417.4</td>
<td>F(1,3920) = 58.16, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECEIVABLES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>43797.64</td>
<td>4608.575</td>
<td>34762.21</td>
<td>52833.07</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>210461.2</td>
<td>18034.02</td>
<td>175104.3</td>
<td>245818.2</td>
<td>F(1,3920) = 79.18, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPEX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>473656.3</td>
<td>40425.98</td>
<td>394398.4</td>
<td>552914.3</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1896059</td>
<td>89875.57</td>
<td>1719852</td>
<td>2072266</td>
<td>F(1,3920) = 201.77, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INVENTORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>28267.06</td>
<td>3235.963</td>
<td>21922.73</td>
<td>34611.39</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>224231.9</td>
<td>23555.13</td>
<td>178050.4</td>
<td>270413.4</td>
<td>F(1,3920) = 67.74, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>33553.44</td>
<td>2845.527</td>
<td>27974.59</td>
<td>39132.29</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>91644.95</td>
<td>5875.072</td>
<td>80126.46</td>
<td>103163.4</td>
<td>F(1,3920) = 78.07, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTRCURRENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>35393.95</td>
<td>10340.1</td>
<td>15121.46</td>
<td>55666.45</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>91688.1</td>
<td>13945.87</td>
<td>64344.25</td>
<td>119029.9</td>
<td>F(1,3920) = 10.50, Prob &gt; F = 0.0012</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALASSETS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>330063</td>
<td>33890.25</td>
<td>263618.8</td>
<td>396507.2</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1013090</td>
<td>63615.78</td>
<td>888366.9</td>
<td>1137813</td>
<td>F(1,3920) = 88.83, Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>CURRLIB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>41321.94</td>
<td>4152.259</td>
<td>33181.15</td>
<td>49462.73</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>219535.6</td>
<td>16594.61</td>
<td>187000.7</td>
<td>252070.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INVESTMENTS</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>7643</td>
<td>1382.565</td>
<td>4932.386</td>
<td>10353.62</td>
</tr>
<tr>
<td>Yes</td>
<td>39383.88</td>
<td>6656.252</td>
<td>26333.84</td>
<td>52433.93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OTRINCOME</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>7959.555</td>
<td>1611.151</td>
<td>4800.781</td>
<td>11118.33</td>
</tr>
<tr>
<td>Yes</td>
<td>37058.99</td>
<td>7760.056</td>
<td>21844.86</td>
<td>52273.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTINCOME</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>605646</td>
<td>46025.93</td>
<td>515408.9</td>
<td>695883</td>
</tr>
<tr>
<td>Yes</td>
<td>2177747</td>
<td>101086.6</td>
<td>1979560</td>
<td>2375935</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTLIABIL-S</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>182690.9</td>
<td>21608.87</td>
<td>140325.3</td>
<td>225056.6</td>
</tr>
<tr>
<td>Yes</td>
<td>610172</td>
<td>44888.48</td>
<td>522165</td>
<td>698178.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPRECATED</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>114580.3</td>
<td>16038.8</td>
<td>83135.14</td>
<td>146025.5</td>
</tr>
<tr>
<td>Yes</td>
<td>294999.7</td>
<td>28988.37</td>
<td>238166</td>
<td>351833.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAND</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>61560.53</td>
<td>18647.45</td>
<td>25000.91</td>
<td>98120.15</td>
</tr>
<tr>
<td>Yes</td>
<td>47229.21</td>
<td>6003.406</td>
<td>35459.11</td>
<td>58999.3</td>
</tr>
</tbody>
</table>

\[
F(1, 3920) = 106.72, \text{ Prob } > F = 0.0000
\]

\[
F(1, 3920) = 21.76, \text{ Prob } > F = 0.0000
\]

\[
F(1, 3920) = 13.43, \text{ Prob } > F = 0.0003
\]

\[
F(1, 3920) = 194.00, \text{ Prob } > F = 0.0000
\]

\[
F(1, 3920) = 72.70, \text{ Prob } > F = 0.0000
\]

\[
F(1, 3920) = 29.57, \text{ Prob } > F = 0.0000
\]

\[
F(1, 3920) = 0.54, \text{ Prob } > F = 0.4642
\]
### FIRMAGE
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.469</td>
<td>16.22688</td>
</tr>
<tr>
<td></td>
<td>.276513</td>
<td>.389167</td>
</tr>
<tr>
<td></td>
<td>12.92688</td>
<td>15.46389</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16.98987</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 33.27, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### TOTEMP
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.030053</td>
<td>14.35153</td>
</tr>
<tr>
<td></td>
<td>.1796891</td>
<td>.4374823</td>
</tr>
<tr>
<td></td>
<td>5.67776</td>
<td>13.49382</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.20925</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 283.10, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### OWNEXP
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.36057</td>
<td>21.5767</td>
</tr>
<tr>
<td></td>
<td>.291261</td>
<td>.4113715</td>
</tr>
<tr>
<td></td>
<td>17.78953</td>
<td>20.77018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.38322</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 40.43, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### OWNAGE
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>51.12127</td>
<td>52.0894</td>
</tr>
<tr>
<td></td>
<td>.2949782</td>
<td>.3996654</td>
</tr>
<tr>
<td></td>
<td>50.54294</td>
<td>51.30582</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.87297</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 3.79, Prob &gt; F = 0.0516</td>
<td></td>
</tr>
</tbody>
</table>

### RELLENGTH
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>117.7714</td>
<td>138.6513</td>
</tr>
<tr>
<td></td>
<td>2.708566</td>
<td>4.059063</td>
</tr>
<tr>
<td></td>
<td>112.4611</td>
<td>130.6932</td>
</tr>
<tr>
<td></td>
<td></td>
<td>146.6094</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 18.12, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### RELNUM
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.284904</td>
<td>2.866383</td>
</tr>
<tr>
<td></td>
<td>.0347736</td>
<td>.0523889</td>
</tr>
<tr>
<td></td>
<td>2.216727</td>
<td>2.763671</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.969095</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 85.13, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### OWNSHR
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>83.21178</td>
<td>76.89289</td>
</tr>
<tr>
<td></td>
<td>.6404027</td>
<td>.8944955</td>
</tr>
<tr>
<td></td>
<td>81.95623</td>
<td>75.13917</td>
</tr>
<tr>
<td></td>
<td></td>
<td>78.64661</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 32.69, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

### OWNERS
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.697411</td>
<td>4.125812</td>
</tr>
<tr>
<td></td>
<td>.0669149</td>
<td>1.719659</td>
</tr>
<tr>
<td></td>
<td>1.56622</td>
<td>.7543026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.497322</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 1.99, Prob &gt; F = 0.1583</td>
<td></td>
</tr>
</tbody>
</table>

### OWNWORTH
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>826077</td>
<td>1418565</td>
</tr>
<tr>
<td></td>
<td>78024.12</td>
<td>213653.9</td>
</tr>
<tr>
<td></td>
<td>673105.3</td>
<td>999681.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1837448</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 6.73, Prob &gt; F = 0.0095</td>
<td></td>
</tr>
</tbody>
</table>

### OWNEQUITY
<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>103781.9</td>
<td>271560.6</td>
</tr>
<tr>
<td></td>
<td>12247.46</td>
<td>21344.07</td>
</tr>
<tr>
<td></td>
<td>79769.92</td>
<td>229714</td>
</tr>
<tr>
<td></td>
<td>127793.9</td>
<td>313407.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F(1,3920) = 46.29, Prob &gt; F = 0.0000</td>
<td></td>
</tr>
</tbody>
</table>

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 PCTDISCOUNTS 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 wLnUNUSEDLOC 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 PCTDISCOUNTS 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

<table>
<thead>
<tr>
<th>Quartile</th>
<th>OWNEXP</th>
<th>OWNSHR</th>
<th>wLnUNUSEDLOC</th>
<th>wLnQUICKRATIO</th>
<th>wlnPROFTOINC~</th>
<th>wLnDEBTRATIO</th>
<th>wLnINVRATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.6234, 3.517784</td>
<td>53.5279, 2.988834</td>
<td>56.1235, 2.427605</td>
<td>46.12135, 3.528986</td>
<td>51.1019, 3.417237</td>
<td>66.18724, 3.246907</td>
<td>58.42607, 3.345904</td>
</tr>
<tr>
<td>2</td>
<td>53.23507, 3.515406</td>
<td>55.69914, 2.10258</td>
<td>46.88208, 3.404893</td>
<td>50.83395, 3.292778</td>
<td>55.12511, 3.207862</td>
<td>49.7661, 3.465199</td>
<td>49.29048, 3.660587</td>
</tr>
<tr>
<td>4</td>
<td>65.79282, 3.143511</td>
<td>59.30912, 3.31286</td>
<td>46.88208, 3.404893</td>
<td>68.61726, 3.170663</td>
<td>59.95796, 3.47159</td>
<td>44.4085, 3.59423</td>
<td>55.76242, 3.510511</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Quartile</th>
<th>OWNEXP</th>
<th>PCTDISCOUNTS</th>
<th>Linearized Std. Err.</th>
<th>Adjusted Wald Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>49.60542</td>
<td>3.872943</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>47.04653</td>
<td>3.436399</td>
<td>F(1,1386)=0.25, Prob &gt; F=0.6192</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>52.11074</td>
<td>3.413026</td>
<td>F(1,1386)=1.06, Prob &gt; F=0.3043</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>58.84394</td>
<td>3.933537</td>
<td>F(1,1386)=1.63, Prob &gt; F=0.2017</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>1</td>
<td>53.34279</td>
<td>3.202047</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>49.18386</td>
<td>4.020549</td>
<td>F(1,1386)=0.65, Prob &gt; F=0.4210</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>50.95087</td>
<td>2.71012</td>
<td>F(1,1386)=0.13, Prob &gt; F=0.7152</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>1</td>
<td>50.67792</td>
<td>2.789129</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>21.16952</td>
<td>8.099946</td>
<td>F(1,1386)=11.92, Prob &gt; F=0.0006</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>44.48487</td>
<td>3.334438</td>
<td>F(1,1386)=7.06, Prob &gt; F=0.0080</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>61.72138</td>
<td>2.604022</td>
<td>F(1,1386)=13.75, Prob &gt; F=0.0002</td>
</tr>
<tr>
<td>wLnQUICKRATIO</td>
<td>1</td>
<td>39.22558</td>
<td>3.471883</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>51.9559</td>
<td>3.59625</td>
<td>F(1,1386)=6.87, Prob &gt; F=0.0089</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>54.0251</td>
<td>3.82929</td>
<td>F(1,1386)=0.16, Prob &gt; F=0.6849</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>60.43858</td>
<td>3.584102</td>
<td>F(1,1386)=1.48, Prob &gt; F=0.2245</td>
</tr>
<tr>
<td>wLnPROFTOINC-</td>
<td>1</td>
<td>46.59505</td>
<td>3.610999</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57.6694</td>
<td>3.880586</td>
<td>F(1,1386)=4.27, Prob &gt; F=0.0390</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>52.11416</td>
<td>3.620205</td>
<td>F(1,1386)=1.09, Prob &gt; F=0.2976</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>49.21903</td>
<td>3.656134</td>
<td>F(1,1386)=0.32, Prob &gt; F=0.5728</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>1</td>
<td>59.96164</td>
<td>4.020407</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>53.01591</td>
<td>3.28547</td>
<td>F(1,1386)=1.75, Prob &gt; F=0.1858</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>50.5953</td>
<td>3.664417</td>
<td>F(1,1386)=0.24, Prob &gt; F=0.6269</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>41.96966</td>
<td>3.583399</td>
<td>F(1,1386)=2.83, Prob &gt; F=0.0926</td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>1</td>
<td>52.45195</td>
<td>3.942713</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>48.20614</td>
<td>3.793182</td>
<td>F(1,1386)=0.60, Prob &gt; F=0.4399</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>48.40459</td>
<td>3.595431</td>
<td>F(1,1386)=0.00, Prob &gt; F=0.9696</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>56.1615</td>
<td>3.349878</td>
<td>F(1,1386)=2.49, Prob &gt; F=0.1150</td>
</tr>
</tbody>
</table>

*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.
### 1998 NSSBF: Estimation of Trade Credit Discount Model

**PCTDISCOUNTS is the dependent variable**

#### 1998 NSSBF Survey - Subpopulation with OFFERTCD=1

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Robust OLS</th>
<th>Robust WLS</th>
<th>Heckman ML</th>
<th>Probit Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN</td>
<td>5.847</td>
<td>6.833*</td>
<td>6.356</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.675)</td>
<td>(4.082)</td>
<td>(4.050)</td>
<td></td>
</tr>
<tr>
<td>MINOWN</td>
<td>-11.98**</td>
<td>-18.56***</td>
<td>-18.59***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.824)</td>
<td>(5.753)</td>
<td>(5.674)</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.433***</td>
<td>0.670***</td>
<td>0.708***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.139)</td>
<td>(0.140)</td>
<td></td>
</tr>
<tr>
<td>OWNEDU</td>
<td>0.840</td>
<td>0.904</td>
<td>0.889</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.696)</td>
<td>(0.853)</td>
<td>(0.845)</td>
<td></td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>5.136</td>
<td>11.77**</td>
<td>13.08**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.426)</td>
<td>(5.124)</td>
<td>(5.178)</td>
<td></td>
</tr>
<tr>
<td>MAINSUP</td>
<td>10.89***</td>
<td>14.26***</td>
<td>14.73***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.503)</td>
<td>(3.209)</td>
<td>(3.191)</td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-0.0180</td>
<td>-0.00436</td>
<td>-0.0335</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0433)</td>
<td>(0.0578)</td>
<td>(0.0599)</td>
<td></td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-4.126</td>
<td>-3.305</td>
<td>-4.487</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.511)</td>
<td>(4.975)</td>
<td>(4.936)</td>
<td></td>
</tr>
<tr>
<td>USEDCARD</td>
<td>-3.981</td>
<td>-2.710</td>
<td>-2.290</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.358)</td>
<td>(4.038)</td>
<td>(3.990)</td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>3.395</td>
<td>5.136</td>
<td>5.537</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.387)</td>
<td>(6.175)</td>
<td>(6.082)</td>
<td></td>
</tr>
<tr>
<td>wLnQUICKRATIO</td>
<td>4.708***</td>
<td>5.071***</td>
<td>4.822***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.623)</td>
<td>(1.871)</td>
<td>(1.847)</td>
<td></td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>12.66**</td>
<td>18.51***</td>
<td>16.62**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.720)</td>
<td>(7.123)</td>
<td>(6.995)</td>
<td></td>
</tr>
<tr>
<td>DBSCORE</td>
<td>-4.909***</td>
<td>-2.915*</td>
<td>-3.243**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.171)</td>
<td>(1.513)</td>
<td>(1.521)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.838)</td>
<td>(3.565)</td>
<td>(3.531)</td>
<td></td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-17.12***</td>
<td>-19.23***</td>
<td>-19.39***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.347)</td>
<td>(4.349)</td>
<td>(4.326)</td>
<td></td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>2.872</td>
<td>1.426</td>
<td>1.068</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.425)</td>
<td>(3.758)</td>
<td>(3.721)</td>
<td></td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>-6.982</td>
<td>-8.557</td>
<td>-5.711</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(11.02)</td>
<td>(13.44)</td>
<td>(13.29)</td>
<td></td>
</tr>
</tbody>
</table>

### Industry Dummies

- **Manufacturing**: 0.401***
- **Transportation**: -0.618***
- **Wholesale**: 0.427***
- **Retail**: -0.0673
- **Services**: -0.426***
- **Manufacturing**
- **Retail**

#### 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

#### Lambda: 7.723

#### SE Lambda: 4.143

#### 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
Table 2.1.6.1.1(b) –
303 NSSBF Survey - Subpopulation with OFFEREDTCD=1

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Robust OLS</th>
<th>(2) Robust WLS</th>
<th>(3) Heckman ML</th>
<th>(4) Probit Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN</td>
<td>-1.372 (3.431)</td>
<td>3.181 (5.346)</td>
<td>3.261 (5.350)</td>
<td></td>
</tr>
<tr>
<td>MINOWN</td>
<td>-4.490 (7.651)</td>
<td>-4.300 (7.923)</td>
<td>-4.347 (7.883)</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.171 (0.105)</td>
<td>0.0556 (0.144)</td>
<td>0.0434 (0.146)</td>
<td></td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.580*** (0.611)</td>
<td>1.406 (0.926)</td>
<td>1.398 (0.922)</td>
<td></td>
</tr>
<tr>
<td>FCACCTNG</td>
<td>6.634 (4.965)</td>
<td>0.844 (6.042)</td>
<td>0.418 (6.113)</td>
<td></td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>6.305*** (2.147)</td>
<td>8.757*** (3.312)</td>
<td>8.805*** (3.286)</td>
<td></td>
</tr>
<tr>
<td>(4) USEDCARD</td>
<td>-7.466** (3.028)</td>
<td>-6.893 (4.457)</td>
<td>-6.890 (4.435)</td>
<td></td>
</tr>
<tr>
<td>(5) wLnUNUSEDLOC</td>
<td>10.89** (5.462)</td>
<td>17.65*** (5.949)</td>
<td>17.67*** (5.925)</td>
<td></td>
</tr>
<tr>
<td>(1) wLnQUICKRATIO</td>
<td>1.432 (1.417)</td>
<td>4.538** (1.902)</td>
<td>4.650** (1.899)</td>
<td></td>
</tr>
<tr>
<td>(2) wLnPROFTOINCOME</td>
<td>0.311 (7.876)</td>
<td>-5.402 (10.60)</td>
<td>-5.024 (10.51)</td>
<td></td>
</tr>
<tr>
<td>(3) DBSCORE</td>
<td>-6.345*** (0.750)</td>
<td>-4.263*** (1.135)</td>
<td>-4.195*** (1.141)</td>
<td>-0.0540** (0.0229)</td>
</tr>
<tr>
<td>(4) PAIDLATE</td>
<td>-18.95*** (2.381)</td>
<td>-20.43*** (3.589)</td>
<td>-20.48*** (3.561)</td>
<td></td>
</tr>
<tr>
<td>(5) FIRMDISTRESS</td>
<td>-7.000 (5.455)</td>
<td>-10.57 (10.17)</td>
<td>-10.76 (10.02)</td>
<td></td>
</tr>
<tr>
<td>(1) wLnDEBTRATIO</td>
<td>-7.705** (3.593)</td>
<td>-3.928 (4.507)</td>
<td>-3.771 (4.506)</td>
<td></td>
</tr>
<tr>
<td>(2) wLnINVRATIO</td>
<td>16.95*** (6.373)</td>
<td>24.25** (9.441)</td>
<td>24.20*** (9.374)</td>
<td></td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>0.280** (0.131)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>-0.579*** (0.196)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>0.230* (0.129)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.247** (0.107)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.712*** (0.0964)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) wLnTOTEMP</td>
<td>0.505** (0.0304)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) wLnFIRMAGE</td>
<td>0.106*** (0.0380)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>51.81 (44.75)</td>
<td>88.41 (61.04)</td>
<td>87.44 (60.56)</td>
<td>-1.286*** (0.169)</td>
</tr>
<tr>
<td>Observations</td>
<td>1460 1458</td>
<td>3741</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.178 0.183</td>
<td>0.183</td>
<td>0.183</td>
<td></td>
</tr>
<tr>
<td>Residual df</td>
<td>17 17</td>
<td>17</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>F statistic</td>
<td>22.13 10.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald Chi-sq</td>
<td>180.2 180.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald indep Obs</td>
<td>1458 1458</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald indep test</td>
<td>0.127 0.127</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P &gt;</td>
<td>0.721 0.721</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>0.01 0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lambda</td>
<td>-1.469 -1.469</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE Lambda</td>
<td>4.122 4.122</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 implication #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

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

*** 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.

USED_CARD 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 USEDCCARD. 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.
Table 2.1.6.1.3(a) – PCTDISCOUNTS is the dependent variable
1998 NSSBF Survey - Subpopulation with OFFEREDTCD=1

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

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

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>With USEDCARD</th>
<th>With USEDGRACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN</td>
<td>3.181</td>
<td>5.106</td>
</tr>
<tr>
<td></td>
<td>(5.346)</td>
<td>(5.672)</td>
</tr>
<tr>
<td>MINOWN</td>
<td>-4.300</td>
<td>-6.407</td>
</tr>
<tr>
<td></td>
<td>(7.923)</td>
<td>(8.959)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.0556</td>
<td>0.0786</td>
</tr>
<tr>
<td></td>
<td>(0.144)</td>
<td>(0.158)</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.406</td>
<td>0.912</td>
</tr>
<tr>
<td></td>
<td>(0.926)</td>
<td>(0.989)</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>0.844</td>
<td>-0.575</td>
</tr>
<tr>
<td></td>
<td>(6.042)</td>
<td>(6.420)</td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>8.757***</td>
<td>8.456**</td>
</tr>
<tr>
<td></td>
<td>(3.312)</td>
<td>(3.536)</td>
</tr>
<tr>
<td>ONSHR</td>
<td>0.0253</td>
<td>0.0191</td>
</tr>
<tr>
<td></td>
<td>(0.0634)</td>
<td>(0.0708)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-3.077</td>
<td>-0.505</td>
</tr>
<tr>
<td></td>
<td>(5.024)</td>
<td>(5.584)</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>-6.893</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.457)</td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>17.65***</td>
<td>14.40**</td>
</tr>
<tr>
<td></td>
<td>(5.949)</td>
<td>(6.689)</td>
</tr>
<tr>
<td>wLnQUICKRATIO</td>
<td>4.538**</td>
<td>4.822**</td>
</tr>
<tr>
<td></td>
<td>(1.902)</td>
<td>(2.031)</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>-5.402</td>
<td>-6.627</td>
</tr>
<tr>
<td></td>
<td>(10.60)</td>
<td>(11.49)</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>-4.263***</td>
<td>-3.645***</td>
</tr>
<tr>
<td></td>
<td>(1.135)</td>
<td>(1.257)</td>
</tr>
<tr>
<td>PAIDLATE</td>
<td>-20.43***</td>
<td>-18.09***</td>
</tr>
<tr>
<td></td>
<td>(3.589)</td>
<td>(3.886)</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-10.57</td>
<td>-13.65</td>
</tr>
<tr>
<td></td>
<td>(10.17)</td>
<td>(10.76)</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-3.928</td>
<td>0.137</td>
</tr>
<tr>
<td></td>
<td>(4.507)</td>
<td>(4.962)</td>
</tr>
<tr>
<td>wLnINVRATIO</td>
<td>24.25**</td>
<td>22.92**</td>
</tr>
<tr>
<td></td>
<td>(9.441)</td>
<td>(10.13)</td>
</tr>
<tr>
<td>USEDGRACE</td>
<td>10.42**</td>
<td>10.85**</td>
</tr>
<tr>
<td></td>
<td>(4.783)</td>
<td>(5.285)</td>
</tr>
<tr>
<td>Constant</td>
<td>88.41</td>
<td>76.42</td>
</tr>
<tr>
<td></td>
<td>(61.04)</td>
<td>(65.68)</td>
</tr>
<tr>
<td>Observations</td>
<td>1458</td>
<td>1259</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.183</td>
<td>0.175</td>
</tr>
<tr>
<td>Model df</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Residual df</td>
<td>1440</td>
<td>1241</td>
</tr>
<tr>
<td>F statistic</td>
<td>10.63</td>
<td>8.976</td>
</tr>
</tbody>
</table>

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 MAINSUPPL are significantly positive and strong in the 1998 estimation, and MAINSUPPL 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

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

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

Subpopulation obs 1458 894 1458
R-squared 1.183
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.
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
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:

\[ H2a: \text{Cash holdings are positively related to the personal wealth of the firm’s owner} \]

\[ H2b: \text{Cash holdings are lower for firms having a financially distressed owner} \]

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:

\[ H3a: \text{Cash holdings are positively related to owner experience} \]

\[ H3b: \text{Cash holdings are higher for firms with a college educated owner} \]

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:

\[ H4: \text{Cash holdings are positively related to the financial constraints of the firm} \]

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.

\[
\ln(CASH/TOSALES)_i = \beta_0 + \beta_1 \cdot \text{PASSTHRU}_i + \beta_2 \cdot \ln(SALES)_i + \beta_3 \cdot \text{FAMOWN}_i + \\
\beta_4 \cdot \text{OWNSHR}_i + \beta_5 \cdot \text{OWNMGR}_i + \beta_6 \cdot \ln(OWNERS)_i + \beta_7 \cdot \text{PURCHASED}_i + \\
\beta_8 \cdot \text{INHERITED}_i + \beta_9 \cdot \text{OWNDISTRESS}_i + \beta_{10} \cdot \text{FIRMDISTRESS}_i + \beta_{11} \cdot \text{FEARDENIAL}_i + \\
\beta_{12} \cdot \ln(OTRINCTOSALES)_i + \beta_{13} \cdot \ln(OWNWORTHOTOSALES)_i + \beta_{14} \cdot \ln(PROFTOINCOME)_i + \\
\beta_{15} \cdot \text{TRADECREDIT}_i + \beta_{16} \cdot \ln(UNUSEDLOC)_i + \beta_{17} \cdot \ln(CURLIBTOSALES)_i + \\
\beta_{18} \cdot \ln(DEBTRATIO)_i + \beta_{19} \cdot \text{COLLEGEGRAD}_i + \beta_{20} \cdot \text{SPECIALD}_i + \beta_{21} \cdot \text{OWNEXP}_i + \epsilon_i
\]

The specific variables chosen in each category are summarized in table 3.1, along with their hypothesized relationship (+ or -) to \(\ln(CASH/TOSALES)\). 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

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Description</th>
<th>Hypothesized Relationship to Cash Holdings</th>
<th>Hypothesis Tested</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm Characteristics</strong> (Controls):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASSTHRU Dummy, 1 = firm is structured as a pass-through entity for tax purposes</td>
<td>(-)</td>
<td>Firms will hold less cash if owners are personally taxed on firm profits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnSALES Natural log of annual sales</td>
<td>(-)</td>
<td>Larger firms hold less cash because they have access to alternate forms of finance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PURCHASED Dummy, 1 = firm was purchased by current owner(s)</td>
<td>(-)</td>
<td>Firm that is purchased may be viewed as an investment rather than a family legacy and will not hold excess cash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INHERITED Dummy, 1 = firm was inherited by current owner(s)</td>
<td>(+)</td>
<td>Firm that is a family legacy will hold accumulated cash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Dummies Dummy variables for: Wholesale, Retail, Manufacturing, Transportation, Services</td>
<td>n/a</td>
<td>Control for industry-specific factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agency and Value Maximization:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAMOWN Dummy, 1 = greater than 50% family ownership</td>
<td>(+)</td>
<td>H1</td>
<td>Family firms are concerned with survival and risk reduction over value maximization; will hold cash to reduce firm risk</td>
<td></td>
</tr>
<tr>
<td>OWNSHR Percentage of business owned by principal owner</td>
<td>(-)</td>
<td>H1</td>
<td>Increasing firm ownership share reduces agency conflict (Jensen and Meckling 1976)</td>
<td></td>
</tr>
<tr>
<td>OWMNGR Dummy, 1 = firm is managed by an owner</td>
<td>(-)</td>
<td>H1</td>
<td>Having firm managed by owner reduces agency conflict (Jensen and Meckling 1976)</td>
<td></td>
</tr>
<tr>
<td>LnOWNERS Natural log of the total number of firm owners</td>
<td>(+)</td>
<td>H1</td>
<td>Increasingly diffuse firm ownership promotes agency conflict</td>
<td></td>
</tr>
<tr>
<td><strong>Owner Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnOWNWORTHOSALES Natural log of the ratio of the primary owner’s personal wealth (net of her share of firm ownership), to Sales</td>
<td>(+)</td>
<td>H2a</td>
<td>Wealthier owners are less likely to extract cash from firm and more able to provide cash infusion to firm than less wealthy owners</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Sign</td>
<td>Hypothesis</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
<td>------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>Dummy, 1 = primary owner declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years</td>
<td>(-)</td>
<td>H2b</td>
<td>Distressed owners more likely to extract cash from firm to cover personal obligations, and less able to make cash infusions to firm</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>Number of years of experience of principal owner managing this or other business</td>
<td>(+)</td>
<td>H3a</td>
<td>More experienced owners have experience with working capital management</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>Dummy, 1 = primary owner of firm is a college grad (or higher)</td>
<td>(+)</td>
<td>H3b</td>
<td>Owners with a college degree or higher may have business training and understand working capital management</td>
</tr>
<tr>
<td>SPECIALED</td>
<td>Dummy, 1 = primary owner of firm is a trade school grad or has associate degree</td>
<td>(-)</td>
<td>H3b</td>
<td>Owners who started firm to leverage their specialized skill or training may not have business training in working capital management</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>Dummy, 1 = firm declared bankruptcy within past 7 years or defaulted on an obligation within past 3 years</td>
<td>(-)</td>
<td>H4</td>
<td>Distressed firms cannot accumulate cash and will deplete cash to meet obligations</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>Dummy, 1 = firm declined to apply for a loan within the past 3 years, even though they needed the funds</td>
<td>(-)</td>
<td>H4</td>
<td>Failure to apply for credit when needed is an indicator of firm’s poor financial condition, including liquidity condition</td>
</tr>
<tr>
<td>LnOTRINCTOSALES</td>
<td>Natural log of the ratio of “other income” to sales</td>
<td>(+)</td>
<td>H4</td>
<td>Firms with income from non-operating sources will use this as “windfall” to accumulate cash.</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>Natural log of the ratio of profit to total income from all sources for current or previous fiscal year</td>
<td>(+)</td>
<td>H4</td>
<td>Profitable firms can more easily accumulate cash; unprofitable ones drain cash reserves.</td>
</tr>
<tr>
<td>LnCURLIBTOSALES</td>
<td>Natural log of the ratio of the firm’s current liabilities to sales</td>
<td>(+)</td>
<td>H5</td>
<td>Firms with higher short-term liabilities will hold more cash to meet obligations</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>Natural log of the ratio of Total Liabilities to Total Assets.</td>
<td>(-)</td>
<td>H5</td>
<td>Firms with higher outstanding debt will need cash to service debt to avoid default.</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>Dummy, 1 = if firm uses trade credit</td>
<td>(-)</td>
<td>H6</td>
<td>Availability of trade credit relaxes firm’s liquidity requirements</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>Natural log of the ratio of unused balance on all Lines of Credit to Sales</td>
<td>(-)</td>
<td>H6</td>
<td>Availability of a Line of credit relaxes firm’s liquidity requirements</td>
</tr>
</tbody>
</table>
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.

Figure 3.1. Sample statistics for numeric model variables from 1998 NSSBF
### Table 3.2

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

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>max</th>
<th>min</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>OWNSHR</td>
<td>3934</td>
<td>76.10473</td>
<td>27.11274</td>
<td>100</td>
<td>8</td>
<td>-4.8843441</td>
<td>1.657802</td>
</tr>
<tr>
<td>ONEWXPR</td>
<td>3934</td>
<td>21.41129</td>
<td>11.51455</td>
<td>65</td>
<td>0</td>
<td>0.4905389</td>
<td>2.982965</td>
</tr>
<tr>
<td>CASHCOST</td>
<td>3934</td>
<td>17.10757</td>
<td>2.032707</td>
<td>112.5</td>
<td>0</td>
<td>46.391</td>
<td>2440.01</td>
</tr>
<tr>
<td>LnCASHCOST</td>
<td>3934</td>
<td>.0929259</td>
<td>.238032</td>
<td>4.731803</td>
<td>0</td>
<td>8.667614</td>
<td>123.721</td>
</tr>
<tr>
<td>wLnCASHCOST</td>
<td>3934</td>
<td>.0869004</td>
<td>.1552212</td>
<td>1.049822</td>
<td>0</td>
<td>3.908554</td>
<td>21.07929</td>
</tr>
<tr>
<td>SALES</td>
<td>3934</td>
<td>4.487467</td>
<td>1.27e+07</td>
<td>7.845808</td>
<td>.042676</td>
<td>2.427398</td>
<td></td>
</tr>
<tr>
<td>wLnSALES</td>
<td>3934</td>
<td>13.20777</td>
<td>2.24785</td>
<td>17.94269</td>
<td>3.931826</td>
<td>4.79431</td>
<td>28.41714</td>
</tr>
<tr>
<td>OWNERS</td>
<td>3934</td>
<td>4.116929</td>
<td>51.93903</td>
<td>2800</td>
<td>1</td>
<td>44.38326</td>
<td>2231.763</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>3934</td>
<td>.5517263</td>
<td>.6871977</td>
<td>3.912023</td>
<td>0</td>
<td>.713829</td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>3934</td>
<td>.5517263</td>
<td>.6871977</td>
<td>3.912023</td>
<td>0</td>
<td>.713829</td>
<td></td>
</tr>
<tr>
<td>OTRINC</td>
<td>3934</td>
<td>.0565075</td>
<td>.1449223</td>
<td>87.64276</td>
<td>-.2831222</td>
<td>56.80069</td>
<td>3401.191</td>
</tr>
<tr>
<td>LnOTRINCTO</td>
<td>3934</td>
<td>.2636256</td>
<td>.0716142</td>
<td>.8255439</td>
<td>.0429466</td>
<td>6.737445</td>
<td>49.86473</td>
</tr>
<tr>
<td>wLnOTRINC</td>
<td>3934</td>
<td>.2636256</td>
<td>.0716142</td>
<td>.8255439</td>
<td>.0429466</td>
<td>6.737445</td>
<td>49.86473</td>
</tr>
<tr>
<td>OWNWORTH</td>
<td>3934</td>
<td>4.035012</td>
<td>.3247742</td>
<td>7.89896</td>
<td>0</td>
<td>5.727057</td>
<td>58.25106</td>
</tr>
<tr>
<td>LnOWNWORTH</td>
<td>3934</td>
<td>4.028175</td>
<td>.253703</td>
<td>5.735924</td>
<td>3.931826</td>
<td>4.79431</td>
<td>28.41714</td>
</tr>
<tr>
<td>wLnOWNWORTH</td>
<td>3934</td>
<td>4.028175</td>
<td>.253703</td>
<td>5.735924</td>
<td>3.931826</td>
<td>4.79431</td>
<td>28.41714</td>
</tr>
<tr>
<td>PROFTOINCOME</td>
<td>3934</td>
<td>.0047387</td>
<td>.535976</td>
<td>1.049822</td>
<td>0</td>
<td>3.908554</td>
<td>21.07929</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>3934</td>
<td>.0628008</td>
<td>.1078748</td>
<td>3.999385</td>
<td>-0.0025357</td>
<td>3.759318</td>
<td>7.060703</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>3934</td>
<td>.0628008</td>
<td>.1078748</td>
<td>3.999385</td>
<td>-0.0025357</td>
<td>3.759318</td>
<td>7.060703</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>3934</td>
<td>.3286982</td>
<td>.922211</td>
<td>284.5529</td>
<td>0</td>
<td>50.7541</td>
<td>2854.338</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>3934</td>
<td>.1247809</td>
<td>.3220724</td>
<td>.5654427</td>
<td>0</td>
<td>5.93584</td>
<td>58.26441</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>3934</td>
<td>.1178517</td>
<td>.2616166</td>
<td>1.673976</td>
<td>0</td>
<td>3.60786</td>
<td>17.86258</td>
</tr>
<tr>
<td>CURLIB</td>
<td>3934</td>
<td>.0720034</td>
<td>.461095</td>
<td>2</td>
<td>0</td>
<td>5.303388</td>
<td>43.2911</td>
</tr>
<tr>
<td>LnCURLIBTO</td>
<td>3934</td>
<td>.0628008</td>
<td>.1078748</td>
<td>1.049822</td>
<td>0</td>
<td>3.759318</td>
<td>22.50921</td>
</tr>
<tr>
<td>wLnCURLIB</td>
<td>3934</td>
<td>.0628008</td>
<td>.1078748</td>
<td>1.049822</td>
<td>0</td>
<td>3.759318</td>
<td>22.50921</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>3934</td>
<td>.8662447</td>
<td>2.602223</td>
<td>53.56457</td>
<td>0</td>
<td>11.15924</td>
<td>167.8626</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>3934</td>
<td>.4243869</td>
<td>.485192</td>
<td>3.999385</td>
<td>0</td>
<td>2.942532</td>
<td>12.69059</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>3934</td>
<td>.4194727</td>
<td>.4587623</td>
<td>2.504837</td>
<td>0</td>
<td>1.979796</td>
<td>8.287826</td>
</tr>
</tbody>
</table>

**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)

<table>
<thead>
<tr>
<th>Dummy/Categorical Vars</th>
<th>Response</th>
<th>Number of Responses</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSTHRU: Firm is structured as a pass-thru entity for tax purposes</td>
<td>No</td>
<td>3127</td>
<td>93.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>211</td>
<td>6.3</td>
</tr>
<tr>
<td>FAMOWN: One Family owns more than 50% of the firm</td>
<td>No</td>
<td>499</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2839</td>
<td>85.1</td>
</tr>
<tr>
<td>OWNMGR: Firm's Manager is an owner</td>
<td>No</td>
<td>346</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2992</td>
<td>89.6</td>
</tr>
<tr>
<td>PURCHASED: Firm was purchased by its current owners</td>
<td>No</td>
<td>2682</td>
<td>80.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>656</td>
<td>19.7</td>
</tr>
<tr>
<td>INHERITED: Firm was inherited by its current owners</td>
<td>No</td>
<td>3152</td>
<td>94.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>186</td>
<td>5.6</td>
</tr>
<tr>
<td>OWNDISTRESS: Principal owner has been bankrupt or delinquent on personal obligations</td>
<td>No</td>
<td>2847</td>
<td>85.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>491</td>
<td>14.7</td>
</tr>
<tr>
<td>COLLEGEGRAD: Primary owner is a college grad or better</td>
<td>No</td>
<td>1595</td>
<td>47.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1743</td>
<td>52.2</td>
</tr>
<tr>
<td>SPECIALED: Primary owner is a trade school or assoc degree grad</td>
<td>No</td>
<td>3022</td>
<td>90.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>316</td>
<td>9.5</td>
</tr>
<tr>
<td>FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations</td>
<td>No</td>
<td>2858</td>
<td>85.6</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>480</td>
<td>14.4</td>
</tr>
<tr>
<td>FEARDENIAL: Firm has not applied for credit due to fear of denial</td>
<td>No</td>
<td>2609</td>
<td>78.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>729</td>
<td>21.8</td>
</tr>
<tr>
<td>TRADECREDIT: Firm has used trade credit within most recent fiscal year</td>
<td>No</td>
<td>1108</td>
<td>33.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2230</td>
<td>66.8</td>
</tr>
</tbody>
</table>
Table 3.3
Sample statistics for dummy/categorical variables from 2003 NSSBF (using implicate #3 only, n=3934)

<table>
<thead>
<tr>
<th>Dummy/Categorical Vars</th>
<th>Response</th>
<th>Number of Responses</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSTHRU: Firm is structured as a pass-thru entity for tax purposes</td>
<td>No</td>
<td>3631</td>
<td>92.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>303</td>
<td>7.7</td>
</tr>
<tr>
<td>FAMOWN: One Family owns more than 50% of the firm</td>
<td>No</td>
<td>613</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3321</td>
<td>84.4</td>
</tr>
<tr>
<td>OWNMGR: Firm's Manager is an owner</td>
<td>No</td>
<td>364</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3570</td>
<td>90.7</td>
</tr>
<tr>
<td>PURCHASED: Firm was purchased by its current owners</td>
<td>No</td>
<td>3088</td>
<td>78.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>846</td>
<td>21.5</td>
</tr>
<tr>
<td>INHERITED: Firm was inherited by its current owners</td>
<td>No</td>
<td>3678</td>
<td>93.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>256</td>
<td>6.5</td>
</tr>
<tr>
<td>OWNDISTRESS: Principal owner has been bankrupt or delinquent on personal obligations</td>
<td>No</td>
<td>3797</td>
<td>96.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>137</td>
<td>3.5</td>
</tr>
<tr>
<td>COLLEGEGRAD: Primary owner is a college grad or better</td>
<td>No</td>
<td>2015</td>
<td>51.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1919</td>
<td>48.8</td>
</tr>
<tr>
<td>SPECIALED: Primary owner is a trade school or assoc degree grad</td>
<td>No</td>
<td>3284</td>
<td>83.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>650</td>
<td>16.5</td>
</tr>
<tr>
<td>FIRMDISTRESS: Firm has been bankrupt/delinquent on business obligations</td>
<td>No</td>
<td>3804</td>
<td>96.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>130</td>
<td>3.3</td>
</tr>
<tr>
<td>FEARDENIAL: Firm has not applied for credit due to fear of denial</td>
<td>No</td>
<td>3376</td>
<td>85.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>558</td>
<td>14.2</td>
</tr>
<tr>
<td>TRADECREDIT: Firm has used trade credit within most recent fiscal year</td>
<td>No</td>
<td>1189</td>
<td>30.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2745</td>
<td>69.8</td>
</tr>
</tbody>
</table>
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.
<table>
<thead>
<tr>
<th>wLnCASHTOS</th>
<th>wLnSALES</th>
<th>FAMOWN</th>
<th>OWNSHR</th>
<th>OWNMGR</th>
<th>OWNEXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>1.0000</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3.3. 1998 NSSBF: Pearson Correlations of Model Variables**
<table>
<thead>
<tr>
<th>wLnCA-ES</th>
<th>PASSTHRU</th>
<th>wLnSALES</th>
<th>FAMOWN</th>
<th>OWNSHR</th>
<th>OWNMGR</th>
<th>OWNEXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>-0.0109</td>
<td>1.0000</td>
<td>-0.3069* -0.0052</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0109</td>
<td>1.0000</td>
<td>-0.3069* -0.0052</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAMOWN</td>
<td>0.0665* -0.1992* -0.2764*</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.0745* -0.2603* -0.3700*</td>
<td>0.4467* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNMGR</td>
<td>0.0745* -0.2603* -0.3700*</td>
<td>0.4467* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.0153* -0.0383* 0.2894*</td>
<td>0.1147* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.0327* -0.0187 0.0848*</td>
<td>-0.0799* -0.0306 -0.0181</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.0244 0.0512* 0.0135</td>
<td>-0.0693* -0.2409* 0.0405* -0.0560*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>-0.0752* 0.1755* 0.4596*</td>
<td>-0.5041* -0.7852* -0.1980* 0.1248*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PURCHASED</td>
<td>-0.0763* 0.0666 0.1881*</td>
<td>-0.0685* -0.0841* -0.0720* 0.0171</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INHERITED</td>
<td>-0.0068 -0.0298 0.1847*</td>
<td>0.0423* -0.0920* -0.0545* 0.0876*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0200 0.0075 -0.1048*</td>
<td>0.0243* -0.0920* -0.0545* 0.0876*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>0.0327* -0.0187 0.0848*</td>
<td>-0.0799* -0.0306 -0.0181</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.4342* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>-0.0034 0.1477* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PURCHASED</td>
<td>-0.0008 0.0353* 0.0657* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INHERITED</td>
<td>-0.0121 0.0075 0.1292* -0.1381* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0411* 0.0014 -0.0417* -0.0252 -0.0220 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.0069 -0.0172 0.0217 0.0175 0.0097 0.2829* 1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0688* -0.0043 -0.0699* -0.0408* -0.0689* 0.2288* 0.1327*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnOTrinct-S</td>
<td>-0.0082 -0.0066 0.0037 -0.0290 0.0112 -0.0007 0.0015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnOWNWORT-S</td>
<td>0.3950* -0.0313* -0.4902* 0.0828* 0.1188* 0.0617* -0.0552*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnPROFTOI-E</td>
<td>-0.0023 -0.0202 -0.0855* 0.1017* 0.1207* 0.0544* -0.0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>-0.1560* -0.0154 0.4159* -0.0905* -0.1601* -0.1070* 0.1652*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>-0.0589* -0.0039 0.0663* -0.0295 -0.0332* 0.0074 0.0166</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnCURLIBT-S</td>
<td>0.0146 -0.0067 0.1920* -0.1157* -0.1038* -0.0926* 0.0670*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.2080* 0.0232 0.1429* -0.0690* -0.0686* -0.0313 -0.0332*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 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 0.0097 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 0.0112 -0.0007 0.0015 |
| wLnOWNWORT-S | 0.3950* -0.0313* -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 | 0.0125 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* |

| 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 | 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.

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

Figure 3.5. Variance Inflation Factors – 1998 NSSBF
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.

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

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.
• OWNOWORTHHTOSALES: 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 (1st-2nd quartile, 2nd-3rd quartile, 3rd-4th 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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>[95% Conf. Interval]</th>
<th>Adjusted Wald test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(H0: Means are equal)</td>
</tr>
<tr>
<td>PASSTHRU</td>
<td>.12389</td>
<td>.0073140</td>
<td>.1095492</td>
<td>.1382305</td>
</tr>
<tr>
<td>Yes</td>
<td>.11824</td>
<td>.0353204</td>
<td>.0489911</td>
<td>.1874961</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 0.02, Prob &gt; F = 0.8756</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAMOWN</td>
<td>.10572</td>
<td>.0196122</td>
<td>.0672659</td>
<td>.1441729</td>
</tr>
<tr>
<td>Yes</td>
<td>.12574</td>
<td>.0077606</td>
<td>.1105185</td>
<td>.1409509</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 0.90, Prob &gt; F = 0.3426</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWMNGR</td>
<td>.10339</td>
<td>.0273053</td>
<td>.0498468</td>
<td>.1569326</td>
</tr>
<tr>
<td>Yes</td>
<td>.12514</td>
<td>.0075053</td>
<td>.1104218</td>
<td>.139853</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 0.59, Prob &gt; F = 0.4427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>.11196</td>
<td>.0094133</td>
<td>.0935075</td>
<td>.1304208</td>
</tr>
<tr>
<td>Yes</td>
<td>.13592</td>
<td>.0110816</td>
<td>.114189</td>
<td>.1576443</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 2.71, Prob &gt; F = 0.0997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIALED</td>
<td>.12626</td>
<td>.0073311</td>
<td>.110981</td>
<td>.1414224</td>
</tr>
<tr>
<td>Yes</td>
<td>.09826</td>
<td>.019639</td>
<td>.059754</td>
<td>.136766</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 1.76, Prob &gt; F = 0.1847</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PURCHASED</td>
<td>.13483</td>
<td>.0087004</td>
<td>.1177652</td>
<td>.1518826</td>
</tr>
<tr>
<td>Yes</td>
<td>.07093</td>
<td>.0053222</td>
<td>.059754</td>
<td>.136766</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 39.35, Prob &gt; F = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INHERITED</td>
<td>.12139</td>
<td>.007345</td>
<td>.1069912</td>
<td>.1357937</td>
</tr>
<tr>
<td>Yes</td>
<td>.17196</td>
<td>.0400117</td>
<td>.093504</td>
<td>.250406</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 1.54, Prob &gt; F = 0.2140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>.13137</td>
<td>.0082459</td>
<td>.1152051</td>
<td>.1475406</td>
</tr>
<tr>
<td>Yes</td>
<td>.08042</td>
<td>.0121697</td>
<td>.056559</td>
<td>.104281</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 12.05, Prob &gt; F = 0.0005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>.13339</td>
<td>.0081399</td>
<td>.1174291</td>
<td>.1493485</td>
</tr>
<tr>
<td>Yes</td>
<td>.05961</td>
<td>.0114798</td>
<td>.0371066</td>
<td>.0821233</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 27.52, Prob &gt; F = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>.13659</td>
<td>.0089284</td>
<td>.1190829</td>
<td>.1540945</td>
</tr>
<tr>
<td>Yes</td>
<td>.07943</td>
<td>.0094224</td>
<td>.060952</td>
<td>.0979014</td>
</tr>
<tr>
<td></td>
<td>F(1,3260) = 19.39, Prob &gt; F = 0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>.16467</td>
<td>.0158017</td>
<td>.1336867</td>
<td>.1956513</td>
</tr>
<tr>
<td></td>
<td>CASHTOSALES</td>
<td>Linearized</td>
<td>Adjusted Wald test for equality of means</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------</td>
<td>------------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Err.</td>
<td>[95% Conf. Interval]</td>
<td>(H0: Means are equal)</td>
</tr>
<tr>
<td>PASSTHRU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>.203309</td>
<td>.0390685</td>
<td>.1267122 - .2799059</td>
<td>F(1, 3862) = 0.02, Prob &gt; F = 0.8895</td>
</tr>
<tr>
<td>Yes</td>
<td>.1938529</td>
<td>.0556456</td>
<td>.0847554 - .3029505</td>
<td></td>
</tr>
<tr>
<td>FAMOWN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>.1349699</td>
<td>.0328682</td>
<td>.0705292 - .1994107</td>
<td>F(1, 3862) = 2.10, Prob &gt; F = 0.1478</td>
</tr>
<tr>
<td>Yes</td>
<td>.2098064</td>
<td>.03982</td>
<td>.131736 - .2878765</td>
<td></td>
</tr>
<tr>
<td>OWMGR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>.094739</td>
<td>.0134023</td>
<td>.0684627 - .1210153</td>
<td>F(1, 3862) = 7.95, Prob &gt; F = 0.0048</td>
</tr>
<tr>
<td>Yes</td>
<td>.2087913</td>
<td>.0381627</td>
<td>.1339703 - .2836123</td>
<td></td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>.1976732</td>
<td>.0574065</td>
<td>.0851232 - .3102231</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>.1157728</td>
<td>.0092411</td>
<td>.0976539 - .138917</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.5

2003 NSSBF: Two-way tabulation of CASHTOSALES versus firm characteristics from model
<table>
<thead>
<tr>
<th>Category</th>
<th>No</th>
<th>Yes</th>
<th>F(1,3862)</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIALED</td>
<td>.1805653</td>
<td>.3170111</td>
<td>0.53</td>
<td>0.4679</td>
</tr>
<tr>
<td>PURCHASED</td>
<td>.1903496</td>
<td>.2590566</td>
<td>0.16</td>
<td>0.6870</td>
</tr>
<tr>
<td>INHERITED</td>
<td>.204179</td>
<td>.2049188</td>
<td>0.00</td>
<td>0.9779</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>.2065174</td>
<td>.1191806</td>
<td>2.84</td>
<td>0.0919</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>.2064703</td>
<td>.0892426</td>
<td>6.13</td>
<td>0.0133</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>.2236478</td>
<td>.1027884</td>
<td>6.74</td>
<td>0.0094</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>.3371961</td>
<td>.150215</td>
<td>5.93</td>
<td>0.0150</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>.2052015</td>
<td>.1681732</td>
<td>0.47</td>
<td>0.4936</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>.2062226</td>
<td>.1079871</td>
<td>3.32</td>
<td>0.0686</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>.2088943</td>
<td>.0989043</td>
<td>7.10</td>
<td>0.0078</td>
</tr>
<tr>
<td>RETAIL</td>
<td>.2206422</td>
<td>.1240289</td>
<td>4.16</td>
<td>0.0415</td>
</tr>
<tr>
<td>SERVICES</td>
<td>.1296883</td>
<td>.2900168</td>
<td>4.11</td>
<td>0.0428</td>
</tr>
</tbody>
</table>
Table 3.6

Means of selected model variables from 1998 and 2003 NSSBF samples

<table>
<thead>
<tr>
<th></th>
<th>***** 1998 NSSBF *****</th>
<th></th>
<th>***** 2003 NSSBF *****</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>[95% Conf. Interval]</td>
</tr>
<tr>
<td>CASHTOSALES</td>
<td>0.112028</td>
<td>0.4056525</td>
<td>0.0982617 - 0.1257943</td>
</tr>
<tr>
<td>OTRINCTOSALES</td>
<td>0.037509</td>
<td>0.7689369</td>
<td>0.0114142 - 0.0636038</td>
</tr>
<tr>
<td>PROFTOINCOME</td>
<td>0.0809244</td>
<td>2.017273</td>
<td>0.0124659 - 0.1493829</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>0.3495936</td>
<td>6.4175</td>
<td>0.1318084 - 0.5673788</td>
</tr>
<tr>
<td>CURLIBTOSALES</td>
<td>0.1001296</td>
<td>0.203248</td>
<td>0.0932321 - 0.1070271</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>0.1144091</td>
<td>1.248427</td>
<td>0.9814949 - 1.248427</td>
</tr>
</tbody>
</table>

Note: strata with single sampling unit treated as certainty
Table 3.7

1998 NSSBF: Mean of wLnCASHTOSALES across quartiles of model variables

<table>
<thead>
<tr>
<th>Number of strata</th>
<th>77</th>
<th>Number of obs</th>
<th>1128</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of PSUs</td>
<td>1128</td>
<td>Population size</td>
<td>1279594</td>
</tr>
<tr>
<td>Design df</td>
<td>1051</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quartile</th>
<th>wLnCASHTOSALES</th>
<th>Linearized Std. Err.</th>
<th>Adjusted Wald Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean of</td>
<td>F(1,3260)</td>
<td>Prob&gt;F=</td>
</tr>
<tr>
<td>wLnSALES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.1588675</td>
<td>.0095929</td>
<td>44.55</td>
</tr>
<tr>
<td>2</td>
<td>.0850707</td>
<td>.0054981</td>
<td>9.30</td>
</tr>
<tr>
<td>3</td>
<td>.0640306</td>
<td>.0041537</td>
<td>6.72</td>
</tr>
<tr>
<td>4</td>
<td>.0501867</td>
<td>.0033539</td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0757363</td>
<td>.0051084</td>
<td>8.33</td>
</tr>
<tr>
<td>2</td>
<td>.0942224</td>
<td>.0038913</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0955543</td>
<td>.0059894</td>
<td>1.71</td>
</tr>
<tr>
<td>2</td>
<td>.0799057</td>
<td>.0055747</td>
<td>0.30</td>
</tr>
<tr>
<td>3</td>
<td>.098225</td>
<td>.0078646</td>
<td>3.61</td>
</tr>
<tr>
<td>4</td>
<td>.0972173</td>
<td>.0108209</td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0946834</td>
<td>.004072</td>
<td>18.87</td>
</tr>
<tr>
<td>2</td>
<td>.0681329</td>
<td>.0045808</td>
<td></td>
</tr>
<tr>
<td>wLnOTRINCTOS~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0883401</td>
<td>.0036337</td>
<td>16.94</td>
</tr>
<tr>
<td>4</td>
<td>.0937339</td>
<td>.0069335</td>
<td>55.53</td>
</tr>
<tr>
<td>wLnOWNWORTHT~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0414717</td>
<td>.0025786</td>
<td>13.59</td>
</tr>
<tr>
<td>2</td>
<td>.0577249</td>
<td>.0029911</td>
<td>21.99</td>
</tr>
<tr>
<td>3</td>
<td>.1084445</td>
<td>.006046</td>
<td>4.52</td>
</tr>
<tr>
<td>wLnPROFTOINC~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0967847</td>
<td>.0079938</td>
<td>13.59</td>
</tr>
<tr>
<td>2</td>
<td>.0637847</td>
<td>.0042014</td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.0988177</td>
<td>.0039959</td>
<td>12.91</td>
</tr>
<tr>
<td>2</td>
<td>.1217171</td>
<td>.0477461</td>
<td></td>
</tr>
<tr>
<td>wLnCURLIBTOS~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.11265</td>
<td>.0060975</td>
<td>41.88</td>
</tr>
<tr>
<td>2</td>
<td>.0590927</td>
<td>.0055972</td>
<td></td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.1352571</td>
<td>.0090247</td>
<td>41.68</td>
</tr>
<tr>
<td>2</td>
<td>.1125734</td>
<td>.0066452</td>
<td></td>
</tr>
</tbody>
</table>

(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 $w\ln(CASH/TOSALES)$ across quartiles of model variables

<table>
<thead>
<tr>
<th>Quartile</th>
<th>$w\ln(CASH/TOSALES)$</th>
<th>Mean of</th>
<th>Linearized Std. Err.</th>
<th>Adjusted Wald Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(HO = means are equal)</td>
</tr>
<tr>
<td>wLnSALES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.188117</td>
<td>0.0116205</td>
<td>F(1,3862)=53.42, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.0925807</td>
<td>0.005965</td>
<td>F(1,3862)=2.31, Prob&gt;F=0.1289</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0675532</td>
<td>0.0054488</td>
<td>F(1,3862)=7.49, Prob&gt;F=0.00973</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0531834</td>
<td>0.0032688</td>
<td>F(1,3862)=4.20, Prob&gt;F=0.0404</td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.0922093</td>
<td>0.0062976</td>
<td>F(1,3862)=1.89, Prob&gt;F=0.1695</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.1041788</td>
<td>0.0047354</td>
<td>F(1,3862)=0.01, Prob&gt;F=0.9352</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.107642</td>
<td>0.0077331</td>
<td>F(1,3862)=10.17, Prob&gt;F=0.00014</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.080271</td>
<td>0.0063303</td>
<td>F(1,3862)=8.54, Prob&gt;F=0.0035</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0952326</td>
<td>0.0064237</td>
<td>F(1,3862)=65.37, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0931823</td>
<td>0.0118272</td>
<td>F(1,3862)=6.86, Prob&gt;F=0.00276</td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.10534</td>
<td>0.0052571</td>
<td>F(1,3862)=1.10, Prob&gt;F=0.2945</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.0942637</td>
<td>0.0061028</td>
<td>F(1,3862)=10.94, Prob&gt;F=0.0009</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0931823</td>
<td>0.0064237</td>
<td>F(1,3862)=65.37, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.1031823</td>
<td>0.0095661</td>
<td>F(1,3862)=6.86, Prob&gt;F=0.00276</td>
<td></td>
</tr>
<tr>
<td>wLnOTRINCTOS~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.0981763</td>
<td>0.0041731</td>
<td>F(1,3862)=1.10, Prob&gt;F=0.2945</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.1103931</td>
<td>0.0092776</td>
<td>F(1,3862)=10.94, Prob&gt;F=0.0009</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0469822</td>
<td>0.0039244</td>
<td>F(1,3862)=17.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0391823</td>
<td>0.0077331</td>
<td>F(1,3862)=10.17, Prob&gt;F=0.00014</td>
<td></td>
</tr>
<tr>
<td>wLnOWNWORTH~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.0666949</td>
<td>0.0047752</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.0917232</td>
<td>0.0058634</td>
<td>F(1,3862)=8.54, Prob&gt;F=0.0035</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.1968215</td>
<td>0.0116104</td>
<td>F(1,3862)=65.37, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0931823</td>
<td>0.0064237</td>
<td>F(1,3862)=65.37, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>wLnPROFTOINC~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.1091862</td>
<td>0.0085835</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.0533232</td>
<td>0.0041731</td>
<td>F(1,3862)=10.94, Prob&gt;F=0.0009</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0533232</td>
<td>0.0073523</td>
<td>F(1,3862)=65.37, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.080213</td>
<td>0.006756</td>
<td>F(1,3862)=4.86, Prob&gt;F=0.0276</td>
<td></td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.1138215</td>
<td>0.0049281</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.0578231</td>
<td>0.0082289</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.0677758</td>
<td>0.0046992</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0971076</td>
<td>0.0079052</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>wLnCURLIBTOS~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.134519</td>
<td>0.0072202</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.1210796</td>
<td>0.0090545</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.069137</td>
<td>0.00426</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.0596535</td>
<td>0.0049781</td>
<td>F(1,3862)=15.58, Prob&gt;F=0.0000</td>
<td></td>
</tr>
</tbody>
</table>

(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

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

* *** 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.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Robust OLS</th>
<th>Robust WLS</th>
<th>Survey-weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>FASTTHRU</td>
<td>-0.00899</td>
<td>-0.0224**</td>
<td>-0.0224**</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0168***</td>
<td>-0.0185***</td>
<td>-0.0185***</td>
</tr>
<tr>
<td>FAMOWN</td>
<td>-0.00025</td>
<td>-0.00715</td>
<td>-0.00715</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.000491</td>
<td>-0.00269</td>
<td>-0.00269</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-1.88e-05</td>
<td>0.000334</td>
<td>0.000334</td>
</tr>
<tr>
<td>ONEWNP</td>
<td>0.000477**</td>
<td>0.000520*</td>
<td>0.000520*</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.00983**</td>
<td>0.0121**</td>
<td>0.0121**</td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.0162**</td>
<td>-0.0144</td>
<td>-0.0144</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.0113***</td>
<td>0.0349***</td>
<td>0.0349***</td>
</tr>
<tr>
<td>PURCHASED</td>
<td>-0.00640</td>
<td>-0.0120**</td>
<td>-0.0120**</td>
</tr>
<tr>
<td>INHERITED</td>
<td>0.0221*</td>
<td>0.0324*</td>
<td>0.0324*</td>
</tr>
<tr>
<td>OWDISTRESS</td>
<td>-0.0178**</td>
<td>-0.0160*</td>
<td>-0.0160*</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.0164***</td>
<td>-0.0138</td>
<td>-0.0138</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0195***</td>
<td>-0.0225***</td>
<td>-0.0225***</td>
</tr>
<tr>
<td>wLnNOTRINCTOSALES</td>
<td>0.285***</td>
<td>0.295***</td>
<td>0.295***</td>
</tr>
<tr>
<td>wLnOWNWORTHTOSALES</td>
<td>7.907***</td>
<td>8.498***</td>
<td>8.498***</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>-0.0235</td>
<td>-0.00731</td>
<td>-0.00731</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>-0.00537</td>
<td>-0.00293</td>
<td>-0.00293</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>-0.0167***</td>
<td>-0.0203**</td>
<td>-0.0203**</td>
</tr>
<tr>
<td>wLnCURLIBTOSALES</td>
<td>0.150***</td>
<td>0.133***</td>
<td>0.133***</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.0429***</td>
<td>-0.0398***</td>
<td>-0.0398***</td>
</tr>
<tr>
<td>Constant</td>
<td>-68.13***</td>
<td>-73.34***</td>
<td>-73.34***</td>
</tr>
<tr>
<td>Observations</td>
<td>3338</td>
<td>3338</td>
<td>3561</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.202</td>
<td>0.206</td>
<td>0.206</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.197</td>
<td>0.201</td>
<td>0.200</td>
</tr>
<tr>
<td>Model SS</td>
<td>13.80</td>
<td>16.23</td>
<td>16.23</td>
</tr>
<tr>
<td>Residual SS</td>
<td>54.62</td>
<td>62.43</td>
<td>62.43</td>
</tr>
<tr>
<td>Model df</td>
<td>21</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Residual df</td>
<td>3316</td>
<td>3316</td>
<td>3483</td>
</tr>
<tr>
<td>F statistic</td>
<td>17.52</td>
<td>12.89</td>
<td>12.88</td>
</tr>
<tr>
<td>Number of strata</td>
<td>78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full Model</td>
<td>Minus LnOWNERS</td>
<td>Minus OWNSHR</td>
<td>Minus SPECIALED</td>
<td>Minus COLLEGEGRAD</td>
</tr>
<tr>
<td>PASSTHRU</td>
<td>-0.0224**</td>
<td>-0.0242**</td>
<td>-0.0264**</td>
<td>-0.0220**</td>
<td>-0.0237**</td>
</tr>
<tr>
<td></td>
<td>(0.0107)</td>
<td>(0.0110)</td>
<td>(0.0109)</td>
<td>(0.0107)</td>
<td>(0.0107)</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0185***</td>
<td>-0.0173***</td>
<td>-0.0188***</td>
<td>-0.0184***</td>
<td>-0.0181***</td>
</tr>
<tr>
<td></td>
<td>(0.00257)</td>
<td>(0.00247)</td>
<td>(0.00259)</td>
<td>(0.00256)</td>
<td>(0.00255)</td>
</tr>
<tr>
<td>FAMOWNN</td>
<td>-0.00715</td>
<td>-0.00830</td>
<td>-0.00242</td>
<td>-0.00696</td>
<td>-0.00789</td>
</tr>
<tr>
<td></td>
<td>(0.00948)</td>
<td>(0.00966)</td>
<td>(0.00918)</td>
<td>(0.00947)</td>
<td>(0.00948)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.00269</td>
<td>-0.00433</td>
<td>-0.00371</td>
<td>-0.00265</td>
<td>-0.00328</td>
</tr>
<tr>
<td></td>
<td>(0.00968)</td>
<td>(0.00985)</td>
<td>(0.00974)</td>
<td>(0.00969)</td>
<td>(0.00968)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.000334</td>
<td>-0.000284**</td>
<td>0.000324</td>
<td>0.000344*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000207)</td>
<td>(0.000125)</td>
<td>(0.000207)</td>
<td>(0.000209)</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.000520*</td>
<td>0.000568*</td>
<td>0.000532*</td>
<td>0.000531*</td>
<td>0.000472</td>
</tr>
<tr>
<td></td>
<td>(0.000303)</td>
<td>(0.000304)</td>
<td>(0.000303)</td>
<td>(0.000301)</td>
<td>(0.000301)</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.0121**</td>
<td>0.0134**</td>
<td>0.0123**</td>
<td>0.0148**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00614)</td>
<td>(0.00619)</td>
<td>(0.00616)</td>
<td>(0.00582)</td>
<td></td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.0144</td>
<td>-0.0137</td>
<td>-0.0140</td>
<td>-0.0205**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00912)</td>
<td>(0.00916)</td>
<td>(0.00913)</td>
<td>(0.00864)</td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.0349***</td>
<td>0.0244***</td>
<td>0.0347***</td>
<td>0.0362***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0106)</td>
<td>(0.00655)</td>
<td>(0.0106)</td>
<td>(0.0107)</td>
<td></td>
</tr>
<tr>
<td>PURCHASED</td>
<td>-0.0120**</td>
<td>-0.0130***</td>
<td>-0.0123**</td>
<td>-0.0122**</td>
<td>-0.0128**</td>
</tr>
<tr>
<td></td>
<td>(0.00505)</td>
<td>(0.00505)</td>
<td>(0.00506)</td>
<td>(0.00504)</td>
<td>(0.00505)</td>
</tr>
<tr>
<td>INHERITED</td>
<td>0.0324*</td>
<td>0.0358**</td>
<td>0.0331*</td>
<td>0.0327*</td>
<td>0.0319*</td>
</tr>
<tr>
<td></td>
<td>(0.0173)</td>
<td>(0.0178)</td>
<td>(0.0174)</td>
<td>(0.0173)</td>
<td>(0.0173)</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0160*</td>
<td>-0.0168*</td>
<td>-0.0163*</td>
<td>-0.0163*</td>
<td>-0.0162*</td>
</tr>
<tr>
<td></td>
<td>(0.00927)</td>
<td>(0.00924)</td>
<td>(0.00926)</td>
<td>(0.00926)</td>
<td>(0.00931)</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.0138</td>
<td>-0.0126</td>
<td>-0.0134</td>
<td>-0.0144*</td>
<td>-0.0137</td>
</tr>
<tr>
<td></td>
<td>(0.00870)</td>
<td>(0.00865)</td>
<td>(0.00867)</td>
<td>(0.00866)</td>
<td>(0.00869)</td>
</tr>
<tr>
<td>Variable</td>
<td>Coefficient 1</td>
<td>Coefficient 2</td>
<td>Coefficient 3</td>
<td>Coefficient 4</td>
<td>Coefficient 5</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0225***</td>
<td>-0.0221***</td>
<td>-0.0224***</td>
<td>-0.0222***</td>
<td>-0.0230***</td>
</tr>
<tr>
<td></td>
<td>(0.00697)</td>
<td>(0.00696)</td>
<td>(0.00697)</td>
<td>(0.00695)</td>
<td>(0.00698)</td>
</tr>
<tr>
<td>wLnOTRINCTOSALES</td>
<td>0.295***</td>
<td>0.301***</td>
<td>0.296***</td>
<td>0.295***</td>
<td>0.299***</td>
</tr>
<tr>
<td></td>
<td>(0.0934)</td>
<td>(0.0938)</td>
<td>(0.0937)</td>
<td>(0.0933)</td>
<td>(0.0939)</td>
</tr>
<tr>
<td>wLnOWNWORTHTOSALES</td>
<td>8.498***</td>
<td>8.761***</td>
<td>8.503***</td>
<td>8.509***</td>
<td>8.648***</td>
</tr>
<tr>
<td></td>
<td>(2.338)</td>
<td>(2.339)</td>
<td>(2.340)</td>
<td>(2.344)</td>
<td>(2.322)</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>-0.00731</td>
<td>-0.00686</td>
<td>-0.00638</td>
<td>-0.00761</td>
<td>-0.00805</td>
</tr>
<tr>
<td></td>
<td>(0.0201)</td>
<td>(0.0201)</td>
<td>(0.0201)</td>
<td>(0.0201)</td>
<td>(0.0201)</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>-0.00293</td>
<td>-0.00296</td>
<td>-0.00291</td>
<td>-0.00305</td>
<td>-0.00327</td>
</tr>
<tr>
<td></td>
<td>(0.00675)</td>
<td>(0.00676)</td>
<td>(0.00675)</td>
<td>(0.00675)</td>
<td>(0.00676)</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>-0.0203**</td>
<td>-0.0193**</td>
<td>-0.0198**</td>
<td>-0.0208**</td>
<td>-0.0195**</td>
</tr>
<tr>
<td></td>
<td>(0.00859)</td>
<td>(0.00880)</td>
<td>(0.00865)</td>
<td>(0.00856)</td>
<td>(0.00850)</td>
</tr>
<tr>
<td>wLnCURLIBTOSALES</td>
<td>0.133***</td>
<td>0.136***</td>
<td>0.135***</td>
<td>0.134***</td>
<td>0.133***</td>
</tr>
<tr>
<td></td>
<td>(0.0248)</td>
<td>(0.0249)</td>
<td>(0.0248)</td>
<td>(0.0248)</td>
<td>(0.0247)</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.0398***</td>
<td>-0.0405***</td>
<td>-0.0401***</td>
<td>-0.0396***</td>
<td>-0.0401***</td>
</tr>
<tr>
<td></td>
<td>(0.00436)</td>
<td>(0.00437)</td>
<td>(0.00436)</td>
<td>(0.00437)</td>
<td>(0.00437)</td>
</tr>
<tr>
<td>Constant</td>
<td>-73.34***</td>
<td>-75.56***</td>
<td>-73.35***</td>
<td>-73.44***</td>
<td>-74.62***</td>
</tr>
<tr>
<td></td>
<td>(20.27)</td>
<td>(20.28)</td>
<td>(20.29)</td>
<td>(20.33)</td>
<td>(20.13)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Model Industries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASSTHRU</td>
<td>-0.0224**</td>
<td>-0.0226**</td>
</tr>
<tr>
<td></td>
<td>(0.0107)</td>
<td>(0.0108)</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0185***</td>
<td>-0.0186***</td>
</tr>
<tr>
<td></td>
<td>(0.00257)</td>
<td>(0.00268)</td>
</tr>
<tr>
<td>FAMOWN</td>
<td>-0.00715</td>
<td>-0.00663</td>
</tr>
<tr>
<td></td>
<td>(0.00948)</td>
<td>(0.00952)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.00269</td>
<td>-0.00247</td>
</tr>
<tr>
<td></td>
<td>(0.00968)</td>
<td>(0.00960)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.000334</td>
<td>0.000345*</td>
</tr>
<tr>
<td></td>
<td>(0.000207)</td>
<td>(0.000208)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.000520*</td>
<td>0.000502*</td>
</tr>
<tr>
<td></td>
<td>(0.000303)</td>
<td>(0.000304)</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.0121**</td>
<td>0.0133**</td>
</tr>
<tr>
<td></td>
<td>(0.00614)</td>
<td>(0.00629)</td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.0144</td>
<td>-0.0137</td>
</tr>
<tr>
<td></td>
<td>(0.00912)</td>
<td>(0.00919)</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.0349***</td>
<td>0.0354***</td>
</tr>
<tr>
<td></td>
<td>(0.0106)</td>
<td>(0.0105)</td>
</tr>
<tr>
<td>PURCHASED</td>
<td>-0.0120**</td>
<td>-0.00996*</td>
</tr>
<tr>
<td></td>
<td>(0.00505)</td>
<td>(0.00527)</td>
</tr>
<tr>
<td>INHERITED</td>
<td>0.0324*</td>
<td>0.0315*</td>
</tr>
<tr>
<td></td>
<td>(0.0173)</td>
<td>(0.0173)</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0160*</td>
<td>-0.0163*</td>
</tr>
<tr>
<td></td>
<td>(0.00927)</td>
<td>(0.00929)</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.0138</td>
<td>-0.0135</td>
</tr>
<tr>
<td></td>
<td>(0.00870)</td>
<td>(0.00869)</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0229***</td>
<td>-0.0224***</td>
</tr>
<tr>
<td></td>
<td>(0.00697)</td>
<td>(0.00704)</td>
</tr>
<tr>
<td>wLnOISTRINCTOSALES</td>
<td>0.295***</td>
<td>0.296***</td>
</tr>
<tr>
<td></td>
<td>(0.5934)</td>
<td>(0.9531)</td>
</tr>
<tr>
<td>wLnOWNWORTHOTOSALES</td>
<td>8.498***</td>
<td>8.519***</td>
</tr>
<tr>
<td></td>
<td>(2.338)</td>
<td>(2.342)</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>-0.00731</td>
<td>-0.00881</td>
</tr>
<tr>
<td></td>
<td>(0.0201)</td>
<td>(0.0202)</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>-0.00293</td>
<td>-0.00202</td>
</tr>
<tr>
<td></td>
<td>(0.00675)</td>
<td>(0.00686)</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>-0.0203**</td>
<td>-0.0214**</td>
</tr>
<tr>
<td></td>
<td>(0.00859)</td>
<td>(0.00869)</td>
</tr>
<tr>
<td>wLnCURLIBTOSALES</td>
<td>0.133***</td>
<td>0.134***</td>
</tr>
<tr>
<td></td>
<td>(0.0248)</td>
<td>(0.0250)</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.0398***</td>
<td>-0.0408***</td>
</tr>
<tr>
<td></td>
<td>(0.00436)</td>
<td>(0.00443)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-0.0159</td>
<td>-0.0159</td>
</tr>
<tr>
<td></td>
<td>(0.0130)</td>
<td>(0.0130)</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>0.00313</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0166)</td>
<td></td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>-0.0149</td>
<td>-0.0149</td>
</tr>
<tr>
<td></td>
<td>(0.0105)</td>
<td>(0.0105)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.0138</td>
<td>-0.0138</td>
</tr>
<tr>
<td></td>
<td>(0.00969)</td>
<td>(0.00969)</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.0118</td>
<td>-0.0118</td>
</tr>
<tr>
<td></td>
<td>(0.00827)</td>
<td>(0.00827)</td>
</tr>
<tr>
<td>Constant</td>
<td>-73.34***</td>
<td>-73.50***</td>
</tr>
<tr>
<td></td>
<td>(20.27)</td>
<td>(20.30)</td>
</tr>
<tr>
<td>Observations</td>
<td>3338</td>
<td>3338</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.206</td>
<td>0.208</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.201</td>
<td>0.201</td>
</tr>
<tr>
<td>Model SS</td>
<td>16.23</td>
<td>16.33</td>
</tr>
<tr>
<td>Residual SS</td>
<td>62.43</td>
<td>62.33</td>
</tr>
<tr>
<td>Model df</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>Residual df</td>
<td>3316</td>
<td>3311</td>
</tr>
<tr>
<td>F statistic</td>
<td>12.89</td>
<td>10.63</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Robust OLS</th>
<th>(2) Robust WLS</th>
<th>(3) Survey-weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PASSTHRU</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0121</td>
<td>-0.000176</td>
<td>-0.000176</td>
</tr>
<tr>
<td></td>
<td>(0.00878)</td>
<td>(0.0171)</td>
<td>(0.0170)</td>
</tr>
<tr>
<td></td>
<td>wLnSALES</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0149***</td>
<td>-0.0200***</td>
<td>-0.0200***</td>
</tr>
<tr>
<td></td>
<td>(0.00175)</td>
<td>(0.00329)</td>
<td>(0.00329)</td>
</tr>
<tr>
<td></td>
<td>FAMOWN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.00248</td>
<td>0.00346</td>
<td>0.00346</td>
</tr>
<tr>
<td></td>
<td>(0.00583)</td>
<td>(0.0134)</td>
<td>(0.0134)</td>
</tr>
<tr>
<td></td>
<td>OWNMGR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.00493</td>
<td>0.00378</td>
<td>0.00378</td>
</tr>
<tr>
<td></td>
<td>(0.00694)</td>
<td>(0.0110)</td>
<td>(0.0110)</td>
</tr>
<tr>
<td></td>
<td>OWNSHR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-8.64e-05</td>
<td>-4.47e-05</td>
<td>-4.47e-05</td>
</tr>
<tr>
<td></td>
<td>(0.000128)</td>
<td>(0.000229)</td>
<td>(0.000228)</td>
</tr>
<tr>
<td></td>
<td>OWNEXP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.000919***</td>
<td>0.00111***</td>
<td>0.00111***</td>
</tr>
<tr>
<td></td>
<td>(0.000242)</td>
<td>(0.000375)</td>
<td>(0.000375)</td>
</tr>
<tr>
<td></td>
<td>COLLEGEGRAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0126**</td>
<td>0.0146*</td>
<td>0.0146*</td>
</tr>
<tr>
<td></td>
<td>(0.00521)</td>
<td>(0.00793)</td>
<td>(0.00792)</td>
</tr>
<tr>
<td></td>
<td>SPECIALED</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.00131</td>
<td>-0.00205</td>
<td>-0.00205</td>
</tr>
<tr>
<td></td>
<td>(0.00616)</td>
<td>(0.00938)</td>
<td>(0.00937)</td>
</tr>
<tr>
<td></td>
<td>wLnOWNERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.00746</td>
<td>0.0193</td>
<td>0.0193</td>
</tr>
<tr>
<td></td>
<td>(0.00472)</td>
<td>(0.0128)</td>
<td>(0.0128)</td>
</tr>
<tr>
<td></td>
<td>PURCHASED</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.00271</td>
<td>0.00146</td>
<td>0.00146</td>
</tr>
<tr>
<td></td>
<td>(0.00421)</td>
<td>(0.00740)</td>
<td>(0.00738)</td>
</tr>
<tr>
<td></td>
<td>INHERITED</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0191**</td>
<td>0.0236</td>
<td>0.0236</td>
</tr>
<tr>
<td></td>
<td>(0.00915)</td>
<td>(0.0146)</td>
<td>(0.0146)</td>
</tr>
<tr>
<td></td>
<td>OWNDISTRESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0144</td>
<td>-0.0154</td>
<td>-0.0154</td>
</tr>
<tr>
<td></td>
<td>(0.0129)</td>
<td>(0.0166)</td>
<td>(0.0165)</td>
</tr>
<tr>
<td></td>
<td>FIRMDISTRESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.00823</td>
<td>-0.000882</td>
<td>-0.000882</td>
</tr>
<tr>
<td></td>
<td>(0.00988)</td>
<td>(0.0182)</td>
<td>(0.0181)</td>
</tr>
<tr>
<td></td>
<td>FEARDENIAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0139**</td>
<td>-0.0121</td>
<td>-0.0121</td>
</tr>
<tr>
<td></td>
<td>(0.00660)</td>
<td>(0.00859)</td>
<td>(0.00857)</td>
</tr>
<tr>
<td></td>
<td>wLnOTRINCTOSALES</td>
<td>0.222***</td>
<td>0.218**</td>
</tr>
<tr>
<td></td>
<td>(0.0619)</td>
<td>(0.0883)</td>
<td>(0.0883)</td>
</tr>
<tr>
<td></td>
<td>wLnOWNWORTHTOSALES</td>
<td>0.164***</td>
<td>0.147***</td>
</tr>
<tr>
<td></td>
<td>(0.0261)</td>
<td>(0.0303)</td>
<td>(0.0302)</td>
</tr>
<tr>
<td></td>
<td>wLnPROFTOINCOME</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.00875</td>
<td>0.00321</td>
<td>0.00321</td>
</tr>
<tr>
<td></td>
<td>(0.0213)</td>
<td>(0.0264)</td>
<td>(0.0263)</td>
</tr>
<tr>
<td></td>
<td>TRADECREDIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.00446</td>
<td>-0.00274</td>
<td>-0.00274</td>
</tr>
<tr>
<td></td>
<td>(0.00574)</td>
<td>(0.00792)</td>
<td>(0.00792)</td>
</tr>
<tr>
<td></td>
<td>wLnUNUSEDLOC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0120*</td>
<td>0.000183</td>
<td>0.000183</td>
</tr>
<tr>
<td></td>
<td>(0.00712)</td>
<td>(0.0124)</td>
<td>(0.0123)</td>
</tr>
<tr>
<td></td>
<td>wLnCURLIBTOSALES</td>
<td>0.152***</td>
<td>0.169***</td>
</tr>
<tr>
<td></td>
<td>(0.0352)</td>
<td>(0.0512)</td>
<td>(0.0512)</td>
</tr>
<tr>
<td></td>
<td>wLnDEBTRATIO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0520***</td>
<td>-0.0520***</td>
<td>-0.0520***</td>
</tr>
<tr>
<td></td>
<td>(0.00434)</td>
<td>(0.00598)</td>
<td>(0.00598)</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.389**</td>
<td>-0.350</td>
<td>-0.350</td>
</tr>
<tr>
<td></td>
<td>(0.177)</td>
<td>(0.232)</td>
<td>(0.231)</td>
</tr>
<tr>
<td></td>
<td>Observations</td>
<td>3934</td>
<td>3934</td>
</tr>
<tr>
<td></td>
<td>R-squared</td>
<td>0.225</td>
<td>0.209</td>
</tr>
<tr>
<td></td>
<td>Adjusted R2</td>
<td>0.221</td>
<td>0.204</td>
</tr>
<tr>
<td></td>
<td>Model SS</td>
<td>21.29</td>
<td>25.12</td>
</tr>
<tr>
<td></td>
<td>Residual SS</td>
<td>73.47</td>
<td>95.31</td>
</tr>
<tr>
<td></td>
<td>Model df</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Residual df</td>
<td>3912</td>
<td>3912</td>
</tr>
<tr>
<td></td>
<td>F statistic</td>
<td>20.30</td>
<td>11.98</td>
</tr>
<tr>
<td></td>
<td>Number of strata</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Population size</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

164
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Full Model</th>
<th>(2) Minus LnOWNERS</th>
<th>(3) Minus OWNSHR</th>
<th>(4) Minus SPECIALED</th>
<th>(5) Minus COLLEGEGRAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSTHRU</td>
<td>-0.000176</td>
<td>-0.000191</td>
<td>0.000288</td>
<td>-8.07e-05</td>
<td>-0.000492</td>
</tr>
<tr>
<td></td>
<td>(0.0171)</td>
<td>(0.0172)</td>
<td>(0.0170)</td>
<td>(0.0171)</td>
<td>(0.0170)</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0200***</td>
<td>-0.0196***</td>
<td>-0.0200***</td>
<td>-0.0200***</td>
<td>-0.0193***</td>
</tr>
<tr>
<td></td>
<td>(0.00329)</td>
<td>(0.00326)</td>
<td>(0.00329)</td>
<td>(0.00328)</td>
<td>(0.00325)</td>
</tr>
<tr>
<td>FAMOWN</td>
<td>0.00346</td>
<td>-0.00103</td>
<td>0.00336</td>
<td>0.00351</td>
<td>0.00112</td>
</tr>
<tr>
<td></td>
<td>(0.0134)</td>
<td>(0.0127)</td>
<td>(0.0134)</td>
<td>(0.0134)</td>
<td>(0.0135)</td>
</tr>
<tr>
<td>OWMGR</td>
<td>0.00378</td>
<td>0.00160</td>
<td>0.00392</td>
<td>0.00369</td>
<td>0.00416</td>
</tr>
<tr>
<td></td>
<td>(0.0110)</td>
<td>(0.0110)</td>
<td>(0.0110)</td>
<td>(0.0109)</td>
<td>(0.0109)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-4.47e-05</td>
<td>-0.000330**</td>
<td>0.000010</td>
<td>-3.86e-05</td>
<td>-2.34e-05</td>
</tr>
<tr>
<td></td>
<td>(0.000229)</td>
<td>(0.000159)</td>
<td>(0.000230)</td>
<td>(0.000228)</td>
<td>(0.000228)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.00111***</td>
<td>0.00115***</td>
<td>0.00110***</td>
<td>0.00111***</td>
<td>0.00107***</td>
</tr>
<tr>
<td></td>
<td>(0.000375)</td>
<td>(0.000377)</td>
<td>(0.000375)</td>
<td>(0.000377)</td>
<td>(0.000375)</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.0146*</td>
<td>0.0146*</td>
<td>0.0146*</td>
<td>0.0152**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00793)</td>
<td>(0.00795)</td>
<td>(0.00789)</td>
<td>(0.00730)</td>
<td></td>
</tr>
<tr>
<td>SPECIALED</td>
<td>-0.00205</td>
<td>-0.00208</td>
<td>-0.00181</td>
<td></td>
<td>-0.00975</td>
</tr>
<tr>
<td></td>
<td>(0.00938)</td>
<td>(0.00939)</td>
<td>(0.00946)</td>
<td></td>
<td>(0.00864)</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.0193</td>
<td>0.0209**</td>
<td>0.0193</td>
<td>0.0192</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0128)</td>
<td>(0.00883)</td>
<td>(0.0128)</td>
<td>(0.0128)</td>
<td></td>
</tr>
<tr>
<td>PURCHASED</td>
<td>0.00146</td>
<td>0.00125</td>
<td>0.00153</td>
<td>0.00142</td>
<td>0.00133</td>
</tr>
<tr>
<td></td>
<td>(0.00740)</td>
<td>(0.00741)</td>
<td>(0.00739)</td>
<td>(0.00740)</td>
<td>(0.00743)</td>
</tr>
<tr>
<td>INHERITED</td>
<td>0.0236</td>
<td>0.0244*</td>
<td>0.0235</td>
<td>0.0236</td>
<td>0.0214</td>
</tr>
<tr>
<td></td>
<td>(0.0146)</td>
<td>(0.0145)</td>
<td>(0.0146)</td>
<td>(0.0146)</td>
<td>(0.0146)</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0154</td>
<td>-0.0153</td>
<td>-0.0154</td>
<td>-0.0154</td>
<td>-0.0158</td>
</tr>
<tr>
<td></td>
<td>(0.0166)</td>
<td>(0.0165)</td>
<td>(0.0166)</td>
<td>(0.0165)</td>
<td>(0.0165)</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.000882</td>
<td>-0.000923</td>
<td>-0.000842</td>
<td>-0.000785</td>
<td>-0.00180</td>
</tr>
<tr>
<td></td>
<td>(0.0182)</td>
<td>(0.0182)</td>
<td>(0.0182)</td>
<td>(0.0183)</td>
<td>(0.0182)</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0121</td>
<td>-0.0119</td>
<td>-0.0122</td>
<td>-0.0120</td>
<td>-0.0135</td>
</tr>
<tr>
<td></td>
<td>(0.00859)</td>
<td>(0.00863)</td>
<td>(0.00865)</td>
<td>(0.00858)</td>
<td>(0.00858)</td>
</tr>
<tr>
<td>wLnOTRINCTOSALES</td>
<td>0.218**</td>
<td>0.218**</td>
<td>0.218**</td>
<td>0.218**</td>
<td>0.217**</td>
</tr>
<tr>
<td></td>
<td>(0.0883)</td>
<td>(0.0883)</td>
<td>(0.0883)</td>
<td>(0.0883)</td>
<td>(0.0884)</td>
</tr>
<tr>
<td>wLnOWNWORTHTOSALES</td>
<td>0.147***</td>
<td>0.148***</td>
<td>0.147***</td>
<td>0.147***</td>
<td>0.150***</td>
</tr>
<tr>
<td></td>
<td>(0.0303)</td>
<td>(0.0303)</td>
<td>(0.0303)</td>
<td>(0.0303)</td>
<td>(0.0298)</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>0.00321</td>
<td>0.00218</td>
<td>0.00317</td>
<td>0.00320</td>
<td>0.00403</td>
</tr>
<tr>
<td></td>
<td>(0.0264)</td>
<td>(0.0265)</td>
<td>(0.0264)</td>
<td>(0.0264)</td>
<td>(0.0264)</td>
</tr>
</tbody>
</table>
Figure 3.11. 2003 NSSBF – Estimations of Cash Holdings Model with Selected Variables Dropped

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate 1</th>
<th>Estimate 2</th>
<th>Estimate 3</th>
<th>Estimate 4</th>
<th>Estimate 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRADECREDIT</td>
<td>-0.00274</td>
<td>-0.00267</td>
<td>-0.00274</td>
<td>-0.00273</td>
<td>-0.00378</td>
</tr>
<tr>
<td></td>
<td>(0.00792)</td>
<td>(0.00794)</td>
<td>(0.00792)</td>
<td>(0.00792)</td>
<td>(0.00802)</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>0.000183</td>
<td>0.000233</td>
<td>0.000205</td>
<td>0.000162</td>
<td>0.00156</td>
</tr>
<tr>
<td></td>
<td>(0.0124)</td>
<td>(0.0124)</td>
<td>(0.0124)</td>
<td>(0.0124)</td>
<td>(0.0123)</td>
</tr>
<tr>
<td>wLnCURLIBTOSALES</td>
<td>0.169***</td>
<td>0.172***</td>
<td>0.168***</td>
<td>0.168***</td>
<td>0.169***</td>
</tr>
<tr>
<td></td>
<td>(0.0512)</td>
<td>(0.0514)</td>
<td>(0.0512)</td>
<td>(0.0511)</td>
<td>(0.0511)</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.0520***</td>
<td>-0.0517***</td>
<td>-0.0520***</td>
<td>-0.0519***</td>
<td>-0.0520***</td>
</tr>
<tr>
<td></td>
<td>(0.00598)</td>
<td>(0.00596)</td>
<td>(0.00597)</td>
<td>(0.00595)</td>
<td>(0.00598)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.350</td>
<td>-0.317</td>
<td>-0.355</td>
<td>-0.352</td>
<td>-0.366</td>
</tr>
<tr>
<td></td>
<td>(0.232)</td>
<td>(0.233)</td>
<td>(0.233)</td>
<td>(0.232)</td>
<td>(0.230)</td>
</tr>
<tr>
<td>Observations</td>
<td>3934</td>
<td>3934</td>
<td>3934</td>
<td>3934</td>
<td>3934</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.209</td>
<td>0.208</td>
<td>0.209</td>
<td>0.209</td>
<td>0.207</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.204</td>
<td>0.204</td>
<td>0.205</td>
<td>0.205</td>
<td>0.203</td>
</tr>
<tr>
<td>Model SS</td>
<td>25.12</td>
<td>25.01</td>
<td>25.12</td>
<td>25.12</td>
<td>24.96</td>
</tr>
<tr>
<td>Residual SS</td>
<td>95.31</td>
<td>95.42</td>
<td>95.31</td>
<td>95.31</td>
<td>95.47</td>
</tr>
<tr>
<td>Model df</td>
<td>21</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Residual df</td>
<td>3912</td>
<td>3913</td>
<td>3913</td>
<td>3913</td>
<td>3913</td>
</tr>
<tr>
<td>F statistic</td>
<td>11.98</td>
<td>12.44</td>
<td>12.57</td>
<td>12.45</td>
<td>12.06</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

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

All columns estimated using Robust WLS
(wLnCASHTOSALES is the dependent variable)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Full Model</th>
<th>Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(0.00171)</td>
<td>(0.0169)</td>
</tr>
<tr>
<td>PASSTHRU</td>
<td>-0.000176</td>
<td>-0.000691</td>
</tr>
<tr>
<td></td>
<td>(0.00329)</td>
<td>(0.00335)</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>-0.0206***</td>
<td>-0.0205***</td>
</tr>
<tr>
<td></td>
<td>(0.0171)</td>
<td>(0.0169)</td>
</tr>
<tr>
<td>FAMOWN</td>
<td>0.00346</td>
<td>0.00311</td>
</tr>
<tr>
<td></td>
<td>(0.0134)</td>
<td>(0.0135)</td>
</tr>
<tr>
<td>OWMGR</td>
<td>0.00378</td>
<td>0.00268</td>
</tr>
<tr>
<td></td>
<td>(0.0110)</td>
<td>(0.0109)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-4.47e-05</td>
<td>-5.25e-05</td>
</tr>
<tr>
<td></td>
<td>(0.000229)</td>
<td>(0.000228)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.00111***</td>
<td>0.00108***</td>
</tr>
<tr>
<td></td>
<td>(0.00375)</td>
<td>(0.00369)</td>
</tr>
<tr>
<td>COLLEGEGRAD</td>
<td>0.0146*</td>
<td>0.0169**</td>
</tr>
<tr>
<td></td>
<td>(0.00793)</td>
<td>(0.00746)</td>
</tr>
<tr>
<td>SPECIALED</td>
<td>0.00206</td>
<td>0.000969</td>
</tr>
<tr>
<td></td>
<td>(0.00938)</td>
<td>(0.00929)</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.0193</td>
<td>0.0192</td>
</tr>
<tr>
<td></td>
<td>(0.0128)</td>
<td>(0.0128)</td>
</tr>
<tr>
<td>PURCHASED</td>
<td>0.00146</td>
<td>0.00418</td>
</tr>
<tr>
<td></td>
<td>(0.00740)</td>
<td>(0.00780)</td>
</tr>
<tr>
<td>INHERITED</td>
<td>0.0236</td>
<td>0.0249*</td>
</tr>
<tr>
<td></td>
<td>(0.0146)</td>
<td>(0.0146)</td>
</tr>
<tr>
<td>OWNDISTRESS</td>
<td>-0.0154</td>
<td>-0.0151</td>
</tr>
<tr>
<td></td>
<td>(0.0166)</td>
<td>(0.0166)</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>-0.000882</td>
<td>-0.000894</td>
</tr>
<tr>
<td></td>
<td>(0.0182)</td>
<td>(0.0185)</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>-0.0121</td>
<td>-0.0116</td>
</tr>
<tr>
<td></td>
<td>(0.00859)</td>
<td>(0.00861)</td>
</tr>
<tr>
<td>wLnOTRINCTOSALES</td>
<td>0.218**</td>
<td>0.218**</td>
</tr>
<tr>
<td></td>
<td>(0.0883)</td>
<td>(0.0884)</td>
</tr>
<tr>
<td>wLnOWNWORTHOTOSALES</td>
<td>0.147***</td>
<td>0.146***</td>
</tr>
<tr>
<td></td>
<td>(0.0303)</td>
<td>(0.0302)</td>
</tr>
<tr>
<td>wLnPROFTOINCOME</td>
<td>0.00321</td>
<td>0.00222</td>
</tr>
<tr>
<td></td>
<td>(0.0264)</td>
<td>(0.0265)</td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>-0.00274</td>
<td>-0.0390</td>
</tr>
<tr>
<td></td>
<td>(0.00792)</td>
<td>(0.00793)</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>0.000183</td>
<td>-0.000558</td>
</tr>
<tr>
<td></td>
<td>(0.0124)</td>
<td>(0.0124)</td>
</tr>
<tr>
<td>wLnCURLIBTOSALES</td>
<td>0.169***</td>
<td>0.168***</td>
</tr>
<tr>
<td></td>
<td>(0.0512)</td>
<td>(0.0513)</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>-0.0520***</td>
<td>-0.0525***</td>
</tr>
<tr>
<td></td>
<td>(0.00598)</td>
<td>(0.00605)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-0.00783</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0148)</td>
<td></td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>-0.00852</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0162)</td>
<td></td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>-0.0192</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0131)</td>
<td></td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.0184*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0112)</td>
<td></td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.0176*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0100)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.350</td>
<td>-0.320</td>
</tr>
<tr>
<td></td>
<td>(0.232)</td>
<td>(0.234)</td>
</tr>
<tr>
<td>Observations</td>
<td>3934</td>
<td>3934</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.209</td>
<td>0.210</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.204</td>
<td>0.205</td>
</tr>
<tr>
<td>Model SS</td>
<td>25.12</td>
<td>25.32</td>
</tr>
<tr>
<td>Residual SS</td>
<td>95.31</td>
<td>95.12</td>
</tr>
<tr>
<td>Model df</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>Residual df</td>
<td>3912</td>
<td>3907</td>
</tr>
<tr>
<td>F statistic</td>
<td>11.98</td>
<td>9.714</td>
</tr>
</tbody>
</table>

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.

\[ \ln \text{INVESTOSALES}_i = \beta_0 + \beta_{1i} \text{OWNSHR}_i + \beta_{2i} \text{OWNMGR}_i + \beta_{3i} \ln \text{OWNERS}_i + \\
\beta_{4i} \text{RELENGTH}_i + \beta_{5i} \text{RELNUM}_i + \beta_{6i} \text{GROWTH}_i + \beta_{7i} \ln \text{CASHTOSALES}_i + \\
\beta_{8i} \ln \text{EXTDEBTRATIO}_i + \beta_{9i} \ln \text{DIVERSE}_i + \beta_{10i} \ln \text{WHOLESALE}_i + \beta_{11i} \text{RETAIL}_i + \\
\beta_{12i} \text{MANUFACTURING}_i + \beta_{13i} \text{TRANSPORTATION}_i + \beta_{14i} \text{SERVICES}_i + \epsilon_i \]
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

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Description</th>
<th>Hypothesized Relationship to Other Investments</th>
<th>Hypothesis Tested</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm Characteristics:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROWTH</td>
<td>Dummy, 1 = firm’s sales have grown over the past 2 years</td>
<td>(-)</td>
<td>H2a</td>
<td>Firms that are growing will not divert cash flows to other investments</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>Dummy variables for: Wholesale, Retail, Manufacturing, Transportation, Services</td>
<td>n/a</td>
<td>n/a</td>
<td>Control for industry-specific factors</td>
</tr>
<tr>
<td><strong>Agency and Monitoring:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>Percentage of business owned by principal owner</td>
<td>(-)</td>
<td>H1a</td>
<td>Increasing primary owner’s firm ownership share reduces agency (Jensen and Meckling 1976)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>Dummy, 1 = firm is managed by an owner</td>
<td>(-)</td>
<td>H1c</td>
<td>Having firm managed by an owner reduces agency (Jensen and Meckling 1976)</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>Natural log of the total number of firm owners</td>
<td>(+)</td>
<td>H1b</td>
<td>Increasingly diffuse firm ownership promotes agency costs</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>Length of the longest relationship (months) firm has had with its primary financial institution</td>
<td>(-)</td>
<td>H1d</td>
<td>Relationship length is a proxy for monitoring by creditors. Longer relationship → more monitoring → lower agency costs</td>
</tr>
<tr>
<td>RELNUM</td>
<td>Number of financial institutions with which the firm does business</td>
<td>(+)</td>
<td>H1d</td>
<td>Relationship number is a proxy for monitoring by creditors. More relationships → more diffuse monitoring → higher agency costs</td>
</tr>
<tr>
<td><strong>Sources and uses of cash flows:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnCASHTOSALES</td>
<td>Natural log of the ratio of the firm’s cash to sales</td>
<td>(+)</td>
<td>H2c</td>
<td>Firms that can accumulate free cash flows can divert cash to other investment purposes</td>
</tr>
<tr>
<td>LnEXTDEBTRATIO</td>
<td>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.</td>
<td>(-)</td>
<td>H2b</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Owner diversification:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnDIVERSE</td>
<td>Natural log of the ratio of the primary owner’s equity share in the firm to the primary owner’s total wealth.</td>
<td>(+)</td>
<td>H3</td>
<td>Higher concentration of owner wealth in the firm leads to more diversification of firm investments.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>max</th>
<th>min</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>OWNSHR</td>
<td>3125</td>
<td>79.76352</td>
<td>27.55503</td>
<td>100</td>
<td>1</td>
<td>-0.907164</td>
<td>2.429518</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>3125</td>
<td>99.15488</td>
<td>100.0857</td>
<td>780</td>
<td>0</td>
<td>2.199216</td>
<td>9.310522</td>
</tr>
<tr>
<td>RELNUM</td>
<td>3125</td>
<td>2.46048</td>
<td>1.737115</td>
<td>20</td>
<td>1</td>
<td>2.309636</td>
<td>13.36609</td>
</tr>
<tr>
<td>INVESTOSALES</td>
<td>3125</td>
<td>.0285819</td>
<td>.3733183</td>
<td>13.7106</td>
<td>0</td>
<td>29.05554</td>
<td>931.9876</td>
</tr>
<tr>
<td>LnINVESTOS-S</td>
<td>3125</td>
<td>.0164366</td>
<td>.1061151</td>
<td>2.688568</td>
<td>0</td>
<td>15.76392</td>
<td>325.5557</td>
</tr>
<tr>
<td>wLnINVESTO-S</td>
<td>3125</td>
<td>.0115683</td>
<td>.0451002</td>
<td>.3257309</td>
<td>0</td>
<td>5.213302</td>
<td>32.35524</td>
</tr>
<tr>
<td>OWNERS</td>
<td>3125</td>
<td>6.72672</td>
<td>74.40251</td>
<td>2500</td>
<td>1</td>
<td>23.87974</td>
<td>649.6574</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>3125</td>
<td>.4885592</td>
<td>.8490488</td>
<td>7.824046</td>
<td>0</td>
<td>3.20902</td>
<td>18.27018</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>3125</td>
<td>.473538</td>
<td>.7640051</td>
<td>3.912023</td>
<td>0</td>
<td>2.263117</td>
<td>9.024026</td>
</tr>
<tr>
<td>CASHOSALES</td>
<td>3125</td>
<td>.1114595</td>
<td>.413744</td>
<td>13.92928</td>
<td>0</td>
<td>17.76343</td>
<td>480.1738</td>
</tr>
<tr>
<td>LnCASHOSA-S</td>
<td>3125</td>
<td>.0833305</td>
<td>.17121</td>
<td>2.703324</td>
<td>0</td>
<td>5.91051</td>
<td>53.71599</td>
</tr>
<tr>
<td>wLnCASHOTS-S</td>
<td>3125</td>
<td>.0795693</td>
<td>.1413111</td>
<td>.924841</td>
<td>0</td>
<td>3.847125</td>
<td>20.20089</td>
</tr>
<tr>
<td>EXTDEBTATIO</td>
<td>3125</td>
<td>1.929716</td>
<td>23.38897</td>
<td>908.733</td>
<td>0</td>
<td>30.49599</td>
<td>1052.505</td>
</tr>
<tr>
<td>LnEXTDEBT-O</td>
<td>3125</td>
<td>.4498331</td>
<td>.5913779</td>
<td>6.813151</td>
<td>0</td>
<td>3.64331</td>
<td>25.03899</td>
</tr>
<tr>
<td>wLnEXTDETB-O</td>
<td>3125</td>
<td>.4400807</td>
<td>.5276574</td>
<td>2.963397</td>
<td>0</td>
<td>2.356749</td>
<td>10.06683</td>
</tr>
<tr>
<td>DIVERSE</td>
<td>3125</td>
<td>.2107726</td>
<td>.2620558</td>
<td>17.60281</td>
<td>0</td>
<td>-7.888889</td>
<td>926.6261</td>
</tr>
<tr>
<td>LnDIVERSE</td>
<td>3125</td>
<td>.207276</td>
<td>.0516503</td>
<td>3.276873</td>
<td>0</td>
<td>-0.111055</td>
<td>1125.089</td>
</tr>
<tr>
<td>wLnDIVERSE</td>
<td>3125</td>
<td>.207584</td>
<td>.0267629</td>
<td>2.290436</td>
<td>0</td>
<td>1.280482</td>
<td>3.791576</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>max</th>
<th>min</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>OWNSHR</td>
<td>3125</td>
<td>75.69244</td>
<td>27.18865</td>
<td>100</td>
<td>1</td>
<td>-0.46084</td>
<td>1.643467</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>3125</td>
<td>99.15488</td>
<td>100.0857</td>
<td>780</td>
<td>0</td>
<td>2.199216</td>
<td>9.310522</td>
</tr>
<tr>
<td>RELNUM</td>
<td>3125</td>
<td>6.72672</td>
<td>74.40251</td>
<td>2500</td>
<td>1</td>
<td>23.87974</td>
<td>649.6574</td>
</tr>
<tr>
<td>INVESTOSALES</td>
<td>3125</td>
<td>.0285819</td>
<td>.3733183</td>
<td>13.7106</td>
<td>0</td>
<td>29.05554</td>
<td>931.9876</td>
</tr>
<tr>
<td>LnINVESTOS-S</td>
<td>3125</td>
<td>.0164366</td>
<td>.1061151</td>
<td>2.688568</td>
<td>0</td>
<td>15.76392</td>
<td>325.5557</td>
</tr>
<tr>
<td>wLnINVESTO-S</td>
<td>3125</td>
<td>.0115683</td>
<td>.0451002</td>
<td>.3257309</td>
<td>0</td>
<td>5.213302</td>
<td>32.35524</td>
</tr>
<tr>
<td>OWNERS</td>
<td>3125</td>
<td>6.72672</td>
<td>74.40251</td>
<td>2500</td>
<td>1</td>
<td>23.87974</td>
<td>649.6574</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>3125</td>
<td>.4885592</td>
<td>.8490488</td>
<td>7.824046</td>
<td>0</td>
<td>3.20902</td>
<td>18.27018</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>3125</td>
<td>.473538</td>
<td>.7640051</td>
<td>3.912023</td>
<td>0</td>
<td>2.263117</td>
<td>9.024026</td>
</tr>
<tr>
<td>CASHOSALES</td>
<td>3125</td>
<td>.1114595</td>
<td>.413744</td>
<td>13.92928</td>
<td>0</td>
<td>17.76343</td>
<td>480.1738</td>
</tr>
<tr>
<td>LnCASHOSA-S</td>
<td>3125</td>
<td>.0833305</td>
<td>.17121</td>
<td>2.703324</td>
<td>0</td>
<td>5.91051</td>
<td>53.71599</td>
</tr>
<tr>
<td>wLnCASHOTS-S</td>
<td>3125</td>
<td>.0795693</td>
<td>.1413111</td>
<td>.924841</td>
<td>0</td>
<td>3.847125</td>
<td>20.20089</td>
</tr>
<tr>
<td>EXTDEBTATIO</td>
<td>3125</td>
<td>1.929716</td>
<td>23.38897</td>
<td>908.733</td>
<td>0</td>
<td>30.49599</td>
<td>1052.505</td>
</tr>
<tr>
<td>LnEXTDEBT-O</td>
<td>3125</td>
<td>.4498331</td>
<td>.5913779</td>
<td>6.813151</td>
<td>0</td>
<td>3.64331</td>
<td>25.03899</td>
</tr>
<tr>
<td>wLnEXTDETB-O</td>
<td>3125</td>
<td>.4400807</td>
<td>.5276574</td>
<td>2.963397</td>
<td>0</td>
<td>2.356749</td>
<td>10.06683</td>
</tr>
<tr>
<td>DIVERSE</td>
<td>3125</td>
<td>.2107726</td>
<td>.2620558</td>
<td>17.60281</td>
<td>0</td>
<td>-7.888889</td>
<td>926.6261</td>
</tr>
<tr>
<td>LnDIVERSE</td>
<td>3125</td>
<td>.207276</td>
<td>.0516503</td>
<td>3.276873</td>
<td>0</td>
<td>-0.111055</td>
<td>1125.089</td>
</tr>
<tr>
<td>wLnDIVERSE</td>
<td>3125</td>
<td>.207584</td>
<td>.0267629</td>
<td>2.290436</td>
<td>0</td>
<td>1.280482</td>
<td>3.791576</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Dummy/Categorical Vars</th>
<th>Response</th>
<th>Number of Responses</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVESTS: Firm makes other investments</td>
<td>No</td>
<td>2574</td>
<td>82.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>551</td>
<td>17.6</td>
</tr>
<tr>
<td>GROWTH: Firm has experienced sales growth from previous to current fiscal year</td>
<td>No</td>
<td>1081</td>
<td>34.6</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2044</td>
<td>65.4</td>
</tr>
<tr>
<td>OWMNMG: Firm's Manager is an owner</td>
<td>No</td>
<td>340</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2785</td>
<td>89.1</td>
</tr>
<tr>
<td>MANUFACTURING: Firm is in the Manufacturing sector (SIC 20-39)</td>
<td>No</td>
<td>2775</td>
<td>88.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>350</td>
<td>11.2</td>
</tr>
<tr>
<td>TRANSPORTATION: Firm is in the Transportation sector (SIC 40-49)</td>
<td>No</td>
<td>3002</td>
<td>96.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>123</td>
<td>3.9</td>
</tr>
<tr>
<td>WHOLESALE: Firm is in the Wholesale sector (SIC 50-51)</td>
<td>No</td>
<td>2907</td>
<td>93.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>218</td>
<td>7.0</td>
</tr>
<tr>
<td>RETAIL: Firm is in the Retail sector (SIC 52-59)</td>
<td>No</td>
<td>2502</td>
<td>80.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>623</td>
<td>19.9</td>
</tr>
<tr>
<td>SERVICES: Firm is in the Services sector (SIC 70-89)</td>
<td>No</td>
<td>1837</td>
<td>58.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1288</td>
<td>41.2</td>
</tr>
</tbody>
</table>
Table 4.3

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

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

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.

<table>
<thead>
<tr>
<th>w\text{LnINVS}</th>
<th>GROWTH</th>
<th>OWNSHR</th>
<th>OWNMGR</th>
<th>w\text{LnOWS}</th>
<th>RELLEN</th>
<th>RELNUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>w\text{LnINVESTO}\text{-S}</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROWTH</td>
<td>-0.0538*</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-0.0598*</td>
<td>-0.0374*</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.2094</td>
<td>0.0289</td>
<td>0.1014*</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>w\text{LnOWNERS}</td>
<td>0.0797*</td>
<td>0.0395*</td>
<td>-0.7990*</td>
<td>-0.1476*</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>0.0241</td>
<td>-0.0979*</td>
<td>-0.0162</td>
<td>-0.0227</td>
<td>0.0467*</td>
<td>1.0000</td>
</tr>
<tr>
<td>RELNUM</td>
<td>0.0856</td>
<td>0.0357*</td>
<td>-0.2127*</td>
<td>-0.0869*</td>
<td>0.2383*</td>
<td>-0.0304</td>
</tr>
<tr>
<td>w\text{LnCASHTOS}\text{-S}</td>
<td>0.0769*</td>
<td>-0.0691*</td>
<td>0.0627*</td>
<td>0.0326</td>
<td>-0.0453*</td>
<td>0.0183</td>
</tr>
<tr>
<td>w\text{LnEXTDEBT}\text{-O}</td>
<td>-0.0367*</td>
<td>0.0376*</td>
<td>-0.0270</td>
<td>-0.0340</td>
<td>0.0162</td>
<td>-0.0561*</td>
</tr>
<tr>
<td>w\text{LnDIVERSE}</td>
<td>0.0845*</td>
<td>0.0019</td>
<td>-0.0070</td>
<td>-0.0272</td>
<td>0.0925*</td>
<td>0.0413*</td>
</tr>
<tr>
<td>MANUFACTUR\text{-G}</td>
<td>0.0203</td>
<td>-0.0212</td>
<td>-0.1207*</td>
<td>-0.0160</td>
<td>0.1722*</td>
<td>-0.0068</td>
</tr>
<tr>
<td>TRANSPORT\text{-A-N}</td>
<td>0.0540*</td>
<td>0.0054</td>
<td>-0.0648*</td>
<td>-0.0297</td>
<td>0.0552*</td>
<td>0.0162</td>
</tr>
<tr>
<td>WHOLES\text{-ALE}</td>
<td>-0.0054</td>
<td>-0.0306</td>
<td>-0.0351*</td>
<td>-0.0173</td>
<td>0.0267</td>
<td>0.0329</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.0504*</td>
<td>-0.0025</td>
<td>0.0027</td>
<td>-0.0391*</td>
<td>-0.0369*</td>
<td>0.0440*</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.0138</td>
<td>0.0212</td>
<td>0.1018*</td>
<td>0.0379*</td>
<td>-0.0858*</td>
<td>-0.0635*</td>
</tr>
</tbody>
</table>

| w\text{LnCASHTOS}\text{-S} | 1.0000 |        |        |               |        |        |
| w\text{LnEXTDEBT}\text{-O} | -0.1711* | 1.0000 |        |               |        |        |
| w\text{LnDIVERSE} | 0.0073 | -0.3108* | 1.0000 |               |        |        |
| MANUFACTUR\text{-G} | -0.0332 | -0.0212 | 0.1082* | 1.0000 |        |        |
| TRANSPORT\text{-A-N} | -0.0058 | 0.0824* | -0.0012 | -0.0719* | 1.0000 |        |
| WHOLES\text{-ALE} | -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 | 1.0000 |

Figure 4.3. 1998 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.
4.3.5 LnDIVERSE and insolvent firms. The value of DIVERSE in this study is calculated as:

\[ \text{DIVERSE} = \frac{\text{OWNEQUITY}}{\text{OWNWORTH} + \text{OWNEQUITY}} \]

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-weighted 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.
<table>
<thead>
<tr>
<th>INVESTOSALES Linearized</th>
<th>Adjusted Wald Test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over</td>
<td>[Mean]</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>GROWTH</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3201) = 1.94, Prob &gt; F = 0.1639</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 1.35, Prob &gt; F = 0.2447</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 5.33, Prob &gt; F = 0.0210</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 0.03, Prob &gt; F = 0.8573</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 6.51, Prob &gt; F = 0.0107</td>
</tr>
<tr>
<td>RETAIL</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 7.18, Prob &gt; F = 0.0074</td>
</tr>
<tr>
<td>SERVICES</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>F(1,3362) = 0.11, Prob &gt; F = 0.7441</td>
</tr>
</tbody>
</table>

Figure 4.7. 1998 NSSBF: Two-way tabulation of INVESTOSALES versus firm characteristics from model
<table>
<thead>
<tr>
<th>INVESTOSALES</th>
<th>Linearized</th>
<th>Adjusted Wald Test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over</td>
<td>Mean</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>GROWTH</td>
<td>No</td>
<td>.0346107</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.1139773</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>No</td>
<td>.1485354</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.0628976</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>No</td>
<td>.0722937</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.0086116</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>No</td>
<td>.0696845</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.0171194</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>No</td>
<td>.0704617</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.0232953</td>
</tr>
<tr>
<td>RETAIL</td>
<td>No</td>
<td>.0808965</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.110237</td>
</tr>
<tr>
<td>SERVICES</td>
<td>No</td>
<td>.0231467</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>.1207833</td>
</tr>
</tbody>
</table>

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 (1st-2nd quartile, 2nd-3rd quartile, 3rd-4th 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 \( \text{wLnINVESTOSALES} \) increases with \( \text{wLnDIVERSE} \), 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:


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.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Mean of wLNINVESTOSALES</th>
<th>Linearized Std. Err.</th>
<th>Adjusted Wald Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td>OWNSHR</td>
<td>1</td>
<td>0.0149181</td>
<td>0.0023408</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.0089814</td>
<td>0.0010297</td>
</tr>
<tr>
<td>wLNOWNERS</td>
<td>1</td>
<td>0.0083313</td>
<td>0.0010519</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0132628</td>
<td>0.0022917</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0188881</td>
<td>0.0041062</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>1</td>
<td>0.0116641</td>
<td>0.0018417</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.008362</td>
<td>0.0019279</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0093226</td>
<td>0.0018233</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0116874</td>
<td>0.0020712</td>
</tr>
<tr>
<td>RELNUM</td>
<td>1</td>
<td>0.007699</td>
<td>0.0014791</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.0115075</td>
<td>0.0018808</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0131959</td>
<td>0.0025707</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0136673</td>
<td>0.0023688</td>
</tr>
<tr>
<td>wLNCASTOSAL~</td>
<td>1</td>
<td>0.0092312</td>
<td>0.0017657</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.0082664</td>
<td>0.0016621</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0084689</td>
<td>0.0014884</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0159592</td>
<td>0.0026318</td>
</tr>
<tr>
<td>wLNEXTEDBTRA~</td>
<td>1</td>
<td>0.0065359</td>
<td>0.0019197</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.0148109</td>
<td>0.0022684</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0133858</td>
<td>0.0021664</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0073915</td>
<td>0.0013034</td>
</tr>
<tr>
<td>wLNDIVERSE</td>
<td>1</td>
<td>0.0058831</td>
<td>0.0012667</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.008553</td>
<td>0.0017633</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.011508</td>
<td>0.0022167</td>
</tr>
</tbody>
</table>

Figure 4.9. 1998 NSSBF: Mean of wLNINVESTOSALES across quartiles of model variables
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-weighted Tobit estimates.

Table 4.4

Summary of observed results compared to hypothesized results

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

*** 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.
### Table 4.11: Comparative Regressions across OLS, SWLS, Logit, Probit and Tobit estimation

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Robust OLS</th>
<th>Svy Regress</th>
<th>Svy Logit</th>
<th>Svy Probit</th>
<th>Svy Tobit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROWTH</td>
<td>-0.00494***</td>
<td>-0.00887</td>
<td>-0.0853</td>
<td>-0.0500</td>
<td>-0.0190</td>
</tr>
<tr>
<td></td>
<td>(0.00186)</td>
<td>(0.0142)</td>
<td>(0.136)</td>
<td>(0.0727)</td>
<td>(0.0133)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-1.03e-05</td>
<td>0.000426</td>
<td>-0.00193</td>
<td>-0.000581</td>
<td>-0.000309</td>
</tr>
<tr>
<td></td>
<td>(6.08e-05)</td>
<td>(0.000570)</td>
<td>(0.00386)</td>
<td>(0.00217)</td>
<td>(0.000349)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.00227</td>
<td>-0.0513*</td>
<td>-0.411**</td>
<td>-0.221**</td>
<td>-0.301*</td>
</tr>
<tr>
<td></td>
<td>(0.00264)</td>
<td>(0.0281)</td>
<td>(0.198)</td>
<td>(0.111)</td>
<td>(0.174)</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.00305</td>
<td>0.108***</td>
<td>0.577***</td>
<td>0.346***</td>
<td>0.0443***</td>
</tr>
<tr>
<td></td>
<td>(0.00424)</td>
<td>(0.0270)</td>
<td>(0.148)</td>
<td>(0.0855)</td>
<td>(0.0126)</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>6.37e-06</td>
<td>7.59e-05</td>
<td>0.000619</td>
<td>0.000319</td>
<td>5.09e-05</td>
</tr>
<tr>
<td></td>
<td>(8.99e-06)</td>
<td>(7.27e-05)</td>
<td>(0.000597)</td>
<td>(0.000330)</td>
<td>(5.98e-05)</td>
</tr>
<tr>
<td>RELNUM</td>
<td>0.00197***</td>
<td>0.0274***</td>
<td>0.207***</td>
<td>0.117***</td>
<td>0.0176***</td>
</tr>
<tr>
<td></td>
<td>(0.000503)</td>
<td>(0.00515)</td>
<td>(0.0360)</td>
<td>(0.0203)</td>
<td>(0.00337)</td>
</tr>
<tr>
<td>wLnCASHTOSALES</td>
<td>0.0247**</td>
<td>-0.00453</td>
<td>-0.0543</td>
<td>-0.0724</td>
<td>0.0555</td>
</tr>
<tr>
<td></td>
<td>(0.0102)</td>
<td>(0.0432)</td>
<td>(0.433)</td>
<td>(0.234)</td>
<td>(0.0497)</td>
</tr>
<tr>
<td>wLnEXTDEBTRATIO</td>
<td>-0.00177*</td>
<td>-0.0193**</td>
<td>-0.211**</td>
<td>-0.116**</td>
<td>-0.0211**</td>
</tr>
<tr>
<td></td>
<td>(0.000993)</td>
<td>(0.00841)</td>
<td>(0.106)</td>
<td>(0.0572)</td>
<td>(0.0105)</td>
</tr>
<tr>
<td>wLnDIVERSE</td>
<td>0.116***</td>
<td>1.099***</td>
<td>9.058***</td>
<td>4.953***</td>
<td>0.860***</td>
</tr>
<tr>
<td></td>
<td>(0.0139)</td>
<td>(0.301)</td>
<td>(2.326)</td>
<td>(1.313)</td>
<td>(0.236)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-0.00427</td>
<td>-0.00520</td>
<td>-0.0470</td>
<td>-0.0231</td>
<td>-0.0181</td>
</tr>
<tr>
<td></td>
<td>(0.00341)</td>
<td>(0.0300)</td>
<td>(0.259)</td>
<td>(0.140)</td>
<td>(0.0244)</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>0.00658</td>
<td>-0.0322</td>
<td>-0.282</td>
<td>-0.131</td>
<td>-0.0185</td>
</tr>
<tr>
<td></td>
<td>(0.00669)</td>
<td>(0.0384)</td>
<td>(0.365)</td>
<td>(0.196)</td>
<td>(0.0388)</td>
</tr>
<tr>
<td>WHOLESALEx</td>
<td>-0.00617*</td>
<td>0.0503</td>
<td>0.363</td>
<td>0.194</td>
<td>0.00411</td>
</tr>
<tr>
<td></td>
<td>(0.00320)</td>
<td>(0.0345)</td>
<td>(0.247)</td>
<td>(0.139)</td>
<td>(0.0226)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.00816***</td>
<td>-0.0343</td>
<td>-0.320</td>
<td>-0.167</td>
<td>-0.0413**</td>
</tr>
<tr>
<td></td>
<td>(0.00268)</td>
<td>(0.0220)</td>
<td>(0.217)</td>
<td>(0.115)</td>
<td>(0.0208)</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.00360</td>
<td>-0.0116</td>
<td>-0.169</td>
<td>-0.0747</td>
<td>-0.0196</td>
</tr>
<tr>
<td></td>
<td>(0.00265)</td>
<td>(0.0194)</td>
<td>(0.185)</td>
<td>(0.0989)</td>
<td>(0.0184)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.243***</td>
<td>-2.359***</td>
<td>-21.91***</td>
<td>-12.12***</td>
<td>-2.082***</td>
</tr>
<tr>
<td></td>
<td>(0.0746)</td>
<td>(0.661)</td>
<td>(5.120)</td>
<td>(2.889)</td>
<td>(0.524)</td>
</tr>
<tr>
<td>Observations</td>
<td>3125</td>
<td>3561</td>
<td>3561</td>
<td>3561</td>
<td>2574</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.32</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.0281</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F statistic</td>
<td>4.414</td>
<td>9.088</td>
<td>10.25</td>
<td>10.43</td>
<td>8.235</td>
</tr>
<tr>
<td>Prob &gt; F</td>
<td>6.89e-08</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Model df</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Uncensored obs</td>
<td>551</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left censored obs</td>
<td>2574</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Robust OLS</th>
<th>Svy Regress</th>
<th>Svy Logit</th>
<th>Svy Probit</th>
<th>Svy Tobit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROWTH</td>
<td>-0.00210</td>
<td>-0.0121</td>
<td>-0.143</td>
<td>-0.0846</td>
<td>-0.0211</td>
</tr>
<tr>
<td></td>
<td>(0.00175)</td>
<td>(0.0120)</td>
<td>(0.145)</td>
<td>(0.0750)</td>
<td>(0.0179)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-1.43e-05</td>
<td>-0.000246</td>
<td>-0.00745*</td>
<td>-0.00361*</td>
<td>-0.000846*</td>
</tr>
<tr>
<td></td>
<td>(6.30e-05)</td>
<td>(0.000445)</td>
<td>(0.00383)</td>
<td>(0.00207)</td>
<td>(0.000489)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.0125***</td>
<td>-0.0274</td>
<td>-0.260</td>
<td>-0.344</td>
<td>-0.0520</td>
</tr>
<tr>
<td></td>
<td>(0.00443)</td>
<td>(0.0294)</td>
<td>(0.129)</td>
<td>(0.0350)</td>
<td></td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.00398</td>
<td>0.0766***</td>
<td>0.519***</td>
<td>0.299***</td>
<td>0.0630***</td>
</tr>
<tr>
<td></td>
<td>(0.00281)</td>
<td>(0.0220)</td>
<td>(0.0865)</td>
<td>(0.0206)</td>
<td></td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>-6.79e-07</td>
<td>0.000125***</td>
<td>0.000132***</td>
<td>0.000743***</td>
<td>0.000133***</td>
</tr>
<tr>
<td></td>
<td>(6.93e-06)</td>
<td>(4.95e-05)</td>
<td>(0.000496)</td>
<td>(0.000274)</td>
<td>(6.49e-05)</td>
</tr>
<tr>
<td>RELNUM</td>
<td>0.00142**</td>
<td>0.0324***</td>
<td>0.296***</td>
<td>0.163***</td>
<td>0.0324***</td>
</tr>
<tr>
<td></td>
<td>(0.000611)</td>
<td>(0.00455)</td>
<td>(0.0364)</td>
<td>(0.0202)</td>
<td>(0.00491)</td>
</tr>
<tr>
<td>wLnCASHTOSALES</td>
<td>0.0344***</td>
<td>-0.00782</td>
<td>-0.216</td>
<td>-0.135</td>
<td>0.0570</td>
</tr>
<tr>
<td></td>
<td>(0.0109)</td>
<td>(0.0302)</td>
<td>(0.444)</td>
<td>(0.213)</td>
<td>(0.0587)</td>
</tr>
<tr>
<td>wLnEXTDEBTRATIO</td>
<td>-0.000891</td>
<td>0.00178</td>
<td>0.0604</td>
<td>0.0444</td>
<td>0.00981</td>
</tr>
<tr>
<td></td>
<td>(0.00186)</td>
<td>(0.0107)</td>
<td>(0.140)</td>
<td>(0.0755)</td>
<td>(0.0193)</td>
</tr>
<tr>
<td>wLnDIVERSE</td>
<td>0.0233***</td>
<td>0.151**</td>
<td>1.761***</td>
<td>0.974***</td>
<td>0.240***</td>
</tr>
<tr>
<td></td>
<td>(0.00851)</td>
<td>(0.0646)</td>
<td>(0.659)</td>
<td>(0.347)</td>
<td>(0.0830)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-0.0107***</td>
<td>-0.0206</td>
<td>-0.241</td>
<td>-0.126</td>
<td>-0.0460</td>
</tr>
<tr>
<td></td>
<td>(0.00308)</td>
<td>(0.0285)</td>
<td>(0.310)</td>
<td>(0.164)</td>
<td>(0.0358)</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>0.00268</td>
<td>-0.00334</td>
<td>-0.0324</td>
<td>-0.0206</td>
<td>0.00256</td>
</tr>
<tr>
<td></td>
<td>(0.00595)</td>
<td>(0.0358)</td>
<td>(0.358)</td>
<td>(0.189)</td>
<td>(0.0452)</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>-0.00416</td>
<td>0.0300</td>
<td>0.234</td>
<td>0.144</td>
<td>0.0200</td>
</tr>
<tr>
<td></td>
<td>(0.00435)</td>
<td>(0.0310)</td>
<td>(0.271)</td>
<td>(0.147)</td>
<td>(0.0325)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.00717**</td>
<td>-0.0403***</td>
<td>-0.456**</td>
<td>-0.247**</td>
<td>-0.0605**</td>
</tr>
<tr>
<td></td>
<td>(0.00301)</td>
<td>(0.0197)</td>
<td>(0.228)</td>
<td>(0.118)</td>
<td>(0.0273)</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.00361</td>
<td>-0.0211</td>
<td>-0.260</td>
<td>-0.139</td>
<td>-0.0263</td>
</tr>
<tr>
<td></td>
<td>(0.00276)</td>
<td>(0.0174)</td>
<td>(0.198)</td>
<td>(0.102)</td>
<td>(0.0239)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.00518</td>
<td>-0.0599</td>
<td>-3.591***</td>
<td>-2.086***</td>
<td>-0.477***</td>
</tr>
<tr>
<td></td>
<td>(0.00939)</td>
<td>(0.0661)</td>
<td>(0.627)</td>
<td>(0.366)</td>
<td>(0.0890)</td>
</tr>
<tr>
<td>Observations</td>
<td>3879</td>
<td>4240</td>
<td>4240</td>
<td>4240</td>
<td>4240</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.027</td>
<td>0.065</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.0232</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F statistic</td>
<td>3.537</td>
<td>11.86</td>
<td>15.52</td>
<td>15.24</td>
<td>8.833</td>
</tr>
<tr>
<td>Prob &gt; F</td>
<td>8.04e-06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Model df</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Uncensored obs</td>
<td>647</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
### Table: Probit and Tobit Estimations with Selected Variables Dropped

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

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
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Svy Probit</th>
<th>Svy Probit</th>
<th>Svy Tobit</th>
<th>Svy Tobit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROWTH</td>
<td>-0.0818</td>
<td>-0.0840</td>
<td>-0.0205</td>
<td>-0.0209</td>
</tr>
<tr>
<td></td>
<td>(0.0750)</td>
<td>(0.0744)</td>
<td>(0.0179)</td>
<td>(0.0178)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-0.132</td>
<td>-0.206</td>
<td>-0.0486</td>
<td>-0.0660*</td>
</tr>
<tr>
<td></td>
<td>(0.130)</td>
<td>(0.127)</td>
<td>(0.0350)</td>
<td>(0.0348)</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>0.427***</td>
<td>0.0925***</td>
<td>0.00128**</td>
<td>0.00143**</td>
</tr>
<tr>
<td></td>
<td>(0.0601)</td>
<td>(0.0150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>0.000728***</td>
<td>0.000775**</td>
<td></td>
<td>0.000128**</td>
</tr>
<tr>
<td></td>
<td>(0.000274)</td>
<td>(6.46e-05)</td>
<td></td>
<td>(6.52e-05)</td>
</tr>
<tr>
<td>RELNUM</td>
<td>0.163***</td>
<td>0.166***</td>
<td>0.0324***</td>
<td>0.0333***</td>
</tr>
<tr>
<td></td>
<td>(0.0202)</td>
<td>(0.0201)</td>
<td>(0.00493)</td>
<td>(0.00492)</td>
</tr>
<tr>
<td>wLnCASHTOSALES</td>
<td>-0.140</td>
<td>-0.111</td>
<td>0.0556</td>
<td>0.0617</td>
</tr>
<tr>
<td></td>
<td>(0.220)</td>
<td>(0.218)</td>
<td>(0.0589)</td>
<td>(0.0589)</td>
</tr>
<tr>
<td>wLnEXTDEBTRATIO</td>
<td>0.0313</td>
<td>0.0690</td>
<td>0.00663</td>
<td>0.0153</td>
</tr>
<tr>
<td></td>
<td>(0.0766)</td>
<td>(0.0733)</td>
<td>(0.0195)</td>
<td>(0.0191)</td>
</tr>
<tr>
<td>wLnDIVERSE</td>
<td>0.899***</td>
<td>1.042***</td>
<td>0.222***</td>
<td>0.256***</td>
</tr>
<tr>
<td></td>
<td>(0.342)</td>
<td>(0.342)</td>
<td>(0.0816)</td>
<td>(0.0823)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-0.129</td>
<td>-0.0927</td>
<td>-0.0472</td>
<td>-0.0386</td>
</tr>
<tr>
<td></td>
<td>(0.164)</td>
<td>(0.160)</td>
<td>(0.0360)</td>
<td>(0.0349)</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>-0.0253</td>
<td>-0.0108</td>
<td>0.00201</td>
<td>0.00364</td>
</tr>
<tr>
<td></td>
<td>(0.190)</td>
<td>(0.186)</td>
<td>(0.0454)</td>
<td>(0.0449)</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>0.144</td>
<td>0.153</td>
<td>0.0201</td>
<td>0.0218</td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.146)</td>
<td>(0.0324)</td>
<td>(0.0327)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.240**</td>
<td>-0.246**</td>
<td>-0.0588**</td>
<td>-0.0611**</td>
</tr>
<tr>
<td></td>
<td>(0.118)</td>
<td>(0.117)</td>
<td>(0.0272)</td>
<td>(0.0272)</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-0.141</td>
<td>-0.137</td>
<td>-0.0267</td>
<td>-0.0262</td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
<td>(0.102)</td>
<td>(0.0240)</td>
<td>(0.0239)</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>-0.00873***</td>
<td></td>
<td>-0.00195***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0140)</td>
<td></td>
<td>(0.000355)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-2.377***</td>
<td>-1.567***</td>
<td>-0.545***</td>
<td>-0.368***</td>
</tr>
<tr>
<td></td>
<td>(0.295)</td>
<td>(0.309)</td>
<td>(0.0795)</td>
<td>(0.0804)</td>
</tr>
<tr>
<td>Observations</td>
<td>4240</td>
<td>4240</td>
<td>4240</td>
<td>4240</td>
</tr>
<tr>
<td>F statistic</td>
<td>16.51</td>
<td>14.74</td>
<td>9.595</td>
<td>8.794</td>
</tr>
<tr>
<td>Prob &gt; F</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Model df</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

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 codebook⁴,

“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. 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.

---

5.2 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

<table>
<thead>
<tr>
<th>Study Variable</th>
<th>1998 NSSBF Variable(s)</th>
<th>2003 NSSBF Variable(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASHTOASSETS</td>
<td>R1 / R12</td>
<td>R1 / R12</td>
</tr>
<tr>
<td>CASHTOSALES</td>
<td>R1 / P2</td>
<td>R1 / P2</td>
</tr>
<tr>
<td>CURLIBTOSALES</td>
<td>(S2 + S3) / P2</td>
<td>(S2 + S3) / P2</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>DB_SCORE</td>
<td>A0_DB_CREDRK (scale reversed to match 1998 order)</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>S8 / R12</td>
<td>S8 / R12</td>
</tr>
<tr>
<td>EXTDEBTRATIO</td>
<td>(S8 - F41) / R12</td>
<td>(S8 - F41) / R12</td>
</tr>
<tr>
<td>DEBTTOASSETS</td>
<td>(S1 + S2 + S3) / R12</td>
<td>(S1 + S2 + S3) / R12</td>
</tr>
<tr>
<td>DENIEDCREDIT</td>
<td>L13=1</td>
<td>L13=1</td>
</tr>
<tr>
<td>DIVERSE</td>
<td>OWNEQUITY/(OWNWORTH+OWNEQUITY)</td>
<td>OWNEQUITY/(OWNWORTH+OWNEQUITY)</td>
</tr>
<tr>
<td>EXTDEBTTOASSETS</td>
<td>(S1 – F41 + S2 + S3) / R12</td>
<td>(S1 – F41 + S2 + S3) / R12</td>
</tr>
<tr>
<td>FAMOWN</td>
<td>C_FAM=1</td>
<td>CF_FAMILY=1</td>
</tr>
<tr>
<td>FEARDENIAL</td>
<td>MRL31=1</td>
<td>MRL31=1</td>
</tr>
<tr>
<td>FEMOWN</td>
<td>C_SEX=1</td>
<td>CF_FEMALE &gt; 50</td>
</tr>
<tr>
<td>FIRMAGE</td>
<td>C_FAGE</td>
<td>CF_FAGE</td>
</tr>
<tr>
<td>FIRMDISTRESS</td>
<td>U1_1 = 1 or U1_1 = 3 or U3 &gt; 1</td>
<td>U1 = 1 or U3 = 1</td>
</tr>
<tr>
<td>Variable</td>
<td>Expression</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>GROWPROB</td>
<td>D6=14</td>
<td></td>
</tr>
<tr>
<td>A0_FIRMPROB</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>GROWTH</td>
<td>P2 &gt; P3</td>
<td></td>
</tr>
<tr>
<td>INHERITED</td>
<td>C_ESTR=3</td>
<td></td>
</tr>
<tr>
<td>CF_ESTAB</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>INVRATIO</td>
<td>R3/R12</td>
<td></td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>L8=1</td>
<td></td>
</tr>
<tr>
<td>MINOWN</td>
<td>C_MINOR=1</td>
<td></td>
</tr>
<tr>
<td>CF_MINOR</td>
<td>&gt; 50</td>
<td></td>
</tr>
<tr>
<td>OFFEREDTCD</td>
<td>L4 &gt; 0</td>
<td></td>
</tr>
<tr>
<td>OPEXTOSALES</td>
<td>P5 / P2</td>
<td></td>
</tr>
<tr>
<td>OTRINCTOSALES</td>
<td>P4 / P2</td>
<td></td>
</tr>
<tr>
<td>INVDISTRESS</td>
<td>U1_1 = 2 or U1_1 = 3 or U2 &gt; 1 or U4 = 1</td>
<td></td>
</tr>
<tr>
<td>OWNEDU</td>
<td>C_EDUC</td>
<td></td>
</tr>
<tr>
<td>OWNEQUITY</td>
<td>EQUITY x (OWNSHR/100)</td>
<td></td>
</tr>
<tr>
<td>OWNERS</td>
<td>C_NOW</td>
<td></td>
</tr>
<tr>
<td>CF_OWNER</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>OWNEXP</td>
<td>C_EXP</td>
<td></td>
</tr>
<tr>
<td>CF_EXP</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>OWNNMGR</td>
<td>C_MGR=1</td>
<td></td>
</tr>
<tr>
<td>CF_MANAGE</td>
<td>= 1</td>
<td></td>
</tr>
<tr>
<td>OWNSHR</td>
<td>C_OWNSH</td>
<td></td>
</tr>
<tr>
<td>OWNWORTH</td>
<td>U_NETW + U_HEQ</td>
<td></td>
</tr>
<tr>
<td>OWNWORTHTOSALES</td>
<td>(U_NETW + U_HEQ) / P2</td>
<td></td>
</tr>
<tr>
<td>PAIDLATE</td>
<td>L6=1</td>
<td></td>
</tr>
<tr>
<td>PASSTHRU</td>
<td>B3=2 or B3=3 or B3=7</td>
<td></td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>D5_7=1</td>
<td></td>
</tr>
<tr>
<td>QUICKRATIO</td>
<td>(R1 + R2) / (S2 + S3)</td>
<td></td>
</tr>
<tr>
<td>RELDIST</td>
<td>Value of IDIST1-20 for MAININST</td>
<td></td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>Max of IMONS1-20 for MAININST</td>
<td></td>
</tr>
<tr>
<td>RELNUM</td>
<td>Sum of “1” for each non-missing IMONS1-20</td>
<td></td>
</tr>
<tr>
<td>SALES</td>
<td>P2</td>
<td></td>
</tr>
<tr>
<td>TOTEMP</td>
<td>TOTEMP</td>
<td></td>
</tr>
<tr>
<td>TRADECREDIT</td>
<td>L1=1</td>
<td></td>
</tr>
<tr>
<td>USEDCCARD</td>
<td>F1=1 or F4=1</td>
<td></td>
</tr>
<tr>
<td>USEDGRACE</td>
<td>F3=1 or F6=1</td>
<td></td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>((f10_3 - f11_3)) / R12</td>
<td></td>
</tr>
</tbody>
</table>
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

\[ Y = \beta X + \epsilon \]  

(1)

where \( Y \) is a vector of responses, \( X \) is an array of predictors, \( \beta \) is a vector of regression coefficients and \( \epsilon \) is an array of random errors. Also assume that there exists an array of stratification variables \( J \) 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

$$\beta_{OLS} = (X'X)^{-1}X'Y$$ \hspace{1cm} (2)

or the weighed OLS estimator given by

$$\beta_{WGT} = (X'WX)^{-1}X'WY$$ \hspace{1cm} (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 $\beta_{OLS}$ for model (1) above can be shown to be biased and inconsistent while $\beta_{WGT}$ 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 $\varepsilon$, 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 $\beta_{WGT}$ that may make it preferable over $\beta_{OLS}$ is that it is consistent in the face of misspecification of the model, while $\beta_{OLS}$ 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)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) OLS</th>
<th>(2) Robust OLS</th>
<th>(3) Robust WLS</th>
<th>(4) Survey-weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN</td>
<td>7.194**</td>
<td>7.194*</td>
<td>8.648**</td>
<td>8.648**</td>
</tr>
<tr>
<td></td>
<td>(3.651)</td>
<td>(3.778)</td>
<td>(4.109)</td>
<td>(4.070)</td>
</tr>
<tr>
<td>MINOWN</td>
<td>-12.53**</td>
<td>-12.53**</td>
<td>-16.34***</td>
<td>-16.34***</td>
</tr>
<tr>
<td></td>
<td>(4.942)</td>
<td>(4.938)</td>
<td>(5.881)</td>
<td>(5.819)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.350***</td>
<td>0.350***</td>
<td>0.626***</td>
<td>0.626***</td>
</tr>
<tr>
<td></td>
<td>(0.118)</td>
<td>(0.113)</td>
<td>(0.142)</td>
<td>(0.140)</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.090</td>
<td>1.090</td>
<td>0.811</td>
<td>0.811</td>
</tr>
<tr>
<td></td>
<td>(0.704)</td>
<td>(0.711)</td>
<td>(0.873)</td>
<td>(0.860)</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>5.306</td>
<td>5.306</td>
<td>12.14**</td>
<td>12.14**</td>
</tr>
<tr>
<td></td>
<td>(4.426)</td>
<td>(4.496)</td>
<td>(5.115)</td>
<td>(5.070)</td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>9.723***</td>
<td>9.723***</td>
<td>13.47***</td>
<td>13.47***</td>
</tr>
<tr>
<td></td>
<td>(2.535)</td>
<td>(2.564)</td>
<td>(3.320)</td>
<td>(3.279)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-17.47***</td>
<td>-17.47***</td>
<td>-7.877</td>
<td>-7.877</td>
</tr>
<tr>
<td></td>
<td>(4.094)</td>
<td>(4.075)</td>
<td>(5.256)</td>
<td>(5.192)</td>
</tr>
<tr>
<td>Variable</td>
<td>Estimate1</td>
<td>Estimate2</td>
<td>Estimate3</td>
<td>Estimate4</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>2.915</td>
<td>2.915</td>
<td>-0.0958</td>
<td>-0.0958</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>-1.622</td>
<td>-1.622</td>
<td>-2.421</td>
<td>-2.421</td>
</tr>
<tr>
<td>RETAIL</td>
<td>-0.702</td>
<td>-0.702</td>
<td>1.299</td>
<td>1.299</td>
</tr>
<tr>
<td>SERVICES</td>
<td>-6.193</td>
<td>-6.193</td>
<td>-1.512</td>
<td>-1.512</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.0333</td>
<td>0.0333</td>
<td>0.0837</td>
<td>0.0837</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-1.238</td>
<td>-1.238</td>
<td>-1.745</td>
<td>-1.745</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>2.304</td>
<td>2.304</td>
<td>4.533*</td>
<td>4.533*</td>
</tr>
<tr>
<td>USEDCARD</td>
<td>-13.07***</td>
<td>-13.07***</td>
<td>-12.98**</td>
<td>-12.98**</td>
</tr>
<tr>
<td>USEDGRACE</td>
<td>11.95***</td>
<td>11.95***</td>
<td>13.34***</td>
<td>13.34***</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>3.523</td>
<td>3.523</td>
<td>4.739</td>
<td>4.739</td>
</tr>
<tr>
<td>LnQUICKRATIO</td>
<td>8.994*</td>
<td>8.994</td>
<td>17.11***</td>
<td>17.11***</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>0.0134</td>
<td>0.0134</td>
<td>0.00830</td>
<td>0.00830</td>
</tr>
<tr>
<td>RELNUM</td>
<td>-0.922</td>
<td>-0.922</td>
<td>-2.313**</td>
<td>-2.313**</td>
</tr>
<tr>
<td>LnRELDIST</td>
<td>-1.151</td>
<td>-1.151</td>
<td>-1.424</td>
<td>-1.424</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>-6.326***</td>
<td>-6.326***</td>
<td>-4.102***</td>
<td>-4.102***</td>
</tr>
<tr>
<td>PAIDLATE</td>
<td>-12.76***</td>
<td>-12.76***</td>
<td>-12.90***</td>
<td>-12.90***</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>-1.066</td>
<td>-1.066</td>
<td>2.759</td>
<td>2.759</td>
</tr>
<tr>
<td>Constant</td>
<td>-7.027</td>
<td>-7.027</td>
<td>-88.73**</td>
<td>-88.73**</td>
</tr>
</tbody>
</table>

Observations: 1138
R-squared: 0.169
Adjusted R2: 0.165
Model SS: 381804
Residual SS: 1.877e+06
Model df: 25
Residual df: 1112
F statistic: 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)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) OLS</th>
<th>(2) Robust OLS</th>
<th>(3) Robust WLS</th>
<th>(4) Survey-weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMOWN</td>
<td>-1.738</td>
<td>-1.738</td>
<td>0.361</td>
<td>0.361</td>
</tr>
<tr>
<td></td>
<td>(3.348)</td>
<td>(3.473)</td>
<td>(5.315)</td>
<td>(5.257)</td>
</tr>
<tr>
<td></td>
<td>(5.081)</td>
<td>(5.502)</td>
<td>(7.535)</td>
<td>(7.468)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>0.108</td>
<td>0.108</td>
<td>-0.0612</td>
<td>-0.0612</td>
</tr>
<tr>
<td></td>
<td>(0.105)</td>
<td>(0.108)</td>
<td>(0.149)</td>
<td>(0.148)</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>1.462**</td>
<td>1.462**</td>
<td>1.183</td>
<td>1.183</td>
</tr>
<tr>
<td></td>
<td>(0.610)</td>
<td>(0.613)</td>
<td>(0.914)</td>
<td>(0.905)</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>6.414</td>
<td>6.414</td>
<td>1.472</td>
<td>1.472</td>
</tr>
<tr>
<td></td>
<td>(4.642)</td>
<td>(5.031)</td>
<td>(6.144)</td>
<td>(6.103)</td>
</tr>
<tr>
<td>MAINSUPL</td>
<td>6.046***</td>
<td>6.046***</td>
<td>7.032**</td>
<td>7.032**</td>
</tr>
<tr>
<td></td>
<td>(2.177)</td>
<td>(2.174)</td>
<td>(3.287)</td>
<td>(3.267)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-5.917*</td>
<td>-5.917*</td>
<td>-8.021</td>
<td>-8.021*</td>
</tr>
<tr>
<td></td>
<td>(3.438)</td>
<td>(3.352)</td>
<td>(4.879)</td>
<td>(4.838)</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>-5.762</td>
<td>-5.762</td>
<td>-9.860</td>
<td>-9.860</td>
</tr>
<tr>
<td></td>
<td>(5.626)</td>
<td>(5.651)</td>
<td>(9.253)</td>
<td>(9.188)</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>3.146</td>
<td>3.146</td>
<td>1.516</td>
<td>1.516</td>
</tr>
<tr>
<td></td>
<td>(4.108)</td>
<td>(4.015)</td>
<td>(5.902)</td>
<td>(5.857)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>8.272**</td>
<td>8.272**</td>
<td>10.14**</td>
<td>10.14**</td>
</tr>
<tr>
<td></td>
<td>(3.407)</td>
<td>(3.360)</td>
<td>(4.973)</td>
<td>(4.955)</td>
</tr>
<tr>
<td>SERVICES</td>
<td>0.772</td>
<td>0.772</td>
<td>3.099</td>
<td>3.099</td>
</tr>
<tr>
<td></td>
<td>(3.358)</td>
<td>(3.382)</td>
<td>(4.926)</td>
<td>(4.897)</td>
</tr>
<tr>
<td>ONSHR</td>
<td>-0.0346</td>
<td>-0.0346</td>
<td>0.0265</td>
<td>0.0265</td>
</tr>
<tr>
<td></td>
<td>(0.0560)</td>
<td>(0.0569)</td>
<td>(0.0898)</td>
<td>(0.0891)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>2.673</td>
<td>2.673</td>
<td>-4.885</td>
<td>-4.885</td>
</tr>
<tr>
<td></td>
<td>(3.084)</td>
<td>(3.111)</td>
<td>(5.148)</td>
<td>(5.090)</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>0.547</td>
<td>0.547</td>
<td>-1.218</td>
<td>-1.218</td>
</tr>
<tr>
<td></td>
<td>(1.884)</td>
<td>(1.860)</td>
<td>(2.847)</td>
<td>(2.817)</td>
</tr>
<tr>
<td></td>
<td>(4.519)</td>
<td>(4.407)</td>
<td>(5.643)</td>
<td>(5.594)</td>
</tr>
<tr>
<td>USEDGRACE</td>
<td>8.947**</td>
<td>8.947**</td>
<td>9.840**</td>
<td>9.840**</td>
</tr>
<tr>
<td></td>
<td>(3.662)</td>
<td>(3.622)</td>
<td>(4.590)</td>
<td>(4.548)</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>4.755</td>
<td>4.755</td>
<td>6.258</td>
<td>6.258</td>
</tr>
<tr>
<td></td>
<td>(4.600)</td>
<td>(5.360)</td>
<td>(6.309)</td>
<td>(6.253)</td>
</tr>
<tr>
<td>LnQUICKRATIO</td>
<td>-2.394</td>
<td>-2.394</td>
<td>7.621</td>
<td>7.621</td>
</tr>
<tr>
<td></td>
<td>(4.500)</td>
<td>(4.495)</td>
<td>(5.682)</td>
<td>(5.622)</td>
</tr>
<tr>
<td>LnPROFTOINCOME</td>
<td>1.911</td>
<td>1.911</td>
<td>-9.144</td>
<td>-9.144</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>0.0198**</td>
<td>0.0198**</td>
<td>0.0368***</td>
<td>0.0368***</td>
</tr>
<tr>
<td></td>
<td>(0.00820)</td>
<td>(0.00762)</td>
<td>(0.0127)</td>
<td>(0.0126)</td>
</tr>
<tr>
<td>RELNUM</td>
<td>-0.0435</td>
<td>-0.0435</td>
<td>-0.603</td>
<td>-0.603</td>
</tr>
<tr>
<td></td>
<td>(0.522)</td>
<td>(0.534)</td>
<td>(0.850)</td>
<td>(0.844)</td>
</tr>
<tr>
<td>LnRELDIST</td>
<td>-0.0609</td>
<td>-0.0609</td>
<td>-0.617</td>
<td>-0.617</td>
</tr>
<tr>
<td></td>
<td>(0.772)</td>
<td>(0.768)</td>
<td>(1.106)</td>
<td>(1.098)</td>
</tr>
<tr>
<td>DBSCORE</td>
<td>-6.391***</td>
<td>-6.391***</td>
<td>-4.514***</td>
<td>-4.514***</td>
</tr>
<tr>
<td></td>
<td>(0.759)</td>
<td>(0.745)</td>
<td>(1.101)</td>
<td>(1.092)</td>
</tr>
</tbody>
</table>
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

\[ x_T = \ln(x_U - \text{min}(x_U) + 1) \]
where $x_T$ is the transformed variable and $x_U$ 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

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCTDISCOUNTS</td>
<td>1455</td>
<td>57.0646</td>
<td>44.43622</td>
<td>0</td>
<td>100</td>
<td>-.2864114</td>
<td>1.251038</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>3441</td>
<td>19.3034</td>
<td>11.7323</td>
<td>0</td>
<td>72</td>
<td>.7947106</td>
<td>3.563414</td>
</tr>
<tr>
<td>ONSHR</td>
<td>3441</td>
<td>80.14356</td>
<td>27.3181</td>
<td>1</td>
<td>100</td>
<td>-.9245613</td>
<td>1.384729</td>
</tr>
<tr>
<td>OWNERS</td>
<td>3441</td>
<td>6.293229</td>
<td>70.96166</td>
<td>1</td>
<td>2500</td>
<td>25.01649</td>
<td>713.5992</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>3435</td>
<td>.4351921</td>
<td>7.701558</td>
<td>0</td>
<td>335</td>
<td>7.237469</td>
<td>9.514999</td>
</tr>
<tr>
<td>QUICKRATIO</td>
<td>2303</td>
<td>8.447221</td>
<td>67.82369</td>
<td>-16</td>
<td>2844.954</td>
<td>33.45103</td>
<td>1346.478</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>3369</td>
<td>96.49688</td>
<td>99.89383</td>
<td>0</td>
<td>780</td>
<td>2.237469</td>
<td>9.514999</td>
</tr>
<tr>
<td>RELNUM</td>
<td>3441</td>
<td>2.405987</td>
<td>1.73606</td>
<td>0</td>
<td>20</td>
<td>2.184701</td>
<td>12.61381</td>
</tr>
<tr>
<td>PROFTOINCOME</td>
<td>3441</td>
<td>.0614868</td>
<td>2.090686</td>
<td>-99</td>
<td>1</td>
<td>33.61023</td>
<td>1494.567</td>
</tr>
<tr>
<td>DEBTORATIO</td>
<td>3441</td>
<td>1.183149</td>
<td>10.65533</td>
<td>0</td>
<td>200</td>
<td>21.04348</td>
<td>495.4953</td>
</tr>
<tr>
<td>LnOWNWORTH-S</td>
<td>3441</td>
<td>8.658844</td>
<td>.0159623</td>
<td>8.645469</td>
<td>9.099521</td>
<td>0.999521</td>
<td>513.3404</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>3435</td>
<td>.1019281</td>
<td>.3348003</td>
<td>0</td>
<td>5.817111</td>
<td>7.906081</td>
<td>21.95885</td>
</tr>
<tr>
<td>LnDEBTOTERM</td>
<td>3441</td>
<td>1.935878</td>
<td>1.554581</td>
<td>0</td>
<td>6.177944</td>
<td>6.387706</td>
<td>2.426204</td>
</tr>
<tr>
<td>LnEXTDEBT-TS</td>
<td>3441</td>
<td>2.573684</td>
<td>2.219167</td>
<td>0</td>
<td>6.825388</td>
<td>9.116327</td>
<td>140.4944</td>
</tr>
<tr>
<td>LnFIRMAGE</td>
<td>3441</td>
<td>2.463372</td>
<td>.7817523</td>
<td>0</td>
<td>4.653918</td>
<td>-.191188</td>
<td>2.423045</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>3441</td>
<td>.4722863</td>
<td>.8270663</td>
<td>0</td>
<td>7.824046</td>
<td>3.262901</td>
<td>18.99913</td>
</tr>
<tr>
<td>LnRELDIST</td>
<td>3369</td>
<td>1.480081</td>
<td>1.355391</td>
<td>0</td>
<td>8.087641</td>
<td>1.803016</td>
<td>7.523452</td>
</tr>
<tr>
<td>LnSALES</td>
<td>3441</td>
<td>12.70946</td>
<td>2.297987</td>
<td>0</td>
<td>20.25166</td>
<td>-99</td>
<td>13.96416</td>
</tr>
<tr>
<td>LnDEBTOSAS</td>
<td>3441</td>
<td>.4877584</td>
<td>.618487</td>
<td>0</td>
<td>6.813151</td>
<td>3.155155</td>
<td>21.4484</td>
</tr>
<tr>
<td>LnDEBTOSATOS</td>
<td>3441</td>
<td>.3210239</td>
<td>.505812</td>
<td>0</td>
<td>5.707111</td>
<td>4.0402</td>
<td>27.30575</td>
</tr>
<tr>
<td>LnCASHSOSAS</td>
<td>3441</td>
<td>2.901952</td>
<td>.201152</td>
<td>2.572988</td>
<td>3.466804</td>
<td>10.56124</td>
<td>267.2516</td>
</tr>
<tr>
<td>LnCASHSOAS</td>
<td>3441</td>
<td>2.255416</td>
<td>.0486456</td>
<td>0</td>
<td>2.335375</td>
<td>-28.7428</td>
<td>1344.681</td>
</tr>
<tr>
<td>LnINVESTOSAS</td>
<td>3441</td>
<td>.59829</td>
<td>.1040132</td>
<td>0</td>
<td>2.689221</td>
<td>15.5671</td>
<td>320.8143</td>
</tr>
<tr>
<td>LnCURLIBTO-S</td>
<td>3441</td>
<td>.090608</td>
<td>.17666</td>
<td>0</td>
<td>2.397895</td>
<td>4.676205</td>
<td>38.93858</td>
</tr>
<tr>
<td>LnOPEXTOSA</td>
<td>3441</td>
<td>.59829</td>
<td>.3086261</td>
<td>0</td>
<td>4.670663</td>
<td>3.997062</td>
<td>38.93404</td>
</tr>
<tr>
<td>LnQUICKRATIO</td>
<td>2303</td>
<td>3.48847</td>
<td>.316317</td>
<td>2.518233</td>
<td>7.963237</td>
<td>5.570422</td>
<td>46.38817</td>
</tr>
<tr>
<td>LnARRATIO</td>
<td>2303</td>
<td>1.153385</td>
<td>.698189</td>
<td>0</td>
<td>7.951091</td>
<td>3.14143</td>
<td>18.92151</td>
</tr>
<tr>
<td>LnOPEXTSOS</td>
<td>2303</td>
<td>.2644093</td>
<td>.102872</td>
<td>0</td>
<td>3.802733</td>
<td>16.4784</td>
<td>447.9679</td>
</tr>
<tr>
<td>LnPROFTOSA</td>
<td>3441</td>
<td>3.605113</td>
<td>.1313835</td>
<td>.82838181</td>
<td>4.203495</td>
<td>-9.603667</td>
<td>153.8676</td>
</tr>
<tr>
<td>LnPROFTOIN</td>
<td>3441</td>
<td>4.221302</td>
<td>.2910459</td>
<td>.1948795</td>
<td>4.81340613</td>
<td>31.71786</td>
<td></td>
</tr>
<tr>
<td>LnCASHTOSA</td>
<td>2303</td>
<td>3.434758</td>
<td>.2076993</td>
<td>2.449088</td>
<td>5.93695</td>
<td>5.744133</td>
<td>46.6338</td>
</tr>
<tr>
<td>LnDEPRTOAS</td>
<td>2303</td>
<td>.2975787</td>
<td>.600102</td>
<td>0</td>
<td>5.919479</td>
<td>4.075874</td>
<td>22.33822</td>
</tr>
<tr>
<td>LnTAXTOSA</td>
<td>3441</td>
<td>1.627487</td>
<td>.0706025</td>
<td>0</td>
<td>2.713252</td>
<td>-9.324826</td>
<td>395.0312</td>
</tr>
<tr>
<td>LnDEPTOAS</td>
<td>3441</td>
<td>.2671958</td>
<td>.216661</td>
<td>0</td>
<td>0.9358733</td>
<td>.5338564</td>
<td>1.978895</td>
</tr>
</tbody>
</table>
Table 6.4

1998 NSSBF - Descriptive statistics for Winsorized numeric variables

<table>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>wLnOWNWORT-S</td>
<td>3441</td>
<td>8.658068</td>
<td>.0031335</td>
<td>8.657129</td>
<td>8.682423</td>
<td>6.142843</td>
<td>43.99415</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>3435</td>
<td>.0912827</td>
<td>.2392581</td>
<td>0</td>
<td>1.593252</td>
<td>4.137629</td>
<td>22.40677</td>
</tr>
<tr>
<td>wLnTOTEMP</td>
<td>3441</td>
<td>1.936577</td>
<td>1.549513</td>
<td>0</td>
<td>5.710427</td>
<td>.6239943</td>
<td>2.376852</td>
</tr>
<tr>
<td>wLnEXTDEBT-S</td>
<td>3441</td>
<td>2.567428</td>
<td>.1324595</td>
<td>2.501447</td>
<td>3.419816</td>
<td>4.451676</td>
<td>25.51915</td>
</tr>
<tr>
<td>wLnFIRMAGE</td>
<td>3441</td>
<td>.4583253</td>
<td>.7456003</td>
<td>0</td>
<td>3.912023</td>
<td>2.305593</td>
<td>9.392093</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>3369</td>
<td>1.475613</td>
<td>1.336221</td>
<td>0</td>
<td>6.887553</td>
<td>1.704202</td>
<td>6.902379</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>3441</td>
<td>12.70437</td>
<td>2.285698</td>
<td>4.330733</td>
<td>17.74784</td>
<td>-.0136965</td>
<td>2.935072</td>
</tr>
<tr>
<td>wLnDEBTTOA-S</td>
<td>3441</td>
<td>.4775423</td>
<td>.5558988</td>
<td>0</td>
<td>2.991288</td>
<td>2.174199</td>
<td>8.849728</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>3441</td>
<td>3.115793</td>
<td>.777023</td>
<td>0</td>
<td>2.735449</td>
<td>2.78372</td>
<td>12.32654</td>
</tr>
<tr>
<td>wLnCASHTOS-S</td>
<td>3441</td>
<td>2.901404</td>
<td>.1114051</td>
<td>2.895275</td>
<td>2.975781</td>
<td>4.604558</td>
<td>26.90122</td>
</tr>
<tr>
<td>wLnCASHTOA-S</td>
<td>3441</td>
<td>2.256423</td>
<td>.0286967</td>
<td>2.227999</td>
<td>2.335375</td>
<td>1.530851</td>
<td>4.368904</td>
</tr>
<tr>
<td>wLnINVESTO-S</td>
<td>3441</td>
<td>.0207043</td>
<td>.0442221</td>
<td>.0095695</td>
<td>.326493</td>
<td>5.322093</td>
<td>33.57129</td>
</tr>
<tr>
<td>wLnCURRIBIT-S</td>
<td>3441</td>
<td>.0852877</td>
<td>.145184</td>
<td>0</td>
<td>.7048291</td>
<td>2.552149</td>
<td>9.394778</td>
</tr>
<tr>
<td>wLnOPFEXTOS-S</td>
<td>3441</td>
<td>.5917811</td>
<td>.264346</td>
<td>.0088079</td>
<td>1.94591</td>
<td>1.598297</td>
<td>11.3426</td>
</tr>
<tr>
<td>wLnQUICKRA-O</td>
<td>2303</td>
<td>3.482648</td>
<td>.2657355</td>
<td>3.34639</td>
<td>5.065166</td>
<td>3.964441</td>
<td>20.62408</td>
</tr>
<tr>
<td>wLnARRATIO</td>
<td>2303</td>
<td>1.143966</td>
<td>.649164</td>
<td>.690441</td>
<td>4.322351</td>
<td>2.540878</td>
<td>10.82637</td>
</tr>
<tr>
<td>wLnOTRINCT-S</td>
<td>3441</td>
<td>.2616718</td>
<td>.0641877</td>
<td>.2477019</td>
<td>.7800731</td>
<td>6.66265</td>
<td>50.24466</td>
</tr>
<tr>
<td>wLnPROFTOS-S</td>
<td>3441</td>
<td>3.608726</td>
<td>.0859346</td>
<td>3.036829</td>
<td>3.743695</td>
<td>3.719563</td>
<td>24.87899</td>
</tr>
<tr>
<td>wLnPROFTOI-E</td>
<td>3441</td>
<td>4.226249</td>
<td>.2562412</td>
<td>2.86409</td>
<td>4.805262</td>
<td>1.565253</td>
<td>11.61904</td>
</tr>
<tr>
<td>wLnCASHRATIO</td>
<td>2303</td>
<td>3.430628</td>
<td>.1686729</td>
<td>3.348437</td>
<td>4.45467</td>
<td>4.193367</td>
<td>22.32254</td>
</tr>
<tr>
<td>wLnOTRATIO</td>
<td>2303</td>
<td>.2914463</td>
<td>.5614324</td>
<td>.062538</td>
<td>3.322558</td>
<td>3.606508</td>
<td>16.75012</td>
</tr>
<tr>
<td>wLnTAXTOSA-S</td>
<td>868</td>
<td>1.627357</td>
<td>.0090998</td>
<td>1.608733</td>
<td>1.695674</td>
<td>5.342303</td>
<td>37.91701</td>
</tr>
<tr>
<td>wLnDEPRTOSA-S</td>
<td>3441</td>
<td>.2671046</td>
<td>.2163937</td>
<td>.0351113</td>
<td>.7108569</td>
<td>.5339541</td>
<td>1.96084</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>variable</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
<th>skewness</th>
<th>kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCTDISCOUNTS</td>
<td>1813</td>
<td>57.07612</td>
<td>44.24405</td>
<td>0</td>
<td>100</td>
<td>-.2598099</td>
<td>1.236721</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>4055</td>
<td>21.418</td>
<td>11.46508</td>
<td>0</td>
<td>65</td>
<td>.4877799</td>
<td>2.985365</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>4064</td>
<td>75.82259</td>
<td>27.25953</td>
<td>8</td>
<td>100</td>
<td>-.4787184</td>
<td>1.665685</td>
</tr>
<tr>
<td>OWNERS</td>
<td>4113</td>
<td>6.296377</td>
<td>75.43168</td>
<td>1</td>
<td>3000</td>
<td>31.45647</td>
<td>1124.18</td>
</tr>
<tr>
<td>UNUSEDLOC</td>
<td>4110</td>
<td>.3314932</td>
<td>4.828495</td>
<td>0</td>
<td>284.5529</td>
<td>51.47675</td>
<td>2950.333</td>
</tr>
<tr>
<td>QUICKRATIO</td>
<td>2920</td>
<td>40.16197</td>
<td>1446.122</td>
<td>-60.37349</td>
<td>77527</td>
<td>52.79333</td>
<td>2825.396</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>4050</td>
<td>136.3719</td>
<td>125.5911</td>
<td>0</td>
<td>1156</td>
<td>1.882428</td>
<td>8.258365</td>
</tr>
<tr>
<td>RELNUM</td>
<td>4113</td>
<td>2.852905</td>
<td>1.892542</td>
<td>0</td>
<td>20</td>
<td>1.711853</td>
<td>8.514778</td>
</tr>
<tr>
<td>PROFOSALES</td>
<td>4113</td>
<td>-.0540128</td>
<td>8.113041</td>
<td>-467.9074</td>
<td>79.61104</td>
<td>-49.65651</td>
<td>2765.75</td>
</tr>
<tr>
<td>PROFINCOME</td>
<td>4113</td>
<td>-.056179</td>
<td>7.705224</td>
<td>-467.9074</td>
<td>1</td>
<td>55.79717</td>
<td>3327.57</td>
</tr>
<tr>
<td>DEBTRATIO</td>
<td>4113</td>
<td>.9717951</td>
<td>9.904458</td>
<td>0</td>
<td>10.75287</td>
<td>32.67862</td>
<td>1285.669</td>
</tr>
<tr>
<td>LnOWNWORTH-S</td>
<td>4064</td>
<td>4.038784</td>
<td>.3513856</td>
<td>0</td>
<td>10.75278</td>
<td>7.709923</td>
<td>79.46949</td>
</tr>
<tr>
<td>LnUNUSEDLOC</td>
<td>4110</td>
<td>.1271379</td>
<td>.352341</td>
<td>0</td>
<td>5.654427</td>
<td>5.85456</td>
<td>56.0604</td>
</tr>
<tr>
<td>LnTOTEMP</td>
<td>4113</td>
<td>4.247571</td>
<td>1.429925</td>
<td>0</td>
<td>6.188264</td>
<td>.5625388</td>
<td>2.148041</td>
</tr>
<tr>
<td>LnEXTDDEBT-TS</td>
<td>4113</td>
<td>4.439389</td>
<td>.285246</td>
<td>0</td>
<td>6.300493</td>
<td>-34.45253</td>
<td>2112.083</td>
</tr>
<tr>
<td>LnFIRMAGE</td>
<td>4113</td>
<td>2.482136</td>
<td>.8973857</td>
<td>0</td>
<td>4.634729</td>
<td>-.701151</td>
<td>3.067271</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>4113</td>
<td>.6083013</td>
<td>1.358869</td>
<td>0</td>
<td>8.006368</td>
<td>2.719065</td>
<td>15.2718</td>
</tr>
<tr>
<td>LnRELDIST</td>
<td>4050</td>
<td>1.502711</td>
<td>1.358869</td>
<td>0</td>
<td>8.003288</td>
<td>1.673633</td>
<td>7.190012</td>
</tr>
<tr>
<td>LnSALES</td>
<td>4113</td>
<td>13.26238</td>
<td>2.248684</td>
<td>7.845808</td>
<td>19.16672</td>
<td>.0249303</td>
<td>2.41746</td>
</tr>
<tr>
<td>LnDEBTTOAS-S</td>
<td>4113</td>
<td>.436103</td>
<td>.5236238</td>
<td>0</td>
<td>6.135193</td>
<td>3.246911</td>
<td>21.43607</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>4113</td>
<td>.309201</td>
<td>.4946478</td>
<td>0</td>
<td>6.122666</td>
<td>3.968073</td>
<td>28.46316</td>
</tr>
<tr>
<td>LnCASHTOAS-S</td>
<td>4113</td>
<td>1.626419</td>
<td>10.29663</td>
<td>0</td>
<td>4.766133</td>
<td>14.53024</td>
<td>369.4341</td>
</tr>
<tr>
<td>LnCASHTOAS-S</td>
<td>4113</td>
<td>2.338514</td>
<td>.190256</td>
<td>.0024007</td>
<td>2.95</td>
<td>1.085783</td>
<td>11.20998</td>
</tr>
<tr>
<td>LnINVESTOS</td>
<td>4113</td>
<td>.1247479</td>
<td>.1325627</td>
<td>0</td>
<td>4.763629</td>
<td>18.33222</td>
<td>494.0478</td>
</tr>
<tr>
<td>LnCURLIBITO-S</td>
<td>4113</td>
<td>.3993719</td>
<td>.1502584</td>
<td>0</td>
<td>3.55246</td>
<td>9.879758</td>
<td>155.6819</td>
</tr>
<tr>
<td>LnOPEXTOSA-S</td>
<td>4113</td>
<td>.6153885</td>
<td>.2844494</td>
<td>0</td>
<td>6.152535</td>
<td>6.35001</td>
<td>90.49075</td>
</tr>
<tr>
<td>LnQUCKRATIO</td>
<td>2920</td>
<td>4.542464</td>
<td>.2518728</td>
<td>3.293698</td>
<td>11.25951</td>
<td>12.80813</td>
<td>252.5891</td>
</tr>
<tr>
<td>LnARRATIO</td>
<td>2920</td>
<td>2.843646</td>
<td>.350259</td>
<td>0</td>
<td>11.22544</td>
<td>8.56013</td>
<td>142.4297</td>
</tr>
<tr>
<td>LnTRINCITO-S</td>
<td>4113</td>
<td>.269143</td>
<td>.1458436</td>
<td>0</td>
<td>4.715734</td>
<td>18.13917</td>
<td>462.067</td>
</tr>
<tr>
<td>LnPROFTOSA-S</td>
<td>4113</td>
<td>1.9219</td>
<td>.0786964</td>
<td>.002781</td>
<td>6.311035</td>
<td>37.62682</td>
<td>2454.155</td>
</tr>
<tr>
<td>LnPROFOIN-E</td>
<td>4113</td>
<td>5.546012</td>
<td>.2620597</td>
<td>.0025357</td>
<td>6.15</td>
<td>5.935544</td>
<td>94.1668</td>
</tr>
<tr>
<td>LnCASHRATIO</td>
<td>2920</td>
<td>6.076206</td>
<td>.1460437</td>
<td>0</td>
<td>9.134718</td>
<td>19.09024</td>
<td>1120.568</td>
</tr>
<tr>
<td>LnGTRRATIO</td>
<td>2920</td>
<td>2.170354</td>
<td>.332077</td>
<td>0</td>
<td>7.564558</td>
<td>7.301879</td>
<td>77.57334</td>
</tr>
<tr>
<td>LnTAXTOSALES</td>
<td>987</td>
<td>.0077109</td>
<td>.0216044</td>
<td>0</td>
<td>.2674974</td>
<td>5.84322</td>
<td>48.75999</td>
</tr>
<tr>
<td>LnDEPTOSAS-S</td>
<td>4113</td>
<td>.430848</td>
<td>.1827241</td>
<td>0</td>
<td>1.280474</td>
<td>.591268</td>
<td>2.213468</td>
</tr>
<tr>
<td>variable</td>
<td>N</td>
<td>mean</td>
<td>sd</td>
<td>min</td>
<td>max</td>
<td>skewness</td>
<td>kurtosis</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------</td>
<td>-------------</td>
<td>------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>wLnOWNWORT~S</td>
<td>4064</td>
<td>4.029828</td>
<td>.2607592</td>
<td>3.931826</td>
<td>5.735924</td>
<td>4.754253</td>
<td>27.73706</td>
</tr>
<tr>
<td>wLnUNUSEDLOC</td>
<td>4110</td>
<td>.1198957</td>
<td>.2680319</td>
<td>0</td>
<td>1.673976</td>
<td>3.594836</td>
<td>17.77041</td>
</tr>
<tr>
<td>wLnEXTDEBT~S</td>
<td>4113</td>
<td>4.439125</td>
<td>.146713</td>
<td>4.427287</td>
<td>4.538799</td>
<td>4.69352</td>
<td>28.88445</td>
</tr>
<tr>
<td>wLnFIRMAGE</td>
<td>4113</td>
<td>2.479929</td>
<td>.893218</td>
<td>0</td>
<td>3.988984</td>
<td>-.7303285</td>
<td>3.049192</td>
</tr>
<tr>
<td>wLnOWNERS</td>
<td>4113</td>
<td>.5960671</td>
<td>.7674966</td>
<td>0</td>
<td>3.912023</td>
<td>1.899047</td>
<td>7.634695</td>
</tr>
<tr>
<td>wLnRELDIST</td>
<td>4050</td>
<td>1.497759</td>
<td>1.337892</td>
<td>0</td>
<td>6.862758</td>
<td>1.562103</td>
<td>6.517399</td>
</tr>
<tr>
<td>wLnSALES</td>
<td>4113</td>
<td>13.25816</td>
<td>2.23922</td>
<td>7.845808</td>
<td>17.94269</td>
<td>.0022758</td>
<td>2.372292</td>
</tr>
<tr>
<td>wLnDEBTTOA~S</td>
<td>4113</td>
<td>.4277022</td>
<td>.717202</td>
<td>0</td>
<td>2.621039</td>
<td>2.084373</td>
<td>8.881183</td>
</tr>
<tr>
<td>wLnDEBTRATIO</td>
<td>4113</td>
<td>.3022441</td>
<td>.4346188</td>
<td>0</td>
<td>2.508437</td>
<td>2.537433</td>
<td>11.20486</td>
</tr>
<tr>
<td>wLnCASHTOS~S</td>
<td>4113</td>
<td>1.622469</td>
<td>.0430507</td>
<td>1.599098</td>
<td>1.9063</td>
<td>4.592323</td>
<td>27.07929</td>
</tr>
<tr>
<td>wLnCASHTOA~S</td>
<td>4113</td>
<td>2.390367</td>
<td>.1840355</td>
<td>2.19317</td>
<td>2.95</td>
<td>1.805196</td>
<td>5.409188</td>
</tr>
<tr>
<td>wLnINVESTO~S</td>
<td>4113</td>
<td>.1666691</td>
<td>.055908</td>
<td>.0036699</td>
<td>.439732</td>
<td>6.005202</td>
<td>41.7637</td>
</tr>
<tr>
<td>wLnCURLIBT~S</td>
<td>4113</td>
<td>.1914493</td>
<td>.0976863</td>
<td>.1368559</td>
<td>.740347</td>
<td>3.327257</td>
<td>16.29101</td>
</tr>
<tr>
<td>wLnOPEXTOS~S</td>
<td>4113</td>
<td>.6069046</td>
<td>.2096139</td>
<td>.0559298</td>
<td>1.603168</td>
<td>.8174081</td>
<td>8.772673</td>
</tr>
<tr>
<td>wLnQUICKRA~O</td>
<td>2920</td>
<td>4.533491</td>
<td>.1395273</td>
<td>4.46875</td>
<td>5.438605</td>
<td>4.470691</td>
<td>25.6513</td>
</tr>
<tr>
<td>wLnARRATIO</td>
<td>2920</td>
<td>2.835851</td>
<td>.2498849</td>
<td>2.707808</td>
<td>2.428443</td>
<td>3.692331</td>
<td>18.14218</td>
</tr>
<tr>
<td>wLnOTRINCT~S</td>
<td>2920</td>
<td>1.2646724</td>
<td>.0742596</td>
<td>.0036699</td>
<td>.439732</td>
<td>6.005202</td>
<td>41.7637</td>
</tr>
<tr>
<td>wLnPROFTOS~S</td>
<td>4113</td>
<td>1.922202</td>
<td>.0549898</td>
<td>.8870555</td>
<td>1.93286</td>
<td>-2.890482</td>
<td>20.23552</td>
</tr>
<tr>
<td>wLnPROFTOJ~E</td>
<td>4113</td>
<td>5.553151</td>
<td>.0202153</td>
<td>4.661638</td>
<td>6.105282</td>
<td>-.3686744</td>
<td>7.203466</td>
</tr>
<tr>
<td>wLnCASHRATIO</td>
<td>2920</td>
<td>6.073819</td>
<td>.2303732</td>
<td>.063999</td>
<td>6.237022</td>
<td>5.326069</td>
<td>34.18732</td>
</tr>
<tr>
<td>wLnOTRRATIO</td>
<td>2920</td>
<td>2.161295</td>
<td>.2438177</td>
<td>2.08043</td>
<td>3.735702</td>
<td>4.665117</td>
<td>26.68125</td>
</tr>
<tr>
<td>wLnTAINTOS~S</td>
<td>987</td>
<td>.0021982</td>
<td>.017825</td>
<td>0</td>
<td>.1145185</td>
<td>3.884959</td>
<td>19.7271</td>
</tr>
<tr>
<td>wLnDEPRTOA~S</td>
<td>4113</td>
<td>.4377332</td>
<td>.1814546</td>
<td>.2405618</td>
<td>.8171616</td>
<td>.5541507</td>
<td>2.016925</td>
</tr>
</tbody>
</table>

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)*

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Implicate 1</th>
<th>Implicate 2</th>
<th>Implicate 3</th>
<th>Implicate 4</th>
<th>Implicate 5</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>FEMOWN</td>
<td>0.990</td>
<td>-0.468</td>
<td>0.463</td>
<td>-0.236</td>
<td>0.434</td>
<td>0.237</td>
</tr>
<tr>
<td></td>
<td>(5.240)</td>
<td>(5.272)</td>
<td>(5.264)</td>
<td>(5.254)</td>
<td>(5.273)</td>
<td>(5.300)</td>
</tr>
<tr>
<td></td>
<td>(7.352)</td>
<td>(7.352)</td>
<td>(7.511)</td>
<td>(7.452)</td>
<td>(7.524)</td>
<td>(7.477)</td>
</tr>
<tr>
<td>OWNEXP</td>
<td>-0.0896</td>
<td>-0.0844</td>
<td>-0.0596</td>
<td>-0.0761</td>
<td>-0.0314</td>
<td>-0.0682</td>
</tr>
<tr>
<td></td>
<td>(0.149)</td>
<td>(0.151)</td>
<td>(0.148)</td>
<td>(0.150)</td>
<td>(0.149)</td>
<td>(0.151)</td>
</tr>
<tr>
<td>OWNEDU</td>
<td>0.988</td>
<td>1.164</td>
<td>1.149</td>
<td>1.105</td>
<td>1.208</td>
<td>1.123</td>
</tr>
<tr>
<td></td>
<td>(0.901)</td>
<td>(0.903)</td>
<td>(0.904)</td>
<td>(0.908)</td>
<td>(0.909)</td>
<td>(0.907)</td>
</tr>
<tr>
<td>PCACCTNG</td>
<td>1.603</td>
<td>1.350</td>
<td>1.478</td>
<td>1.215</td>
<td>1.583</td>
<td>1.446</td>
</tr>
<tr>
<td>MAINSUPPL</td>
<td>6.730**</td>
<td>7.116**</td>
<td>7.053**</td>
<td>6.929**</td>
<td>7.222**</td>
<td>7.010**</td>
</tr>
<tr>
<td></td>
<td>(3.281)</td>
<td>(3.285)</td>
<td>(3.267)</td>
<td>(3.275)</td>
<td>(3.275)</td>
<td>(3.283)</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>-8.424*</td>
<td>-7.906*</td>
<td>-8.038*</td>
<td>-7.905</td>
<td>-8.413*</td>
<td>-8.137*</td>
</tr>
<tr>
<td>WHOLESALE</td>
<td>1.302</td>
<td>1.630</td>
<td>1.506</td>
<td>1.602</td>
<td>1.396</td>
<td>1.487</td>
</tr>
<tr>
<td></td>
<td>(5.900)</td>
<td>(5.872)</td>
<td>(5.857)</td>
<td>(5.870)</td>
<td>(5.870)</td>
<td>(5.876)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>9.557*</td>
<td>9.954**</td>
<td>10.23**</td>
<td>10.20**</td>
<td>10.17**</td>
<td>10.02**</td>
</tr>
<tr>
<td>SERVICES</td>
<td>3.156</td>
<td>3.245</td>
<td>3.064</td>
<td>3.204</td>
<td>3.021</td>
<td>3.138</td>
</tr>
<tr>
<td>OWNSHR</td>
<td>0.0115</td>
<td>0.0208</td>
<td>0.0244</td>
<td>0.0167</td>
<td>0.0101</td>
<td>0.0167</td>
</tr>
<tr>
<td></td>
<td>(0.0898)</td>
<td>(0.0899)</td>
<td>(0.0892)</td>
<td>(0.0899)</td>
<td>(0.0898)</td>
<td>(0.0900)</td>
</tr>
<tr>
<td>OWNMGR</td>
<td>-5.598</td>
<td>-4.980</td>
<td>-4.957</td>
<td>-5.377</td>
<td>-4.553</td>
<td>-5.093</td>
</tr>
<tr>
<td></td>
<td>(5.074)</td>
<td>(5.087)</td>
<td>(5.087)</td>
<td>(5.092)</td>
<td>(5.054)</td>
<td>(5.098)</td>
</tr>
<tr>
<td>LnOWNERS</td>
<td>-1.831</td>
<td>-1.707</td>
<td>-1.375</td>
<td>-1.776</td>
<td>-1.804</td>
<td>-1.699</td>
</tr>
<tr>
<td></td>
<td>(2.856)</td>
<td>(2.835)</td>
<td>(2.818)</td>
<td>(2.832)</td>
<td>(2.838)</td>
<td>(2.843)</td>
</tr>
<tr>
<td></td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
<td>Value 4</td>
<td>Value 5</td>
<td>Value 6</td>
</tr>
<tr>
<td>----------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>(5.604)</td>
<td>(5.634)</td>
<td>(5.607)</td>
<td>(5.621)</td>
<td>(5.615)</td>
<td>(5.626)</td>
</tr>
<tr>
<td></td>
<td>(5.880)</td>
<td>(5.629)</td>
<td>(5.659)</td>
<td>(5.551)</td>
<td>(5.555)</td>
<td>(5.665)</td>
</tr>
<tr>
<td>RELLENGTH</td>
<td>0.0397***</td>
<td>0.0392***</td>
<td>0.0377***</td>
<td>0.0394***</td>
<td>0.0365***</td>
<td>0.0385***</td>
</tr>
<tr>
<td></td>
<td>(0.0123)</td>
<td>(0.0123)</td>
<td>(0.0123)</td>
<td>(0.0123)</td>
<td>(0.0123)</td>
<td>(0.0124)</td>
</tr>
<tr>
<td>RELNUM</td>
<td>-0.629</td>
<td>-0.607</td>
<td>-0.653</td>
<td>-0.630</td>
<td>-0.713</td>
<td>-0.646</td>
</tr>
<tr>
<td></td>
<td>(0.835)</td>
<td>(0.844)</td>
<td>(0.835)</td>
<td>(0.840)</td>
<td>(0.834)</td>
<td>(0.839)</td>
</tr>
<tr>
<td></td>
<td>(1.094)</td>
<td>(1.106)</td>
<td>(1.095)</td>
<td>(1.103)</td>
<td>(1.098)</td>
<td>(1.103)</td>
</tr>
<tr>
<td></td>
<td>(3.615)</td>
<td>(3.624)</td>
<td>(3.606)</td>
<td>(3.611)</td>
<td>(3.615)</td>
<td>(3.633)</td>
</tr>
<tr>
<td>LnDEBTRATIO</td>
<td>0.988</td>
<td>0.393</td>
<td>0.741</td>
<td>0.553</td>
<td>0.825</td>
<td>0.700</td>
</tr>
<tr>
<td>Constant</td>
<td>80.45</td>
<td>77.93</td>
<td>87.21</td>
<td>83.87</td>
<td>71.76</td>
<td>80.24</td>
</tr>
<tr>
<td></td>
<td>(54.55)</td>
<td>(54.45)</td>
<td>(54.47)</td>
<td>(54.37)</td>
<td>(53.94)</td>
<td>(54.74)</td>
</tr>
</tbody>
</table>

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

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


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


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.


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


