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**RESOURCEFUL FINANCING BY NEW FIRMS:
THE USE OF MULTIPLE CREDIT SOURCES**

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M.B.A., University of Illinois, 1999
B.B.A., Southern Methodist University, 1992

A Dissertation
Submitted to the Faculty of the
College of Business of the University of Louisville
in Partial Fulfillment of the Requirements
for the Degree of

Doctor of Philosophy

College of Business
University of Louisville
Louisville, Kentucky

December 2012

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By

John M. Mueller
M.B.A., University of Illinois, 1999
B.B.A., Southern Methodist University, 1992

A Dissertation Approved on

November 15, 2012

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DEDICATION

This dissertation is dedicated to my immediate family (Widad, Martin, Naya, Peter Pan, GusGus, and Chuckles), parents, grandparents, and individuals that are trudging through the entrepreneurial trenches of joy.

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Thank y’all.

ABSTRACT

RESOURCEFUL FINANCING BY NEW FIRMS: THE USE OF MULTIPLE CREDIT SOURCES

John M. Mueller

November 15, 2012

New firms face financial constraints that could hinder firm performance. Yet founders exhibit persistence and resourcefulness in building their new ventures and finding solutions to their financial constraints. The use of financial theories that focus on financing costs, profit maximization, and valuation of firms draws attention to the question of whether entrepreneurs increase survival and growth prospects for their firms through resourcefulness in financing (e.g. using multiple credit sources) or instead make suboptimal financing decisions (i.e. when being resourceful in their financing) that actually decrease the probability of new venture survival and high growth rates.

My dissertation examines if being resourceful in financing in the form of multiple credit source usage is beneficial to the performance (survival and growth) of new firms. A theory of resourceful financing by new firms using multiple credit sources is developed based upon financial constraints, credit rationing, and capital structure theories (pecking order theory and financial growth cycle theory). The study incorporates a six year longitudinal design and mixed statistical methods to test hypotheses and perform sensitivity analyses to better understand this specific form of resourceful financing activities of new firms.

The results suggest that the use of multiple credit sources is positively related to growth rates for firms that are growing above average, thus supporting the theoretical framework proposed in the study with boundary conditions. However, for firms that are growing below average, multiple credit source usage is found to be negatively associated with the survival rates. This suggests that founders should be resourceful in their financing options only when they are growing quickly and they should not use multiple credit sources when they are not growing or as a means to get out of a dire financial situation. The use of multiple credit sources cannot be used by creditors as a signal to determine the survival and growth of firms during their early years of operations. It is only after the third or fourth year that the use of multiple credit sources provides a positive or negative signal to external entities such as creditors. Limitations to the study apply.

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CHAPTER 1

INTRODUCTION

Financial capital is one of the fundamental resources needed to start and operate a firm (A. C. Cooper, Gimeno-Gascon, & Woo, 1994), and is a main factor in the performance of new firms¹ (e.g. Cressy, 2006a, 2006b; Musso & Schiavo, 2008; Oliveira & Fortunato, 2006; Parker & Van Praag, 2006). Many founders are personally constrained financially when trying to start and operate their firms as they lack personal wealth (e.g. Evans & Jovanovic, 1989; Evans & Leighton, 1989; Holtz-Eakin, Joulfaian, & Rosen, 1994a; Lindh & Ohlsson, 1996). As a result they look for external funds to survive and grow their venture during their early years (Cressy, 2006a, 2006b). Retained earnings (i.e. internally generated equity), debt, and external equity are all forms of financing that a firm could use to finance operations. New firms have access to only a limited number of external funding options, be it debt or equity, early in their lives. It is only as they age that new firms gain access to more external funding options, giving the firms options to choose from to fund their operations (Berger & Udell, 1998).

It has been suggested that firms use a pecking order to finance their operations, choosing to first use retained earnings, then debt, and lastly external equity (Myers & Majluf,

¹ New firms are defined as firms that have recently been started by an individual (i.e. a founder) or group of individuals (i.e. founding team). The new firm can either be unincorporated or incorporated (i.e. sole-proprietorship, LLC, partnership, S-corporation, or C-corporation). In this study, new firms are not nascent ventures, in which the business is only an idea and no activities have been embarked upon to call it a “business”.

1984; Myers, 1984). New firms do not generate much, if any, internal equity as retained earnings are generated over time by a firm and by default a new firm has not existed long enough to have generated any retained earnings. Also, founders find it more difficult to quickly convince investors of the value from investing equity in their new firms than convincing lenders to provide debt because of adverse selection and moral hazard problems² (Myers & Majluf, 1984; Myers, 1984). This is supported empirically, as only 0.03% to 3% of new firms receive venture capital funding in any given year (Parker, 2009; Shane, 2008), and 3% to 8% of firms receive angel funding in a given year (Mason & Harrison, 2000; Sohl, 2003). Finally, founders prefer to not share the upside with equity investors if possible (Landier & Thesmar, 2009). Thus, debt often becomes the first sizeable financing option available to new firms (e.g. T. Bates, 1997; Berger & Udell, 1998; Cosh & Hughes, 1994; Cressy, 1996a; M. A. Petersen & Rajan, 1994).

While banks can provide debt to assist new firms to overcome the financial constraints they face, they may ration credit to new firms due to information asymmetry prevalent in the relationship between borrowers and banks (e.g. Jaffee & Russell, 1976; Stiglitz & Weiss, 1981). Banks, which are financial intermediaries, are used by many firms. For credit, new firms tend to approach banks first since founders often have a prior personal relationship with a bank and banks (namely, commercial banks) have a strong market presence with many outlets (Berger & Udell, 1998). Research suggests that banks have a strong ability to gather information and monitor borrowers through relationships and contract covenants (e.g. Berger & Udell, 1998; Diamond, 1984, 1991a; Fama, 1985; Ramakrishnan &

² Adverse selection is defined as the situation where the “poorer” options (e.g. products, services, etc.) are selected due to a lack of information between two parties (i.e. information asymmetry), such that the selecting party cannot distinguish between good and bad options. Moral hazard is defined as the situation where a party, in maximizing his/her own utility, behaves differently when insulated from risks they would be otherwise not be exposed to if they were fully exposed to the risk.

Thakor, 1984). Even so, information asymmetry could still exist between the banks and new firms. This information asymmetry is more prevalent when the firm is small and/or new. The information asymmetry prevalent in the relationship between a new firm and its bank is magnified because new firms do not have a track record and possess limited collateral, unlike small established firms (Cressy, 1996b). This lack of a track record creates an obstacle for banks when they attempt to evaluate new firms' ability to service the debt. Even though banks have evolved to work successfully with small, established firms, they may have greater difficulty accurately determining which new firms will be able to repay their debt due to high information asymmetry prevalent in their relationships with new firms. This is the case even when founders share accurate information about the quality of their firms and their abilities, commitment, and drive to execute their plans. In addition, founders might not be truthful in releasing this information as: a) they have the incentive to overstate their abilities, and/or b) they might not be willing to reveal specific information about their innovation since that information can be expropriated by outsiders. Thus, banks may ration credit to firms due to information asymmetry (Jaffee & Russell, 1976; Jaffee & Stiglitz, 1990; Keeton, 1979; Stiglitz & Weiss, 1981), and the rationing problem is more prevalent for new firms than older firms.

Credit rationing could inhibit a new firm's growth and survival, since this means that banks will not lend money, or will lend less than the optimal amount, to positive net present value projects (Becchetti, Garcia, & Trovato, 2011; Jaffee & Russell, 1976; Jaffee & Stiglitz, 1990; Keeton, 1979; Stiglitz & Weiss, 1981). With the possibility that creditors ration credit and turn down requests for all or part of the requested funds by viable new firms that objectively should be able to service the debt, new firms will be less able to successfully

operate and grow. This suggests that new firms require additional sources of external financing when their initial creditor imposes credit limits on them. The inability to obtain additional external sources of financing could result in the firm shutting down entirely or having its growth hindered.

However, entrepreneurship research suggests that new firms may continue to survive even when rationed credit, since the founders who start new firms tend to be persistent (e.g. Astebro, Jeffrey, & Adomdza, 2007; Cardon, Zietsma, Saporito, Matherne, & Davis, 2005; Gimeno, Folta, A. C. Cooper, & Woo, 1997; P. Gompers, Kovner, Lerner, & Scharfstein, 2010; Hamilton, 2000; Sexton & Bowman-Upton, 1991), persevere longer than rational decision making models would predict (M. W. Meyer & Zucker, 1989; D. A. Shepherd, Wiklund, & Haynie, 2009; Van Witteloostuijn, 1998), and are resourceful³ (Baker & R. E. Nelson, 2005; Bhidé, 1992; Hmieleski & Corbett, 2008). These character traits suggest that founders will look for other funding options to help their firms survive when their firms are rationed credit rather than close their firms, or they will settle for their firms being smaller than desired. If they look for other funding options, these funding options include bootstrapping (Van Auken & Neeley, 1996; Bhidé, 1992; Winborg & Landstrom, 2001), accessing external equity, or accessing alternative credit sources.

Research suggests that, before trying to tap into external equity options, new firms will exhaust their debt options (Myers & Majluf, 1984; Myers, 1984), with more options becoming available as they age (Berger & Udell, 1998). This suggests that new firms will examine all of their credit (debt) sources of which they are aware and possibly use more debt

³ “Resourceful” has several meanings. Resourceful could mean someone who is capable of dealing with difficult situations. However, in this study, resourceful refers to wisely using, or using ingeniously, a combination of materials that are at hand or are accessible in the environment. Specific to this study, resources at hand are credit sources that are available to new firms. A new firm is considered to be more resourceful if it takes advantage of a combination of credit sources (i.e. resources) available in their environment.

options. Different credit instruments include loans, letters of credit, credit cards, and trade credit. These credit instruments are provided by different sources, including banks, non-bank financial institutions, credit card institutions, the government, other businesses, family and friends, and other individuals (e.g. Astebro & I. Bernhardt, 2003; Berger & Udell, 1995, 1998; Danielson & Scott, 2004; Huyghebaert & Van de Gucht, 2007; M. A. Petersen & Rajan, 1997; Robb & D. T. Robinson, 2010). These various sources offer credit to firms in different ways, each of which tends to have different market power, offers different interest rates, provides different schedules of payment, provides different levels of funding, has different application procedures, has different collateral requirements, applies different lending covenants, differs in their risk attitudes and ability to diversify, gathers information differently, monitors differently, and reacts differently to financial distress. These differences could possibly affect firm performance, with prior studies finding mixed results when testing the relationship between different credit sources and firm performance (e.g. Astebro & I. Bernhardt, 2003; Ayyagari, Demirguc-Kunt, & Maksimovic, 2010; T. Bates, 1990; Cressy, 1996b; Scott III, 2009).

Using one credit source might not fulfill the financing needs of the firm due to credit rationing (Type I credit rationing⁴). Rather, in order to survive and grow, new firms might need to use several credit sources to obtain the additional funds required. Small firms, both new and old, have been found to use multiple credit sources. In the 1993 and 1998 Surveys of Small Business Finances (SSBF), around 50% of the firms borrowed from multiple creditors. Using multiple credit sources could provide access to additional debt capital

⁴ Type I credit rationing is defined as credit rationing that occurs when a partial amount of credit that is desired is provided by the creditor. In other words, the amount of credit that is extended by a creditor is positive but below the level that maximizes the firm's profit (Gale & Hellwig, 1985; Keeton, 1979). This is as opposed to Type II credit rationing which is the case where only a fraction of the applicants are able to obtain credit (Keeton, 1979; Stiglitz & Weiss, 1981).

(capital constraint argument). Obtaining more funds could increase the survival probability and growth rate of new firms. By using multiple credit sources, entrepreneurs are being resourceful in the means to finance their firms. Thus, being resourceful in financing by using multiple credit sources could benefit new firms.

This leads to the following research question:

Does resourceful financing, in the form of multiple credit source usage, affect the performance (survival and growth) of new firms?⁵

The theory developed results in two hypotheses that posit a positive relationship between multiple credit sources and survival and multiple credit sources and growth. A longitudinal study is performed to test the two hypotheses and to answer the research question. Data from the Kauffman Firm Survey (KFS) are used to examine the use of credit sources over a six year period starting from the first year of a firm's existence while controlling for various factors that could affect its financing decisions, including the characteristics of the founders. The KFS data set is a panel study consisting of firms that were started in 2004 in the USA. Multiple statistical analysis tools are used, including OLS regression, Probit regression, survival analysis using cox proportional hazard regression (Cox, 1972), growth curve analysis using hierarchical linear modeling (Raudenbush & Bryk, 2002), and panel data regression. The use of multiple statistical analyses results in a robust set of findings.

The results suggest that the use of multiple credit sources is negatively associated with the survival for new firms that are growing below average and possibly already failing.

⁵ A related question that is asked in the finance literature, but only for banks, is, what is the optimal number of banks for a firm to borrow from (Bonfim, Dai, & Franco, 2008)?

Thus, being resourceful in financing by using multiple credit sources doesn't stop these firms from failing and possibly makes them fail quicker. However, the use of multiple credit sources for new firms growing above average is positively associated with an increased growth rate. This suggests that founders should be resourceful in their financing options only when they are growing quickly and to not use multiple credit sources as a means to get out of a dire financial situation. The use of multiple credit sources cannot be used by creditors as a signal to determine the survival and growth of firms during the early years of operations. It is only after the third or fourth year that the use of multiple credit sources provides a positive or negative signal to external entities such as creditors. There are several limitations of the study that need to be considered when understanding the results of the study. One of the limitations pertains to endogeneity due to causal direction. With the decision to use multiple credit sources being a choice for founders, and the founders have a goal for their firms to survive and possibly grow, the possibility of endogeneity exists in the statistical analysis that might bias the results because a viable instrumental variable was not found.

Understanding financing decisions and whether they have an impact on survival and growth of new firms has important economic implications for a variety of stakeholders, including researchers, entrepreneurs, and policy makers. The decisions affecting debt-related financing are important for economic development. The reliance on debt by new and small firms has come to light through research related to the United States "credit crunch" in the early 1990s, which saw available credit diminish for small firms because of the consolidation in the banking industry (Berger & Udell, 1998). Similarly, almost 15 years later, the concerns of the effects of credit availability rose again after the "credit crisis" in 2007-2008.

The survival and growth of new firms are important to study. From 1998 to 2007 in the United States, the average number of firms started each year was 612,257 while the average annual number of firm closures was 560,729 (SBA, 2010). The closure rate of new firms is up to 60% within the first six years (Cressy, 2006a, 2006b; Phillips & Kirchhoff, 1989), with the majority of closures happening within the first 2-3 years (Bruderl, Preisendorfer, & Ziegler, 1992; Cressy, 1999, 2006b; Gimeno et al., 1997). Some suggest that the importance of capital as it relates to survival is at its highest during the first 2-3 years of a firm's life (Cressy, 2006b)⁶. In the years 4+, the capital structure of a firm becomes less of a factor of survival (Cressy, 2006b). During this stage, the firm determines if it wants to or can grow. If a new firm is able to overcome the financial constraints during its early years and grow, it is able to contribute positively to a country's economic welfare by adding to its gross domestic product (GDP) and creating jobs (Davidsson & Delmar, 2006; Kirchhoff & Phillips, 1988). In the Phillips & Kirchhoff (1989) data set, which used data from United States firms, if a firm survived six years it also demonstrated growth. New firms that grow have been found to be the real drivers of new job growth in an economy (Haltiwanger, Jarmin, & Miranda, 2009). Survival and growth for new firms thus are important to understand.

Specifically for researchers, this study contributes to the body of literature pertaining to new firm financing by developing a theoretical framework to explain resourceful financing by new firms and the relationship between resourceful financing and new firm performance. The theoretical framework builds upon the theories of credit rationing, pecking order, and financial growth cycle, which all use information asymmetry arguments. In addition, the longitudinal nature of the study offers a dynamic view of the financing process that new

⁶ (Cressy, 2006a: 34) refers to the first 2-3 years of a firm's existence as the "valley of death".

firms go through to possibly diversify their debt structures to affect firm performance. This is important to finance research, which has shown that large firms have similar opportunities to diversify their debt sources, albeit in different ways than new firms, including using capital markets, both domestic and international. The dynamic aspect of the study is also important in entrepreneurship research since new firms change rapidly (Davidsson, Low, & Wright, 2001; Low & MacMillan, 1988). New firms have dynamic capital structures (Berger & Udell, 1998; J. Lee & Zhang, 2010; Vos, Yeh, S. Carter, & Tagg, 2007), and are by nature evolving organisms; they are in a learning experiment (Jovanovic, 1982a). When researching such a dynamic and evolving environment, it is best to use longitudinal methods. From a researcher's perspective, it is novel to model the use of multiple credit sources over time for new firms. Doing so helps us better understand the financing decisions of new firms over time. Finally, this study examines the decision to employ multiple credit sources, consistent with the call by Berger & Udell (1998: 627) to examine multiple financing sources together rather than individually.

This study is beneficial from a pedagogy perspective when educating potential entrepreneurs. It is helpful for entrepreneurs to understand if they should be resourceful in their means of financing, just as they are resourceful in their other activities involving their firms. The results suggest that entrepreneurs should seek and use multiple credit sources to improve their firms' chance of survival and growth rates depending on the reason to use multiple credit sources. The use of multiple credit sources as the last resort by a new firm that is struggling accelerates the closure of the firm; whereas, the use of multiple credit sources for new firms that are already growing above average increases the growth rate of the firm. This is important from a pedagogy perspective as teachers can better educate inspiring

entrepreneurs by explaining to them that being resourceful in their financing can be helpful depending on the situation their firm is in.

Policy makers will be interested in the findings as they suggest that it is beneficial to allow and support multiple types of credit sources in the market rather than just commercial banks if they care about increasing the growth of potential high growth firms. The argument used in this study for why new firms use multiple credit sources is based upon the firm being able to obtain additional funds. This implies there is a market failure since one credit source (e.g. banks) did not provide the necessary funds to some firms and thus is detrimental to them. This market failure possibly indicates credit rationing exists and that new firms are financially constrained. Credit rationing has received considerable attention in policy circles (e.g. J. E. Bolton, 1971; Brierley, 2001; MacMillan Committee, 1931; Parker, 2002; Stanworth & Gray, 1991; Wilson, 1979), with several solutions derived to try and alleviate such financial constraints on new firms. One means to alleviate credit rationing is by combining multiple credit sources that new firms use. Doing so would suggest that new firms that are operating positive net present value projects are possibly alleviating the information asymmetry issues and thus making credit rationing less prevalent. Therefore, it might be in the best interest for the policy makers to ensure that legislation does not hinder the resourcefulness of new firms when regulating the various credit sources that are available in the market place. However, even though such a financing strategy promotes the growth for new firms that are already growing quickly, implementing such a financing strategy can also accelerate the closure of firms that are not growing. Thus, any policies implemented which affect multiple credit source usage need to be well thought out.

My dissertation is structured as follows. Chapter 2 presents a review of the literature on new firm financing, financing and new firm performance, and explains in depth the various credit instruments and sources that can be used by new firms. Upon providing an examination of the relevant literature on new firm financing, testable hypotheses are developed in Chapter 2 using the financial constraints, credit rationing, pecking order, and financial growth cycle theories. In chapter 3, I explain the methods and data used to test the hypotheses. I present the results of the analysis in chapter 4. Chapter 5 concludes the study by discussing the results, summarizing the findings, examining the limitations of the data and analyses, and providing suggestions for further research.

CHAPTER 2

THEORY DEVELOPMENT

How firms finance their operations has been a question that researchers have been interested in for a number of years. Past studies in corporate finance have suggested that firms make logical financing decisions that lead to predictable capital structures and that capital structure affects firm performance. A firm's capital structure refers to the mix of financing sources used to finance real investment (Myers, 2001). In its simplest essence, a firm's capital structure is made up of a mix of debt and equity. Various theories have been developed regarding how an established firm's capital structure evolves (e.g. Jensen & Meckling, 1976; Mac an Bhaird, 2010; Modigliani & M. H. Miller, 1958, 1963; Myers & Majluf, 1984; Myers, 1984). Only a few of these theories have many advocates to support their continued existence and popularity in the academic community. These notable capital structure theories that are derived from corporate finance include static trade-off theory (Mac an Bhaird, 2010; Modigliani & M. H. Miller, 1958, 1963), agency theory (free cash flow theory) (Jensen & Meckling, 1976), and pecking order theory (Myers & Majluf, 1984; Myers, 1984).

The results for testing capital structure theories have been mixed, and as such, after more than 40 years of studying capital structure our understanding of firms' financing decisions is limited (Myers, 2001), especially for new firms. The corporate finance capital structure theories have shown mixed results when testing these theories with large,

established firms. And when bringing these theories into the entrepreneurship context by examining small and new firms, the results are also mixed. While these theories are derived for established and usually large firms and thus assume a firm has a track record and existing assets that can be used for collateral, new firms are different than established firms and possibly require new capital structure theories that do not assume a firm is established. As a result, capital structure theories have evolved from entrepreneurship research, including the financial growth cycle theory (Berger & Udell, 1998) and the financial theory of entrepreneurial types (Cressy, 1995). These two theories have not been tested extensively, and the little empirical work that has been performed has produced mixed results. Thus, even though firms' capital structure decisions are not completely understood, it is not due to a lack of trying.

Capital structure is important to understand as it has been found to affect the value and performance of established firms (Modigliani & M. H. Miller, 1963). The earliest rigorous capital structure theory concluded that the capital structure of a firm did not affect its total value (Modigliani & M. H. Miller, 1958). This would suggest that capital structure is not important to examine. However, their assumptions of perfect capital markets are not representative of the real world, as they assumed competitive, frictionless, and complete markets. Since Modigliani and Miller (1958), further research has found that capital structure may matter to firms, including their own study in 1963. In 1963, by changing just one assumption, they demonstrated the existence of tax subsidies on interest payments meant the debt-equity choice could affect the value of the firm (Modigliani & M. H. Miller, 1963). Different capital structures provide different levels of discipline for the firm and different levels of incentives to the firm's external equity investors (Dewatripont & Tirole, 1994),

which in turn affects performance of established firms. Performance has thus also been associated with capital structure decisions. By affecting valuation and performance of established firms, capital structure becomes important to understand for both academics and practitioners.

This line of research supports the reason why understanding capital structure is important for established firms. However, capital structure has also been found to be important for new firms. A large percentage of firms close within the first six years (e.g. Bruderl et al., 1992; Cressy, 2006a; Gimeno et al., 1997; Phillips & Kirchhoff, 1989). Although multiple factors have been found to be associated with closure of new firms (including selling to another firm, poor management, poor business idea, pursuing other opportunities), capital structure has been found to be one of the main factors affecting the survival rate of new firms (Cressy, 2006a). The effect of capital structure has been found to be greater on the survival of firms during the first 2-3 years of a firm's life than in subsequent years (Cressy, 2006a). This first 2-3 year period of a firm's life is considered the "valley of death", as the rate of closure is highest during the early years. By understanding capital structure of new firms we will better understand the failure rates of new firms and how they can overcome the "valley of death" issue.

My research question for this study revolves around answering part of the capital structure issue by focusing on the debt of new firms. To answer the research question and ultimately shine more light on capital structure decisions of new firms, I posit herein an argument based upon new firms being resourceful with their credit options which leads to being able to obtain additional funds. By obtaining additional funds, new firms are able to improve their performance (survival and growth). In this chapter, I first explain the general

research on financing of new firms and why new firms would use debt. Then I explain the different credit instruments and credit sources that are available to new firms. This leads to the development of a theory explaining how and why new firms can be resourceful in their financing activities when they use multiple credit sources, and how such resourcefulness affects the rate of survival and growth of new firms. Thus, I am able to address the research question that is posed in this study, does being resourceful in financing by using multiple credit sources affect the performance of new firms.

Financing of New Firms

Researchers have found that new firms face financial constraints (e.g. Astebro & I. Bernhardt, 2003; Blanchflower & Oswald, 1998; Evans & Jovanovic, 1989; Holtz-Eakin et al., 1994a; Holtz-Eakin, Joulfaian, & Rosen, 1994b; Lindh & Ohlsson, 1996). Securing external funds from any source could possibly relax financial constraints on investment for a new firm. By securing funding, conventional logic dictates that new firms should have a higher probability of survival and growth.

These financial constraints push new firms to use external funds. External funds can be offered in the form of either debt or equity. A debt claim entitles the creditor to a contracted set of cash flows in the form of interest and principal payments (Damodaran, 2010). An equity claim entitles the investor to residual cash flow left over after a firm has met all other promised claims. Debt is a claim to a set amount of a firm's future cash flow via a contract, and has a priority over equity in that debt is not a residual item that is payable after all other claims have been paid.

Sources of equity for new firms include venture capital funds, angel investors, corporate investors, and family and friends. Venture capital funds are private equity funds focused on investing in high risk capital, including investing in new and young firms. Dollar

commitments to venture capital funds increased from \$3.1 billion in 1992 in the United States to \$87.3 billion in 2000 at the height of the Internet boom (Denis, 2004). In 2011, the new commitments to venture capital funds amounted to \$18.7 billion (NVCA, 2012). At the peak of the capital commitments in 2000, venture capital funds in the United States invested \$105 billion in firms (PricewaterhouseCoopers, 2012). In comparison, in 2011, venture capital funds in the United States invested \$29.1 billion in firms (PricewaterhouseCoopers, 2012). As the supply of funds in venture capital funds decrease, so does the amount of money that firms receive in investment from venture capital funds.

Venture capital funds provide benefits to new firms that are not normally provided by other investors and creditors (e.g. Sapienza, Manigart, & Vermeir, 1996). The involvement by venture capitalists results in a reduction in the founder's decision and control rights. Angel investors tend to invest at earlier stages than venture capital funds and are not as involved as partners involved in venture capital funds (Mason & Harrison, 2000; Van Osnabrugge & R. J. Robinson, 2000; Wong, Bhatia, & Freeman, 2009; Wong, 2002). Partners in venture capital funds tend to try to manage the market risk, while angel investors tend to manage the agency risk that exists with the founders (Fiet, 1996).

Typically academic scholars have treated entrepreneurial finance separate from corporate finance since issues faced by new, young, and small firms are different than the issues faced by publicly traded and large firms. New, young, and small firms face agency problems and information asymmetries like publicly traded and large firms, but in a much more pronounced fashion – the magnitude of these two issues is larger for new, young, and small firms (Denis, 2004). This has resulted in different contractual solutions and alternative sources of capital being used by new, young, and small firms.

In addition, due to the differences in equity and debt instruments, equity investors have different incentives than creditors that result in different financing strategies. Equity investors can afford to lose on a majority of their investments in new firms because of the oversized returns on the few successful investments. Lenders have a limited upside and cannot afford to have a many of their borrowers fail. For example, a couple of million dollars in equity investment might turn into a billion dollar return (e.g. Google, Facebook, Zynga). While the same amount made in the form of debt will yield a return of only the interest payments. This results in creditors using relatively risk adverse strategies when choosing their borrowers.

New firms are often associated with venture capital financing (i.e. equity finance). However, debt is a more common source of funding for new ventures in general (Berger & Udell, 1998), especially when excluding personal equity provided by the founders (Parker, 2009). And when project returns are not known ex-ante, debt becomes the financing instrument used by external financiers (Parker, 2009). Both debt and external equity financing use covenants to restrict the borrower's behavior, use capital rationing through stage financing, and financing limits to provide additional control in the event the borrowing firm performs poorly. There are differences between debt and external equity in that external equity finance tends to have very skewed return distributions and is used by firms in specific industries; whereas debt financing tends to have normally distributed returns and is used by firms in a wide variety of industries⁷ (Fenn, Liang, & Prowse, 1995; Sahlman, 1990). In addition, equity investors play an active role in the firm's major decisions (Steven N. Kaplan & Stromberg, 2001; Sahlman, 1990), whereas creditors do not. Berger & Udell (1998) find

⁷ To clarify this point, this is not saying that a single loan to a single borrower produces normally distributed returns. Rather, I am trying to make the point that banks that make many loans to many borrowers end up realizing normally distributed returns.

that small and young firms (firms 2 years and younger) in the United States use roughly the same amount of debt as they do equity even at a young age. This is also supported by the study performed by Beck, Demirguc-Kunt, and Maksimovic (2008) in which they use the World Business Environment Survey (WBES) to analyze the capital structure of 2,754 firms in 48 countries.

In the United States, in 1988 (& 1989) one-third of small firms (firms with less than \$15,000 in assets) borrowed from at least one credit source (M. A. Petersen & Rajan, 1994). This figure increases with size to 90% for firms with more than \$1.3 million assets, indicating that a greater percentage of large firms use debt than do small firms. Overall borrowing by small firms decreases with age as they pay back the creditors; 79% of firms less than 2 years old use credit, whereas 59% of firms greater than 30 years old use credit. There is a similar trend in the United Kingdom. In 1988 in the United Kingdom, one-third of new firms borrow on lines of credit, with half of them doing so by their 3rd year of operations, and 10% of new firms use bank loans (Cressy, 2007). During the early years, bank borrowing increases with age (Cressy, 1993). Even though these are cross-sectional studies, the results suggest that as firms grow in size and age they use more credit sources.

Hughes (1997) performs a study in the United Kingdom to examine the financing habits of small firms since entrepreneurs had complained that problems in financing of their firms significantly hindered their ability to operate successfully. His study compares large and small firms to determine if there is a difference in their financing habits. He finds there is little evidence of gaps in equity and debt financing. However, what is more important in his study as it relates to my study is that he examines additional financing sources by small and medium-sized firms. He finds that banks accounted for 60.6% of the additional

financing used, followed by hire purchase⁸ (16%), partners / shareholders (7.6%), factoring (3.5%), venture capital (2.9%), other private investors (1.7%), and other miscellaneous sources (7.6%). This indicates that small firms have access to a variety of financing sources, including various credit sources.

The next logical line of thought is to understand why these firms use debt. Various arguments have been suggested, including the static trade off theory, agency cost theory, pecking order theory, and financial growth cycle theory. The static trade-off theory suggests that firms try to balance interest tax shields against the cost of bankruptcy and agency costs to determine their use of debt (e.g. DeAngelo & Masulis, 1980; Kraus & Litzenberger, 1973). The theory has evolved, starting with Modigliani & Miller's (1958) seminal paper. At first, they proposed a firm's capital structure does not affect its value. They assumed a world of no income taxes and agency costs. They later added corporate income taxes (Modigliani & M. H. Miller, 1963), proposing that a firm would use its debt financing options to decrease its tax burden. The tax deductibility of interest lowers the cost of debt financing making debt the cheapest type of outside financing. This would suggest that a firm should borrow as much as possible, with 100% debt financing maximizing firm value. However, with the increase of debt, there is an increase in the risk that lenders will push the firm into bankruptcy if the firm is not able to service the debt. So the firm tries to balance its tax shield against the cost of bankruptcy. Bankruptcy costs are the costs associated with the perceived probability that the firm will default on financing and become insolvent. Bankruptcy costs can be direct or indirect. Direct bankruptcy costs affect liquidation returns (Harris & Raviv, 1991); whereas, indirect bankruptcy costs relate to stakeholders losing

⁸ "Hire purchase" is a term mainly used in the United Kingdom and refers to a contract where the borrower agrees to pay for a good or service in separate payments. In the United States, this is referred to as an installment plan, rent-to-own, or closed-end leasing.

confidence in the firm's ability to survive (Titman & Wessels, 1988). Tax law is written to provide an incentive for debt use as interest is deductible. With more debt increasing the after-tax proceeds to the suppliers of capital, this would suggest that firms will balance the tax benefits with bankruptcy and agency costs (DeAngelo & Masulis, 1980). DeAngelo & Masulis (1980) articulate this theory as the debt/equity mix being such that the firm's weighted average cost of capital is minimized and the firm's value maximized.

Agency theory explains the capital structure of firms through the importance of agency costs (Jensen & Meckling, 1976; Jensen, 1986). Agency costs arise when firms utilize external financiers. According to agency theory, a firm tries to manage multiple relationships between different stakeholders through contracts resulting in the firm being a "nexus of contracts". The stakeholders mainly are the firm's owners and creditors (principals) and the firm's managers (agents). The relationship between the principals and agents is considered the agency relationship, with the relationship involving a contract under which one or more persons (principals) engage another person (the agent) to perform some service on their behalf. If both parties are utility maximizers, there is good reason that the agent will not always act in the best interest of the principals, as these two parties have different incentives. This creates agency costs that involve the monitoring expenditures by the principal, the bonding expenditures by the agent, and the residual loss as the agent cannot fully bond his/her expenditures (Jensen & Meckling, 1976). The introduction of agency costs creates the need to balance the use of debt and equity.

The pecking order theory is based upon information asymmetry between firms and external financiers. Information asymmetry arises from insiders being more informed than outsiders of firms since the insiders have access to information about the activities and

situation of the firm (Williamson, 1975). This theory takes into account that managers favor internal funds as a source of funding future growth even to the exclusion of external funds (Donaldson (1961)). The pecking order theory suggests there is an orderly priority that firms will follow to determine what type of financing to use (Myers & Majluf, 1984; Myers, 1984), as opposed to targeting an optimal debt-to-equity ratio or mitigating the agency costs. Rather, the financing preferences are more about balancing the ability to obtain financing to implement the desired project while minimizing the intrusion of external financing in their operations. The pecking order theory says that internal funding is used first (i.e. retained earnings), followed by debt, and then by equity. The logic behind this order of funding sources is based upon information asymmetry issues arising from the principal-agent relationship between the suppliers of capital and the firm.

Another theory concerning capital structure is the financial growth cycle theory. The financial growth cycle theory is derived from the perspective of new firms. Posited by Berger & Udell (1998), the theory suggests that different capital structures are optimal at different points in the development of a firm. This is a dynamic perspective of capital structure for new firms as it is based upon time. Newness and scale of a firm make some financing options unavailable to new firms. New firms rely on internal sources of funds in their early years of operation (Berger & Udell, 1998; Huyghebaert, 2001). As new firms grow in size and age, they should have better access to external funding sources. This is because larger and older firms (firms with a track record) have more assets which to use as collateral for credit and have less informational opacity and thus less information asymmetry. This uses logic similar to the pecking order theory – as it includes the concept of information asymmetry. Berger & Udell (1998) support their theory inductively as they construct the

theory by examining their data. They find initially that new firms use insider finance, trade credit, and/or angel finance. As new firms age and grow, they tap into venture capital and mid-term loans as sources of intermediate equity and debt. In the final stage of their theory, the focal firm is now older and larger, and thus possesses more experience and appears informationally transparent. This allows the firm to gain access to public equity and/or long-term debt financing. The Berger and Udell theory is a supply-side theory of capital structure as firms are not able to use certain financing options until they reach a certain stage. It is based upon the external financiers deciding when to provide funding as opposed to when the firms need the financing. For example, even if a firm wants to go public the first day of their operations, financiers (through the market – aggregate of financiers) do not allow them to do so. These circumstances create a greater role for debt financing for new firms (Berger & Udell, 1998; Scholtens, 1999).

In addition, entrepreneurs do not want to share any upside with external funders (Landier & Thesmar, 2009). Entrepreneurs started the firm to succeed, not fail, with many of them being overly optimistic (Camerer & Lovo, 1999; A. C. Cooper, Woo, & Dunkelberg, 1988; Hayward, D. A. Shepherd, & Griffin, 2006; Koellinger, Minniti, & Schade, 2007). Along with being constrained financially (e.g. Evans & Jovanovic, 1989; Evans & Leighton, 1989; Holtz-Eakin et al., 1994b; Lindh & Ohlsson, 1996), this would lead many entrepreneurs to use debt over equity when possible.

Credit Rationing

Even though banks tend to be the largest provider of credit to new firms (T. Bates, 1997; Berger & Udell, 1995, 1998), new firms still feel constrained financially (e.g. Astebro & I. Bernhardt, 2003; Blanchflower & Oswald, 1998; Evans & Jovanovic, 1989; Holtz-Eakin et al., 1994a, 1994b). In a perfect capital market, all firms should be able to find the funds to

invest in positive net present value projects (Fazzari, Hubbard, & B. C. Petersen, 1988). Such a capital market assumes that information is symmetrical; meaning that the financier and borrower have the same information about the potential of the firm. However, information is not symmetric in the relationship between the banker and a new firm. Thus, banks cannot easily identify a good entrepreneur from a bad entrepreneur, nor a good project from a bad project. This suggests that good entrepreneurs may not be able to easily access external funds even when the new firm is a positive net present value project. Basically, lenders either do not lend enough to a viable borrower or do not lend at all to them (Jaffee & Stiglitz, 1990; Keeton, 1979). This is a market failure, as lenders, if their goal is to maximize profit, should lend to viable borrowers if they represent a positive net present value project; the loan will be repaid. Positive new present value projects are expected to provide a positive return for lenders, and thus lenders should want to lend to them. However, if there is credit rationing, then some viable borrowers are not able to obtain credit to finance their ventures. This is considered the financing gap (Storey, 1994; Deakin, 1996; Berger and Udell, 1998).

Credit rationing occurs when firms needing external financing for positive net present value projects either do not obtain all the money they need (Type I) or do not obtain any of the money they need (Type II) to implement the project (Jaffee & Stiglitz, 1990; Keeton, 1979). Credit rationing was posited by Jaffee & Russell (1976) and expanded on by Stiglitz & Weiss (1981). The existence of crediting rationing has been supported by various researchers (J. Black, Meza, & Jeffreys, 1996; Blanchflower & Oswald, 1998; Evans & Jovanovic, 1989; Holtz-Eakin et al., 1994a, 1994b; Lindh & Ohlsson, 1996). Pure credit

rationing involves competition between banks which keep interest rates low and then randomly select which applicants get loans (Stiglitz & Weiss, 1981).

Gersbach and Uhlig (2007) also find support that credit rationing exists when there is competition between different type of banks. They postulate a market with a standard commercial bank and an investment bank. The commercial bank is good at monitoring after loaning the money and the investment bank is good at screening which firms are good to provide loans to. The result is that investment banks obtain the better borrowers and the commercial banks provide credit to the weaker borrowers. The result is that competition from different types of creditors causes market inefficiencies. Such market inefficiencies could result in credit rationing by commercial banks and thus be detrimental to new firms.

A theoretical model of credit rationing involving entrepreneurs is posited by Bernhardt (2000). He builds a single period model where an entrepreneur has the ability to move a project forward but lacks the capital to do so, which leads him to borrow from a bank. The entrepreneur is a price taker, and the lender dictates the interest rate. The result of the model is an equilibrium interest rate at which entrepreneurs desire to still obtain additional capital but cannot. This goes against the intuition that interest rates alone can solve credit rationing (i.e. raise interest rates as high as the risk warrants) or that competition among creditors will induce an interest rate that will result in efficient investment. Rather, Type I could be caused by limitation of funds based on the size of collateral from the borrower. Collateral mitigates credit rationing (e.g. Besanko & Thakor, 1987; Bester, 1985; Chan & Kanatas, 1985). However, new firms and founders of new firms have limited collateral. Collateral ends up being less than what is needed to be borrowed. Therefore, collateral doesn't completely solve the credit rationing problem faced by new firms. This

leaves the need for new firms to try to obtain the remaining funds from other sources. In addition, even if a firm does have enough collateral, and thus there is less possibility of being credit rationed, the necessary collateral still provides access to additional credit options that would not otherwise be available (Chittenden, G. Hall, & Hutchinson, 1996).

Relationships can possibly help mitigate costs and credit rationing. Creditors can utilize either transaction-based or relationship-based lending. Transaction-based lending is based on hard information like financial statements. Transaction-based lending is primarily focused on informationally transparent borrowers (i.e. large, established firms). However, creditors tend to use relationship-based lending with small and new firms (e.g. Berger & Udell, 1995). Relationship-based lending is based on soft information generated via interactions between the lender and the borrower. This includes communications like meetings, emails, etc. Relationship-based lending is primarily focused on informationally opaque borrowers. Large financial institutions have a comparative advantage in transaction lending to small firms; whereas, small financial institutions have an advantage in relationship-lending to small firms (Berger & Udell, 2006). Closer relationships between creditors and borrowers can help reduce interest rate costs and monitoring by banks (D. W. Blackwell & Winters, 1997), and mitigate credit rationing.

Credit rationing should not be evident in efficient financial markets, even when a project is a high risk. Some suggest that a banker should raise interest rates to cover for higher risk, and thus allow a borrower to obtain as large a loan as they wish (M. H. Miller, 1962). Assuming it can raise interest rates without losing business (i.e. can offer higher interest rates than other banks and not lose business), a bank could cover its risk by increasing the interest rate and allowing the risky borrower to take out as large a loan as the

borrower desires. However, this strategy does not work for profit-maximizing bankers since the borrower can default on their loan and lose only their collateral. Collateral is used by banks to mitigate the risk they face due to information asymmetry in the relationship between them and the borrowers to whom they lend. Therefore, if the loan is higher than the value of collateral the bank loses the difference between the loan amount and the value of the collateral. Thus, the bank does not lend more than the value of the collateral even when the project is a positive net present value project. Therefore the banker who maximizes the expected profit on a loan will ration credit when the borrower needs more money than the borrower has in collateral (Freimer & Gordon, 1965). The collateral requirement is also confirmed by studies that find riskier borrowers can borrow more on a secured basis than on an unsecured basis (Klapper, 2001). In addition, a higher interest rate can distort entrepreneurs' incentives and persuade them to choose the riskier projects. This means that adverse selection can lead to moral hazard that in turn can lead to credit rationing (Stiglitz & Weiss, 1981).

Assuming that credit rationing exists, it leads to a debt gap. In other words, firms are not able to obtain all the necessary funds from one credit source. This possibly leads to other credit sources that firms might use to obtain the necessary funds to survive and possibly grow.

Resourcefulness and New Firms

New firms are resourceful in their activities (Baker, Miner, & D. T. Eesley, 2003; Baker & R. E. Nelson, 2005). "Resourceful" can have several meanings. Resourceful could mean someone who is capable of dealing with difficult situations. However, there is a dynamic that is missing from this definition which relates to what studies have found which entails a combination of resources rather than a single resource. Thus, in this study,

resourceful refers to wisely using, or using ingeniously, a combination of materials that are at hand or are accessible in the environment.

Various terms have been used to explain resourcefulness in the organizational setting, including bricolage, improvisation, and bootstrapping⁹. One of the most cited papers along the lines of resourcefulness of new and young firms is Baker and Nelson (2005). Using a concept from biology, bricolage, they explain how resource-constrained firms differ in their responses to operating in a resource-poor environment. Bricolage is defined as "always to make do with 'whatever is at hand'" (Levi-Strauss, 1966: 17). From their field study of 29 service firms, Baker and Nelson observe the new firms rendering unique services by recombining resources at hand for new purposes. The resulting services challenged the limits of the existing institutions. The notion of bricolage is based upon the evolution framework (variation, selection, and retention) which means there is no agency involved. Thus, entrepreneurs can combine various resources, but don't know which ones will be successful or not; rather the environment is what determines which combinations are selected. However, entrepreneurs tend to believe their own abilities mitigate the risk their business faces, with these abilities including leadership, hard work, and resourcefulness (Isenberg, 2010).

An example of bricolage is found in the study by Garud & Karnoe (2003) who compare bricolage activity in Denmark to breakthrough activity in the USA in the wind-turbine industry. The firms in Denmark used bricolage in which the designers and producers

⁹ Additional terms that are similar to resourcefulness and are used in the literature are adaptation and effectuation. Adaptation is an adjustment of a system from its current state (Campbell, 1969; Stein, 1989). Unlike the other terms similar to resourcefulness, adaptation can occur without convergence of design and execution and may involve planning and/or using routines (Baker, Miner, & D. T. Eesley, 2003). Effectuation is the process where a set of means is given and the individual selects between possible outcomes that can be created with such means (Sarasvathy, 2001). Effectuation differs from bricolage in that bricoleurs can possibly use resources at hand both to see what can be accomplished (effectuation) and find out how they can meet pre-existing goals from resources at hand (causation) (Baker et al., 2003).

improved their designs while incorporating the inputs of the actors involved, which included the designers, producers, users, evaluators, and regulators. The actors took a low-tech design, took small steps to improve the design, and engaged in product development in between various stages of the development process. It is this combination of available resources that provides the example of being resourceful; in this example, the resources are individuals that possessed various levels of knowledge. With limited financial resources, they spent hours in the scrap yards to obtain materials for their design. In contrast, U.S. companies started with a high-tech design and took large steps to improve on the technology. They purchased or built new components from scratch designed specifically for their wind turbines. The U.S. counter parts felt the Danish design features were too easy or not challenging enough, and thus didn't pursue the Danish technology even though it was already successful.

Improvisation is another term used in the literature that has a similar meaning to resourcefulness. Like bricolage, improvisation has been adapted from other fields (theater, musical performances, therapy, and education) to explain and better understand creativity and innovation in organizations. Improvisation theory is couched in organization theory where order and control is prevalent (e.g. DiMaggio & Powell, 1983; Weber, 1947), however, the main theories don't explain that creativity and innovation come from spontaneous and not planned activities within an organization. Improvisation is defined as "the negation of foresight, of planned-for, of doing provided for by knowing, and of the control of the past over the present and future" (S. A. Tyler & M. G. Tyler, 1990: x). Thus, spontaneity is an important dimension of improvisation, and with it comes intuition (Weick, 1998).

In organizational theory, improvisation has been studied with firefighters (Weick, 1993), new product development (Eisenhardt & Tabrizi, 1995; Miner, Bassoff, & Moorman, 2001; Moorman & Miner, 1998, 2002), in schools (March & Olsen, 1976), during a strike (Preston, 1991), and after a failure in a navigational system (Hutchins, 1991). In addition, Baker et al. (2003) studied the firm founding process, where design and execution of novel activities converge.

Thus, multiple activities and resources are combined in an unplanned order and done so in varying degrees. This implies there are varying degrees and forms of improvisation in the organizational context, and thus it lies on a continuum (Weick, 1998). Finally, improvisation does not start from a blank slate where there are no resources. "You can't improvise on nothing; you've gotta improvise on something" (Kernfeld, 1995: 119). As with bricolage, there is an element which implies there is no agency involved as no planning can be done by an agent.

Entrepreneurial finance literature is biased towards studying the process of acquiring a large amount of financial resources from external financiers. However, new firms often experience limited access to external finance due to market imperfections. With the financial constraints faced by new firms due to market imperfections, and with entrepreneurs being resourceful, firms are taxed with the decision to try to find external funds and manage cash flow in non-traditional ways. One of those ways is via bootstrapping. Faced with financial constraints, entrepreneurs resort to trying to reduce as much as possible the need for external finance (Bhide, 1992) and bootstrapping ends up being a way of life for new firms (Timmons, 1999). The logic behind firms using bootstrapping techniques is that it is often impossible for new firms to acquire all the resources needed to fully develop over time

(Baker & R. E. Nelson, 2005), but entrepreneurs continue to pursue new opportunities despite their inability to acquire the traditional resources (Starr & MacMillan, 1990).

Bootstrapping is defined as “highly creative ways of acquiring the use of resources without borrowing money or raising equity financing from *traditional* sources” (Freear, Sohl, & Wetzel, 1995: 394), and could be considered improvisational activities that involve financial resources. Traditional sources of start-up capital include using funds from personal savings, borrowing from financial institutions, or obtaining funds from venture capital and angel investors in return for a percentage of ownership in the new firm. Bootstrapping techniques range from hiring personnel on a contract basis (instead of as an employee) to bartering for goods and services (instead of buying goods and services), from sharing premises with others to running the business from home. Bootstrapping also entails funding techniques such as using funds from a second mortgage, sale of personal assets, inheritance, credit cards, leases, and more¹⁰.

There are different categorizations of bootstrapping (e.g. Van Auken & Neeley, 1996; Freear et al., 1995; Harrison, Mason, & Girling, 2004; Winborg & Landstrom, 2001). One categorization method is based upon product development and business development (e.g. Freear et al., 1995; Harrison et al., 2004). The second categorization method is based upon 1) delaying bootstrappers, 2) relationship-oriented bootstrappers, 3) subsidy-oriented bootstrappers, 4) minimizing bootstrappers, 5) private owner-financed bootstrappers (Winborg & Landstrom, 2001). The second categorization method is based upon external finance reliance and cost minimization (e.g. Vanacker, Manigart, Meuleman, & Sels, 2011). For this latter categorization method, the “external finance reliance” includes strategies to acquire resources without using bank finance and external equity financing, while “cost

¹⁰ Winborg & Landstrom (2001) list 32 different bootstrapping techniques in their paper.

minimization” includes strategies that minimize the need for cash by securing resources at little or no cost. Thus, bootstrapping may allow new firms to pursue new opportunities without the need to own a large amount of resources, and thus do not have to look for a large amount of external financing.

Prior studies show that new firms rely heavily on bootstrapping methods and these techniques change over time as firms age and grow. Freear et al. (1995) survey 77 computer software firms about their financial activities, which include a list of 20 different bootstrapping techniques. They find that 56% of the software entrepreneurs in their survey utilize bootstrapping techniques within the first four years of their firms’ existence. A study by Van Auken & Neeley (1996) examine 78 United States firms and find that on average 35% of the firms’ start-up capital is obtained by bootstrapping techniques. Winborg & Landstrom (2001) survey Swedish firms and ask them about their usage of 32 bootstrapping techniques. The result is a clustering of the 32 bootstrapping techniques into five¹¹ different bootstrapping techniques that the firms indicate they use. R. B. Carter & Van Auken (2005) find that owners who perceive themselves as being less capable rely more heavily on owner-related bootstrapping techniques. N. M. Carter, Brush, et al. (2003) perform a study with 235 women entrepreneurs and find that for women, social capital increases the odds of using bootstrapping techniques. Brush, N. M. Carter, E. J. Gatewood, Greene, & Hart (2006) interview 88 women entrepreneurs who were seeking an equity investment to grow their firms. Their results show differences in the use of bootstrapping techniques which women entrepreneurs use depending on the development stage of their firms. Firms that had not

¹¹ There were six different clusters of bootstrapping techniques. However, one of the six techniques was “non-bootstrappers”. This indicates that those techniques are not bootstrapping techniques, even though they were included in the initial 32 techniques in Winborg & Landstrom's (2001) survey. Thus, there are only five bootstrapping categories that the authors found to be unique from one another.

achieved their first sale yet are more likely to emphasize bootstrapping to reduce labor; whereas, firms that have greater sales are more likely to focus on bootstrapping techniques that minimize operation costs. Ebben & A. Johnson (2006) survey 183 retail and service firms in the Midwestern United States that are between 2 and 40 years old. The results of their study indicate that firms change their reliance on bootstrapping techniques over time. The amount of owner-related, joint-utilization, and delaying-payments techniques decreases over time, with the customer-related techniques increasing over time. The increase in customer-related techniques might suggest a resource dependence and organizational learning trend. Firms might be able to possibly gain leverage with customers or learn ways to obtain payments earlier. Harrison et al. (2004) find that 95% of software firms in Northern Ireland / South East England and the United States use at least some form of bootstrapping. They also find that larger firms tend to make use of bootstrapping for product development and smaller firms tend to make use of bootstrapping for value cost-reduction. Overall, research shows that bootstrapping techniques depend on the characteristics of the firm and the owner, and the techniques change over time as the firm ages and grows.

As the first studies focus on determining if firms used bootstrapping techniques, a more recent study on bootstrapping focuses on how bootstrapping techniques affect the performance of firms. Ebben (2009) examines the income statements and balance sheets of 901 manufacturing firms over a two year period, with 186 of them indicating they use bootstrapping techniques. His results indicate that firms that use bootstrapping techniques are more highly levered, illiquid, and are underperforming based upon financial measures. Vanacker, Manigart, Meuleman, & Sels (2011) perform a longitudinal study in Belgium that include 214 new firms and find that bootstrapping techniques are either positive or have no

effect on performance. Specifically they find that new firms that use more internal funds, employ more temporary workers, encourage customers to pay quicker, and obtain funds from subsidies exhibit higher growth over time.

In a constrained environment, the ability to be resourceful can be the difference between surviving and not surviving. Kodithuwakku and Rosa (2002) find that when investigating the economic and business success of Sri Lanka villagers via case studies, it is not the ability to find or create innovative business opportunities that increase the survival and starting rates of new firms. Rather, it was founders being more creative and persistent in finding solutions to better mobilize scarce resources that increased the survival and starting rates of new firms. This indicates in particular the ability of founders to tap into their social network to overcome their struggle of accumulating additional funds. Thus, being resourceful can provide a means to obtain additional financial capital.

The use of bootstrapping techniques show that new firms are financially constrained and that they use multiple techniques and sources to manage their cash flow and fund their operations. In addition, new firms call upon various techniques to obtain additional funds, especially in a constrained environment. The use of multiple and a combination of techniques indicate these firms are resourceful in their means to operate and finance their operations. In addition, using multiple traditional funding sources has been found to be positively related to growth of owner-managed firms (Westhead & Cowling, 1995).

Going back to the definition of resourcefulness and relating the definition to this study, resources at hand are credit sources that are available to new firms. A new firm is considered to be more resourceful if it takes advantage of the various credit sources (i.e. resources) available to them in their environment. With firms found to be resourceful and

using multiple funding sources, the next step is to examine the most used type of funding, debt, as explained next.

Most corporate finance literature on capital structure theories tends to treat all types of debt the same (as one source). Actually, there are multiple sources of credit available to firms. The literature that does distinguish different credit sources categorizes the debt in ways such as outside and inside debt, and formal and informal debt. And recent studies on new firms have examined financing from suppliers via trade financing separate from other types of financing (Huyghebaert, Van de Gucht, & Van Hulle, 2007; Huyghebaert & Van de Gucht, 2007; Huyghebaert, 2006). However, credit can be provided in different ways and from different sources. The different credit instruments and sources are different in nature, as are equity sources (e.g. venture capital firms, angel investors, family and friends). Different sources of credit use different contracting mechanisms and possibly have different motives for financing a new firm (Cassar, 2004). These different contracting mechanisms and motives could be important for a new firm in determining which credit sources to use in order to survive and grow. The different credit sources include credit provided by banks, non-bank financial institutions, credit card institutions, other businesses (i.e. strategic partner), government, owners, employees, family members, friends, and other individuals. Each one of these sources offers credit to firms in different ways, each of which tends to have different market power, offer different interest rates, provide different schedules of payment, provide different levels of funding, have different application procedures, have different collateral requirements, apply different lending covenants, differ in their risk attitudes and ability to diversify, gather information differently, monitor differently, and react differently

to financial distress. These differences are summarized in Table 1 and are further explained in the next section.

Table 1: Credit Sources and Instruments

Source	Credit Instruments Provided	Formal / Informal	Internal / External	Market Power	Interest Rate	Amount of Financing	Application Process
Organizations							
Bank	Loans, Lines of credit	Formal	External	High	Low / Med	Large	Slow, large amount of paperwork
Non-bank financial institutions	Loans	Formal	External	High	Med / High	Large	Slow, large amount of paperwork
Credit card institutions	Credit cards	Formal	External	High	High	Small	Fast, Small amount of paperwork
Other businesses	Loans	Formal	External	High	Med / High	Med-Large	Medium
Government	Loans	Formal	External	High	Med	All sizes	Slow, large amount of paperwork
Individuals							
Owners	Loans	Informal	Internal	Low	Low	All sizes	Fast, Small amount of paperwork
Employees	Loans	Informal	Internal	Low	Low	Small	Fast, Small amount of paperwork
Family	Loans	Informal	External	Low	Low	Small	Fast, Small amount of paperwork
Other individuals	Loans	Informal	External	Low	Low-High	Small	Medium
Source	Collateral Requirement	Risk Aversion	Availability to Diversify	Info Gathering	Monitoring	Reaction to Borrower Financial Distress	Motivation
Organizations							
Bank	Yes	High	High	Arms length, detailed, formal	Formal	Strict, push into bankruptcy	Profit, obtain additional services
Non-bank financial institutions	Yes	Med-High	High				Profit
Credit card institutions	No	High	High				Profit
Other businesses	No	Med	High				Obtain additional resources
Government	Yes	Med	High	Arms length, detailed, formal	Formal, but inefficient	Med	Support economy
Individuals							
Owners	None	Low	Low				Support firm
Employees	None	Low-Med	Low	Close, less formal	Informal	Provide leeway (more flexible)	Support firm
Family	None	Low	Low				Support firm
Other individuals	Yes	Low-Med	Low-High				Profit, support firm

Credit Instruments Available to New Firms

Credit can be provided in multiple forms as there are multiple types of credit instruments available to new firms. Credit instruments are distinguished from each other by the means that the credit instrument is provided; whereas credit sources are distinguished by the entity that provides the credit. A credit source can provide multiple types of credit instruments. With equity, the two financing forms are common and preferred stock. With credit, there are more forms, which include loans, lines of credit, credit cards, corporate bonds, and trade credit. Corporate bonds are usually not available to new firm (e.g. Berger & Udell, 1998). Trade credit is operational funding and represents spontaneous funding which might or might not be costly. This leaves loans, lines of credit, and credit cards which are

available to new firms, have a measureable cost associated with them, and would not be considered spontaneous financing.

Loans

Term loans are loans for a specific amount that have a specific repayment schedule and an interest rate that can be fixed or floating. Bullet loans are loans that do not have any amortization but require a balloon payment at the end of the term. Bullet loans are usually used for interim financing (e.g. bridge financing), with the hope of obtaining refinancing before the balloon payment is due. Both term and bullet loans usually are extended as secured credit instruments which entail the creditor requesting a form of collateral from the borrower (e.g. Berger & Udell, 1990). Most of the credit in terms of dollar value is extended to new and small firms in the form of loans (e.g. T. Bates, 1991, 1997; Beck et al., 2008; Berger & Udell, 1998; Cressy, 1993, 2007; Hughes, 1997; M. A. Petersen & Rajan, 1994). Term and bullet loans are provided by various sources, including commercial banks, non-bank financial institutions, government, owners, family, friends, and other businesses (i.e. strategic partners).

Lines of Credit

Another credit option is a line of credit, which is similar to a term loan and is usually provided by commercial banks (Berger & Udell, 1995). Lines of credit represent a forward commitment to provide working capital financing under predetermined terms. The borrower can draw down on the loan up to the maximum loan balance at any time, and can repay the outstanding balance at any time. The borrower only pays interest on the amount which they have drawn down (i.e. the outstanding balance). The payment schedule is flexible with a minimal amount to be paid monthly. The borrower does not have to apply for the funds each time they are needed, and the amount of funds used is not a set amount as the borrower can

pay it off early and still have access to the unused balance. As opposed to bank loans, these predetermined terms are easier to adjust, and in many cases are adjusted on a scheduled basis by the financial institution that is providing the line of credit. Lines of credit usually are smaller in size than bank loans (Duca, 1986).

Lines of credit may be extended as either secured or unsecured. When extending an unsecured line of credit, the creditor cares about the borrower's ability to pay back the outstanding balance of the line of credit. Lines of credit are often secured by accounts receivables as a form of inside collateral. Account receivables are balances that the borrower "loaned" customers to purchase their products or services. Lenders that use accounts receivable as a means to secure the amount lent to borrowers care more about the ability of the borrower's customer to pay than the borrower's ability to continue to generate new sales (Klapper, 2001). It has been suggested that lines of credit are the first financing instrument used by small firms rather than term loans (Cressy, 2007). The line of credit is used by the small firms to finance working capital as opposed to purchasing fixed assets. Cosh & Hughes (1994) find that in the United Kingdom, lines of credit finance 11% of a small firm's assets. This is compared to 6% for large manufacturing firms and 4.4% for large service firms. Berger & Udell (1998) find that 52% of the debt is drawn under lines of credit by the firms in their sample. Most lines of credit are provided by banks, and are used by the borrowers to reduce transaction costs and provide insurance against credit rationing and credit crunches which are based upon general market conditions rather than specific characteristics of the borrower (Berger & Udell, 1998).

Credit Cards

Another credit facility available to new firms are credit cards, which are issued and maintained by credit card institutions. Credit cards are complex financial instruments that

have different characteristics and motivations (transactions, line of credit, etc.), involve a large number of prices (interest rates, teaser rates, grace periods, penalty fees, annual fees, etc.), and quantity constraints (credit limits and minimum payments). Credit card debt is unsecured debt resulting when a borrower purchases a product or service through the card system, and tends to be provided by credit card institutions where the credit card is the primary financing instrument they offer.

Use of credit cards by businesses has increased over the last twenty years, especially after the market for consumer credit cards became saturated (*Small Business and Micro Business Lending in the United States, for Data Years 2007-2008, 2009*; Sullivan, Warren, & Westbrook, 2001). Credit cards were initially a finance tool for consumers. However, within the past 20 years, credit cards have become more prevalent in the world of business. Businesses now have business-related credit cards which allow their employees to make purchases for the businesses. It has been found recently that founders use either their personal or business credit cards to finance their businesses (Robb & D. T. Robinson, 2010). Credit cards could possibly be used during times of credit market contraction when new firms have greater difficulty borrowing through the traditional markets, such as during the 2008 credit crisis (NSBA, 2009). Thus, it has been suggested that credit cards are an option to increase access to funds when banks limit credit to firms (Danielson & Scott, 2004). In addition, it is easy to open up multiple credit cards, as their applications are simple and now can be done online without talking with a human being. Having multiple credit cards available, firms can possibly use them to obtain more funds than can be obtained with only one credit card. However, the amount of credit available via credit cards, either one or more credit cards, is usually much smaller than the amount provided by other credit sources.

Credit cards, since they are the easiest form of credit to get and don't require collateral, are one of the most popular forms of borrowing among new small firms (J. D. Cole, Lahm Jr, Little Jr, & Seipel, 2005; NSBA, 2009), especially unsecured debt (Sullivan et al., 2001). Small and medium-sized firms use credit cards to pay for day-to-day expenses and fixed capital (Fraser, 2005). In 2008, 59% of small businesses in the United States (firms with 500 employees or less) used credit cards to finance their firms, with only 40% of the small firms able to pay off their outstanding credit debt every month (*Small Business and Micro Business Lending in the United States, for Data Years 2007-2008*, 2009). This is a rising trend as only 16% of small firms used credit cards in 1993 (NSBA, 2009). Several studies have acknowledged the emergence of credit cards as a new means to finance small firms.

Credit cards offer several benefits to businesses. Credit cards are easier to obtain compared to traditional bank loans or government grants as they do not require a business plan or months of waiting for loan processing and approval (G. Kim, 2007; Manning, 2001). As well, credit cards help small firms manage their finances and streamline payments, smooth revenue streams, and improve the ability to accept payment and pay for business expenses virtually anywhere. Finally, credit card applications are arm's length borrowing, and thus can be considered an anonymous funding source (as compared to family and friends).

Even though credit cards are widely used by small and medium-sized firms, but do not represent a large dollar amount of the overall debt for the firms. Berger & Udell (1998) find credit card financing to be small (0.14%), although much press has been given to financing of new firms with credit cards (e.g. Dale, 2007; R. Johnson, 2010; Silver-

Greenberg, 2010). Fraser (2005) finds this to be the case with small and medium-sized firms in the U.K. as well. This differs for nascent ventures, where Gartner et al. (2010) find that 14% of their sample, which was the Panel Study of Entrepreneurial Dynamics (PSED), use credit cards to start their firms.

Loans are provided according to a fixed, predetermined amount that will not increase during the life of the loan. By contrast, credit card repayment schedules for credit card loans are more unpredictable than loans due to the open-ended nature of revolving credit contracts and the minimum monthly payment requirements. Lines of credit are the only facility similar to credit cards in that regards.

Each of these financing credit instruments provides different revenue streams for the creditors, along with different profit margins for them. In addition, each of these credit instruments has different application procedures. The process of obtaining a term loan, especially one that is long-term, can be laborious; whereas with credit cards, the application can be completed and approved online in minutes. This is because the credit card applications require less information from the borrower and don't require collateral. As such, borrowers can setup multiple credit cards in many cases, and might have to because one credit card can't provide all the needed funds for the firm's operations.

Credit Sources that Provide Credit Instruments to New Firms

Different entities provide loans, lines of credits, and credit cards. The main provider of these credit instruments are banks, which are highly regulated due to being depository institutions. This has led many of the past studies that focus on debt to only examine banks. Even though a large portion of debt studies use banks as the only provider of debt, there are other credit sources available to firms. These other credit sources are non-depository institutions, and it has been suggested that non-depository institutions have become more

important to small firms. Mach & J. D. Wolken (2006) compare earlier Surveys of Business Finances (SSBF) with the latest SSBF (2003) and find that non-depository sources increased in monetary value from 25% in 1987 to 54% in 2003. Non-depository sources include non-bank financial institutions, credit card institutions, government, owners, family, friends, and other individuals and businesses.

Banks

Banks are the most used credit source by new firms (e.g. Astebro & I. Bernhardt, 2003; T. Bates, 1990; Berger & Udell, 1998; Fraser, 2005). Banks tend to be unique from other credit sources (Diamond, 1984, 1991a; Fama, 1985; Ramakrishnan & Thakor, 1984), and the bank loan market tends to differ from other debt markets (Carey, Prowse, Rea, & Udell, 1993). Banks are financial institutions that accept deposits and pool those deposits to provide credit to borrowers. They are highly regulated. As financial intermediaries, banks exist because they enjoy economies of scale and comparative advantages in the production of information about borrowers, namely for borrowers with high information asymmetries (Diamond, 1984, 1991a; Fama, 1985; Leland & Pyle, 1977; Myers & Majluf, 1984; Ramakrishnan & Thakor, 1984). When costly information asymmetries exist between external financiers and firm insiders, a bank becomes the optimal financial institution for channeling funds from savers to borrowers (Diamond, 1984). Receiving a bank loan not only is beneficial because of the funds received from the loan, it is also a positive signal to investors. Large, publicly traded borrowing firms experience abnormal equity returns after they announce a loan agreement. This supports the hypothesis that banks are special types of financial intermediaries (James, 1987; Lummer & McConnell, 1989; Mikkelsen & Partch, 1986). Banks tend to know more about a firm's future cash flow potential than other external financiers (James, 1987).

As mentioned in the previous section, banks generally provide credit to borrowers through loans and/or lines of credit. Banks usually rely on collateral, interest rates, loan sizes, ratio analyses, and forecasts of specific industries to gather information on a firm. Banks are reluctant to extend loans to firms that offer little evidence of cash flows, raising doubt about their ability to repay the loan. In return, banks require collateral against the risk of default. Berger & Udell (1990) find that 70% of the firms in their sample that have bank loans are collateralized. Banks use collateral to mitigate their risk in the event of default. In addition, collateral provides a signal to the bank that the founder believes the project will succeed (Storey, 1994a). Thus, collateral mitigates information asymmetries and can possibly reduce credit rationing (Besanko & Thakor, 1987). Many new firms do not have a positive cash flow or sufficient collateral for the debt needed to finance the firm's operations. Since new firms cannot use the full value of their future returns as backing for their financial claims (i.e. for collateral) (Diamond, 1990, 1991a, 1991b), new firms require outside collateral. One means of obtaining outside collateral is from the equity in the founder's house. Using one's house as collateral for a bank loan for the business can help get a business started. To support this notion, Black et al. (1996) find that a 10% rise in the value of unreleased net housing increases the number of businesses registrations in the United Kingdom by 5%. And it is not the low quality firms that are started in this 5% as they find that the additional businesses started are at least average quality based upon their survival rates. It is difficult for banks to shift all default risk onto borrowers in absence of full collateral, which leads to new firms in new industries being credit rationed even more so than established firms (Duca, 1986).

There are several variations of banks. Most research assumes that banks are commercial banks. Commercial banks are banks that offer services to the general public and companies. These services mainly include accepting deposits and making loans. Commercial banks provide a variety of deposit accounts, including checking, savings, and time deposits. These institutions are operated to generate a profit and are owned by a group of individuals or another institution. Two other variations of banks are credit unions and savings and loans. Credit unions are member-owned financial cooperatives controlled by its members. The difference between credit unions and commercial banks is that the members who have accounts are the owners of the credit union and the members elect the board of directors. Credit unions sometimes provide support for community development. Thus, credit unions feel they are community oriented and serve the people, and are not necessarily operated for a profit. Savings and loans specialize in accepting deposits from consumers and make mortgage and other loans. Similar to credit unions, depositors are members of the savings and loan and have voting rights. Thus, they have the ability to direct the goals and future of the organization. However, unlike credit unions, savings and loans provide only savings deposits and cannot have more than 20% of their loans in commercial loans (i.e. loans to businesses).

Non-bank Financial Institutions

Contrary to banks, non-bank financial institutions do not accept deposits from individuals and they are not highly regulated like banks. These institutions include venture debt companies, finance companies, thrift institutions, leasing companies, brokerage firms, mortgage companies, and insurance companies. Non-bank financial institutions do not tend to show up in studies on credit that examine new and small firms. Some of the few studies that have included non-bank financial institutions are Berger & Udell (1998) and Astebro &

I. Bernhardt (2003). In both of these studies, non-bank financial institutions represent a small percentage of the overall loans provided to the small firms in their data set, both new and old.

However, this is not to say that non-bank financial institutions are not used by new firms. Venture debt companies have been very active recently (Hardymon & Leamon, 2001; Hardymon, Lerner, & Leamon, 2005). Two-thirds to three-quarters of new firms in the United States use venture debt (Sormani, 2004). In 2010, the venture debt industry provided \$3 billion in loans to new firms in the United States (T. Fischer & De Rassenfosse, 2011). Well-known companies have used venture debt to finance their operations, including Facebook (Musil, 2008), YouTube (Haislip, 2007), and Amazon.com (Haislip, 2007; Musil, 2008). These are firms that are considered successful, and have grown to be sizeable in the market. Venture debt firms tend to finance high growth firms, with most of the firms not having revenues initially. They lend to firms even when there is a high level of information asymmetry due to rapid growth, new markets, new products, and when the firms have no track record, no cash flow, and no tangible collateral. Thus venture debt firms finance risky ventures.

To help mitigate their risk, venture debt firms tend to provide funds alongside equity financing that is provided by venture capital firms. Venture debt firms rely on the due diligence of venture capital firms to determine if a firm is credit worthy, leaving the venture debt firm to focus on the quality of the venture capital firm. The quality of the venture capital firm is more important for the venture debt firms, as they assume that higher quality venture capital firms will lead to more credit worthy firms which the venture debt firm can provide credit to. Thus, since banks that provide venture debt have more regulation

requirements, non-bank financial institutions can offer larger loans and with fewer covenants than banks (Levin, 2008). In some cases, this situation has resulted in banks and non-bank financial institutions partnering, with banks initially offering loans at lower interest rates and non-bank financial institutions providing larger loans when regulation hinders banks from providing further funding (Ibrahim, 2010). Thus, new firms would use multiple credit sources by utilizing both banks and non-bank financial institutions.

As a result of more usage by new firms, venture debt is readily accepted as part of the capital structure of new firms in some industries. However, venture debt has a negative effect on new firms. Recent research finds that new firms that obtain venture debt are less likely to perform an IPO, be acquired, and venture debt has a negative effect on a firm's valuation (Chakraborty & Ewens, 2011).

The motivation of banks to provide debt to new firms with no track record or collateral is to possibly secure the firms' deposit accounts. Non-bank financial institutions are motivated by repayment of the loan with high interest rates (Ibrahim, 2010).

Credit Card Institutions

Another credit source available to new firms is the credit card institution, which issues credit cards to borrowers. The credit card market in the United States is one of the largest debt markets in the world, with \$800 billion total bank credit card debt outstanding in 2004 (Furletti & Ody, 2006a), with new firms using one or more cards regularly (Scott III, 2009).

Much has changed since 1980s in the credit card industry. These changes include rapid growth in direct mail solicitations, credit scoring technology and data quality and warehousing have led to the use of automated systems for prescreening and solicitation of applicants. Some claim that these changes improve the issuers' ability to judge the

creditworthiness of applicants and lowers the evaluation costs. However, with the changes there has been an increase in the delinquency rates on cards. Penalty fees in 2004 amounted to \$13 billion (Massoud, Saunders, & Scholnick, 2011). The literature on credit cards mainly focuses on the interest rate charged by card issuers. Interest rates on credit cards are primarily based on the risk of the cardholder (Furletti & Ody, 2006b: 18). However, credit card companies tend to charge a hefty penalty for late payments. Credit card penalty fees serve a different function than interest rates. Penalty fees are a means by which card issuers can extract rents from only those borrowers who break their contractual obligations – by being late or over their credit limit. In contrast, interest rates serve the purpose of charging all borrowers who use their credit cards and do not repay the full amount. Interest rates are a function of the amount not repaid, while penalty fees are imposed independent of the dollar value outstanding. Massoud et al. (2011) find that credit card penalty fees are positively related to default risk of consumers. This supports the argument that lenders are able to use penalties to offset the risk of default rather than only adjusting the interest rate.

The majority of unsecured business debt is debt provided by credit card institutions (Sullivan et al., 2001). This is important when a firm fails and bankruptcy can erase unsecured debt such as credit cards. However, terms are easier to change for card issuers. For example, in the five years ending in 2008, 79% of small firms surveyed in the United States stated that their credit card terms had become more imposing and burdensome (NSBA, 2009). Part of this 5-year period includes the beginning of the 2008 credit crisis. So when the credit market becomes tighter, credit card issuers can change their terms to benefit them, and implement more onerous terms on the borrowers. In addition, the minimum monthly

payments amounts have been raised since the implementation of the Credit Card Holders Bill of Rights in 2009.

Governments

Governments try to spur new firm formation by providing incentives to start firms. One means is to provide loans to new firms, while another means is to provide guarantees for term loans provided by banks. Government loans represent a small percentage of loans to new firms. For example, Berger and Udell (1998) find that only 0.49% of the firms use government loans. However, the government does provide financial support to new firms through other methods. For example, in the United States since 1953, the Small Business Association (SBA) has provided guarantees to banks on loans that banks have provided to small firms, and in 1997 the U.S. Congress passed legislation for the SBA to provide over \$50 billion for the SBA's business loan programs. In 2006, the SBA extended \$20 billion in new guarantees, and its outstanding guarantees amounted to \$67 billion (CBO, 2007). By providing guarantees, the government helps banks provide long-term credit to borrowers. Without the guarantee the banks would more willing to provide short-term credit or not provide term loans.

Owners, Family, Friends, and Other Individuals

Another source of credit available to new firms is provided in the form of informal entities. Berger and Udell (1998) find that 5.17% of the total funding from debt sources is from owners, employees, family, and other individuals. However, most of that amount is by owners (4.10%). The owners have both debt and equity interest (this 4.10% is only for the debt amount). It could be that these personal loans by the owners are an easy mechanism to provide short-term financing to the firm. Or it could be a means to create a tax benefit for the

firm (supporting the static trade-off theory). Of the 1.47% provided by other individuals, most is likely from family and friends (Berger & Udell, 1998).

The use of informal creditors is also supported by other studies. Extended family networks have been found to be one of the main sources of funds for new firms (Pistrui, Huang, Welsch, & Jing, 2006). In his study, Bates (1990) finds that the second most used credit source was family and friends. In addition, Fraser (2005) finds support for this with new firms in the U.K. And finally the Global Entrepreneurship Monitor (GEM) study finds that four out of five informal investors are either family members or friends of the founders (Bygrave & Quill, 2007), while historical World Bank studies find this is also the case in developing countries (World Bank Economic Research Group, 1989).

The funds offered by family and friends could help the performance of new firms by providing these additional funds. The motivation of family and friends is different than with formal creditors. Family members may lend money at lower interest rates than formal creditors (Bygrave & Reynolds, 2005; Collins, Morduch, Rutherford, & Ruthven, 2010), and are possibly more lenient with repayment of the funds borrowed (Basu & Parker, 2001), since family members will provide funds out of love rather than for a financial return. This is especially the case when founders come from ethnic minorities (Basu & Parker, 2001).

Family members have a built in monitoring mechanism as they are around their family members on a regular basis – more so than would be a financial institution. Hence, costly monitoring mechanisms can be avoided (Fama & Jensen, 1983). Therefore, the family member does not have to account for monitoring expenses that formal financial institutions do. In addition, when family members own more of the firm, the firm is able to obtain a lower cost of debt from formal financial institutions (Anderson, Mansi, & Reeb, 2003).

Informal creditors also have an advantage over formal creditors as they have superior information, cheaper monitoring, and informal enforcement through social mechanisms – which mitigate moral hazard and adverse selection. However, informal creditors are wealth-constrained and thus cannot offer large and follow-up rounds of financing.

Even though family and friends offer access to additional funds, there is also an argument that borrowing from family and friends possibly hinders the performance of new firms. The reason is that borrowing from family and friends deters risk-taking due to the threat of social repercussions in case of default (Besley, Coate, & Lounsbury, 1993; Besley & Coate, 1995; S. Lee & Persson, 2012). To continue and survive and possibly grow, new firms need to take risks when they are faced with an uncertain environment. If new firms are too risk averse, they won't capitalize on the opportunity they have and their chance of survival possibly decreases. Over time, new firms use less and less informal financing, and replace it with formal (bank) financing (Chavis, Klapper, & Love, 2010, 2011).

Other Businesses

Firms have strategic relationships with other business which provide access to resources to which they wouldn't otherwise have access (e.g. Ahuja, 2000; Eisenhardt & Schoonhoven, 1996). These unique partnerships create value, provide competitive advantages, and lead to better performance (e.g. Dyer & H. Singh, 1998; K. Singh & Mitchell, 2005). These strategic relationships could entail one of the firms providing financing to the other firm as part of its responsibilities in the relationship (Deeds & Hill, 1996; P. A. Gompers & Lerner, 2000; Rind, 1981; Robinso & Stuart, 2007). The purpose of the relationship is to be a benefit to the operations of both firms. By benefiting both firms, the relationship could entail increasing sales, decreasing costs, or providing access to an innovative product or service. Thus, the motivation is to improve the main operations of the

firms. However, seldom does one firm provide all the necessary external financing to another firm. If a firm did that, then it is usually better for one firm to buy the other firm rather than the two firms operating as separating entities.

In summary, the credit sources differ in that each tends to have different market power, have different interest rates, provide different schedules of payment, provide different amounts of funding, have different application procedures, have different collateral requirements, differ in their risk attitudes and ability to diversify, gather information differently, monitor differently, react differently to borrowers in financial distress. With these differences, it would suggest that the credit source that is chosen by a new firm could affect the firm's performance.

Credit Sources and Performance of New Firms

How the use of these credit sources affects performance is the next logical examination of multiple credit source usage, as performance is important to the firm's future and its stakeholders. Performance of new firms is measured by survival and growth rates as these two measurements are priorities for entrepreneurs. In the corporate finance literature, capital structure is looked at mainly for the purpose of maximizing the value of a firm. The assumption is that the firm exists, and that it is up to managers to decide how to maximize firm value and/or profit based upon their financing options. In contrast, the entrepreneurial finance literature focuses on external financing of firms and the capital structure of these firms is important in terms of getting the firm started, to survive, and to possibly grow. Thus, in the performance dependent variables of entrepreneurial finance studies, valuation and profit are not variables that are often examined. Rather, it is founding, survival, and growth rates that are measured.

Survival and growth are interrelated, but are different in nature. Survival is a necessary, but not sufficient, condition for growth; if a firm does not exist, it cannot possibly grow. In addition, growth in terms of size and age of the firm is influenced by the survival rates of firms (Cressy, 2006a). Jovanovic (1982a) provides a stochastic model of firm survival and growth based on individual optimism and market equilibrium. Other models of firm behavior as they relate to the growth process include the Lucas (1978) model and Khilstrom and Laffont (1979) model. However, these two models are not stochastic like the Jovanovic model. The Jovanovic model represents a learning experiment in that an entrepreneur finds out how good he/she is at starting and running a firm only after entering the market and getting feedback from the market. The process of learning starts with the individual's prior belief about entrepreneurial ability and evolves over time either up or down. The model predicts 1) smaller firms fail more frequently than larger firms, 2) younger firms are more likely to fail than older firms, 3) surviving firms grow more slowly than firms that failed, and 4) older firms have a smaller variance of growth rates than younger firms. Thus, growth rates are negatively related to size. This is supported by Hall (1987) in her study with publicly traded small firms and with manufacturing firms. In contrast, a later study (Hopenhayn, 1992) finds support for the variance of growth rates to decline with the increase in the size of the firm. To make the results more complex, a study commissioned by the SBA and performed by Teitelbaum and Axtell (2005) finds that firm growth is a random walk and that the probability of a given percentage change in size is the same for all firms in a given industry. This supports Gibrat's law which says that percentage change in growth rates should not be associated with the size of a firm (Gibrat, 1931).

Evans (1987a, 1987b) is the first to use a panel data set with truly small firms, consisting of manufacturing firms in the United States covering a 5 year period between 1976-1980. The data set includes more than 20,000 firms. He includes firms with as few as five employees (Evans, 1987a) and as few as one employee (Evans, 1987b). He finds that smaller and younger firms grow faster and fail more frequently than large, older firms (liability of newness and smallness, Stinchcombe, 1965). As well, he finds that the variability of growth decreases as age of the firm increases, thus, supporting Jovanovic (1982b) and Hopenhayn (1992). Young firms more likely grow faster than older firms (Vos et al., 2007).

New firms usually start small (Audretsch & Mahmood, 1995; Birley, 1987), with only a minority that grow to any substantial size (e.g. Acs, Arenius, Hay, & Minniti, 2005; Reynolds, 2007; Vos et al., 2007). The majority of firms that survive are small, as shown by there being many more small firms than large firms in an economy at any given time (Berger & Udell, 1998; SBA, 2010). With past results showing mixed results with growth rates and size, but not with age, the pursuit of growth is a choice made by the owners of the firm. For example, Vos et al. (2007) find that only 8.36% of the firms in their sample wanted to grow. And over a period of several years or more, it is difficult to sustain the growth (Barringer, Jones, & Neubaum, 2005; Parker, Storey, & Van Witteloostuijn, 2010; Zook & Allen, 1999).

Even though few firms grow or want to grow, the growth firms are important to an economy as they create a larger number of jobs (Birch & Medoff, 1994; Haltiwanger et al., 2009; Henrekson & Johansson, 2010; Storey, 1994b). The growth of the firm will affect its funding needs. If the firm is able to generate positive cash flow while growing, then the firm can use retained earnings (i.e. internal funds) to fund future operations and thus possibly not

need as much or additional external funds. However, if the firm is growing without generating a positive net cash flow, or growth is faster than the cash flow growth, then the firm will still need to obtain funds externally as it grows. Or by recapitalizing, the firm would decide to use external funding to replace other external funding sources (i.e. recapitalize itself). In general, growth-oriented firms are more likely to seek external financing and are able to secure financing from at least one of the sources available to new firms (Cosh, Cumming, & Hughes, 2009).

Capital structure has been found to be a main factor in determining if a new firm will survive during its first 2-3 years of existence. A new firm with a better capital structure will be able to survive through the “valley of death”. Cressy (1996b) examines the relationship between the survival rate of new firms and their use of bank loans. He examines around 2,000 start-ups in the United Kingdom and finds that owner characteristics have a significant impact on the survival rate of new firms, and that firm characteristics have less of an effect on obtaining bank loans than originally thought.

Bates (1990) studies the survival rates of new firms and concludes that the initial capital of firms increases their chances of survival. However, the specific reliance on bank debt to finance the new firm’s operations does not affect the survival rate. Bank loans are the most frequent source of credit for the firms in Bates’ study. In addition, debt and equity capital are found to be complements of one another. Astebro & Bernhardt (2003) use data from firms started in 1987 in the United States from the Characteristics of Business Owners (CBO) survey that is conducted by the U.S. Census and find an interesting relationship between survival and bank loans for new firms. They find a statistically significant negative association between having a bank loan and new firm survival, especially if a new firm

obtains the bank loan in the first year¹². This is in spite of these firms with bank loans having higher average sales than firms that did not have a bank loan. This finding is contrary to Bates' (1990) finding that debt does not affect the survival rate. In the Astebro & Bernhardt (2003) study, the survival rate increases if the firm has a loan from friends, family, former owners, or a house mortgage. The credit sources used in their study are the owner's spouse, other family members, friends, personal credit card, refinanced home, former owner, bank loan, other type of loan, and federal / state / local government. The highest category as a percentage of dollar value of the debt used by a firm is bank loans (up to 22.4%), with other family members the next highest (up to 11.5%). This suggests it is not the amount of funds that makes the difference in surviving or not surviving, but possibly the use of these additional sources. This is consistent with Bates' (1990) statistics.

Most founders are similar in their intentions to start and operate a firm that survives. However, founders differ in their goals for growing their firms. Some founders want to grow fast, and some want to grow slow, while others don't want to grow at all after they have reached a certain level of sustainability (Cassar, 2004; Vos et al., 2007). Thus, the motives of founders differ based upon their need for growth. In addition, there are cases where founders want and try to grow their firms but other factors hinder their growth. One of these factors is the capital structure of the firm.

Capital structure has not conclusively been found to be a main factor in determining if a new firm will grow initially. In some studies, debt has helped new firms grow, while debt has been found to hinder growth in other studies. Ayyagari, Demirguc-Kunt, & Maksimovic (2010) study bank usage amongst growing Chinese firms. Their study is motivated by the

¹² In the Astebro & I. Bernhardt (2003) study, a firm is considered to be a surviving firm if the original owners remain owners for four years or if the firm is still operating after four years but under new owners

dominant view that informal finance institutions act in a complementary role to formal financial systems. Informal financing institutions complement formal financing institutions. They do so by servicing the lower end of the market since informal financing normally consists of small, unsecured and short term financing facilities provided to small firms. Using a database of 2,400 Chinese firms, the authors find that firms with bank loans grow faster than firms that use informal methods of financing. Their results hold for their entire sample as well as with only private sector firms.

The relationship between credit card usage and firm performance is not heavily researched; only recently have studies been conducted to examine this relationship. As it relates to survival of new firms and the use of credit cards, Scott III (2009) investigates whether the survival rates of new firms depends on revolving credit card debt. Revolving credit card debt is debt that is not paid off at the end of the month and therefore is subject to interest rate charges. Credit cards are useful for new firms because of the ease of acceptance, accessibility and anonymity. However, credit card debt comes with high carrying (interest) costs for small firms relative to other types of business loans. This suggests that firms using credit cards to finance their activities may have a lower likelihood of survival during their early years. In investigating this, Scott III (2009) finds that new firms that have higher revolving credit card debt balances have a lower survival probability. He concludes that this is the case because credit card debt is expensive relative to other types of credit and distressed firms use credit cards to sustain firms that should fail (i.e. that are negative net positive projects).

Fraser (2005) finds no difference between the usage of credit cards based upon growth rates. Small and medium-sized firms use credit cards to pay for day-to-day expenses

and fixed capital (Fraser, 2005). However, Fraser (2005) saw 79% to 90% of the firms in his data set pay off their outstanding credit balance each month. Thus, many firms do not incur the high interest rate costs.

These studies provide mixed results for how individual credit instruments and sources affect survival and growth of new firms. Using multiple credit sources is another external financing strategy for firms to use to possibly improve their survival and growth rates.

Multiple Credit Source Usage by New Firms

Multiple credit source usage is empirically demonstrated in a recent study. Studying bank-borrower relationships in the United Kingdom over the past 100 years, Braggion & Ongena (2011) find that since 1966, firms began to move to multiple banking relationships. This was especially the case for larger, more transparent, and better governed borrowers. From 1960 to 1966, 85% of the firms in their sample had a single bank relationship. From 1966 to 1986 (the last year in their data set), this figure dropped to 60%. The authors posit that the reason for this change was due to the deregulation and resulting increase in competition in the banking section in the United Kingdom in the 1970s, as was written about by Saunders & Ward (1976).

Firms may use multiple credit sources to fund their operations for various reasons. The reasons for using multiple credit sources are based upon the existence of financially weak creditors (Detragiache, Garella, & Guiso, 2000), hold-up costs (Farinha & J. A. C. Santos, 2002), threat of bankruptcy of the creditors (e.g. Bisin & Rampini, 2006; P. Bolton & Scharfstein, 1996; Rajan, 1992), strong negotiation positions for the entrepreneur (Bergman & Callen, 1991), and access to additional funds (Hackbarth, Hennessy, & Leland, 2007).

Detragiache et al (2000) examine multiple banking relationships using private firms in Italy to find out why firms, including small firms, need more than one bank. They

construct a model that involves firms' multiple banking relationships where firms wish to reduce liquidity risk. Their model predicts that firms whose banks are less fragile or whose creditors find it more difficult to enforce loan repayment will be more likely to resort to multiple banking relationships. The reason is that the number of banks increases when the firm goes to refinance and a more fragile bank cannot increase the amount they have lent to the firm. So the firm looks for additional banks at that time which leads to multiple banking relationships. In their model, they refer to this as the bank having a "liquidity crisis" (a run on the bank; lower deposits). So with this in mind, borrowers will actually seek to have multiple banking relationships. The analysis of their data supports this logic.

Farinha & Santos (2002) find that many firms start with borrowing from a single bank and then add additional banks over time. Their analysis shows that a firm will substitute a single banking relationship with a multiple banking relationship based upon the lengths of the relationship with the banks; the longer the duration of the relationship with the banks, the higher probability that the firm will use multiple banking relationships. The same is true with firms with poor performance and more growth opportunities. This suggests that firms will use multiple banking relationships to either try to survive or to grow. The poorly performing firms that use multiple banking relationships do not improve their performance because of the use of multiple banking relationships. Thus the use of multiple banking relationships does not help firms perform better if they are already performing poorly. The authors feel their results suggest that hold-up costs are the main reason for the firms to initiate additional banking relationships early in their life. Hold-up costs comprise the extra rent that a financial institution earns by taking advantage of collecting proprietary information on a borrower in a long relationship. This is referred to as the "hold-up"

problem¹³. This is confirmed in a recent study by Howorth & Moro (2012) where they investigate small Italian firms. They find that interest rates are higher for firms with longer relationships and multiple product relationships – supporting the argument that small firms may be locked into the relationship with a single bank.

Another reason why firms might have multiple banks is because some banks specialize in the type of loans they provide. In this case, a firm might work with one bank to obtain a loan based upon using account receivables as collateral, and another bank to obtain a loan based upon the owner's mortgage as collateral. With founders not having all the collateral needed, these differences in collateral requirements could push new firms to use multiple credit sources so they can obtain additional funds.

In the research stream focusing on multiple creditors, several papers base their reasoning on using multiple credit sources because of the threat of bankruptcy – that managers make decisions to use multiple creditors based upon what might happen if the firm was to default on the debt from the creditors. The threat of bankruptcy due to not being able to service debt from creditors affects managers' decisions to use multiple creditors. The bankruptcy models show that there is a benefit to both firms (borrowers) and creditors, suggesting that multiple creditors solve the moral hazard problem between creditor and borrower. The motive for the borrower to default is overcome since it is harder to renegotiate with multiple sources. The papers have modeled multiple creditor problems based upon a borrower voluntarily or involuntarily going into default (Bergman & Callen, 1991; Bisin & Rampini, 2006; P. Bolton & Scharfstein, 1996; Bris & Welch, 2005; Hackbarth et al., 2007; Rajan, 1992; von Thadden, Berglof, & Roland, 2010; Winton, 1995).

¹³ See Rajan (1992) and Sharpe (1990) for more about the “hold-up” problem.

Bris & Welch (2005) also examine the coordination problem between multiple creditors in ex-post negotiations. They discuss that such negotiations are inefficient, but that free-riding due to using multiple creditors reduces the incentives for such wasteful activities. Their view is that dispersed creditors are unable to be proactive as a group since they are not able to easily and cost effectively coordinate with one another. In their model, an entrepreneur who decides to use multiple credit sources assures himself / herself of better bargaining ability against the creditors if the firm falls into financial distress. However an entrepreneur who selects to use only one credit source is forced to negotiate extensively with that one creditor and this one creditor will be relatively more successful in enforcing its claim. The resulting model suggests that using fewer creditors ends up being worse for entrepreneurs in financial distress, while fewer creditors means more collection efforts, costs, and waste for creditors. Thus, there is an incentive for both the entrepreneur and the creditor to have multiple creditors involved in funding a business.

Bisin & Rampini (2006) study the role of bankruptcy when borrowers can enter into multiple credit relationships with non-exclusive contracts and when creditors cannot observe one another. Bankruptcy laws inhibit entrepreneurs from using multiple creditors since the laws enable the enforcement of a primary creditor's claim to any assets that the entrepreneur has above the bankruptcy protection level. Therefore, bankruptcy restricts the number of creditors available to firms in the secondary market when assuming banks are the only creditors. However, bankruptcy laws might not be a perfect substitute for enforceability of exclusive contracts. Their model suggests that secondary markets do not have to include additional banks, but can include credit cards, loans from friends and family, and other non-bank financial institutions that do not require collateral and are thus unsecured creditors.

Unlike the other papers on bankruptcy, the Bisin & Rampini (2006) model incorporates the entrepreneur and thus is not contingent on the firm being large or established.

Von Thadden et al (2010) use an optimal contracting framework with imperfect negotiation to model the use of multiple creditors. They show that having multiple creditors will increase a firm's access to debt while also increasing its incentive to default strategically. Their findings support having bankruptcy rules that protect creditors, because without the bankruptcy rules, firms would use multiple creditors unethically as default would be in their best interest.

Hackbarth et al (2007) examine continuous-time models¹⁴ of debt renegotiation due to the possibility of bankruptcy. They extend the model of Hege & Mella-Barral (2005) to include both market and bank debt. Market debt is made up of bonds that are financial facilities that are issued to public – thus, market debt can be considered public debt. Bank debt can be costlessly and efficiently renegotiated. Since market debt is offered to numerous entities, it is not costlessly and efficiently renegotiated¹⁵. Therefore, firms would want to only contract bank debt. However, the amount of bank debt that a firm can obtain is limited to the firm's collateral. In order to increase the debt capacity of the firm, the model shows that a firm will have multiple creditors in the form of market and bank debt. Although market debt is usually not available to new and small firms, Hackbarth et al (2007) provide another example why firms use multiple credit sources.

Most of the studies mentioned above assume firms are large or are established. Large and established firms are different than new firms, in that they latter experience greater

¹⁴ Continuous-time models are models in which the “system” is constantly changing over time. Such models are often described by a set of linear differential equations. Continuous-time models have an advantage over discrete time models in that they are friendlier to mathematical manipulation.

¹⁵ Bank debt also ends up having a senior priority over market debt (e.g. Welch, 1997).

information asymmetry with external funders due to various reasons (as mentioned earlier). Higher information asymmetry possibly leads to credit rationing of new firms. Established firms are more readily able to tap into debt markets and thus it is by choice that they do so. In contrast, new firms are limited in their access to debt markets, and there are fewer and smaller credit sources available. In addition, they need additional funds to get started and to initially survive. Established firms do not have this issue.

Studies also show small and young firms use multiple credit sources, but borrowing patterns of small and young firms reveal a complex picture. In the 1993 and 1998 Survey of Small Business Finances (SSBF), around 50% of the firms borrowed from multiple creditors, and firms borrowed different amounts from different creditors (SSBF). For example, using the SSBF, Guiso & Minetti (2010) find that for firms with two credit sources, the largest credit source provides 76.5% of the total credit. For firms with three credit sources, the largest creditor provides 65.1% of the total credit. Therefore, even when using multiple credit sources, there is one main credit source that provides the majority of the credit in terms of dollar amount. The dollar amount is not evenly spread across credit sources used. The additional credit sources fill the difference in terms of the total funds needed by the firm. When using the entire SSBF data set, the firms are not young firms since the average age of the firms is 17.6 years (Ang, R. A. Cole, & Lin, 2000). Guiso & Minetti (2010) use the entire data set along with sub-samples of the SSBF, all of which have firms that have an average age of approximately 15 years. Thus, these are not new firms, but are small firms of all ages in the analysis performed by Guiso & Minetti (2010).

Berger & Udell (1998) find that one-third of the firms in their sample of small firms use more than one financing institution and the firms tend to stay with their current financial

institution an average of 6.64 years (supporting relationship-based lending, as opposed to transaction-based lending¹⁶). However, the authors do not examine the data based upon age, i.e. they do not report if older or newer firms use a different number of credit sources or not. Although they do break out the sample into other categories based upon age, they combine the entire sample into one group when examining the number of financing institutions small firms use. It could be that older firms dominate this figure and as the firm ages it tends to move to one financing source.

Petersen & Rajan (1994) were one of the first to examine the benefits of multiple lending relationships by small firms. They examine how the relationships between a firm and its creditors affect the availability of funds for small firms, as well as the cost of funds for small firms. They find that the primary benefit of having multiple banking relationships is to increase the availability of financing, and not to decrease the financing costs. If offered the choice, firms prefer more credit rather than cheaper credit. They use data from the Survey of Small Business Finances (SSBF), where small firms are defined as those having less than 500 employees. The 3,404 firms in their sample have a median age of 10 years, with a median size of book assets of \$130,000 and median sales of \$300,000. The firms in their sample borrow about 50% of their debt from banks, with 26% coming from the firm's owners and their families. They suggest there is a "pecking order" of borrowing by new firms, with the closest sources being used first (e.g. family) and then moving to lenders that are more at arm's length. They do break up their sample by both size (book value of assets) and age (< 2 years old, 2-5 years old, 5-10 years old, and 3 other categories). They find that 18% of the firms in their sample borrow from more than one bank. Their results also suggest

¹⁶ Relationship-based banking is when bank managers base their decision to provide credit on their relationship with the borrower; whereas, transaction-based banking is when bank managers base their decision to provide credit solely on the financial situation (figures) of the borrower.

that using more than one bank increases the firm's cost of financing, as the interest rate increases by 31 basis points for each additional bank that a firm borrows from. These results go against the rationale for the "hold-up" problem related to single banking relationships. It could be that the number of banks is a proxy for the firm's quality, i.e. lower quality firms are unable to borrow additional money from their first bank, and thus must approach other banks for additional capital. Therefore, the unwillingness of the first bank to extend the firm additional credit could be a signal of the firm's quality. In contrast, they find that increasing the number of non-bank financial institutions that a firm borrows from has no effect on the firm's borrowing interest rate with banks¹⁷.

Cole (2011) uses multiple instances of the SSBF and finds 60-70% of the firms in the SSBF have multiple relationships with financial institutions. The average number of relationships that firms have with financial institutions is 2.4 in 2003. 25% of the firms have multiple bank relationships, with the average being 1.3. In addition, 6-12% of the firms have no relationships with banks, and around 50% have no relationships with non-bank financial institutions. Credit card usage increases from 54% in 1993 to 78% in 2003. The percentage of firms that do not pay off their credit card balance each month increases from 13% in 1993 to 23% in 2003. In addition, the use of trade credit declines from 83% in 1987 to 61% in 2003.

Vos et al (2007) find that 25% of the firms in their sample use five or more types of financing (out of 26 options in their survey): 50.8% - line of credit, 30.6% - personal savings, 29.5% - bank loans, 28.5% - retained earnings, 25.5% - credit cards - these are the

¹⁷ With non-bank financial institutions having higher average interest rates than banks, it could be the case that even after seeing the lowering effect of the interest rates with non-bank financial institutions and an increase in the interest rate offered by banks due to multiple relationships, banks still have a lower interest rate than non-bank financial institutions.

main types of financing used. In their study, only a limited number of firms use financing from informal sources such as family (8.4%) and friends (3.1%). The use of venture capital (0.8%) and angel (0.7%) funding is used even less. They examine small and medium-sized firms in the United Kingdom and the United States (using the 1998 SSBF). The 44% of the firms in the United Kingdom sample were 5 years old or less.

The use of multiple credit cards is an option for new firms to use (Scott III, 2009). With new firms often obtaining less funding from formal credit sources because they are considered risky by most banks (Berger & Udell, 1998; Colombo & Grilli, 2007), credit cards are a popular form of borrowing among new firms (J. D. Cole et al., 2005). This is especially the case during times of tight credit (National Small Business Association, 2009). With credit card institutions using simple and automated application processes, credit cards are one of the easiest means for firms to obtain credit. However, credit card institutions put strict limits on the amount of credit which a firm can borrow, which is a small amount relative to the needs of the firm and what banks loan to firms. Thus, if a firm is going to use credit cards, they don't use just one credit card. Rather, they use multiple credit cards to try to obtain any sizeable financing from this source. And, if firms don't repay their outstanding balance on time, this can be very costly as the interest rates for credit cards can be high compared to other sources of credit. In addition, credit card institutions charge much higher interest rates for cash advances compared to purchases of products and services. This pushes firms to use credit cards mainly for purchasing products and services specific to their operations. New firms use other funding sources to pay for expenses that require cash payment, such as payroll, since it would be very expensive to use credit cards to fund such expenses.

Multiple Credit Source Usage and New Firm Performance

New firms have limited financial capital and tap into external funding sources, including creditors. They are limited with their access and are only able to tap into a limited number of options initially. However, as their needs start to materialize, they likely require additional funds. They turn to banks for these funds initially. But with the possibility of credit rationing due to high information asymmetry issues associated with new firms (Stiglitz & Weiss, 1981), new firms explore the use of multiple credit sources. Securing credit from any source could possibly relax financial constraints on investment for a new firm. By securing credit from one source, new firms should have a higher probability of survival and growth. However, as shown, there are mixed results in how an individual credit source affects survival and growth of new firms. Alternative credit sources tend to be a more expensive option of external funding for new firms than bank loans (e.g. Bonfim, Dai, & Franco, 2008; Danielson & Scott, 2004; Huyghebaert & Van de Gucht, 2007; Rajan, 1992; Sharpe, 1990). In addition, these alternative credit sources tend to provide smaller amounts of credit. The small amount of additional credit could satisfy the capital needs of new firms. However, the use of multiple credit sources by new firms (as opposed to a single source) might be needed for them to survive longer and possibly grow. The past studies imply that multiple credit sources can affect performance, but none of them address how the use of multiple credit sources affects the performance of new firms.

Entrepreneurship research suggests that new firms may continue to survive even when rationed credit, since the founders who start new firms tend to be persistent (Astebro, 2003; e.g. Cardon et al., 2005; Gimeno et al., 1997; P. Gompers et al., 2010; Hamilton, 2000; Sexton & Bowman-Upton, 1991), persevere longer than rationally thought (M. W. Meyer & Zucker, 1989; D. A. Shepherd et al., 2009; Van Witteloostuijn, 1998), and are resourceful

(Baker & R. E. Nelson, 2005). Entrepreneurs typically have most of their personal wealth tied up in their firm. This signals they have a high degree of commitment or emotional investment in the outcome. Hamilton (2000) shows that even when controlling for many characteristics, founders enter and persist in their firms despite having lower initial earnings and lower earnings growth than if they were in paid employment. Moskowitz & Vissing-Jorgensen (2002) find similar results with family firms. They find the return on family firms is no better than on public equity, but the risk is far greater. And finally, when examining innovative firms, Astebro (2003) finds that independent inventors are often committed to unprofitable firms. Many of the inventors persisted in trying to bring their ideas to market despite being advised their venture had a low probability of making money. Persistence can be beneficial as entrepreneurial returns are only realized after a long delay (Hamilton, 2000). Moreover, entrepreneurs need to persist (survive) to be able to capitalize on the financial benefits of starting and operating one's own firm. As well, one does not find out if he/she is good at running one's own firm until after sometime since entrepreneurship is a "learning experiment" (Jovanovic, 1982a).

As for the effects of multiple credit sources usage on firm performance, the results are mixed. Degryse & Ongena (2001) find a negative relationship between the number of banking relationships and firm profitability using Norwegian data; whereas, Weinstein & Yafeh (1998) find a positive relationship between the same two variables using Japanese data. Castelli, Dwyer, & Hasan (2010) further this line of research by studying Italian firms in which they find a negative relationship between the number of banking relationships and both return on equity and return on assets, with the relationship being stronger for smaller firms.

It is difficult to predict the survival and growth of new firms when they use non-bank credit sources (Astebro & I. Bernhardt, 2003), and even more difficult to predict survival and growth rates when examining multiple credit source usage. We cannot say ex-ante if having non-bank credit sources will have a greater effect on survival and growth of a firm. A loan obtained from family and friends may be a poor signal of business credibility. However, family and friends have better knowledge of personal characteristics of the founders than other credit sources.

Debt and use of multiple credit sources can lead to growth of a firm. This is supported by the finding in Huyghebaert & Van de Gucht (2004). Their first finding is that firms in high growth industries have higher bank debt usage as a percentage of total external financing. Using a data set of new firms in Belgium, the proportion of debt as it relates to the total amount of funding is significantly larger for firms in industries with higher historical growth rates. These industries may be increasing in the number of firms and not necessarily increasing in firm size. However, they also find a positive relationship between growth and debt (Huyghebaert & Van de Gucht, 2007). Houston & James (1996) also find support for this when firms have multiple bank relationships when examining large publicly traded firms. This suggests that debt and the use of multiple credit sources can be used to promote growth of new firms.

An obvious benefit to new firms is access to additional funds. For example, Cole (2011) finds that leverage increases with number of bank relationships, supporting the idea that as more banks provide credit to firms, the more credit firms are able to use in their operations. These additional funds could improve the performance of new firms.

If new firms use multiple credit sources because of capital constraints, then using multiple credit sources could help firms grow. Binks & Ennew (1996) examine the use of financing constraints on growing firms. With a survey of over 6,000 firms in the United Kingdom, they find that firms that expect to grow in the future have the perception that they are under tight credit constraints. If new firms feel they are under tight credit constraints, then they are constantly trying to expand their access to additional credit. Trying to expand access to additional credit would suggest these firms would try to use additional credit sources to expand access to additional credit.

Relationship banking is a key aspect in banking research, and has mixed results in terms of the relationship between number of banking relationships and firm performance. A close relationship between a bank and firm can reduce information asymmetries and thus improve the firm's access to credit and save on transaction and negotiation costs. Banks acquire information about a firm over the course of the relationship (e.g. Lummer & McConnell, 1989; M. A. Petersen & Rajan, 1994). Creditors use this information garnered from closer relationships to set contractual terms (Berger & Udell, 1995). The longer the relationship a firm has with a bank tends to lead to more access to credit from the bank at lower interest rates (Boot & Thakor, 1994; M. A. Petersen & Rajan, 1994, 1995). A decrease in the information asymmetry in the relationship between lender and firm and better access to credit due to the closer relationship between the two parties would suggest using one credit source because a close relationship with that credit source could reduce the threat of credit rationing by that source. In other words, a closer relationship would lead to the firm being able to borrow as much as they need from the lender. This is using the reasoning used by Stiglitz & Weiss (1981), where information asymmetry is the cause of credit rationing.

A counter argument exists that a long-term relationship between a bank and a firm allows the bank to exploit the relationship. The bank has the most information about the firm and the firm is then unable to convey information about its quality to other banks quickly to strike another relationship (Sharpe, 1990). This is referred as the “hold-up problem” in the finance literature. Examining 18,000 bank loans to small Belgian firms, Degryse & Van Cayseele (2000) find support that the interest rate increases as the duration of the bank-firm relationship increases even when the collateral requirements decrease over the course of the relationship. In their study, interest rates only decrease when the borrower purchases more than one credit instrument from the bank (e.g. multiple loans, or a loan and a line of credit). The hold-up problem is a large issue for growth firms as they are stretched thin financially, living from one day to the next in many cases. This is further supported with research that indicates that successful firms don’t want to be held hostage to the risk of a creditor going bankrupt (e.g. Detragiache et al., 2000).

In a study examining the link between internal financing and firm growth, G. W. Haynes & J. R. Brown (2009) discover that small growth firms are more likely to have more lines of credit, motor vehicle loans, capital leases, equipment loans, and loans from both bank and non-bank financial institutions than non-growth firms.

The financial growth cycle theory says, in summary, that as a firm ages and grows, more information is available about the firm which leads to the less information asymmetry between external funders and the firm (borrower). Less information asymmetry results in the new firm having the ability to obtain funds from multiple credit sources if it chooses to do so. This is the scenario that is implicitly depicted in Berger & Udell's (1998) financial growth theory. Figure 1 on page 623 of their article, and which is provided herein as Figure 1,

suggests that new firms are able to obtain different types of financing as they age. Through the paper, the authors discuss how firms can use different funding sources, but not necessarily at the same time. However, when looking at their Figure 1, one can see overlapping bars that indicate the firms might use multiple types of financing instruments at any given time. They however don't breakout the funding based upon the sources of credit. They do break out the funding sources based upon equity sources (venture capital, angels, and insiders). I have illustrated there are various credit sources that are important to understand and understand how they can be used simultaneously, which can be considered an extension of the finance growth theory.

Figure 1: Berger and Udell's "Firm Continuum and Sources of Finance"

Potential lenders are more likely to extend credit to small firms if they have performed a transaction with the small firm or founder / owner in the past (R. A. Cole, 1998) and borrowers that use debt once tend to use more debt over time (Vanacker & Manigart, 2006). Using the 1993 SSBF, Cole (1998) examines the pre-existing relationships between a firm and its potential lender to determine the effects of that relationship on obtaining further credit. He finds that a pre-existing relationship is helpful in obtaining further credit from that same creditor. This follows on the idea that lenders perceive follow-up loans to be less risky when past transactions are successful as the business is considered to be viable and

trustworthy (Diamond, 1991b). Thus, as the new firm ages, it is not required to look outside of pre-existing credit relationships to obtain additional funds if the borrower growth rate doesn't require more funds than can be provided by the existing creditors. In other words, more credit options become available as the firm ages; however, if the firm doesn't want to grow and rather wants to be stable, the use of multiple credit sources should level off at some point in time.

Vanacker & Manigart (2006) find that firms that previously issued external financing are more likely to do so in the future. They also find that firms that issue debt are more likely to issue debt in the future. This suggests a learning or information effect. New firms that access multiple credit sources get used to doing so or once a new firm is comfortable with one type of credit source they use that same credit source multiple times (e.g. multiple bank loans or multiple credit cards).

The theory of debt structure presented by Bolton & Scharfstein (1996), their theory of debt structure shows there is an optimal number of credit sources between using one or two credit sources. In their model, having two creditors can increase firm value because of increased bargaining pressure in strategic default by the borrower. On the other hand, having two creditors can decrease firm value because of less efficient continuation choices in liquidity default. What emerges is an optimal number of creditors that is based upon the trade-off between these two tendencies. In addition, the search cost for finding a new bank can stop firms from obtaining multiple banking relationships (N. R. Blackwell & Santomero, 1982). This results in a hold-up problem that could restrict firms from adding another banking relationship.

Firms that continue to survive are able to pay off their debt with cash flow and require less external funds. For example, Cole (2011) finds that book-value leverage (total loans / total assets) is negatively related with age for small, privately-held firms. Thus, as a firm ages, the less leverage it uses relative to its total assets. Therefore there may be less of a need for using multiple credit sources.

Credit sources other than banks can be more costly. Loans from non-bank financial institutions, credit cards from credit card institutions, and trade finance tend to have higher interest rates¹⁸. Hence, if a firm uses these non-bank credit sources, the financing costs could actually be higher. Danielson & Scott (2004) and Huyghebaert & Van de Gucht (2007) find that non-bank credit sources are more expensive. Danielson & Scott (2004) use the 1995 Credit, Banks, and Small Business Survey (CBSBS) which focuses on small, privately owned firm and is conducted by the National Federation of Independent Businesses (NFIB) with their 600,000 members at the time the surveys were conducted in 1980, 1982, 1984, 1987, and 1995. Unlike the SSBF, which is used by Petersen & Rajan (1994, 1997) and uses detailed balance sheet and profit/loss information, the CBSBS asks the firms to provide the categories that best fit their firm (self-reports and Likert scales). Their study focuses on understanding whether the availability of bank loans affects trade credit and credit card demand¹⁹. Their main finding is that firms increase their demand for trade credit and credit card debt when faced with credit constraints, and they conclude that there is a “pecking order” within debt financing where firms increase their demand of potentially expensive credit sources when banks will not lend to them. Their study is focused on determining if

¹⁸ Credit cards and trade financing usually have higher interest rates than other types of credit sources. However, the cost is only higher to borrowers if they do not pay on time.

¹⁹ The NFIB CBSBS survey asks respondents about possible problems with financial institutions, sources of funding, current bank funding, outcome of most recent loan request, and more. See Dunkelberg (1998) for a more detailed description of the CBSBS survey.

credit limits on small firms by banks increase the reliance on trade credit and credit card debt. Huyghebaert & Van de Gucht (2007) find that new firms with high adverse selection and risk shifting problems use less bank debt and compensate for this by using other credit sources, such as leasing and trade credit. Firms in growth industries are not able to use alternative credit sources to fully compensate for the lack of access to bank debt.

Huyghebaert & Van de Gucht (2007) use a data set of 244 manufacturing firms incorporated in Belgium. However, they also find that trade credit and credit card debt are more expensive than bank credit.

Banks may be eager to build a relationship with new firms that have the potential to grow. By establishing a relationship with the firm at an early age, they are hoping that the long-term relationship will pay off in the future. Throughout the relationship, banks hope to obtain private information about the firm to better understand the firm's ability to meet future financial obligations. Such information may allow the bank to lock in the firm as a customer and extract higher interest rates (Degryse & Ongena, 2002). Hence, the banks help new firms get off the ground, but might hinder their growth if the banks try to subsequently extract higher interest rates.

Studies presented herein suggest that the general population of new, young, and small firms are credit rationed by banks, but banks are the first to be approached by these firms when deciding to borrow. Banks are the most frequently used source of credit by new firms, even though entrepreneurs don't trust banks. A firm's propensity to borrow decreases with age, and bank borrowing becomes less important as the firm ages. However, if the firm grows in size, borrowing may become necessary to finance the acquisition of fixed assets and

fund working capital. Access to additional funds could be gained through using alternative and multiple credit sources.

New firms usually require more resources as they grow, emerge, and mature (H. E. Aldrich & Ruef, 2006; Greiner, 1972). If they are able to access multiple credit sources during their early years of existence, it would be logical that new firms continue to utilize more credit sources as they come available over time for the purpose of obtaining additional funds. Over time, new firms start to mature and accumulate assets on the balance sheet against which they can borrow (Berger & Udell, 1998). This may provide new firms access to more credit sources. With banks possibly rationing credit (Stiglitz & Weiss, 1981), new firms have to look elsewhere for adequate amounts of funds. Firms will try to exhaust their debt options first before tapping into equity options (Myers & Majluf, 1984; Myers, 1984). New firms can leverage the positive signal of a bank loan to obtain more debt from multiple credit sources since banks produce valuable information about new firms (James, 1987; Lummer & McConnell, 1989; Shockley & Thakor, 1997). This would possibly suggest that as new firms age they start to leverage their bank relationship to obtain additional funds from additional sources, possibly other credit sources.

Theory of Resourceful Financing Using Multiple Credit Sources

The previous sections in this chapter each provided a building block for the theory of resourceful financing by using multiple credit sources, specifically for new firms. A summary of the theory, which is based upon the capital constraints argument, is as follows.

As shown in the chapter, considerable (but not all) research indicates that new firms face financial constraints. New firms are thus often required (or need) to obtain funds from external sources if they are to survive and possibly grow. The external sources of funding include debt and equity. Debt is one of the first sizeable sources of external funding by new

firms, in particular debt from banks. However, due to a large amount of information asymmetry prevalent in the relationship between banks and new firms, banks may ration credit to new firms and thus don't provide any or all of the necessary funds needed to operate a positive new present value project (and there are specific sets of assumptions that are sufficient to theoretically result in credit rationing, and there are empirical studies that show that credit rationing does occur). Type I credit rationing occurs when banks provide only a portion of the required funds to the borrower. With Type I credit rationing prevalent with new firms, they are not able to obtain all of the necessary funds from one bank. They need additional funds to continue to survive and possibly grow. According to the pecking order theory (which, along with credit rationing theory, is based upon information asymmetry reasoning), new firms will exhaust their other credit options first before looking for funds via equity. In addition, entrepreneurs favor debt over equity because they do not want to share the upside with equity investors and don't trust banks. Thus, new firms possibly evaluate other credit sources. To obtain additional funds they can access non-bank financial institutions, government, other businesses, owners, employees, family, friends, and other individuals. However, non-bank financial institutions operate in conjunction with banks over time. In addition, credit card institutions don't provide a large amount of funds even though it is generally quite easy to obtain funds from them. Family and friends offer funds, but may be financially constrained themselves and possibly hold back the firm from reaching its potential. However, family and friends will generally not push a firm into bankruptcy as formal credits would do when the firm faces financial distress. None of these individual credit sources provide all the necessary funds needed to survive and possibly grow. However, according to the financial growth cycle theory, new firms provide more

information to external funding sources as they age and grow and thus are possibly able to use multiple credit sources at the same time. This resourceful activity of using multiple credit sources would enable the new firm to obtain additional funds. With additional funds associated with higher survival and growth rates, being resourceful in financing by using multiple credit sources should lead to higher survival and growth rates.

Thus, I hypothesize the following:

Hypothesis 1: For new firms, being resourceful in financing by using multiple credit sources is positively associated with survival

Hypothesis 2: For new firms, being resourceful in financing by using multiple credit sources is positively associated with growth

Figure 2 depicts the hypothesized model:

Figure 2: Hypothesized Model

Assumptions and Boundary Conditions

In my theory, I use arguments that refer to financial constraints, credit rationing theory, pecking order theory, and financial growth cycle theory. Each of these theories has

assumptions upon which the arguments hold true. These assumptions also apply to my theory of resourceful financing. For credit rationing to exist, there is a market assumption that says that credit rationing in the market place exists due to information asymmetry and it is Type I credit rationing (not Type II credit rationing²⁰). Thus, firms are able to obtain partial funding from credit sources rather than no funding from credit sources. The financial growth cycle theory assumes that the available credit sources are banks, non-bank financial institutions, credit card institutions, other businesses, government, owners, employees, family, and other individuals (Berger & Udell, 1998). Other types of credit sources, such as corporate bonds, are not available to new firms until they become older and larger. Contrary to the financial growth cycle theory, I don't include trade financing in the theory as trade financing is operational funding and represents spontaneous funding that might or might not be costly.

Specific to my theory, it is assumed that new firms need external financing and that new firms want to survive and grow. This is supported by financial constraints studies, such as Evans and Jovanovic (1989), Evans and Leighton (1989), Holtz-Eakin, et al (1994a), and Lindh and Ohlsson (1996). If new firms do not need external financing, then there is not a financial constraint on the firms. Thus, the first argument of my theory falls apart. In addition, for my theory to hold, new firms need to want to survive and grow. If new firms don't want to survive or grow, then the reasoning behind obtaining additional funds through multiple credit sources takes on a different meaning. Rather than focusing on using external funds to improve performance, the new firms might obtain money for the sake of obtaining additional funds with no intention to improve performance.

²⁰ If Type II credit rationing was assumed to exist only, new firms would not be able to obtain any funds from any credit source and thus would never be able to use multiple credit sources.

Another assumption specific to my theory is that borrowers self select whom they will borrow from but not how much they will borrow from each creditor. From the founder's perspective, founders make the decision they want to make. Borrowers self-select their financing rather than being selected by the lender (Cressy, 1996b). However, borrowers don't select how much each credit source will provide them. Borrowers wish to obtain the most credit they can get based upon their need and at the lowest cost. Thus, lenders select how much is lent to the borrowers, which allows credit rationing to exist. This is unlike Cressy's (1996b) argument where borrowers self-selected lenders AND how much they can borrow. If this is the case, then credit rationing would not exist. Finally, other market variables are assumed to not influence the decision of the founders (e.g. supply of credit, legal environment, etc.).

A boundary constraint for my theory is that it applies to only new firms (and young firms as new firms only stay new for a short period of time). Established firms are different from new firms in relationship to my theory as established firms exhibit less information asymmetry and thus should not experience credit rationing, or at least experience much less credit rationing.

CHAPTER 3

RESEARCH METHODS AND DATA

In this study, I examine the resourceful financing decisions of using multiple credit sources by new firms and try to determine the effects of such financing decisions on new venture survival and growth. In Chapter 2, I built the theory to explain why being resourceful by using multiple credit sources possibly leads to additional funds and thus is positively associated with survival and growth of new firms. Testable hypotheses were developed as a result of the theory development. To test these hypotheses, I perform a longitudinal study as new firms change rapidly (Davidsson et al., 2001; Low & MacMillan, 1988) and capital structure is dynamic (Berger & Udell, 1998; J. Lee & Zhang, 2010; Vos et al., 2007).

A longitudinal study offers the best means to test the hypotheses and thus answer the research questions posed in this study. Past studies have used cross-sectional data to examine the financing of new and young firms. Using cross-sectional data would allow me to examine multiple credit usage in a given year. However, cross-sectional data alone would not provide a full understanding of how new firms change their usage of credit sources over time, which could affect their survival and growth. As mentioned earlier, the capital structure of firms is evolutionary in nature, especially for new firms where the organization can evolve quickly. Entrepreneurship research, the study of the emergence of new ventures (Davidsson, 2004), involves a process. A process cannot be examined effectively with a

snapshot in time or by static comparisons of a beginning state and an end state. Many things can happen in a new venture between the two states. In addition, a cross-sectional study would suffer from endogeneity issues due to reverse causality – performance could affect multiple credit usage rather than multiple credit usage affecting performance. A longitudinal study helps mitigate, not eliminate, this endogeneity effect²¹.

Another benefit of using longitudinal data is to be able to overcome retrospective bias, as founders of the firms answer questions shortly after the completion of the year to which the questions pertain. In addition, survival bias is overcome as a panel of firms started in the same year is tracked from their first year of existence until they close or the data collection is stopped, whichever comes first. Only a few relevant studies on new firms have been able to overcome survival bias (e.g. Cassar, 2004; Huyghebaert & Van de Gucht, 2007; S. N. Kaplan, Sensoy, & Stromberg, 2009). Thus, I use longitudinal data consisting of six years of data from new firms to answer the research questions posed in this study and test the hypotheses.

Data

The data set for this study is the private version of the Kauffman Firm Survey (KFS), which is a longitudinal survey conducted by the Ewing Marion Kauffman Foundation. Access to the data set is via the National Opinion Research Center's (NORC) secure data enclave server, where the data is stored and analyses are performed.

²¹ I am referring to the endogeneity issue that pertains to reverse causality, which the longitudinal nature of the study addresses. Omitted variable bias is another cause of endogeneity, and is not addressed by the longitudinal nature of the study. Omitted variable bias occurs when statistical analysis leaves out one or more important causal variable. The statistical analysis compensates for the missing variable or variables by over or under estimating one of the other variables in the analysis, causing a bias in the results. In regression analysis, this is mathematically seen when the error term of the linear regression formula is correlated with one or more of the covariates in the formula. I address the endogeneity issue caused by omitted variable bias later in the study.

The level of analysis in this study is the firm, which has become more commonly used in entrepreneurship research in the last two decades (Davidsson & Wiklund, 2001; Ireland, Reutzel, & J. W. Webb, 2005). As such, the data are based upon firm level while the actual respondents are the founders of the firms. The founders provide information about the firm in their responses. Even though the primary level of analysis is the firm, this is not to be confused with the 3-level analysis that is performed in the multi-level statistical method (level-1 = time, level-2 = firm, level-3 = location; which will be explained later in the study).

For the Kauffman Firm Survey (KFS), 32,469 firms were randomly sampled from Dun and Bradstreet's database of roughly 250,000 firms that started in 2004 in the United States²². A firm was deemed a firm that started in 2004 if at least one of the following activities had been performed in 2004 and none of the activities performed in a prior year:

- Payment of state unemployment taxes
- Payment of Federal Insurance Contributions Act (FICA) taxes
- Presence of a legal status for the business (incorporation)
- Use of an Employer Identification Number (EIN)
- Use of Schedule C to report income on a personal tax return

17,258 firms were screened for eligibility that resulted in the identification of 6,030 eligible firms (DesRoches, Mulcahy, Robb, & Shane, 2008). The sample excluded non-profit firms, firms owned by existing firms, and firms inherited from another individual, and oversampled high technology firms²³. The KFS research team initially interviewed founders of the 4,928 firms between July 2005 and July 2006, representing a response rate of 43% from the

²² The United States Small Business Association (SBA) recorded 628,917 firm births in the USA in 2004 (SBA, 2007: 309). Hence, the Dun and Bradstreet database does not include all of the firms that are started in a given year.

²³ High technology is based upon the intensity of research and development employment in a firm's primary industry(or industries).

original sampling frame after the sampling weights were applied (Ballou et al., 2007). These firms were then surveyed on an annual basis thereafter. This study uses data through 2009, which is the latest data available at the time this study was initiated²⁴. The mode of data collection consisted of computer assisted telephone interviews (CATI), Internet, and mail. Respondents were paid \$50 to complete each instance of the survey. Table 2 indicates the timeframe of the data collection for each year.

Table 2: Data Collection Timeframe

Survey	Year	Fiscal Period of Business Operations	Start of Data Collection	End of Data Collection
Baseline	Year 1 (2004)	Jan-2004 through Dec-2004	Jun-2005	Jul-2006
First Follow-up	Year 2 (2005)	Jan-2005 through Dec-2005	Jun-2006	Jan-2007
Second Follow-up	Year 3 (2006)	Jan-2006 through Dec-2006	May-2007	Dec-2007
Third Follow-up	Year 4 (2007)	Jan-2007 through Dec-2007	May-2008	Dec-2008
Fourth Follow-up	Year 5 (2008)	Jan-2008 through Dec-2008	May-2009	Dec-2009
Fifth Follow-up	Year 6 (2009)	Jan-2009 through Dec-2009	May-2010	Dec-2010

Six data points are used for each firm, representing six years of data. Six is an important number of years to examine as most studies on failure of new firms use six years or less (e.g. Bruderl et al., 1992; Cressy, 2006b; Evans, 1987a, 1987b; Mata & Portugal, 1994; Phillips & Kirchhoff, 1989), and one of the areas of focus for this study is survival. Bruderl et al. (1992) find that 24% of a cohort of new firms in Germany cease operations within two years, and 37% cease within five years. Cressy (1996b) finds that a cohort of new firms in the U.K. had 45% cease operations within 2.5 years and 80% within six years. And Mata & Portugal (1994) see 20% of their sample of new Portuguese firms die in the first year and 50% by year four. In the USA, Phillips & Kirchhoff (1989) find 66% of new firms cease operations within six years. In addition, researchers find USA technology-based firms have

²⁴ Data will be collected for 2010 and 2011 to complete eight years of data collection for the Kauffman Firm Survey. However, that data is not available at the time this study was started.

an even lower survival rate, with 64% of firms established between 1991 and 2000 closing within four years and 88% closing within five years (Song, Podoynitsyna, Van Der Bij, & Halman, 2008). The longest period of time these studies used is six years. Thus, I use six years in my study to define new firms²⁵.

In response to the Kauffman Foundation's interest in understanding the dynamics of high-technology, medium-technology, and woman-owned businesses, the KFS is a stratified sample based on industrial technology level (High-Tech, Medium-Tech, and Non-Tech) and gender that oversamples firms in high and medium tech industries (given a higher selection probability). Thus, weights in the KFS are used to correct for sample design (over-sampling), and for non-response bias. Oversampling a key population subgroup in survey data in response to the small size of that subgroup or for a special interest in that subgroup is a common practice in policy making surveys.

Meanwhile, a major drawback of longitudinal data is sample attrition. As a result of sample attrition respondents might drop out from the sample prior to the completion of the study, thus reducing the sample size in later waves or producing an unbalanced panel. An examination of the longitudinal response rates of the KFS indicates that considerable effort was made to reduce the impact of sample attrition; the longitudinal response rates across the six surveys is 66.9% (out of the 4,928 firms in the baseline, 3,297 are longitudinal respondents in fifth Follow-Up Survey – year 2009).

To create the sample to be used in the analysis, I first construct the longitudinal population from the KFS data set. This will ensure I am performing a true longitudinal study with panel data. The longitudinal population includes all firms in the baseline survey that:

²⁵ It could be argued that I am examining new and young firms. However, for simplistic purposes, I label firms six years and younger as new firms rather than saying new and young firms throughout the document.

1) responded in the first, second, third, fourth, and fifth follow-up surveys, 2) responded in every follow-up from the first follow-up up to the follow-up when they permanently stopped operations or sold or merged, and 3) responded to every follow-up from the first follow-up up to the fifth follow-up and report that they have temporarily stopped operations in the fifth follow-up survey. In other words, the longitudinal population includes firms that responded to the survey when they are alive. Out of the 4,928 firms in the baseline survey, 3,297 firms fit the criteria. Thus, 1,631 firms are removed due to dropping out of the longitudinal population. Table 3 shows the number of firms that dropped out of the longitudinal population each year.

Table 3: Longitudinal Population

	<u># of Firms</u>	
Initial sample in 2004	4,928	
Non-response in 2005	561	11.4%
Non-response in 2006	389	7.9%
Non-response in 2007	332	6.7%
Non-response in 2008	227	4.6%
Non-response in 2009	122	2.5%
Longitudinal population	3,297	66.9%

I then remove the observations of firms that are not started as a new independent business, with zero capital in year one, no founding team members, missing data in the credit source variables, didn't use credit within six years, sold or merged, and outliers and those with obvious incorrect data entry. Firms that are purchased as an existing business, purchased as an existing franchise, or are started by means other than from scratch are excluded. These firms have an advantage over new independent firms in terms of survival and growth. In effect, they have a head-start on new firms by owning assets and generating

revenue and profit from the start, and thus should not be considered new firms. This criterion entails removing 217 firms. I exclude firms that are not started for business reasons and thus companies that would possibly not be reasonable candidates for business-related debt. Some firms could be started by individuals who file business tax forms to reduce tax liability rather than for business reasons. Thus, in following Astebro & Bernhardt (2003) and Bates (1990), I remove firms that have zero capital at start-up, which is measured by the total amount of assets in year one²⁶. There are 381 firms with zero capital in year one. For the same reasoning, firms that do not have founders are removed from the sample. This results in removing an additional 16 firms. In addition, firms that are sold to another firm or merged with another firm during the six year period of the data set are removed as this represents a positive closure as opposed to a negative closure. When a firm is sold or merged, that firm might be a healthy firm, and I want to determine if multiple credit sources negatively affects the survival rate. A sold business may offer a premium over the liquidation value of the firm. This is the same argument made by Gimeno et al. (1997) when they removed sold companies in their analysis of survival of new firms. A negative closure occurs when the firm stops operations, which represents a negative outcome and thus a failure. A positive closure of a firm is a positive outcome, and thus is not a failed firm. I am interested in equating “non-surviving” with a negative outcome, not a positive outcome. This results in removing 122 firms. Missing data is an issue in statistical analysis, thus firms that have any missing data in their credit source variables (dependent variables in the analysis) in any year are removed. Missing data in a longitudinal study can be due to respondents choosing not to answer a specific question in a given year or due to attrition in the respondents over time. This results

²⁶ Assets include cash, accounts receivables, equipment, land / buildings, vehicles, other owner property, and other miscellaneous assets

in 139 firms being removed²⁷. 756 firms that didn't use any credit during the first six years are also removed. These firms are removed since I am examining credit sources and use a Type I credit rationing argument (Keeton, 1979; Parker, 2009) to partially explain the trend of multiple credit source usage and how that trend affects firm performance. A firm that uses no credit the first six years of its existence does so either by choice or because it may (or may not) be due to Type II credit rationing. Hence, a different explanation is warranted – an explanation which I am not theorizing and am not testing in this study. Finally, 32 observations with incorrect data entry or outliers are removed. Incorrect data entry and outliers are removed by using the *explorer* function in SPSS and through a visual inspection of each variable used in the analyses based upon realistic levels (e.g. one firm indicates it used 50 credit sources, and another firm indicates it has revenue of \$800 million in year three when it's previous and following years of revenue are minuscule). A total of 1,663 firms are removed from the longitudinal population²⁸, leaving 1,634 firms that provide valid responses in the first year (2004) of the survey and these are used in the statistical analysis. Table 4 shows the data sample selection.

²⁷ It is possible for hierarchical linear modeling (HLM) growth curve models, the statistical method used in this study, to handle situations when a firm provides answers to at least two years of credit source variables. However, there are few instances when a surviving firm provided answers to the credit source questions in selective years and not other years. Rather, firms that didn't answer the credit source questions in one year tended to not answer the credit source questions in any of the years.

²⁸ t-tests were performed to compare the firms that were removed from the sample to the firms that were kept in the sample. The variables that were compared were variables used in the main analysis. Some variables are not significantly different, while other variables are. The results of the t-tests are provided in the appendix.

Table 4: Sample Selection

	# of Firms in 2004	
Longitudinal population	3,297	
Firms which are not new independent businesses	217	6.6%
Firms with zero capital in 1 year	381	11.6%
Firms with no founding team members	16	0.5%
Firms that are sold or merged within 6 years	122	3.7%
Firms with missing data in credit source variables	139	4.2%
Firms that didn't use any credit within 6 years	756	22.9%
Outliers / incorrect data entry	32	1.0%
Final sample (n)	1,634	49.6%

Variables, with Descriptive Statistics

This section describes the variables used in the analyses, including the dependent, independent, and control variables. Table 5 is a list of the variables.

Table 5: List of Variables

Survival (6 years)	Age of Founders
Growth	Gender
Revenue (6 years)	Race
Employees (6 years)	Citizenship
Multiple Credit Sources	Technology Level
Number of Total Credit Sources (6 years)	Product / Service
Number of Unique Credit Sources (6 years)	Incorporation (in year 1)
Diversity Index of Credit Sources (6 years)	Commitment to Venture
Number of Founders	Number of Hours Worked in Venture (6 years)
Education of Founders	Founder Contributed Equity (in year 1)
Type of Education of Main Founder	Quality of Business Idea
Work Experience of Founders (overall)	Intellectual Property (any year)
Work Experience of Founders (start-up)	Competitive Advantage over Competitors (any year)
Amount of Outstanding Debt (6 years)	Credit Crisis (6 years)
Amount of New Equity (6 years)	Location

Dependent Variables

The dependent variable for the analysis is performance, which is made up of survival and growth. In the corporate finance literature, capital structure research primarily assumes

that the firm's goal is to maximize value. The assumption is that the firm exists, and that it is up to managers to decide how to maximize equity value and/or the risk adjusted present value of the firm's profits based upon their financing options. In contrast, the entrepreneurial finance literature focuses on the financing of new, young, and small firms and the capital structure is important in terms of getting the firm started, surviving, and growing. Thus, the performance dependent variables of entrepreneurial finance studies tend to be starting, survival, and growth rates that are measured. Although starting rates do not pertain to my research question, and thus I do not examine starting rates²⁹, I do follow along the lines of entrepreneurial finance studies and measure performance based upon survival and growth.

The distribution of the closure (the inverse of survival) of the firms is show in Table 6, a life table indicating the number of firms that died / survived each of the six years, with Figure 3 showing a graphical representation of the hazard (closure) function. There are still 1,251 firms operating after year six. They are considered "censored" as the data collection period stops after year six, and could still possibly die sometime after year six. The cumulative closure rate for firms through year six is 23.4%³⁰.

Table 6: Life Table (Survival)

Year	Year	Time Interval	# of Firms at Beginning of Year	Firms that Died during Year	Censored at End of Year	Proportion of Firms at Beginning of Year who Left during Year (Hazard Function)	Firms Still in Operations at End of Year (Survival Function)
2004	0	[0,1)	1,634	0	0	0.0%	100.0%
2005	1	[1,2)	1,634	47	0	2.9%	97.1%
2006	2	[2,3)	1,587	80	0	5.0%	95.0%
2007	3	[3,4)	1,507	96	0	6.4%	93.6%
2008	4	[4,5)	1,411	89	0	6.3%	93.7%
2009	5	[5,6)	1,322	71	1,251	5.4%	94.6%

²⁹ "Starting rates" are often called "entrepreneurship rates", especially in literature that is published from the discipline of economics.

³⁰ This closure rate includes only negatively closed firms. When including positively closed firms, this figure increases to 31%.

Figure 3: Yearly Failure Rate (Hazard Function)

Growth is an important measurement of firm performance (e.g. Brush & Vanderwerf, 1992; Danson, 1999), but is multi-dimensional (Parker, 2009). Growth can be measured by revenue, profit, number of employees, assets, and other variables. However, in this analysis, I use only revenue and number of employees to represent growth, which have been regarded as very important indicators in past studies (e.g. Hmieleski & Baron, 2009). Sales growth tends to be the indication of performance which entrepreneurs use (Barkham, Gudgin, M. Hart, & Hanvey, 1996; Robson & Bennett, 2000), whereas policy makers are more interested in employment growth (Parker, 2009). New firms do not have a large amount of profit and assets during their early years. So their trends might not represent a clean representation of growth for a new firm. In addition, these two variables have a large amount of missing data. Employment has found to be correlated with profit and assets in past studies (Davidsson, Delmar, & Wiklund, 2006). Thus, profit and assets might provide the same results as employment and would justify not using these variables. Growth is represented in multiple models for each one of these dimensions: revenue and number of employees.

The distribution of growth for revenue and number of employees is shown in Table 7, Figure 4, and Figure 5. Average revenue grows from \$0 before 2004 to \$692,144 in 2009. Revenue grows steadily over the first five years before a decline in the sixth year. The

decline in revenue in the sixth year could have been caused by the recession that began in December 2007. Standard deviation of revenue has the same trend over time, with the largest standard deviation being \$2.638 million in 2007. The large standard deviation compared to the mean indicates that revenue is skewed. There is a small number of firms that experience a larger growth rate than the majority of firms. The average number of employees grows from 0 before 2004 to 3.972 in 2009. As with revenue, the number of employees increases for the first five years before declining slightly in 2009. However, unlike revenue, the rate of growth in employees slows earlier. The standard deviation increases over time to 12.816 in 2008. As with revenue, the employee variable shows that a few firms grow at a higher rate, but the majority of firms grow at a much lower rate in terms of number of employees.

Table 7: Distribution of the Growth Variables

Year	Revenue			Employees		
	Mean	Std Dev	N	Mean	Std Dev	N
2004	\$149,404	\$600,391	1,634	1.629	4.024	1,634
2005	\$371,712	\$1,251,130	1,587	2.967	6.984	1,587
2006	\$555,537	\$2,013,950	1,507	3.510	8.668	1,507
2007	\$727,152	\$2,650,270	1,411	3.788	10.669	1,411
2008	\$763,381	\$2,638,490	1,322	3.979	11.982	1,322
2009	\$692,144	\$2,374,950	1,251	3.972	12.816	1,251

Figure 4: Revenue over Time

Figure 5: Employment over Time

Different measurements of survival and growth are used depending on the statistical method being used. In OLS regression, which is cross-sectional analysis, survival is measured by age at which the firm was when it closes. Growth (revenue and number of employees) is measured based upon the last full year of operations. In Probit regression, survival is measured as a dichotomous variable, with 0 indicating the firms survive the entire data collection (6 years), and 1 indicating the firm closed within the data collection period. In Cox proportional hazard modeling, the closure status of the firm is measured each year (for 6 years). In HLM and panel data regression, revenue and number of employees is used for each year a firm is operating. Revenue and number of employees are transformed using the natural log formula since the variables are not normally distributed.

Independent Variables

This study examines credit usage by new firms. Table 8 presents a summary of the number of firms that use and do not use credit over six years. Credit is used by 50.7% of the 1,634 firms in 2004, with an increase of credit usage in 2005 to 53.3%. Thereafter, the number and percentage of firms using credit drops steadily each year to 44.1% in 2009. Table 8 also shows which firms continuously used credit throughout the six years. The percentage of firms that use credit in year two after also using credit in year one drops is 29.1%. This is a considerable drop in the number of firms that used credit in year one

(50.7%). This figure continues to decline each year indicating that firms which use credit in the early years do not necessarily continue to use credit as they age. Only 4% of the firms used credit all six years. The average number of years firms use credit is 2.652. The descriptive statistics indicate that new firms do use credit during their early years.

Table 8: General Summary of Credit Usage

	Number of Firms											
	2004		2005		2006		2007		2008		2009	
Use Credit	828	50.7%	846	53.3%	785	52.1%	731	51.8%	576	43.6%	552	44.1%
Don't Use Credit	806	49.3%	741	46.7%	722	47.9%	680	48.2%	746	56.4%	699	55.9%
Total	1,634	100.0%	1,587	100.0%	1,507	100.0%	1,411	100.0%	1,322	100.0%	1,251	100.0%

	Number of Firms											
	2004		2004-2005		2004-2006		2004-2007		2004-2008		2004-2009	
Use Credit	828	50.7%	462	29.1%	287	19.0%	185	13.1%	105	7.9%	72	5.8%
Don't Use Credit	806	49.3%	1,125	70.9%	1,220	81.0%	1,226	86.9%	1,217	92.1%	1,179	94.2%
Total	1,634	100.0%	1,587	100.0%	1,507	100.0%	1,411	100.0%	1,322	100.0%	1,251	100.0%

	Number of Firms	
1 Year of Credit Usage Only	471	29%
2 Years of Credit Usage Only	383	23%
3 Years of Credit Usage Only	318	19%
4 Years of Credit Usage Only	240	15%
5 Years of Credit Usage Only	150	9%
6 Years of Credit Usage Only	72	4%
Total	1,634	100%

Average # of Years Using Credit	2.652
Standard Deviation	1.476

Multiple Credit Sources Used. Three different variables are used to measure the use of multiple credit sources by new firms over time: 1) number of total credit sources, 2) number of unique credit sources, and 3) diversity index of credit sources. The first variable examined in the growth curve model is the number of total credit sources a firm uses during each of its first six years. Since all firms in the sample started in 2004, it can be interpreted that the credit source usage is from the first year of the firm's existence. There are ten different credit sources that are measured: 1) banks, 2) non-bank financial institutions, 3) credit card institutions, 4) other businesses, 5) government, 6) owners, 7) employees, 8)

family, 9) other individuals, and 10) other sources³¹. There are questions in the KFS survey that the respondents answered about the number of different credit sources their firm used. All of the credit source option variables are then added together to calculate the different types of debt financing options a firm uses in a given year. The number of total credit sources used by each firm is calculated for each of the six years that the survey was administered. Table 9, Table 10, Figure 6, Figure 7, and Figure 8 show the distribution of number of total credit sources used over time, and broken out by the type of credit source used over time. Figure 6, Figure 7, and Figure 8 show the distribution of this variable in graphical format. Figure 8 is included to show the trends of the type of multiple credit sources that are not discernible in Figure 7. This is done by removing the bank and credit card data from Figure 7 to create Figure 8.

Table 9: Data for Histogram of Number of Total Credit Sources over Time

Number of Total Credit Sources	Number of Firms											
	2004		2005		2006		2007		2008		2009	
0	806	49.3%	741	46.7%	722	47.9%	680	48.2%	746	56.4%	699	55.9%
1	493	30.2%	429	27.0%	375	24.9%	336	23.8%	294	22.2%	284	22.7%
2	182	11.1%	236	14.9%	227	15.1%	196	13.9%	140	10.6%	151	12.1%
3	86	5.3%	90	5.7%	87	5.8%	97	6.9%	65	4.9%	61	4.9%
4	38	2.3%	36	2.3%	36	2.4%	42	3.0%	28	2.1%	20	1.6%
5	15	0.9%	22	1.4%	25	1.7%	25	1.8%	17	1.3%	12	1.0%
6	6	0.4%	9	0.6%	12	0.8%	11	0.8%	9	0.7%	7	0.6%
7	1	0.1%	6	0.4%	5	0.3%	7	0.5%	6	0.5%	8	0.6%
8	1	0.1%	4	0.3%	4	0.3%	2	0.1%	5	0.4%	1	0.1%
9	1	0.1%	2	0.1%	2	0.1%	1	0.1%	1	0.1%	0	0.0%
10	0	0.0%	3	0.2%	3	0.2%	5	0.4%	3	0.2%	1	0.1%
> 10	5	0.3%	9	0.6%	9	0.6%	9	0.6%	8	0.6%	7	0.6%
Total	1,634	100.0%	1,587	100.0%	1,507	100.0%	1,411	100.0%	1,322	100.0%	1,251	100.0%

³¹ These credit sources are similar to the categories used by Berger & Udell (1998).

Table 10: Distribution of Number of Total Credit Sources over Time by Source

Type	2004			2005			2006		
	Mean	Std Dev	%	Mean	Std Dev	%	Mean	Std Dev	%
Bank	0.208	0.577	23.1%	0.271	0.846	24.6%	0.289	0.761	25.7%
Non-Bank	0.041	0.425	4.6%	0.023	0.209	2.1%	0.023	0.251	2.0%
Credit Card	0.523	0.853	58.1%	0.710	0.138	64.4%	0.722	1.489	64.1%
Other Businesses	0.006	0.085	0.7%	0.005	0.070	0.5%	0.004	0.063	0.3%
Government	0.010	0.112	1.1%	0.008	0.096	0.7%	0.008	0.145	0.7%
Owners	0.027	0.221	2.9%	0.021	0.285	1.9%	0.024	0.527	2.1%
Employees	0.005	0.085	0.5%	0.001	0.035	0.1%	0.005	0.092	0.4%
Family	0.068	0.468	7.6%	0.055	0.437	5.0%	0.045	0.533	4.0%
Other Individuals	0.007	0.143	0.8%	0.006	0.086	0.6%	0.003	0.063	0.2%
Other Sources	0.005	0.088	0.6%	0.004	0.070	0.3%	0.004	0.109	0.3%
Total	0.900	1.311	100.0%	1.104	1.829	100.0%	1.125	1.953	100.0%
N	1,634			1,587			1,507		
Type	2007			2008			2009		
	Mean	Std Dev	%	Mean	Std Dev	%	Mean	Std Dev	%
Bank	0.385	1.223	32.6%	0.321	1.138	32.4%	0.274	0.927	29.7%
Non-Bank	0.037	0.340	3.1%	0.032	0.628	3.2%	0.041	0.707	4.4%
Credit Card	0.713	1.465	60.4%	0.569	1.329	57.4%	0.567	1.112	61.5%
Other Businesses	0.000	0.000	0.0%	0.006	0.102	0.6%	0.003	0.056	0.3%
Government	0.035	0.070	3.0%	0.007	0.125	0.7%	0.006	0.174	0.7%
Owners	0.006	0.095	0.5%	0.004	0.061	0.4%	0.007	0.146	0.8%
Employees	0.001	0.027	0.1%	0.001	0.027	0.1%	0.001	0.028	0.1%
Family	0.028	0.217	2.4%	0.031	0.271	3.1%	0.016	0.154	1.7%
Other Individuals	0.003	0.053	0.2%	0.020	0.531	2.1%	0.004	0.116	0.4%
Other Sources	0.004	0.092	0.4%	0.001	0.027	0.1%	0.003	0.069	0.3%
Total	1.211	3.581	102.7%	0.990	4.241	100.0%	0.922	3.489	100.0%
N	1,411			1,322			1,251		

Figure 6: Number of Total Credit Sources on Average over Time

Figure 7: Number of Total Credit Sources on Average over Time by Source

Figure 8: Number of Total Credit Sources on Average over Time by Source (without Bank and Credit Cards)

The number of total credit sources includes cases where multiple instances of the same credit source can be used. For example, five different credit cards can be used, and thus count for five in the calculation of total number of credit sources used. It could be the case where the number of different types of credit sources used is important. As such, I also run analysis using the number of unique type of credit sources to determine if the type of credit sources used is important. Table 11, Table 12, Figure 9, Figure 10, and Figure 11 show the distribution of number of unique credit sources used broken out by the type of credit source used over time, along with the amount of debt by unique type of credit source used over time. Figure 11 is included to show the trends of the type of multiple credit sources that are not discernible in Figure 10. This is done by removing the Bank and Credit Card data from Figure 10 to create Figure 11.

Table 11: Data for Histogram of Number of Unique Credit Sources over Time

Number of Unique Credit Sources	Number of Firms											
	2004		2005		2006		2007		2008		2009	
0	806	49.3%	741	46.7%	722	47.9%	680	48.2%	746	56.4%	699	55.9%
1	625	38.2%	632	39.8%	564	37.4%	519	36.8%	412	31.2%	417	33.3%
2	159	9.7%	163	10.3%	182	12.1%	159	11.3%	132	10.0%	112	9.0%
3	38	2.3%	46	2.9%	36	2.4%	52	3.7%	28	2.1%	22	1.8%
4	6	0.4%	2	0.1%	2	0.1%	0	0.0%	4	0.3%	0	0.0%
5	0	0.0%	3	0.2%	1	0.1%	1	0.1%	0	0.0%	1	0.1%
Total	1,634	100.0%	1,587	100.0%	1,507	100.0%	1,411	100.0%	1,322	100.0%	1,251	100.0%

Table 12: Distribution of Number of Unique Credit Sources over Time by Source

Type	2004				2005				2006			
	#	Mean	Std Dev	%	#	Mean	Std Dev	%	#	Mean	Std Dev	%
Bank	243	0.148	0.355	23.2%	268	0.170	0.375	24.9%	301	0.200	0.400	30.1%
Non-Bank	42	0.026	0.159	4.1%	24	0.016	0.124	2.3%	21	0.014	0.117	2.1%
Credit Card	608	0.376	0.484	59.1%	678	0.426	0.495	62.6%	609	0.402	0.490	60.6%
Other Businesses	9	0.005	0.073	0.8%	8	0.005	0.070	0.7%	6	0.004	0.063	0.6%
Government	14	0.009	0.095	1.4%	12	0.008	0.086	1.1%	8	0.005	0.072	0.8%
Owners	32	0.019	0.138	3.0%	20	0.013	0.114	1.9%	14	0.009	0.095	1.4%
Employees	6	0.004	0.060	0.6%	2	0.001	0.035	0.2%	5	0.003	0.057	0.5%
Family	66	0.041	0.198	6.4%	54	0.034	0.182	5.0%	34	0.022	0.148	3.4%
Other Individuals	7	0.004	0.065	0.7%	8	0.006	0.075	0.8%	3	0.002	0.044	0.3%
Other Sources	7	0.004	0.065	0.7%	5	0.003	0.056	0.5%	3	0.002	0.044	0.3%
Total	1,034	0.636	0.721	100.0%	1,079	0.681	0.745	100.0%	1,004	0.663	0.731	100.0%
N	1,634				1,587				1,507			
Type	2007				2008				2009			
	#	Mean	Std Dev	%	#	Mean	Std Dev	%	#	Mean	Std Dev	%
Bank	328	0.233	0.423	34.6%	257	0.194	0.395	34.9%	222	0.179	0.384	32.6%
Non-Bank	28	0.021	0.144	3.1%	16	0.012	0.109	2.2%	12	0.010	0.097	1.7%
Credit Card	543	0.385	0.487	57.2%	420	0.313	0.464	56.2%	426	0.336	0.472	60.9%
Other Businesses	0	0.000	0.000	0.0%	6	0.005	0.067	0.8%	4	0.003	0.056	0.6%
Government	4	0.003	0.053	0.4%	6	0.005	0.067	0.8%	3	0.024	0.049	4.4%
Owners	7	0.005	0.700	0.7%	5	0.004	0.061	0.7%	4	0.003	0.056	0.6%
Employees	1	0.001	0.027	0.1%	1	0.001	0.027	0.1%	1	0.001	0.028	0.1%
Family	29	0.020	0.131	3.0%	24	0.018	0.133	3.2%	16	0.013	0.112	2.3%
Other Individuals	4	0.003	0.053	0.4%	7	0.005	0.072	1.0%	2	0.002	0.040	0.3%
Other Sources	4	0.003	0.530	0.4%	1	0.001	0.027	0.1%	3	0.002	0.049	0.4%
Total	948	0.673	0.742	100.0%	743	0.556	0.720	100.0%	693	0.551	0.694	103.9%
N	1,411				1,322				1,251			

Figure 9: Number of Unique Credit Sources on Average over Time

Figure 10: Number of Unique Credit Sources on Average over Time by Source

Figure 11: Number of Unique Credit Sources on Average over Time by Source (without Bank and Credit Cards)

To clarify the distinction between the number of total credit sources and number of unique credit sources, I have provided the following example for the usage of credit sources by three firms as shown in Table 13. In the example, Firm 1 uses one bank loan and 1 credit card. The number of total credit sources for Firm 1 is two, as is the number of unique credit sources. Whereas, Firm 2 uses one bank loan, three credit cards, and two loans from family members. The number of total credit sources for Firm 2 is six, and the number of unique credit sources is three. Firm 3 uses 5 credit cards, and thus the number of total credit sources is five, and the number of unique credit sources is one.

Table 13: Examples of Number of Total and Unique Credit Sources

Type	Firm 1 #	Firm 2 #	Firm 3 #
Bank	1	1	0
Non-Bank	0	0	0
Credit Card	1	3	5
Other Businesses	0	0	0
Government	0	0	0
Owners	0	0	0
Employees	0	0	0
Family	0	2	0
Other Individuals	0	0	0
Other Sources	0	0	0
Number of TOTAL Credit Sources	2	6	5
Number of UNIQUE Credit Sources	2	3	1

In addition to the total number and unique number of credit sources used, I also measure the diversity of credit sources used by new firms. The diversity of credit sources could be important because having the same number of credit sources does not always mean the same thing, as shown in the example above. The number of unique credit sources partially captures the diversity of credit source usage. However, it uses a count variable. The diversity might be better captured by also incorporating the dollar figures of debt. For this I used a variation of the Herfindahl Index to measure diversity based upon the dollar amount of debt raised from the various credit sources used by new firms. The Herfindahl Index has been used in strategy research and is a measure of diversity in competition among firms in an industry (e.g. Berry, 1975; Geringer, Beamish, & Dacosta, 1989; Tallman & Li, 1996). More specifically, the Herfindahl Index is a measure of the market size of firms in relation to the industry, and is an economic measurement applied in competition law, antitrust, and technology management. A benefit of the index is that it gives more weight to

the larger firms (credit sources in my study). An increase in the Herfindahl Index indicates a decrease in competition and an increase in market power (concentration).

The modified version of the Herfindahl Index (per Berry, 1975; Geringer et al., 1989; Tallman & Li, 1996), which is the complement of the Herfindahl Index³², is:

$$HICS_{if} = 1 - \sum_{n=1}^c D_{nif}^2 \quad [1]$$

where,

$HICS_{if}$ is the Herfindahl Index of credit source usage at time t for firm f

D_{nif}^2 is the square of the ratio of debt (\$) for credit source n to the total debt (\$) at time t for firm f

c is the number of types of credit sources available for the firm to use, which is 10 at all time periods and for all firms

Squaring the proportion of debt gives more weight to the credit source that provides the largest amount of debt to the firm. Using the complement of the Herfindahl Index indicates that a higher value from the formula means that there is a greater diversity in the credit sources used to raise debt by a new firm. The variable varies from 0 to 1 and higher values indicate higher diversity of credit source usage.

Table 14 and Figure 12 show the distribution of the diversity of credit sources based upon the Herfindahl Index of credit sources in my sample. The Herfindahl Index of credit sources steadily increases over time for the first three years for firms before declining, starting at 0.021 in year one and rising to 0.034 in year three. Lower figures indicate there is

³² The modified Herfindahl Index formula which I present herein is also referred to as Blau's (1977) index of heterogeneity. Blau built the index as a measure of inequality for continuous parameters.

little diversity in multiple credit source usage. Over time, the standard deviation of the Herfindahl Index of credit sources follows the same trend.

Table 14: Distribution of the Herfindahl Index of Credit Sources

Type	2004		2005		2006	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Herfindahl Index	0.021	0.092	0.031	0.114	0.034	0.117
N	1,634		1,587		1,507	
Type	2007		2008		2009	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Herfindahl Index	0.029	0.107	0.031	0.113	0.026	0.104
N	1,411		1,322		1,251	

Figure 12: Growth Trend of the Herfindahl Index of Credit Sources over Time

There are several weaknesses in using the Herfindahl Index. Table 15 shows examples of the modified Herfindahl Index of credit sources to illustrate how the Herfindahl Index measures the diversity in credit source usage. The table highlights four possible configurations of debt for a fictional firm. In example 1, the firm only has bank debt. The modified Herfindahl Index of credit sources is 0, which indicates there is no diversity in the credit sources that are used by the firm. The firm only uses one credit source, but there are nine other credit sources available to the firm. In example 2, the firm uses two different types of credit sources: \$7,500 from banks and \$2,500 from non-bank financial institutions. The modified Herfindahl Index of credit sources is 0.375, indicating that example 2 is a more diverse usage of credit sources by the firm than example 1 when the firm used only banks for

credit. In example 3, the firm uses equal amounts of credit from banks and non-bank financial institutions and has a modified Herfindahl Index of credit sources of 0.500. Even though the total amount borrowed is the same (\$10,000), and there are two different credit sources used, example 3 is more diverse than example 2. Example 4 represents the highest diversity that can be seen in types of credit sources used. In example 4, the firm has borrowed the same amount (\$1,000) from all ten available types of credit sources. The modified Herfindahl Index is 0.900 for example 4.

Table 15: Examples of the Herfindahl Index of Credit Sources

	Example 1			Example 2			Example 3			Example 4		
Type of Credit Source	Debt	D	D ²	Debt	D	D ²	Debt	D	D ²	Debt	D	D ²
Bank	\$10,000	1.000	1.000	\$7,500	0.750	0.563	\$5,000	0.500	0.250	\$1,000	0.100	0.010
Non-Bank	\$0	0.000	0.000	\$2,500	0.250	0.063	\$5,000	0.500	0.250	\$1,000	0.100	0.010
Credit Card	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Other Businesses	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Government	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Owners	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Employees	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Family	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Other Individuals	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Other Sources	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$1,000	0.100	0.010
Total	\$10,000	1.000	1.000	\$10,000	1.000	0.625	\$10,000	1.000	0.500	\$10,000	1.000	0.100
Modified Herfindahl Index			0.000			0.375			0.500			0.900

	Example 5			Example 6			Example 7			Example 8		
Type of Credit Source	Debt	D	D ²	Debt	D	D ²	Debt	D	D ²	Debt	D	D ²
Bank	\$2,500	0.250	0.063	\$0	0.000	0.000	\$2,500	0.333	0.111	\$0	0.000	0.000
Non-Bank	\$2,500	0.250	0.063	\$2,500	0.250	0.063	\$2,500	0.333	0.111	\$0	0.000	0.000
Credit Card	\$2,500	0.250	0.063	\$2,500	0.250	0.063	\$2,500	0.333	0.111	\$0	0.000	0.000
Other Businesses	\$2,500	0.250	0.063	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000
Government	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000
Owners	\$0	0.000	0.000	\$2,500	0.250	0.063	\$0	0.000	0.000	\$0	0.000	0.000
Employees	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000
Family	\$0	0.000	0.000	\$2,500	0.250	0.063	\$0	0.000	0.000	\$0	0.000	0.000
Other Individuals	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000
Other Sources	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000	\$0	0.000	0.000
Total	\$10,000	1.000	0.250	\$10,000	1.000	0.250	\$7,500	1.000	0.333	\$0	0.000	0.000
Modified Herfindahl Index			0.750			0.750			0.667			1.000

Examples 5 and 6 show one of the weaknesses of the modified Herfindahl Index. In example 5, the firm borrows the same amount from four different credit sources. The modified Herfindahl Index of credit sources is 0.750. In example 6, the firm borrows the same amount from four different types of credit sources like in example 5. The modified Herfindahl Index of credit sources is the same for both examples (0.750). However, the firm borrows from different types of credit sources. While Herfindahl indices are equal, different

types of credit sources are tapped (i.e. the Herfindahl Index of credit sources does not distinguish between the different types of credit sources). This could be an issue if the types of credit sources are of different quality (e.g. borrowing from a bank offers a higher “quality” of credit than borrowing from family members because borrowing from a bank signals to the market the firm is doing well).

There is a second weakness with the Herfindahl Index of credit sources as the index does not rank the diversity of firms using zero credit sources in a given year. As shown in Example 8 in Table 15, firms with zero credit in a given year have an index value of 1. This would be the highest level of diversity, which is not a true indication of diversity of credit source usage. Using none of the credit sources should not indicate a high level of diversity of credit source usage since the firm is not using any credit sources. The Herfindahl Index of credit sources interprets a firm using no credit sources as one that is evenly using all credit sources. This would not be an issue if a few firms used zero credit sources. The Herfindahl Index of credit sources does not take zero into account in past studies since the index is used for examining existing industries. Existing industries have at least one firm in the industry – the industry would not exist if zero firms were in the industry. This, however, is an issue in this data set and in this study as there are a large percentage of firms that do not use credit in any given year. The sample only includes firms that use credit at least one year in the data set, as firms that did not use credit in any of the six years have been removed from the sample. These zeros for firms in any given year will change as the firm will have used at least one credit source during the six years, and these firms should not be removed as they provide value data to analyze. Plus, only 72 firms use credit every year. A solution is an avoidance index of credit sources.

The avoidance index of credit sources is a measure of a firm's willingness not to use the available credit sources in a given period (e.g. a year). A higher avoidance index indicates a firm avoids more types of unique credit sources than a firm that has a lower avoidance index. 0% represents no avoidance of unique credit sources (i.e. the firm uses every credit source available to it evenly), and 100% indicates the firm avoided every credit source available to it (i.e. the firm didn't use any credit and thus had \$0 of total debt). This solves the issue with distinguishing between firms that use one unique credit source from firms that use zero credit sources. The avoidance index of credit sources is calculated as follows:

If $TD_{tf} > 0$,

$$AICS_{tf} = \left(\sum_{n=1}^c \left((D_{ntf} - TD_{tf}) / TD_{tf} \right)^2 - MIN \right) / (MAX - MIN) \quad [2]$$

Or if $TD_{tf} = 0$,

$$AICS_{tf} = (MAX + (MAX - MIN)) / (MAX - MIN) \quad [3]$$

where,

$AICS_{tf}$ is the avoidance index of credit source usage at time t for firm f

D_{ntf} is the debt (\$) for credit source n at time t for firm f

TD_{tf} is the total debt (\$) at time t for firm f

c is the maximum number of types of credit sources available for the firm to use,

which is 10 at all time periods and for all firms

MIN is the minimum AICS possible for 10 credit sources, which is 0.100; this represents no avoidance of the available types of credit sources by a firm as the firm would use all 10 types of credit sources evenly

MAX is the maximum AICS possible; for 10 credit sources, the maximum avoidance is 0.111), which is when a firm uses no credit sources (\$0 of total debt)

However, I am interested in diversity of credit source usage, not necessarily avoidance of types of credit sources. So I modify the avoidance index to derive the diversity of credit sources as follows:

$$DICS_{tf} = 1 - AICS_{tf} \quad [3]$$

where,

$DICS_{tf}$ is the diversity index of credit source usage at time t for firm f

Table 16 shows examples of the diversity and avoidance indexes of credit sources. The eight examples are the same configurations of debt shown in Table 15. Example 4 depicts a firm that uses every credit source available to it, and Example 8 uses none of the available credit sources available to it. The diversity index of credit sources for Example 4 is 100%, and is 0% for Example 8. This correctly depicts firms that use no credit sources use less types of unique credit sources than firms that use every credit source. In addition, the other six examples are ranked properly by diversity.

Table 16: Examples of the Diversity and Avoidance Indexes of Credit Sources

Type of Credit Source	Example 1				Example 2				Example 3				Example 4			
	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²
Bank	\$10,000	\$0	0.000	0.000	\$7,500	\$2,500	0.028	0.001	\$5,000	-\$5,000	0.056	0.003	\$1,000	-\$9,000	0.100	0.010
Non-Bank	\$0	-\$10,000	0.111	0.012	\$2,500	-\$7,500	0.083	0.007	\$5,000	-\$5,000	0.056	0.003	\$1,000	-\$9,000	0.100	0.010
Credit Card	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Other Businesses	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Government	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Owners	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Employees	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Family	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Other Individuals	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Other Sources	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$1,000	-\$9,000	0.100	0.010
Total	\$10,000	-\$90,000	1.000	0.111	\$10,000	-\$90,000	1.000	0.106	\$10,000	-\$90,000	1.000	0.105	\$10,000	-\$90,000	1.000	0.100
Avoidance Index of Credit Sources				0.0111				0.00648				0.00494				0.00000
Avoidance Index of Credit Sources (%)				50.0%				29.2%				22.2%				0.0%
Diversity Index of Credit Sources (%)				50.0%				70.8%				77.8%				100.0%

Type of Credit Source	Example 5				Example 6				Example 7				Example 8			
	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²	Debt	Total Debt	D	D ²
Bank	\$2,500	-\$7,500	0.083	0.007	\$0	-\$10,000	0.111	0.012	\$2,500	-\$5,000	0.074	0.005	\$0	\$0	0.000	0.000
Non-Bank	\$2,500	-\$7,500	0.083	0.007	\$2,500	-\$7,500	0.083	0.007	\$2,500	-\$5,000	0.074	0.005	\$0	\$0	0.000	0.000
Credit Card	\$2,500	-\$7,500	0.083	0.007	\$2,500	-\$7,500	0.083	0.007	\$2,500	-\$5,000	0.074	0.005	\$0	\$0	0.000	0.000
Other Businesses	\$2,500	-\$7,500	0.083	0.007	\$0	-\$10,000	0.111	0.012	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Government	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Owners	\$0	-\$10,000	0.111	0.012	\$2,500	-\$7,500	0.083	0.007	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Employees	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Family	\$0	-\$10,000	0.111	0.012	\$2,500	-\$7,500	0.083	0.007	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Other Individuals	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Other Sources	\$0	-\$10,000	0.111	0.012	\$0	-\$10,000	0.111	0.012	\$0	-\$7,500	0.111	0.012	\$0	\$0	0.000	0.000
Total	\$10,000	-\$90,000	1.000	0.102	\$10,000	-\$90,000	1.000	0.102	\$7,500	-\$67,500	1.000	0.103	\$0	\$0	0.000	0.000
Avoidance Index of Credit Sources				0.00185				0.00185				0.00288				0.02222
Avoidance Index of Credit Sources (%)				8.3%				8.3%				13.0%				100.0%
Diversity Index of Credit Sources (%)				91.7%				91.7%				87.0%				0.0%

Table 17 and Figure 13 show the distribution of the diversity of credit sources based upon the diversity index of credit sources. Higher figures indicate there is more diversity of the usage of various types of credit sources. The diversity index of credit sources has a minimum of 17% (2004) and a maximum of 19.6% (2006). The range of the figures is small, however, a small change in the index represents a material change in the different types of credit sources used by firms. An inverted U-shape trend is seen for the index, as shown in Figure 13. The index is shown increasing for the first three years, and then decreasing for the subsequent three years. Over time, there is little change in the standard deviation of the avoidance index of credit sources, ranging from 25.4% (2004) to 26.9% (2006).

Table 17: Distribution of the Diversity Index of Credit Sources

Type	2004		2005		2006	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Diversity Index	0.170	0.254	0.189	0.265	0.196	0.269
N	1,634		1,587		1,507	
Type	2007		2008		2009	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Diversity Index	0.186	0.264	0.188	0.266	0.178	0.260
N	1,411		1,322		1,251	

Figure 13: Growth Trend of the Diversity Index of Credit Sources over Time

Control Variables

As discussed below, human capital variables are included as independent variables. Entrepreneurship research has suggested that founding teams that have more education and more work experience improve the success of new firms. The entrepreneurship research has suggested that firms started by founding teams, as opposed to a single entrepreneur, are more successful (Cressy, 1996b), because multiple founders can complement each other's skills. As well, when things get rough in the business, each founding team member can pull up another founding team member psychologically. In addition, entrepreneurship research has suggested that the education level of founders is important in determining if new firms will be successful. The studies suggest that the more educated a founder or the founders are, the better chance of survival for the firm. Findings from entrepreneurship research also suggest that prior work experience of the founders is important in determining if new firms will be successful, especially work experience in the industry that the new firm will operate in. They suggest that the more work experience a founder or the founders has, the better chance of survival for the firm.

Bates (1990) finds that educational background of founders is a determinant of the capital structure of new firms. Human capital is considered an endogenous variable because founders accumulate human capital in anticipation of performing better in the future (Cressy, 1996b; Parker & Van Praag, 2006). Parker & Van Praag (2006) show that human capital decreases the capital constraints while increasing performance. Human capital is measured as a) the founding team size, b) work experience of the founders, and c) the education of the founders. Explanation of these variables can be found in more detail below.

Number of Founders. The number of founders for each firm is calculated as the number of owner-operators in the firm during the first year of its existence (2004) (e.g. Eisenhardt & Schoonhoven, 1990). Using owner-operators as opposed to owners ensures that investor-only types are not included in the number of founders. In addition, the number of owner-operators is only calculated for the first year of the firm's existence even though the number of owner-operators can change from year to year. The average number of founders is 1.416 (std dev = 0.698). 68.1% of firms (1,112) have only one founder, 24.5% (401) have two founders, and 7.4% (121) have three or more founders. Table 18 shows the distribution of the founding team size.

Table 18: Distribution of Founding Team Size

#	Frequency	%
1	1,112	68.1%
2	401	24.5%
3	88	5.4%
4	29	1.8%
5	4	0.2%
Total	1,634	100.0%

Education of Founders. Education was measured on the highest level for each founder as of 2004, ranging from 1 (less than 9th grade) to 10 (professional school or doctorate). It is important that this variable is not based upon the number of years of education, but rather highest degree achieved. The number of years is not a good measure for this study since founders that more quickly finish a degree have been found to be more successful (Backes-Gellner & Werner, 2007). Table 19 shows the levels (categories) of education, and the number of firms with that average level of education.

Table 19: Levels (Categories) of Education

Value	Category
1	Less than 9th grade
2	Some high school, but no diploma
3	High school graduate (diploma or equivalent diploma [GED])
4	Technical, trade or vocational degree
5	Some college, but no degree
6	Associate's degree
7	Bachelor's degree
8	Some graduate school but no degree
9	Master's degree
10	Professional school or doctorate

The average level of education of the founders is measured by summing the levels of education of each member of the founding team and dividing by the number of members on a founding team. This provided a measure of average education of the founders that could be compared across the firms in the sample. The average level of education for each firm was 6.416 (std dev = 1.994), which is between an Associate's degree and a Bachelor's degree based upon the scale used in the survey.

Type of Education of Founders. Founders engage in a complex array of financing decisions that possibly affect the success of their firms. Founders with a business education

might be able to better handle these financing decisions because they would have higher financial literacy since business schools expose individuals to finance. Founders with a business education have been found to be more knowledgeable in their financing options (Drexler, G. Fischer, & Schoar, 2010). And as argued in the theory development section, a member of the founding team with a business education might use more credit sources as they know more about the various funding sources. Therefore, a dichotomous variable has been created, equal to 1 if any of the founding team members has a business college degree and 0 if none of the members of the founding team has a non-business college degree. The average type of education is 0.189 which indicates most founding teams do not have a member with a business degree (std dev = 0.92).

Work Experience of Founders (Overall). Each founder of a firm reported the number of years of work experience in the firm's industry. The average work experience of the founders is measured by summing the years of work experience of each member of the founding team and dividing by the number of members on a founding team. The average work experience is 13.116 years (std dev = 10.140).

Work Experience of Founders (Start-up). Each founder of a firm reported if he or she had started a previous firm. If at least one founder had started a firm before, this variable is 1, and otherwise 0. Almost half of the firms had at least one founder that had started a firm previously (mean = 0.474; std dev = 0.499).

Amount of Outstanding Debt. The amount of outstanding debt is important as a control variable to be able to determine if firms are obtaining additional debt when they change credit sources or if they are paying off or consolidating their debt. Table 20, Figure 14, Figure 15, and Figure 16 show the distribution of the outstanding amount of debt broken

out by the type of credit source used per year. Average total outstanding debt increases the first four years to \$62,906 before falling to \$37,788 in year six (2009). The standard deviation of total outstanding debt has the same trend, peaking at \$595,714 in year four (2007). Banks provide the largest portion of credit, ranging from 56.4% of total outstanding debt in 2004 to 82.0% in 2008. The next highest provider of credit varies from year to year. Non-bank financial institutions and owners provide just over 10% each in the first year. Owners stay the second highest provider of credit in year two (9%). The situation changes in year three as debt provided by non-bank financial institutions decreases. Debt from credit card institutions rises the first three years before falling in 2007 and 2008. In 2009, credit card institutions are the third largest providers of debt (10.3%). Government provides little debt to firms until the sixth year, when it becomes the second largest provider of debt (13.7%). The reason why government was the second largest provider is because the government figure is skewed in 2009 as two firms received \$5.4m and \$1.6m in this year. Prior to these two firms obtaining government financing, the highest amount of debt a firm received was \$1m (in 2004) in any of the previous five years. The highest number of firms with government debt in any given year is in 2004 and 2005, when 13 firms used government debt. Debt from family members increases for the first three years in dollar amount, but the percentage stays stable. However, the standard deviation is large compared to the mean for most of the years. Hence, there are a few firms that receive a large amount of debt from family members which account for the high standard deviation. Debt from other business, employees, and other individuals stays relatively low throughout the six year period.

Table 20: Distribution of Outstanding Debt by Source by Year

Type	2004			2005			2006		
	Mean	Std Dev	%	Mean	Std Dev	%	Mean	Std Dev	%
Bank	\$15,867	\$113,820	56.4%	\$21,441	\$268,883	63.0%	\$24,743	\$327,255	62.8%
Non-Bank	\$2,958	\$53,742	10.5%	\$2,473	\$62,628	7.3%	\$3,455	\$81,851	8.8%
Credit Card	\$1,279	\$7,851	4.5%	\$2,576	\$15,350	7.6%	\$3,068	\$22,194	7.8%
Other Businesses	\$759	\$18,773	2.7%	\$362	\$7,994	1.1%	\$1,014	\$38,440	2.6%
Government	\$1,944	\$34,751	6.9%	\$1,409	\$30,401	4.1%	\$917	\$14,108	2.3%
Owners	\$2,941	\$64,752	10.4%	\$3,073	\$90,776	9.0%	\$585	\$10,412	1.5%
Employees	\$78	\$2,481	0.3%	\$14	\$435	0.0%	\$83	\$1,922	0.2%
Family	\$2,033	\$32,429	7.2%	\$2,345	\$40,566	6.9%	\$2,412	\$65,903	6.1%
Other Individuals	\$138	\$3,270	0.5%	\$72	\$2,085	0.2%	\$12	\$395	0.0%
Other Sources	\$145	\$3,591	0.5%	\$277	\$4,494	0.8%	\$3,134	\$104,343	7.9%
Total	\$28,142	\$189,099	100.0%	\$34,055	\$302,192	100.0%	\$39,423	\$375,948	100.0%
N	1,634			1,587			1,507		
Type	2007			2008			2009		
	Mean	Std Dev	%	Mean	Std Dev	%	Mean	Std Dev	%
Bank	\$45,618	\$511,888	72.5%	\$34,718	\$281,864	82.0%	\$24,801	\$167,051	65.6%
Non-Bank	\$8,736	\$171,915	13.9%	\$2,410	\$46,552	5.7%	\$1,951	\$33,979	5.2%
Credit Card	\$2,538	\$11,536	4.0%	\$2,465	\$9,254	5.8%	\$3,884	\$24,781	10.3%
Other Businesses	\$0	\$0	0.0%	\$671	\$16,116	1.6%	\$10	\$288	0.0%
Government	\$703	\$17,972	1.1%	\$356	\$6,925	0.8%	\$5,179	\$153,434	13.7%
Owners	\$1,062	\$22,416	1.7%	\$835	\$17,550	2.0%	\$669	\$16,540	1.8%
Employees	\$1	\$27	0.0%	\$0	\$0	0.0%	\$2	\$85	0.0%
Family	\$1,164	\$18,795	1.9%	\$651	\$34,103	1.5%	\$1,143	\$24,257	3.0%
Other Individuals	\$646	\$23,861	1.0%	\$1,035	\$34,103	2.4%	\$85	\$1,997	0.2%
Other Sources	\$2,439	\$86,248	3.9%	\$108	\$3,488	0.3%	\$63	\$1,642	0.2%
Total	\$62,906	\$595,714	100.0%	\$42,349	\$298,779	102.1%	\$37,788	\$242,607	100.0%
N	1,411			1,322			1,251		

Figure 14: Distribution of Outstanding Debt on Average over Time

Figure 15: Distribution of Outstanding Debt by Source over Time

Figure 16: Distribution of Outstanding Debt by Source over Time (without Bank)

Amount of New Equity Funding. Another variable examined over time in the growth curve model is the dollar amount of new funds provided to a firm in the form of equity during its first six years. External equity can be provided by multiple sources, including venture capital firms, angel investors, owners, family, and friends. However, for this analysis, the amount of external equity that is provided to new firms is aggregated over these sources each year. Thus, one value for each year measures the total amount of external equity the firm has obtained in that year. Including equity as a control variable in the analyses relates to the multiple credit source usage by providing a means to determine if firms substitute debt funding with equity or use equity to obtain additional funds above and beyond what they have obtained in the form of debt. In addition, having the amount of equity included in the model handles an endogeneity issue that is in the model. Firm size is endogenous to finance conditions at the time a firm is started. This could bias the estimate of

the coefficient parameters in the statistical model. The amount of equity is a component of firm size. Firms obtained the highest amount of equity in the first (\$48,559) and sixth years (\$50,406). After year one, the amount of new equity obtained slowly decreases until rebounding in year six. The standard deviation in all six years is much higher than the mean, indicating that a few firms obtain large amounts of new equity. Table 21 and Figure 17 show the distribution of the dollar amount of external equity funding obtained each year.

Table 21: Distribution of New Equity Funding each Year

Type	2004		2005		2006		2007		2008		2009	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Amount of New Equity Funding	\$48,554	\$269,361	\$45,974	\$377,862	\$42,801	\$454,509	\$41,412	\$455,271	\$33,166	\$331,110	\$50,406	\$521,648
N	1,634		1,587		1,507		1,411		1,322		1,251	

Figure 17: Distribution of New Equity Funding on Average each Year over Time

Age of Founders. The age of the founders could influence the usage of credit sources, as younger founders might have less of a history with main credit sources such as commercial banks. Thus they are required to use alternative credit sources as a necessity to keep their firm operating. As well, older founders have had the opportunity to save money to invest in their firm, and thus require less external funds. In addition, the age of founders could influence the survival and growth of the firm. New firms run by older founders have been found to survive longer as older founders can stave off bankruptcy or these older founders are more skilled at running a firm (e.g. T. Bates, 1990; Cosh & Hughes, 1994; Cressy, 2006b). In addition, young founders are more likely to find more opportunities

outside of their firm and voluntarily exit the venture. Finally, Hsu, E. B. Roberts, & Eesley (2007) show that founders that graduated from technology-based universities have a decreasing median age over time. This implies that founders from tech-based universities may now be starting firms at younger ages³³. The average age of founders is 44.9 years (std dev = 10.813). This is similar to the founding age reported in prior studies, as the average age of entrepreneurs when they start their firms has been found to be between 35 and 64 (Fairlie, 2009; Stangler, 2009), and recent report shows the average age is 40 in some data sets (e.g. Wadhwa, Saxenian, Rissing, & Gereffi, 2007).

Gender. Despite the growing number of female-owned firms in the USA, female-owned firms tend to be smaller in size and have slower growth rates than male-owned firms (e.g. Cliff, 1998; A. C. Cooper et al., 1994; E. M. Fischer, Reuber, & Dyke, 1993; E. M. Fischer, 1992). In addition, firms started by women have a lower survival rate than firms started by men (Bosma, Van Praag, Thurik, & De Wit, 2004; Robb, 2002). One reason for women possibly not building growth firms and having lower survival rates is their differences in access to financial capital. The ability to obtain external financing might be affected by the gender of the founder or founders (Brush, N. M. Carter, Greene, M. M. Hart, & Gatewood, 2002; Coleman, 2000; Robb & Coleman, 2010). Studies have shown mixed results in terms of gender affecting access to external financing. For example, G. W. Haynes & D. C. Haynes (1999) and Verheul & Thurik (2001) find that gender does not influence the likelihood of getting a loan. In addition, no difference is found due to gender when

³³ Some research has found that a larger number of individuals start firms when they are in their low-20s or older than 40 (e.g. Minniti & Levesque, 2008; Parker, 2009). Thus there might not be a positive linear relationship between the probability of starting a firm and age; but rather, a convex relationship ("U"-shape). This would suggest the age variable should be squared. However, I am not examining the starting rate. I am examining credit usage, and older individuals tend to have more money and assets than younger individuals. Having additional money and assets can affect credit usage as the individuals can either use the money to fund the business (thus, the firm requires less credit) or they could use their assets as collateral to obtain more credit. Thus, I do not square the age variable in the analysis.

examining the different types of bootstrapping methods used by firms to finance their operations (Neeley & Van Auken, 2010). However, S. Carter & Rosa (1998) and Alsos, Isaksen, & Ljunggren (2006) find that women tend to use less institutional finance, and less financing capital in general. As well, it has been suggested that women ask for external financing less often than men. To control for gender, a variable indicating the percentage of females on the founding team is computed. On average, the founding team consists of 25.9% female members (std dev = 0.391).

Race. Financial institutions have been found to redline certain populations (see Parker, 2009, Chapter 7). One of the implications of the Stiglitz & Weiss (1981) model of credit rationing is redlining. Redlining occurs when a specific group of borrowers who share the same traits as other borrowers cannot obtain a loan even at higher interest rates, but not because of a lack of supply of funds. Redlining is often racially determined. For example, in the mortgage business, black and Hispanic borrowers were charged a higher interest rate than white borrowers with the same credit profiles (Savage, 2011). To control for race, a variable indicating the percentage of non-White individuals on the founding team is computed. On average, the founding team consists of 13.0% non-white members (std dev = 0.325).

Citizenship. Non-American entrepreneurs have a higher rate of starting firms in the United States on a percentage basis of their respective population living in the United States, than American citizens (D. H. Hsu et al., 2007). These firms started by non-Americans tend to generate more innovation (Saxenian, 2002a, 2002b) and have higher survival rates (Coleman, Cotei, & Farhat, 2011). However, with non-technical entrepreneurship by non-Americans it has been found that there is a lower survival rate than with American

entrepreneurs that start non-technical firms (Georgarakos & Tatsiramos, 2009). The reason is because non-technical entrepreneurs tend to start firms due to necessity and will thus leave the entrepreneurship ranks quickly when a wage opportunity appears. To control for citizenship, a variable indicating the percentage of non-American individuals on the founding team is computed. On average, the founding team consists of 6.2% non-American members (std dev = 0.224).

Technology Level. The technology level of a firm can possibly affect survival, growth, and access to external financing. Founders of high technology firms tend to have various reasons for starting their firms, which are not necessarily the same for founders of non-high technology firms. Founders in general have been found to sacrifice economic rationality for non-financial rewards (Cyert & March, 1963; Simon, 1955), and founders of high-technology firms tend to violate economic rationality even more so than founders of firms that are not high technology firms. Reasons include independence (Deakins & Philpott, 1994; Oakey, 1984, 1995) and location (Greenhut & Colberg, 1962). Thus, founders of high technology firms are more willing to substitute profit maximization with non-financial objectives as a key goal for their firms as long as the firm does not become insolvent (Oakey & S. Y. Cooper, 1989). The high-technology founder may be prepared to have his / her firm remain static or grow slowly by avoiding the use of external funds (Deakins and Philpott, 1994). This attitude could affect the survival rate of high technology firms.

High technology firms tend to spend a higher percentage of their funds on research and development. Research and development expenditures tend to be difficult to finance via external means, and for new firms, equity (either internal or external) tends to be the source

used (Auerswald & Branscomb, 2002; Brierley, 2001; Carpentier & Suret, 2006; P. A. Gompers & Lerner, 2001; B. H. Hall & Lerner, 2009; Lerner, 2010; Lindstrom & Olofsson, 2001). Thus, high technology firms could have a different usage of credit sources. For these reasons, a technology variable is included as a control variable.

Multiple methods have been used for operationalizing the concept of a technology, with most of them pertaining to defining an industry's level of technology (as opposed to defining each individual firm's level of technology). The most common indicators of an industry's technology level are measured using expenditures on research and development or the proportion of the workforce in science and technology occupations (Malecki, 1991). Thus, the level of technology is defined by the amount of innovation or human capital in an industry. Following Chapple, Markusen, Schrock, Yamamoto, & Yu (2004), the level of technology of a firm is defined in two ways: 1) technology employers, and 2) technology generators. Technology employers are identified as high technology if they are in an industry where the employment of these occupations exceeds three times the national average of 3.33%, or 9.98% (Chapple et al., 2004). Technology generators are identified as firms being in industries (as defined by NAICS codes) that exceed the U.S. average for both research and development expenditures per employee (\$11,297) and for the proportion of full-time equivalent research and development scientists and engineers in the industry workforce (5.9%). If a firm is in an industry that is either a technology employer or technology generator, it is considered high technology. Firms in all other industries are considered low technology. This is a dichotomous variable, where 1 represents high technology and 0 represents low technology. 44.0% of the firms in my sample are considered to be high technology firms (std dev = 0.497).

Product / Service. Product and service firms have different capital requirements which could affect the need for external financing. The service sector has a smaller need for fixed assets than the product (manufacturing) sector since investment in plant, property, and equipment is relatively low (Cressy & Olofsson, 1997; ENSR, 1996; Hughes, 1997). For example, Cressy & Olofsson (1997) find that the median debt/equity ratio for service firms is 30%, compared to 69% for manufacturing firms. Thus, based upon if the firm is a product or service firm, it is important to control for the type of firm. A dichotomous variable has been created to determine if the firm provides a service (0) or a product (1)³⁴. Approximately half of the firms offer products or products and services, and half offer a service only (std dev = 0.500).

Incorporation. A business is considered to be incorporated if it is a s-corp or a c-corp. Unincorporated businesses are sole proprietorships, limited liability corporations (LLCs), general partnerships, and limited liability partnerships (LLPs). They are different than s-corps and c-corps as taxes can be run through the owner's personal tax filing. Incorporation could affect the credit a firm is available to obtain. Thus, a dichotomous variable is used to indicate if a firm is incorporated (1) or not (0) in the first year of operations. Only 31.4% of the firms are incorporated in the first year of their operations (std dev = 0.464).

Commitment to Venture. The level of commitment to the venture by founders can be an important factor in determining if a new firm survives and grows (Reynolds & B. Miller, 1992). For example, Reynolds (2007) says that the intensity of effort is a positive indicator for venture success. Level of commitment can be measured by number of hours worked by

³⁴ If a firm provides both a product and a service, it is considered a product firm. This is done based upon the reasoning of capital requirements for product firms. If a firm is a product firm and decides to add a service, the capital requirements don't change drastically unlike a service firm that decides to add a product.

the founders and the amount of capital initially provided to the venture at startup (Semasinge, Davidsson, & Steffens, 2011). The number of hours a founder puts into the venture could affect the success of the new firm, with more hours resulting in better performance (Gatewood, Shaver, & Gartner, 1995). The reason is because the founder is more committed to the positive performance of the firm and isn't distracted by other opportunities. However, it has also been found that financial constraints might be less for new firms if the founders continue with their day job and work only part-time in the venture (Petrova, 2010). This is because the individual is earning money from his or her day job, and is not solely reliant on his or her "side" job. These are competing forces as less financial constraints should lead to a higher chance of survival and growth for new firms. As such, I include the number of hours worked by the founders. The variable is calculated by adding the total number of hours worked each week by all the founding team members and dividing by the number of founders. For example, if there are 3 founders, with founder 1 working 50 hours per week on average, founder 2 working 40 hours per week on average, and founder 3 working 20 hours per week on average, the formula would be: $(50 + 40 + 20) / 3 = 36.67\%$. With the standard work week in the United States being 40 hours, any firm with an average of less than 40 hours would indicate the founding team on average works less than full time on the activities related to the firm. The average hours worked by founders was rather stable, with the highest average being 42.5 (in 2005) and the lowest being 39.9 (in 2009). Standard deviations are also fairly steady over the six years, with the highest being in the first year (std dev = 22.243). Table 22 and Figure 18 show the distribution of the dollar amount of new equity each year.

Table 22: Distribution of Hours Worked in Venture by Founders on Average

Type	2004		2005		2006		2007		2008		2009	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Number of Hours Worked in Venture	42.3	22.243	42.5	21.697	42.1	21.815	42.0	21.462	41.0	21.621	39.9	21.127
N	1,634		1,587		1,507		1,411		1,322		1,251	

Figure 18: Distribution of Hours Worked in Venture by Founders on Average

Investment of money by a founder can possibly affect the performance of new firms. Cooper et al. (1994) find that initial financial capital affects the growth and survival of new firms, whereas Cassar (2004) finds that founders with higher household income have higher growth intentions for their firms. Along with measuring the commitment of the firm this variable controls for startup size. Treating the amount of equity contributed by the owners as exogenous can be considered a component of firm size (Astebro & I. Bernhardt, 2003). Firm size is endogenous to finance conditions at the time a firm is started and thus could bias the estimate of the coefficient parameters in the statistical model. Hence, the amount of funds provided by the founders in the form of equity in year one is included in the model. Founders contributed \$27,412 on average at start-up (standard deviation = \$66,349). The variable is not normally distributed, as there are many firms in the data set where the founders did not provide equity in year one and an instance where the founders provided \$1.5 million. To handle this non-normal distribution, the variable is transformed using the natural log function.

Quality of Business Idea. The quality of the business idea needs to be controlled for as a firm with a better business idea could see higher growth and survive longer than a firm with a poorer business idea. Firms with a better business idea have been found to survive longer and in many cases have a higher growth rate than firms with lower quality business ideas. In addition, a firm with a better business idea could have better access to external funds. Or it could be that a firm's multiple relationships with creditors could indicate it is in distress. Even though M. A. Petersen & Rajan (1994) do not find using multiple banks provides a poor signal to the market, they do discuss how multiple relationships with creditors can be a proxy for firms in distress. For example, floundering firms could be cut off by financial institutions and be forced to financing options such as trade credit (M. A. Petersen & Rajan, 1994: 33). In addition, finance provided by founders later in the life of the firm could be a sign of last resort if the firm is performing poorly (Ou & G. W. Haynes, 2006). This would indicate that that researchers should control for the quality of the idea when examining the effects of multiple credit relationships on survival and growth of the firm.

As a proxy, two binary variables are used to measure the quality of the business idea. The first variable measures the existence of intellectual property for a firm. The second proxy variable is based upon the competitive advantage of the firm over its competitors. Measureable legal intellectual property of the firm consists of patents, trademarks, and copyrights. Firms with patents, trademarks, or copyrights tend to be firms with stronger business ideas and often higher valuations (e.g. Block, De Vries, & Sandner, 2010; Cao & P.-H. Hsu, 2010; Eisdorfer & P.-H. Hsu, 2011; Lerner, 1994; Mann & Sager, 2007). A dichotomous variable equals 1 for firms that have a patent, trademark, or copyright in any of

the years of operations and equals 0 otherwise. 38.4% of the firms had intellectual property in the form of a patent(s), trademark(s), and/or copyright(s) within six years of their operations (std dev = 0.486).

To measure competitive advantage over competitors, respondents indicate if they felt if their firm has a competitive advantage over competitors when they started the firm. The common thought is that all entrepreneurs are going to answer yes to this question, as entrepreneurs tend to be overconfident (Busenitz & Barney, 1997), and they would not have started the business if they felt otherwise. This is not necessarily seen as 36.5% indicate they didn't believe they had a competitive advantage in year one. However, the notion is subsequently supported by the percentage of firms indicating they don't have a competitive advantage increasing with firm age as 49.0% indicate they don't have a competitive advantage by year six. This however doesn't weaken the use of this variable as a proxy for business idea quality, as this increase could be that founders are becoming more realistic in describing their firm's level of competitive advantage but don't feel they should quit since the firm has survived, although not grown (most firms are not growth firms). Thus, a dichotomous variable is computed indicating if the founders felt they had a competitive advantage over their competitors in any of the six years, with 1 indicating they feel they have a competitive advantage and 0 indicating they feel they do not. Of the firms that survive all six years, 90.6% indicate they had a competitive advantage in year one. On average, 88.9% of the firms indicate they have a competitive advantage in at least one of the years (std dev = 0.315).

A summary of the descriptive statistics of the invariant control variables is provided in Table 23. In addition, a summary of the descriptive statistics of the multiple credit source

variables and outstanding debt is provided Table 24 in to better illustrate the distribution of the multiple credit sources over time and to compare the amount of debt outstanding each year.

Table 23: Summary of the Descriptive Statistics for the Time Invariant Control Variables

Variable	Mean	Std Dev
Number of Founders	1.416	0.698
Education of Founders	6.416	1.994
Type of Education of Main Founder	0.189	0.392
Work Experience of Founders (overall)	13.116	10.140
Work Experience of Founders (start-up)	0.474	0.499
Age of Founders (in year 1)	44.942	10.813
Gender	0.259	0.391
Race	0.130	0.325
Citizenship	0.062	0.224
Technology Level	0.440	0.497
Product / Service	0.521	0.500
Incorporation (in 1st Year)	0.314	0.464
Founder Contributed Equity (in year 1)	\$27,412	\$66,349
Intellectual Property (any year)	0.384	0.486
Competitive Advantage over Competitors (any year)	0.889	0.315

N = 1,634

Table 24: Summary of the Descriptive Statistics for the Multiple Credit Source and Outstanding Debt Variables

Year	Number of Total Credit Sources		Number of Unique Credit Sources		Diversity Index of Credit Sources		Outstanding Debt (\$)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2004	0.900	1.311	0.636	0.721	0.170	0.254	\$28,142	\$189,099
2005	1.104	1.829	0.681	0.745	0.189	0.265	\$34,055	\$302,192
2006	1.125	1.953	0.663	0.731	0.196	0.269	\$39,423	\$375,948
2007	1.180	2.036	0.673	0.742	0.186	0.264	\$62,906	\$595,714
2008	0.990	2.136	0.556	0.720	0.188	0.266	\$42,349	\$298,779
2009	0.921	1.768	0.551	0.694	0.178	0.260	\$37,788	\$242,607

Credit Crisis. During 2007 and 2008, the United States experienced a credit crisis that dramatically impacted the economy and the availability of credit which firms were able to obtain during the crisis period (e.g. Brunner & Krahnen, 2008; Ivashina & Scharfstein, 2010). The data set covers this period as the panel of firms is tracked from 2004 through 2009. The usage of credit by these firms could be impacted by the credit crisis. Thus, a dichotomous variable has been set up to indicate if the economy was in the credit crisis or not for a given year. For years 2004-2006 and 2009, the ECONOMY variable is set to 0. For years 2007 and 2008, the years encompassing the credit crisis, the ECONOMY variable is set to 1. In addition, there might be an interaction effect between outstanding debt and new equity based upon the economic environment. Therefore, two interaction terms are created (economy x debt and economy x equity). The variables are mean centered between creating the interaction variables so to not have an issue with multicollinearity (DeMaris, 2004).

Location. Different locations in the United States experience different levels of credit availability at different times. For example, local banks in Texas might be more willing to lend to oil companies started in Texas when oil prices are high. Or perhaps local banks in New York might not have been willing to lend to local Internet firms just after the end of the dot-com bubble. In addition, banks might be more or less willing to lend to firms in urban areas than firms in rural areas. Thus, a variable which indicates the metropolitan statistical area of the firm is included in the analysis and will be controlled for in the 3rd level of the HLM model as firms are nested within a metropolitan statistical area. A metropolitan statistical area is defined as a geographical region with a high population density of people and has close economic ties throughout the area. Metropolitan statistical areas were established by the U.S. Office of Management and Budget (a division of the U.S.

government) for the purpose of a population census and the compilation of related statistical data. To be considered a metropolitan statistical area, the area has to have at least one urbanized area of 50,000 or more in population. In 2004, when the survey was initiated, there were 362 metropolitan statistical areas in the United States (Office of Management and Budget, 2003)³⁵. 243 of these metropolitan statistical areas are represented in the sample. Not all firms are in a designated metropolitan statistical area as they might be located in rural areas or small towns. A firm is given a value of 0 if it is not in a designated metropolitan statistical area. There are 282 firms not in a designated metropolitan statistical area.

Analysis

Multiple statistical analyses are used in this study to ensure the robustness of the findings. It is informative to perform these analyses using the different statistical methods to determine if the results are similar or not. Results are more robust when using other available statistical methods to further confirm the findings from the main analyses (e.g. Creswell & Clark, 2007). Initially, OLS regression is performed using a proxy for survival in and difference scores for growth analysis like past studies. Difference scores are used for the dependent variables (performance) as OLS regression is a cross section method of analysis. For the independent variables, the level of the variables for the last full year of operations are used, along with an additional analysis using the first year of operations. OLS and Probit regression are used for the initial survival analysis using continuous and dichotomous measures for survival. These methods use difference scores to analyze new firms and their financing decisions. With difference scores, change is calculated using two end points to measure the change (difference scores). Performing analyses with difference scores using

³⁵ A map of the metropolitan statistical areas can be found online via the following link:
http://www.census.gov/geo/www/maps/msa_maps2004/msa2004_previews_htm/cbsa_us_wall_1104.htm

OLS and Probit regression is what most past studies have used and allows me to compare these basic results to those from more sophisticated analyses performed in this study, including survival analysis, growth curve analysis, and panel data regression.

The independent variables in the OLS and Probit regression are the three multiple credit source variables: number of total credit sources, number of unique credit sources, and diversity index of credit sources, each run in separate regression models as they measure different faucets of multiple credit source usage. Two measurements of each of these multiple credit source variables are used: 1) the level of the multiple credit source variable in the last full year of the firm's operation, and 2) the level of the multiple credit source variable at the end of the first year of operations (i.e. 2004). This follows the concept from the Westhead and Cowling (1995) study when they examined the number of financial sources used by a firm at startup and the firm's last financial year (1986). The levels of variables in the last full year of operations for a firm is important to examine as the usage of multiple credit sources in the last full year of operations is the last full measurement before the firm either closes or the data collection is finished – thus, providing a picture of multiple credit source usage near the time the dependent variables are being measured. However, with new firms, the first year of operations is also considered a crucial time for the firm (e.g. J. W. Meyer & Rowan, 1977; Stinchcombe, 1965; Wiklund, Baker, & D. Shepherd, 2010). During the first year of operations, many activities are set in motion that could affect firms' survival and growth rates. Thus OLS and Probit regression is also performed using the end of first year levels for multiple credit sources.

Upon completing the initial analyses of growth and survival using OLS and Probit regression, I use several additional statistical methods that effectively incorporate

longitudinal data, including survival analysis using Cox proportional hazard modeling, and growth curve modeling using hierarchical linear modeling and panel data regression.

Survival analysis is a statistical method that deals with the death or failure of an organism, system, or organization. The analysis technique involves data which estimates the time to a certain event such as death, to relapse, an onset of a disease, etc. – as such, it was initially used in the medical field (E. T. Lee & Wang, 2003). Over the past 20 years, applications for survival analysis have been extended outside the medical field to other fields, including criminology, sociology, marketing, and entrepreneurship. The main statistic in survival analysis is survival time. Survival time is the time to the occurrence of a given event. In the case of my analysis, the given event is the closure of the new firm.

The survival analysis method I use is Cox proportional hazard modeling (Cox, 1972). It is a multiple regression method for examining the relationship between survival time and possible predictor variables. The data are censored because some of the firms are still alive at year six when the data collection stops (i.e. not all the firms have “died” and thus their survival rates are not known; I can’t assume 100% of those firms survive indefinitely). In addition, the distribution of survival of new firms is not normal as more firms fail earlier than later within the first six years. However, when removing the firms that don’t close by the end of the data collection period, the data does show the failure rate as being normally distributed. The normality test was performed using a visual test and examining the P-P plot and Q-Q plot results. As mentioned earlier, removing the firms that don’t close before the end of the data collection period would bias the results. Hence, when examining the entire sample, the dependent variable is not normally distributed. Such data lends itself to the Cox method as the method is a general nonparametric model which is appropriate for the analysis

of data with and without censoring (E. T. Lee & Wang, 2003). The model uses the hazard function as the dependent variable. The hazard function is proportional to that of the underlying survival distribution.

Growth curve modeling is the statistical analysis tool that I use to examine the trend of multiple credit source usage by new firms over time based upon their performance. Growth curve modeling has the benefit of analyzing the change of a repeated measure over time rather than just a discrete event (as is the case in survival analysis), including being able to estimate flexible curve shapes. Growth curve modeling is a broad term that has been used in different contexts for longitudinal analyses (see Bollen & Curran, 2006). The contemporary use of the term typically refers to statistical methods that estimate between-firm difference in within-firm change (e.g. Raudenbush & Bryk, 2002; Singer & Willett, 2003). The within-firm patterns of change are referred to as time trends or growth curves. A basic growth model is composed of the fixed and random effects. A fixed effect represents a value in the population (e.g., the population mean age of the firms). A random effect represents the random probability distribution around the fixed effect (e.g. the population variance in age of firms). In a growth model the fixed effects represent the mean of the “growth” of all the firms within the sample, and the random effects represent the variance of the individual growth curves around the group means (Curran, Obeidat, & Losardo, 2010).

In growth curve modeling, longitudinal data are modeled from variables that describe a mean trend for the population while allowing for between firm differences (Duncan, Duncan, Strycker, 2006). Growth curve modeling provides several advantages over other methods when analyzing trends, including flexibility, practicality, and its robustness to model development processes and outcomes of change (Muthen, 1991). Growth curve modeling is

able to capture important changes in variables over time that allow the researcher to study the development at the aggregate level of young firms, while also capturing individual firm differences in levels and trends over time (Muthen & Curran, 1997). Growth curve models can be used to model growth as a factor of repeated observations of a single variable, as well as with multiple variables. It is possible to use growth curve modeling to determine whether development in one variable covaries with the development of another variable – time varying covariates (T. E. Duncan, S. C. Duncan, & Strycker, 2006). Such models are considered multivariate growth curve models, which depict two trends affecting one another. These models provide a more dynamic view of the correlates of change as compared to a univariate growth curve model or cross-sectional studies, which offer static views of the data (T. E. Duncan et al., 2006; Muthen & Curran, 1997; Muthen, 1991). I include time varying covariates in my models and control variables. Longitudinal studies and dynamic views are important in entrepreneurship research since new firms are changing rapidly (Davidsson et al., 2001; Low & MacMillan, 1988).

Hierarchical linear modeling (HLM)³⁶ is the framework that is used for the growth curve analysis (Raudenbush & Bryk, 2002). There are two general approaches used to fit growth curve models to observed data: hierarchical linear modeling (Raudenbush & Bryk, 2002) or structural equation modeling (SEM) (T. E. Duncan et al., 2006). The similarities between these methods outnumber the differences (see Curran et al., 2010). HLM tends to be used when there are time varying covariates, multiple levels, and unequal spaced time points in the analysis. SEM tends to be used when latent variables are involved in the analysis.

³⁶ Hierarchical linear modeling is also referred to as multi-level modeling, random coefficient modeling, and mixed-effects modeling.

Since there are no latent variables involved, I use HLM rather than SEM for the growth curve modeling analysis.

HLM is a statistical technique that is typically used when respondents are nested within groups or observations are nested within respondents. Cross-sectional multi-level models examine level-1 responses (e.g. individuals, firms, etc.) nested within higher level entities (e.g. teams, firms, location). The technique takes into account the dependency between observations whereas conventional multiple regression analysis does not (J. Cohen, P. Cohen, West, & Aiken, 2003). However, HLM can also be used for longitudinal data analysis by treating time as nested within respondents. In longitudinal analyses, the models examine patterns of repeated measures nested within individuals, firms, etc. Instead of focusing on inter-firm differences, the multi-level framework focuses on modeling intra-firm changes over time (Bliese & Ployhart, 2002; Singer & Willett, 2003). HLM provides a method of estimating growth models that result in correct standard errors for parameter estimates and thus correct significance tests (MacCallum, C. Kim, Malarkey, & Kiecolt-Glaser, 1997).

The basic conceptualization of HLM is a two level model where level-1 is within-firm and level-2 is between-firm. For growth models, the approach in HLM is that time points are modeled at level-1, with firms which are being observed modeled at level-2. The level-1 models represent repeated measures from the same firm but at different points in time. The multiple-level aspect of HLM using panel data with firms allows me to model the usage of multiple credit source usage over six years of a firm's life.

Panel data regression is another popular form of longitudinal data analysis that is increasingly being used by social science researchers, namely economists. As with growth

curve modeling, panel data regression is a method of studying a particular subject within multiple sites and the subject being observed over a defined time frame. With repeated measures, panel analysis data regression permits the analysis on the dynamics of change over time.

HLM and panel data regression are similar, as they both can capture within group and between group variance. Panel data regression emphasizes specification procedure and misspecification testing. Model specification tends to be simple, with greater attention put on issues related to endogeneity of the regression, the structure of the errors, and the normality of the estimators. For the method of estimation, panel data models have closed-form solutions that can be solved via linear algebra³⁷. The estimation usually generalized least squares based on Aitken's Theorem. HLM models do not have closed-form solutions and are solved by non-linear numerical optimization, as maximum likelihood is used. Thus, HLM models are dependent on approximation and convergence criteria. Even though general serial correlation and heteroskedasticity can be controlled in panel data modeling (e.g. using generalized least squares (GLS)), the HLM framework allows for a more general specification of heteroskedasticity (e.g. allowing to have non-linear covariates) and within group serial correlation (Raudenbush & Bryk, 2002). HLM also allows covariates to vary by group, whereas panel data models do not³⁸. It is arguable which of these methods is best, so both are performed.

³⁷ A mathematical equation is said to be a closed-form solution if it solves a given problem in terms of a finite number of known functions and mathematical operations. The closed-form solution in panel data regression uses generalized least squares (GLS) for efficient estimation of unobserved effects models, which means the variance components are estimated first (create the covariance matrix of errors) and then the parameters (betas) are estimated. More about panel data regression is provided in Chapter 4 - Results.

³⁸ For a more detailed explanation of the differences between HLM and panel data regression, see Croissant & Milla (2008).

Survival analysis, growth curve analysis, and panel data regression using longitudinal data are more robust than analysis using differencing scores with cross-sectional data, and enables analyzing the evolution of a firm's change in credit usage over time. In cross-sectional studies, change is calculated using two end points to measure the change, which fails to use important data in between the two points. In contrast to survival analysis, growth curve analysis and panel data regression use longitudinal data to examine each point in time – in this study, the change for each of the first six years of a firm's life. However, cross-sectional methods are more regularly used in past studies. Thus, OLS regression, Probit regression, Cox proportional hazard modeling (survival analysis), HLM (growth curve modeling), and panel data regression are all performed.

Figure 19 illustrates the statistical methods used in this study as related to the amount of usage of the statistical method in past studies and the complexity of the method.

With the statistical methods being a mix of cross-sectional and longitudinal methods, the measurement of the variables change for some of the variables. Table 25 indicates how these variables are measured for each statistical method.

Table 25: Summary of Variable Measurement for each Statistical Method Used

Variable Name	OLS Regression		Probit Regression		Cox Proportional Hazard Modeling	HLM	Panel Data Regression
	MCS: Last Full Year of Operations	MCS: First Year of Operations	MCS: Last Full Year of Operations	MCS: First Year of Operations			
Dependent Variables							
Survival	Age at 2009	Age at 2009	0, 1 *	0, 1 *	Up to 6 years	N/A	N/A
Growth							
Revenue (LN)	Last Full Year of Operations	Last Full Year of Operations	N/A	N/A	N/A	Up to 6 years	Up to 6 years
Employees (LN)	Last Full Year of Operations	Last Full Year of Operations	N/A	N/A	N/A	Up to 6 years	Up to 6 years
Independent Variables							
Multiple Credit Sources							
Number of Total Credit Sources	Last Full Year of Operations	First Year of Operations	Last Full Year of Operations	First Year of Operations	Up to 6 Years	Up to 6 Years	Up to 6 Years
Number of Unique Credit Sources							
Diversity Index of Credit Sources							

* 0 = survived, 1 = closed

MCS = multiple credit sources, LN = natural log, N/A = not applicable

Variable Name	OLS Regression		Probit Regression		Cox Proportional Hazard Modeling	HLM	Panel Data Regression
	MCS: Last Full Year of Operations	MCS: First Year of Operations	MCS: Last Full Year of Operations	MCS: First Year of Operations			
Control Variables							
Number of Founders	Time Invariant						
Education of Founders							
Type of Education of Main Founder							
Work Experience of Founders (overall)							
Work Experience of Founders (start-up)							
Amount of Outstanding Debt (LN)	Last Full Year of Operations	First Year of Operations	Last Full Year of Operations	First Year of Operations	Up to 6 years	Up to 6 years	Up to 6 years
Amount of New Equity (LN)	Last Full Year of Operations	First Year of Operations	Last Full Year of Operations	First Year of Operations	Up to 6 years	Up to 6 years	Up to 6 years
Age of Founders	Time Invariant						
Gender							
Race							
Citizenship							
Technology Level							
Product / Service	Time Invariant						
Incorporation - in year 1							
Commitment to Venture							
Number of Hours Worked in Venture	Last Full Year of Operations	First Year of Operations	Last Full Year of Operations	First Year of Operations	Up to 6 years	Up to 6 years	Up to 6 years
Founder Contributed Equity - in year 1 (LN)	Time Invariant						
Quality of Business Idea							
Intellectual Property - any year							
Competitive Advantage over Competitors - any year							
Credit Crisis	Not Used	Not Used	Not Used	Not Used	Up to 6 years	Up to 6 years	Up to 6 years
Location	Not Used	Not Used	Not Used	Not Used	Not Used	3rd Level	Not Used

LN = natural log

CHAPTER 4

RESULTS

In this section, I report the results of the statistical analyses. As mentioned in the previous chapter, multiple statistical methods are used, spanning from simple statistical analyses to more sophisticated statistical analyses. I perform OLS regression, Probit regression, survival analysis using Cox proportional hazard modeling, growth curve analysis using hierarchal linear modeling, and panel data regression analyses on the entire sample using survival and growth variables as the dependent variables. In addition, I perform additional analysis using subsets of the data based upon a 2x2 framework³⁹ with the dimensions of survival and growth. These additional analyses also include OLS regression, Probit regression, survival analysis, growth curve analysis, and panel data regression. Finally, robustness checks are performed to confirm the rationale of the hypotheses and to better understand which credit sources are driving the results.

Statistical Software

The statistical software *R 2.15.1* (R Development Core Team, 2012) is used for the statistical analysis. *R* is an integrated suite of software tools that can be used for data manipulation, calculation, and graphical display⁴⁰. There are a number of statistical packages that can be installed in *R* to allow for robust statistical analysis. I use the base statistical

³⁹ The 2x2 framework is explained in further detail in a later section of this chapter.

⁴⁰ Source: <http://cran.r-project.org/doc/manuals/R-intro.html>

package for OLS regression and Probit regression, which includes the *lm* and *glm* functions. The other packages I use are *survival* (Therneau, 2012), *nlme* (non-linear and mixed-effects)⁴¹ (Pinheiro & D. M. Bates, 2000), and *plm* (Croissant & Millo, 2008). The *survival* package examines and models the time it takes for events to occur. The package uses the *coxph* function to fit the Cox proportional hazard regression model. The *nlme* package can be used to estimate a variety of hierarchical linear (multi-level) models and provides flexibility to easily control the settings of the statistical models, including using the maximum-likelihood method for estimation when using the *lme* function. The *plm* package uses the generalized least squares estimation method to fit an econometrics-based model, panel data regression.

Multicollinearity and Common Method Bias

Before running the detail analysis, I investigate for multicollinearity and common method bias issues. I check for multicollinearity by examining the correlations. Multicollinearity occurs when there are two or more variables in the model that are highly correlated and provide redundant information. If there is multicollinearity, there could be inflation in the variances of regression estimates and inflation in the magnitudes of the coefficients (DeMaris, 2004). The average of the absolute correlation values is 0.088, with the highest absolute correlate value being 0.953 (between number of employees in 2008 and number of employees in 2009). There is a high correlation between repeated measures, which include the following variables: revenue, employees, number of total credit sources, number of unique credit sources, and diversity index of credit sources. It is normal to have high correlation between repeated measures. Longitudinal studies can handle the high

⁴¹ The *lme4* package (D. Bates, Maechler, & Bolker, 2011) is a newer version of the *nlme* package. However, it doesn't allow for autocorrelation. And since there is an issue with autocorrelation in the growth curve models, the *nlme* package is used instead of the newer *lme4* package.

correlation. For example, with HLM, autocorrelation is controlled for (explained further in the HLM section). The correlations are much lower when examining only correlations between variables that are used in the same equation (e.g. there are them different multiple credit source variables, and none of them are used in the same equation; they are tested separately). After removing the correlations between repeated measures and correlations between variables that are not used in the same equation, the highest correlations are found between several of the outstanding debt variables and multiple credit source variables (the highest being 0.801, 0.756, 0.735, 0.734, 0.705, 0.701). This is still high. However, these five correlations are in the mix of 108 correlations between outstanding debt and the three multiple credit source variables, and if those five correlations are removed, the next highest correlation in the entire correlation matrix then becomes 0.595. Such levels of correlation between the variables are not very high, especially when the average absolute correlation is much lower. The overall levels of correlations don't indicate an issue with multicollinearity.

Common method variance is not an issue in the data set even though the same respondent that answered the independent variables also answered the dependent variable in the survey. When the same respondent answers the independent variable and dependent variable the association of these variables could be stronger than they really are. This could possibly bias the coefficient estimates due to common method variance (P. M. Podsakoff, MacKenzie, J.-Y. Lee, & N. P. Podsakoff, 2003; P. M. Podsakoff & Organ, 1986). Hence, I test for common method bias by examining the correlations and performing a Harman's single-factor test (P. M. Podsakoff & Organ, 1986). As mentioned when examining for the possibility of multicollinearity, the absolute values for the correlations between the variables are low on average (0.088). In addition, I conduct a Harman's single-factor test to test for

common method variance. This is done by performing a factor analysis with principal components extraction using all of the independent and dependent variables included in the analysis. 15 factors have eigenvalues greater than 1, with the first factor accounting for only 11.5% of the variance. Since one factor did not explain more than 50% of the variance, this suggests that common method variance should not be a critical problem for this study.

OLS Regression

The first statistical method I use in this analysis is ordinary least squares (OLS) regression. I perform OLS regression analysis using three different dependent variables: age at 2009 (proxy for survival), revenue (growth), and number of employees (growth), each run in separate regression models. The independent variables are the three multiple credit source variables: number of total credit sources, number of unique credit sources, and diversity index of credit sources, each run in separate regression models as they measure different faucets of multiple credit source usage. Two measurements of each of these multiple credit source variables are used: 1) the level of the multiple credit source variable in the last full year of the firm's operation, and 2) the level of the multiple credit source variable at the end of the first year of operations (i.e. 2004).

The covariates in the model are: number of founders, education of founders, type of education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology level, incorporation (in year 1), number of hours worked in venture, founder contributed equity (in year 1), intellectual property (any year), and competitive advantage over competitors (any year). The credit crisis and location variables are not included in this analysis. The credit crisis variable is time varying and the same logic of using the last full year level is not appropriate. For the location variable, the

variable is essentially a categorical variable with more than 211 categories. It would be unreasonable to include more than 211 dummy variables for the location variable. Thus, both the credit crisis and location variables are not included in the regression model.

The dependent variables for this analysis are age at 2009, revenue, and number of employees. The proxy for survival in the regression model is age at 2009. This variable represents how old the firm is in 2009. If the firm is still living when the data collection stops in 2009, the age is 7. If the firm closed in 2009 or before, the age of the firm at which it closed is the age of the firm in 2009. The revenue and number of employees are taken at the level of the firm's last year of operation. The results are shown in Table 26, Table 27, and Table 28.

Table 26: OLS Regression Results, Dependent Variable: Age at 2009 (MCS – Last Full Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	-0.021	-1.030	0.303	-0.217	-3.733	<0.001 ***	-0.206	-0.333	0.739
Number of Unique Credit Sources							0.061	1.246	0.213
Diversity of Index of Credit Sources							0.025	1.419	0.156
Number of Founders	0.065	1.333	0.183	0.060	1.239	0.216	0.491	5.690	<0.001 ***
Education of Founders	0.025	1.432	0.152	0.027	1.525	0.128	0.011	2.983	0.003 **
Type of Education of Main Founder	0.492	5.709	<0.001 ***	0.479	5.586	<0.001 ***	0.002	0.033	0.974
Work Experience of Founders (overall)	0.011	3.010	0.003 **	0.012	3.291	0.001 **	-0.010	-0.565	0.572
Work Experience of Founders (start-up)	0.001	0.013	0.990	-0.001	-0.021	0.983	-0.033	-8.706	<0.001 ***
Amount of Outstanding Debt	-0.014	-3.533	<0.001 ***	-0.006	-1.398	0.162	-0.005	-1.555	0.120
Amount of New Equity	-0.033	-8.704	<0.001 ***	-0.033	-8.796	<0.001 ***	-0.102	-1.207	0.228
Age of Founders	-0.005	-1.559	0.119	-0.006	-1.748	0.081	-0.170	-1.617	0.106
Gender	-0.105	-1.246	0.213	-0.107	-1.274	0.203	0.278	1.822	0.069
Race	-0.166	-1.574	0.116	-0.177	-1.695	0.090	-0.016	-0.233	0.816
Citizenship	0.278	1.822	0.069	0.274	1.803	0.072	-0.002	-0.025	0.980
Technology Level	-0.013	-0.190	0.849	-0.004	-0.055	0.957	-0.099	-1.386	0.166
Product / Service	-0.001	-0.018	0.986	0.008	0.120	0.905			
Incorporation (in year 1)	-0.097	-1.354	0.176	-0.102	-1.439	0.150			
Commitment to Venture									
Number of Hours Worked in Venture	0.002	0.975	0.330	0.002	1.000	0.318	0.002	0.949	0.343
Founder Contributed Equity (in year 1)	0.001	0.333	0.739	0.001	0.356	0.722	0.001	0.356	0.722
Quality of Business Idea									
Intellectual Property (any year)	0.275	3.916	<0.001 ***	0.278	3.972	<0.001 ***	0.277	3.942	<0.001 ***
Competitive Advantage over Competitors (any year)	0.499	4.656	<0.001 ***	0.478	4.469	<0.001 ***	0.500	4.659	<0.001 ***
R ²	0.119			0.126			0.119		
Adjusted R ²	0.108			0.116			0.108		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Age at 2009

Table 27: OLS Regression Results, Dependent Variable: Revenue in Last Full Year (MCS – Last Full Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	0.124	4.249	<0.001 ***	0.288	3.670	<0.001 ***			
Number of Unique Credit Sources							-2.444	-2.992	0.003 **
Diversity of Index of Credit Sources							0.616	9.312	<0.001 ***
Number of Founders	0.618	9.388	<0.001 ***	0.636	9.649	<0.001 ***	0.084	3.387	<0.001 ***
Education of Founders	0.086	3.507	<0.001 ***	0.085	3.448	<0.001 ***	0.162	1.396	0.163
Type of Education of Main Founder	0.171	1.482	0.138	0.190	1.649	0.099	0.017	3.354	<0.001 ***
Work Experience of Founders (overall)	0.016	3.227	0.001 **	0.016	3.096	0.002 **	0.261	2.806	0.005 **
Work Experience of Founders (start-up)	0.253	2.723	0.007 **	0.258	2.776	0.006 **	0.093	3.875	<0.001 ***
Amount of Outstanding Debt	0.013	2.371	0.018 **	0.010	1.601	0.110	-0.023	-4.457	<0.001 ***
Amount of New Equity	-0.023	-4.357	<0.001 ***	-0.023	-4.325	<0.001 ***	-0.013	-2.628	0.009 **
Age of Founders	-0.013	-2.684	0.007 **	-0.013	-2.568	0.010 *	-0.432	-3.677	<0.001 ***
Gender	-0.425	-3.627	<0.001 ***	-0.436	-3.715	<0.001 ***	-0.210	-1.407	0.160
Race	-0.279	-1.880	0.060	-0.250	-1.684	0.092	0.474	2.278	0.023 *
Citizenship	0.428	2.064	0.039 *	0.455	2.190	0.029 *	0.081	0.871	0.384
Technology Level	0.073	0.788	0.431	0.068	0.736	0.462	0.221	2.404	0.016 *
Product / Service	0.220	2.403	0.016 *	0.214	2.334	0.020 *	0.553	5.680	<0.001 ***
Incorporation (in year 1)	0.544	5.598	<0.001 ***	0.564	5.803	<0.001 ***			
Commitment to Venture									
Number of Hours Worked in Venture	0.043	19.410	<0.001 ***	0.043	19.420	<0.001 ***	0.043	19.357	<0.001 ***
Founder Contributed Equity (in year 1)	0.007	1.201	0.230	0.006	1.139	0.255	0.007	1.255	0.210
Quality of Business Idea									
Intellectual Property (any year)	-0.055	-0.584	0.559	-0.069	-0.724	0.469	-0.049	-0.519	0.604
Competitive Advantage over Competitors (any year)	0.210	1.392	0.164	0.235	1.556	0.120	0.214	1.414	0.158
R ²	0.373			0.371			0.369		
Adjusted R ²	0.365			0.362			0.360		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Revenue in last full year

Table 28: OLS Regression Results, Dependent Variable: Number of Employees in Last Full Year (MCS – Last Full Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	0.087	1.149	0.251	0.420	1.977	0.048 *			
Number of Unique Credit Sources							-4.557	-2.031	0.042 *
Diversity of Index of Credit Sources							0.676	3.831	<0.001 ***
Number of Founders	0.688	3.898	<0.001 ***	0.704	3.999	<0.001 ***	0.021	0.326	0.745
Education of Founders	0.024	0.366	0.714	0.021	0.325	0.745	0.154	0.492	0.663
Type of Education of Main Founder	0.184	0.586	0.558	0.206	0.659	0.510	0.018	1.342	0.180
Work Experience of Founders (overall)	0.017	1.286	0.199	0.015	1.154	0.249	0.421	1.706	0.088
Work Experience of Founders (start-up)	0.412	1.667	0.096	0.415	1.681	0.093	0.202	3.082	0.002 **
Amount of Outstanding Debt	0.064	4.367	<0.001 ***	0.053	3.205	0.001 **	0.030	2.141	0.032 *
Amount of New Equity	0.030	2.142	0.032 *	0.030	2.179	0.030 *	-0.036	-2.880	0.004 **
Age of Founders	-0.036	-2.895	0.004 **	-0.035	-2.795	0.005 **	-0.615	-2.001	0.046 *
Gender	-0.619	-2.011	0.044 *	-0.620	-2.014	0.044 *	0.843	2.204	0.028 *
Race	0.744	1.946	0.052	0.783	2.055	0.040 *	0.521	0.941	0.347
Citizenship	0.481	0.869	0.385	0.492	0.889	0.374	-0.123	-0.497	0.619
Technology Level	-0.130	-0.523	0.601	-0.141	-0.570	0.569	0.461	1.882	0.060
Product / Service	0.467	1.907	0.057	0.450	1.836	0.067			
Incorporation (in year 1)	1.508	5.799	<0.001 ***	1.523	5.865	<0.001 ***	1.518	5.845	<0.001 ***
Commitment to Venture									
Number of Hours Worked in Venture	0.072	12.394	<0.001 ***	0.072	12.414	<0.001 ***	0.072	12.438	<0.001 ***
Founder Contributed Equity (in year 1)	0.053	3.692	<0.001 ***	0.053	3.675	<0.001 ***	0.053	3.715	<0.001 ***
Quality of Business Idea									
Intellectual Property (any year)	0.470	1.840	0.066	0.463	1.812	0.070	0.489	1.916	0.056
Competitive Advantage over Competitors (any year)	0.022	0.057	0.955	0.061	0.156	0.876	0.020	0.052	0.958
R ²	0.214			0.216			0.216		
Adjusted R ²	0.205			0.206			0.206		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Number of employees in last full year

Two of the multiple credit source variables were not statistically significant, with the third multiple credit source variable found to be statistically significant but negatively associated with age at 2009. The number of total credit sources is not statistically significant

with age at 2009 (-0.021, t-value = -1.030, $p = 0.303$). The number of unique credit sources is negative and statistically significant with age at 2009 (-0.217, t-value = -3.733, $p < 0.001$). The diversity of credit sources is not statistically significant with age at 2009 (-0.206, t-value = -0.333, $p = 0.739$). These results suggest that hypothesis 1, which posited a positive relationship between multiple credit sources and survival, is not supported. The results indicate that new firms that use fewer unique credit sources experience higher survival rates. In other words, new firms that use a higher number of unique credit sources are found to have lower survival rates. The negative relationship with survival and the unique credit source variables is contrary to the positive relationship found between revenue and the multiple credit source variables. This could be because the usage of unique credit sources is a last ditch effort for firms that are already failing. The unique credit sources may be measuring the efforts of firms that are on the verge of failing as firms have to tap into credit sources which they have not previously used. Further analyses will need to be performed on surviving and non-surviving firms to further confirm this result, with such analyses reported later in this chapter.

The negative relationship between survival and the number of unique credit sources is contrary to the positive relationship found between revenue and the number of total and unique credit sources. The number of total credit sources is positive and statistically significant with revenue (0.124, t-value = 4.249, $p < 0.001$). Also, the number of unique credit sources is positive and statistically significant with revenue (0.288, t-value = 3.670, $p < 0.001$). However, the diversity of credit sources is negative and statistically significant with revenue (-2.444, t-value = -2.992, $p = 0.003$). These results suggest partial support for

hypothesis 2, which posited a positive relationship between multiple credit sources and growth.

The relationship between the number of employees and multiple credit sources has a similar result. Although the number of total credit sources is not statistically significant (0.087, t -value = 1.149, p = 0.251), the number of unique credit sources is positive and statistically significant with number of employees (0.420, t -value = 1.977, p = 0.048). The diversity of credit sources is negative and statistically significant with number of employees (-4.557, t -value = -2.031, p = 0.042). Again, these results indicate partial support for hypothesis 2.

Several of the control variables are statistically significant. Type of education of the main founder, work experience of the founders, intellectual property, and competitive advantage are positive and statistically significant with age at 2009. A positive relationship between type of education of the main founder, which is a dummy variable that equals 1 if the founder has a business education, indicates that founders with a business education tend to start firms that survive longer than firms started by founders without a business education. Amount of outstanding debt and amount of new equity are negative and statistically significant with age at 2009. Number of founders, education of the founders, work experience of the founders, startup work experience of the founders, amount of outstanding debt, incorporation, and number of hours worked are positive and statistically significant with revenue. Amount of new equity, age of the founders, gender, and race are negative and statistically significant with revenue. Number of founders, amount of outstanding debt, amount of new equity, incorporation, number of hours worked in the venture, and founder

contributed equity are positive and statistically significant with number of employees. Age of founders and gender are negative and statistically significant with number of employees.

The type of education of the main founder is not statistically significant with growth (revenue and number of employees). These results, along with the result that the type of education of the main founder is statistically significant and positively associated with age at 2009, suggests business education helps firms survive longer but does not necessarily lead to starting a firm that will grow faster. There are several possible explanations for this result. One, business educated founders vary in their goals when starting firms that generate a large amount of revenue or when hiring a large number of employees as opposed to starting lifestyle businesses. Second, business educated founders are contributing to the “walking dead” problem, in which they should be closing their firms earlier as the firm is officially and legally an organization but is not fully operating (the founders know how to make ends meet to not have to close the firm, with the hopes it will revive itself sometime in the future). A third possible explanation for the result is that business educated founders know how to use losses from a business as a tax write off more so than non-business educated founders.

Overall work experience is statistically significant and positively associated with the age of the firm and revenue. The overall work experience is not statistically significant with number of employees. This would suggest that founders with more overall work experience start firms that have a higher survival rate or these types of founders are more persistent in general. With overall work experience also being positively associated with revenue, the reasoning that founders with more overall work experience start firms having a higher survival rate (e.g. T. Bates, 1990; Bosma et al., 2004; A. C. Cooper et al., 1994; Cressy, 1996b) makes more sense than the persistence reasoning. The persistence reasoning states

that entrepreneurs have a tendency to continue operating their firms even though rational individuals would cease their firm's operations (e.g. Gimeno et al., 1997). For example, entrepreneurs continue to operate their firms even though their firms are not growing or are losing money. If the persistence reasoning was the case, overall work experience would not be positively associated with revenue. With overall work experience not statistically significant with the number of employees, but statistically significant with revenue, founders with more overall work experience are starting firms that grow financially but don't add jobs – they are utilizing resources other than employees to build their revenue.

The number of founders is not statistically significant with the age of the firm, but is statistically significant and positive with growth (both revenue and number of employees). The relationship with growth supports past studies which find that firms started with more than one individual are more successful (e.g. Cressy, 2006a, 2006b; Forster, 2012).

The outstanding debt for the last full year is statistically associated with the age of the firm and growth. Outstanding debt is negatively associated with age, but is positively associated with growth (both revenue and employees). This indicates that more debt is associated with both lower survival rates and higher growth. This supports recent work by Huyghebaert & Van de Gucht (2007), in which they examine new firms in the Netherlands and find that new firms that use debt grow faster. In addition, this indicates that funds gained from an increase in revenue are not used to retire debt, but rather to support future growth of the firm⁴².

The amount of new equity in the last full year is negatively associated with age of the firm and revenue, but positively associated with employees. This indicates the amount of

⁴² Further analysis is needed to confirm this, for example, examine assets and expenses to see where the funds are being used specifically.

new equity received in the last full year of operations possibly decreases the survival rate and revenue growth. However, new equity is associated with firms with more employees, suggesting that new equity can spur growth in the form of jobs in new firms.

The previous OLS regression analysis examined the levels of multiple credit source variables in the last full year of operations for firms. The next OLS regression analysis examines the multiple credit source variables at the end of the first year of operations. Table 29, Table 30, and Table 31 present the OLS regression using the end of first year levels for the multiple credit source variables, amount of outstanding debt, amount of new equity, and number of hours worked in the venture (i.e. the time varying covariates in the main analysis). When examining the multiple credit source variables, the results are different than the previous OLS regression results presented in Table 26, Table 27, and Table 28 where these variables used the level of the variables in the last full year of operations as opposed to the level of these variables at the end of the first year of operations.

Table 29: OLS Regression Results, Dependent Variable: Age at 2009 (MCS – End of First Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	-0.221	-3.637	<0.001 ***	-0.518	-0.804	0.421			
Number of Unique Credit Sources							0.014	0.284	0.776
Diversity of Index of Credit Sources							0.727	9.789	<0.001 ***
Number of Founders	0.075	1.505	0.123	0.071	1.419	0.156	0.063	2.307	0.021 *
Education of Founders	0.028	1.544	0.123	0.027	1.473	0.141	0.154	1.212	0.226
Type of Education of Main Founder	0.485	5.612	<0.001 ***	0.494	5.694	<0.001 ***	0.026	4.583	<0.001 ***
Work Experience of Founders (overall)	0.011	3.062	0.002 **	0.011	2.893	0.004	0.309	3.006	0.003 **
Work Experience of Founders (start-up)	-0.036	-0.528	0.597	-0.030	-0.439	0.661	0.010	1.421	0.155
Amount of Outstanding Debt	-0.003	-0.654	0.513	-0.001	-0.032	0.974	-0.009	-0.460	0.646
Amount of New Equity	-0.008	-0.641	0.522	-0.007	-0.596	0.551	-0.020	-3.767	<0.001 ***
Age of Founders	-0.006	-1.846	0.065	-0.006	-1.779	0.075	-0.486	-3.739	<0.001 ***
Gender	-0.107	-1.253	0.211	-0.092	-1.068	0.286	-0.336	-2.057	0.040 *
Race	-0.220	-2.077	0.038 *	-0.207	-1.937	0.053	0.471	2.060	0.040 *
Citizenship	0.251	1.633	0.103	0.253	1.643	0.101	0.105	1.020	0.308
Technology Level	-0.001	-0.015	0.988	0.006	0.086	0.932	0.183	1.801	0.072
Product / Service	-0.025	-0.373	0.710	-0.021	-0.306	0.760	0.618	5.723	<0.001 ***
Incorporation (in year 1)	-0.086	-1.195	0.232	-0.096	-1.329	0.184			
Commitment to Venture									
Number of Hours Worked in Venture	0.001	0.862	0.389	0.001	0.859	0.390	0.027	11.461	<0.001 ***
Founder Contributed Equity (in year 1)	0.006	0.526	0.599	0.006	0.474	0.636	0.010	0.541	0.589
Quality of Business Idea									
Intellectual Property (any year)	0.229	3.244	0.001 **	0.235	3.313	0.001 **	-0.086	-0.824	0.410
Competitive Advantage over Competitors (any year)	0.472	4.384	<0.001 ***	0.489	4.528	<0.001 ***	0.245	1.470	0.142
R ²	0.077			0.080			0.074		
Adjusted R ²	0.066			0.069			0.062		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Age at 2009

Table 30: OLS Regression Results, Dependent Variable: Revenue in Last Full Year (MCS – End of First Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	-0.063	-0.687	0.492						
Number of Unique Credit Sources				-4.399	-4.594	<0.001 ***			
Diversity of Index of Credit Sources							0.065	0.540	0.589
Number of Founders	0.730	9.850	<0.001 ***	0.720	9.779	<0.001 ***	0.833	4.474	<0.001 ***
Education of Founders	0.063	2.330	0.020 *	0.059	2.197	0.028 *	0.002	0.024	0.981
Type of Education of Main Founder	0.151	1.189	0.235	0.147	1.172	0.241	0.219	0.678	0.498
Work Experience of Founders (overall)	0.026	4.626	<0.001 ***	0.025	4.561	<0.001 ***	0.033	2.385	0.017 *
Work Experience of Founders (start-up)	0.307	2.984	0.003 **	0.310	3.035	0.002 **	0.431	1.683	0.093
Amount of Outstanding Debt	0.015	1.919	0.055	0.137	4.898	<0.001 ***	0.064	0.540	0.589
Amount of New Equity	-0.009	-0.475	0.635	-0.010	-0.534	0.594	0.039	2.263	0.024 *
Age of Founders	-0.021	-3.789	<0.001 ***	-0.021	-3.829	<0.001 ***	-0.046	-3.612	<0.001 ***
Gender	-0.490	-3.770	<0.001 ***	-0.453	-3.504	<0.001 ***	0.750	-2.346	0.019 **
Race	-0.338	-2.068	0.039 *	-0.272	-1.667	0.096	0.682	1.728	0.084
Citizenship	0.471	2.059	0.040 *	0.469	2.065	0.039 *	0.457	0.800	0.424
Technology Level	0.102	0.993	0.321	0.124	1.209	0.227	-0.184	-0.713	0.476
Product / Service	0.180	1.775	0.076	0.158	1.567	0.117	0.414	1.635	0.102
Incorporation (in year 1)	0.623	5.787	<0.001 ***	0.612	5.729	<0.001 ***	1.633	6.050	<0.001 ***
Commitment to Venture									
Number of Hours Worked in Venture	0.027	11.472	<0.001 ***	0.027	11.496	<0.001 ***	0.046	7.999	<0.001 ***
Founder Contributed Equity (in year 1)	0.010	0.557	0.577	0.011	0.602	0.547	0.044	0.950	0.342
Quality of Business Idea									
Intellectual Property (any year)	-0.089	-0.851	0.395	-0.073	-0.707	0.480	0.548	2.078	0.038 *
Competitive Advantage over Competitors (any year)	0.242	1.453	0.146	0.241	1.456	0.146	0.202	0.504	0.614
R ²	0.237			0.237			0.248		
Adjusted R ²	0.226			0.226			0.238		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Revenue in last full year

Table 31: OLS Regression Results, Dependent Variable: Number of Employees in Last Full Year (MCS – End of First Year)

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	0.064	0.540	0.589						
Number of Unique Credit Sources				0.115	0.510	0.610			
Diversity of Index of Credit Sources							-5.885	-2.466	0.014 *
Number of Founders	0.833	4.474	<0.001 ***	0.838	4.510	<0.001 ***	0.046	8.004	<0.001 ***
Education of Founders	0.002	0.024	0.981	0.002	0.026	0.980	-0.003	-0.051	0.960
Type of Education of Main Founder	0.219	0.678	0.498	0.220	0.682	0.496	0.227	0.661	0.509
Work Experience of Founders (overall)	0.033	2.385	0.017 *	0.033	2.379	0.017 *	0.032	2.374	0.018 *
Work Experience of Founders (start-up)	0.431	1.683	0.093	0.432	1.688	0.092	0.430	1.683	0.092
Amount of Outstanding Debt	0.039	2.263	0.024 *	0.038	2.029	0.043	0.213	3.053	0.002 **
Amount of New Equity	0.002	0.038	0.970	0.004	0.091	<0.001 ***	0.002	0.038	0.969
Age of Founders	-0.046	-3.612	<0.001 ***	-0.046	-3.595	<0.001 ***	-0.046	-3.620	<0.001 ***
Gender	-0.750	-2.346	0.019 *	-0.749	-2.345	0.019 *	-0.710	-2.225	0.026 *
Race	0.682	1.728	0.084	0.680	1.724	0.085	0.765	1.937	0.053
Citizenship	0.457	0.800	0.424	0.460	0.804	0.422	0.441	0.772	0.440
Technology Level	-0.184	-0.713	0.476	-0.184	-0.714	0.475	-0.150	-0.583	0.560
Product / Service	0.414	1.635	0.102	0.417	1.646	0.100	0.378	1.491	0.136
Incorporation (in year 1)	1.633	6.050	<0.001 ***	1.637	6.073	<0.001 ***	1.634	6.076	<0.001 ***
Commitment to Venture									
Number of Hours Worked in Venture	0.046	7.999	<0.001 ***	0.046	8.027	<0.001 ***	0.046	8.004	<0.001 ***
Founder Contributed Equity (in year 1)	0.044	0.950	0.342	0.041	0.900	0.368	0.043	0.951	0.342
Quality of Business Idea									
Intellectual Property (any year)	0.548	2.078	0.038 *	0.544	2.067	0.039 *	0.555	2.110	0.035 *
Competitive Advantage over Competitors (any year)	0.202	0.504	0.614	0.207	0.515	0.607	0.188	0.469	0.639
R ²	0.145			0.145			0.148		
Adjusted R ²	0.135			0.135			0.138		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Number of employees in last full year

In the previous OLS analysis, only number of unique credit sources was statistically significant with age at 2009. When using the first year levels of multiple credit sources, only number of total credit sources is statistically significant with age at 2009. The relationship

between number of total credit sources and age at 2009 is negative (-0.221 , $t\text{-value} = -3.637$, $p < 0.001$). The results are consistent in that they are both indicating a negative relationship with age at 2009. These results may suggest that obtaining unique credit sources during the last full year of operations could be a sign a firm is grasping at straws to survive, while using more credit sources in the first year of operations could indicate that firms are struggling to obtain the necessary financing from traditional sources (e.g. banks). This could be a sign the firm is not a quality business idea or that management is not managing the firm's financing in an efficient manner.

In the previous OLS analysis, all three multiple credit sources were statistically significant, with number of total and unique credit sources both positively related to revenue and diversity of credit source negatively related to revenue. When examining the first year levels of multiple credit sources, only number of unique credit sources is statistically significant with revenue. Unlike the previous OLS analysis, number of unique credit sources is negatively related with revenue (-4.399 , $t\text{-value} = -4.594$, $p < 0.001$).

The diversity of credit sources in the first year is negative and statistically significant with number of employees (-5.855 , $t\text{-value} = -2.466$, $p = 0.014$). This is consistent with the previous OLS analysis that used the last full year levels.

For the control variables, the relationships with the dependent variables have a different sign for startup work experience, amount of outstanding debt, amount of new equity, age of founders, and race in several of the models. Amount of outstanding debt is no longer statistically significant in the models where the growth is the dependent variable. Age of founders is now statistically significant and negative in the model where the number of

employees is the dependent variable. Finally, race is now statistically significant and negative in the models where age of the firm is the dependent variable.

Probit Regression

In the previous OLS regression that analyzed survival, the variable used for measuring survival was based upon age at which the firm closed (if the firm closed within 6 years). Another way to measure survival is to use a dichotomous variable for survival rather than age at which the firm closed. Therefore, another analysis of survival can specify the dependent variable be 0 if the firm survives more than six years, and 1 if the firm closes within six years⁴³. A different form of regression should be used as OLS regression should not be used when the dependent variable is dichotomous (as opposed to continuous). When the dependent variable is dichotomous, OLS regression becomes inefficient at estimating the coefficients (e.g. J. H. Aldrich & F. D. Nelson, 1984). A solution to this problem is to use Probit regression to estimate the model, which constrains the estimated probability to be between 0 and 1. Table 32 presents the results of the Probit analysis using the last full year of operation variables.

⁴³ As mentioned earlier, six years is an important length of time as most studies concerned with new firm survival examined firms that were six years or less.

Table 32: Probit Regression Results (MCS – Last Full Year)

	Standardized			Standardized			Standardized		
	Coefficient	z-value	Sig.	Coefficient	z-value	Sig.	Coefficient	z-value	Sig.
Number of Total Credit Sources	0.010	0.429	0.668						
Number of Unique Credit Sources				0.135	2.106	0.035 *			
Diversity of Index of Credit Sources							0.005	0.007	0.994
Number of Founders	-0.048	-0.872	0.383	-0.045	-0.828	0.408	-0.046	-0.847	0.397
Education of Founders	-0.052	-2.653	0.008 **	-0.053	-2.712	0.007 *	-0.052	-2.653	0.008 **
Type of Education of Main Founder	-0.361	-3.479	0.001 **	-0.353	-3.397	0.001 **	-0.361	-3.471	0.001 **
Work Experience of Founders (overall)	-0.015	-3.571	<0.001 ***	-0.015	-3.728	<0.001 ***	-0.015	-3.559	<0.001 ***
Work Experience of Founders (start-up)	0.018	0.243	0.888	0.019	0.248	0.804	-0.361	-3.471	0.001 **
Amount of Outstanding Debt	0.008	1.906	0.057	0.003	0.609	0.543	0.009	0.467	0.640
Amount of New Equity	0.027	6.596	<0.001 ***	0.027	6.630	<0.001 ***	0.027	6.594	<0.001 ***
Age of Founders	0.006	1.598	0.110	0.006	1.711	0.087	0.006	1.601	0.109
Gender	0.042	0.450	0.652	0.043	0.461	0.645	0.040	0.437	0.662
Race	0.139	1.206	0.228	0.146	1.267	0.205	0.142	1.234	0.217
Citizenship	-0.319	-1.778	0.075	-0.320	-1.782	0.075	-0.318	-1.773	0.076
Technology Level	-0.024	-0.317	0.751	-0.030	-0.399	0.690	-0.023	-0.302	0.762
Product / Service	-0.068	-0.910	0.363	-0.074	-0.995	0.320	-0.068	-0.908	0.364
Incorporation (in year 1)	0.087	1.096	0.273	0.089	1.120	0.263	0.088	1.111	0.267
Commitment to Venture									
Number of Hours Worked in Venture	-0.004	-2.092	0.036 *	-0.004	-2.111	0.035 *	-0.004	-2.079	0.038 *
Founder Contributed Equity (in year 1)	-0.002	-0.443	0.658	-0.002	-0.442	0.659	-0.002	-0.453	0.651
Quality of Business Idea									
Intellectual Property (any year)	-0.224	-2.830	0.005 **	-0.226	-2.852	0.004 **	-0.224	-2.830	0.005 **
Competitive Advantage over Competitors (any year)	-0.286	-2.557	0.011 *	-0.273	-2.436	0.015 *	-0.286	-2.562	0.010 *

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Closure

The number of total credit sources is positive but is not statistically significant with closure of the firm (0.010, z-value = -0.429, p-value = 0.668). The number of unique credit sources is positive and is statistically significant with closure of the firm (0.135, z-value = 2.106, p-value = 0.035). These results are consistent with the OLS regression that used age at 2009 as the dependent variable. These results suggest that an increase in the number of unique credit sources is negatively associated with survival rate of new firms. Even though these relationships are statistically significant, the direction of the relationship is opposite of what was hypothesized in hypothesis 1. Unlike the OLS regression results, diversity of credit sources is not statistically significant with closure of the firm (0.005, z-value = 0.007, p-value = 0.994).

Several control variables in the models are statistically significant across the three models. Education of founders, type of education of the main founder, and overall work experience of the founders are all negative and statistically significant with closure of the firm. Amount of new equity in the last full year of operation is positive and statistically significant with closure of the firm in all three models. The proxy variables used for the

quality of the business idea, intellectually property and competitive advantage over competitors, are negative and statistically significant in all three models. Only one of the two proxy variables for commitment to the venture, number of hours worked in venture, is statistically significant.

Table 33: Probit Regression Results (MCS – End of First Year)

	Standardized Coefficient	z-value	Sig.	Standardized Coefficient	z-value	Sig.	Standardized Coefficient	z-value	Sig.
Number of Total Credit Sources	0.090	2.769	0.006 **						
Number of Unique Credit Sources				0.226	3.547	0.001 ***			
Diversity of Index of Credit Sources							0.961	1.463	0.143
Number of Founders	-0.060	-1.092	0.275	-0.054	-0.988	0.323	-0.047	-0.854	0.393
Education of Founders	-0.051	-2.688	0.007 **	-0.052	-2.694	0.007 **	-0.050	-2.699	0.009 **
Type of Education of Main Founder	-0.387	-3.772	<0.001 ***	-0.383	-3.735	0.001 ***	-0.385	-3.770	<0.001 ***
Work Experience of Founders (overall)	-0.015	-3.813	<0.001 ***	-0.016	-3.871	0.001 ***	-0.015	-3.782	<0.001 ***
Work Experience of Founders (start-up)	0.043	0.581	0.561	0.045	0.610	0.542	0.038	0.516	0.606
Amount of Outstanding Debt	0.002	0.412	0.680	-0.003	-0.506	0.613	-0.018	-0.929	0.353
Amount of New Equity	0.008	0.621	0.534	0.013	0.975	0.330	0.012	0.951	0.342
Age of Founders	0.007	1.927	0.054	0.008	2.031	0.042 *	0.007	2.007	0.045
Gender	0.060	0.655	0.513	0.063	0.688	0.492	0.044	0.486	0.627
Race	0.176	1.555	0.120	0.174	1.530	0.126	0.155	1.366	0.172
Citizenship	-0.263	-1.515	0.130	-0.258	-1.486	0.137	-0.263	-1.514	0.130
Technology Level	-0.037	-0.496	0.620	-0.038	-0.503	0.615	-0.048	-0.637	0.524
Product / Service	-0.048	-0.640	0.522	-0.040	-0.545	0.586	-0.041	-0.565	0.572
Incorporation (in year 1)	0.059	0.755	0.450	0.060	0.773	0.440	0.073	0.935	0.350
Commitment to Venture									
Number of Hours Worked in Venture	-0.002	-0.943	0.346	-0.001	-0.796	0.426	-0.001	-0.815	0.415
Founder Contributed Equity (in year 1)	-0.007	-0.511	0.690	-0.011	-0.866	0.386	-0.011	-0.826	0.409
Quality of Business Idea									
Intellectual Property (any year)	-0.194	-2.500	0.012 *	-0.196	-2.525	0.012 *	-0.205	-2.649	0.008 **
Competitive Advantage over Competitors (any year)	-0.296	-2.709	0.007 **	-0.287	-2.620	0.009 **	-0.302	-2.765	0.006 **

Statistical significance: * p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

N = 1,643

Dependent variable: Closure

Table 33 presents the results using the first year values for multiple credit sources. The number of total credit sources (0.090, z-value = 2.769, p-value = 0.006) and number of unique credit sources (0.226, z-value = 3.547, p-value < 0.001) are both positive and statistically significant with closure of the firm. The diversity of credit sources is not statistically significant with closure of the firm. These results are similar to the Probit analysis with multiple credit source variables that used data from the last full year of operations. In addition, the number of total credit sources and number of unique credit sources results are similar to the OLS regression analysis that used multiple credit source usage levels for the end of the first year of operations.

Education of founders, type of education of the main founder, and work experience of founders are all negative and statistically significant with firm closure for all three models.

The proxy variables for quality of business idea, intellectual property and competitive advantage over competitors, are negative and statistically significant with firm closure. These results are similar to the Probit regression results which used the levels of multiple credit sources for the last full year of operations.

Survival Analysis

In the previous analyses, age of the firm at 2009 was used as a proxy for survival in OLS regression and a dichotomous variable was used to represent survival in Probit regression. Such means to measuring survival in statistical analyses has its flaws. For example, the variable is right censored as firms that are still alive at the end of the data collection period (2009) are thought to live forever. This flaw refers to the issue that the firms were not observed long enough for all the firms to close. In addition, firms surviving through the end of the data collection period (measured as 7) in the OLS regression are considered to being just one year greater than firms that closed in 2009 (measured as 6) in the OLS regression. Finally, an issue in using OLS and Probit regression to analyze survival data is that OLS and Probit regression analyses assume the distribution of the residuals to be normally distributed. However, time to an event is usually not normally distributed for many events. In the case of the proxy used for survival in the OLS regression, the age at 2009 variable is not normally distributed, nor is the dichotomous variable used in the Probit regression. 1,251 firms are still alive after 2009, and only 383 firms are closed between 2004 and 2009. A natural log transformation of the variables does not make the variables normally distributed. It is only when the 1,251 surviving firms are removed from the data set that the survival variable becomes normally distributed. Removing 1,251 firms in a data set consisting of 1,643 firms would leave only a small percentage of firms (23.3%) to be used in the analysis. Thus, in the OLS regression, the variable was used without a transformation.

This could lead to a bias in the results of the OLS regression. These weaknesses in the analyses warrant using a more robust analysis of survival that can address these issues. Therefore, survival analysis is performed using Cox proportional hazard modeling (Cox, 1972).

Survival analysis is performed using time invariant and time varying variables. The time invariant analysis uses the values of the last year the firm was alive for the multiple credit source, debt, equity, and number of hours worked variables. The time varying analysis allows for the multiple credit source, debt, equity, and number of hours worked variables to vary over time.

The credit crisis and location variables are left out of the model. The credit crisis variable didn't allow the model to converge. The location variable is a categorical variable with more than 211 categories. This would add 211 dummy variables in the regression, which is not feasible for the regression model to converge properly. Thus, these two variables are not included in the model.

In the survival analysis, the event that is being evaluated is closure of the firm. The dependent variable is thus coded as 0 if the firm is surviving and 1 if the firm has closed for each year. When the coefficient estimate is positive, it indicates a positive relation with closure of a firm.

Cox proportional hazard modeling is similar to multiple regression except the dependent variable is the hazard function at a given time. With the explanatory variables, the hazard or risk of firm closure at time t can be expressed as:

$$h(t) = h_0(t) * \exp(\beta_1 (\text{MCS}) + \dots + \beta_{19} (\text{COMPADV}))$$

taking the natural logarithm of both sides,

$$\ln(h(t)) = \ln(h_0(t)) * \beta_1 (\text{MCS}) + \dots + \beta_{19} (\text{COMPADV})$$

where,

$h(t)$ is the hazard function taking into account the baseline hazard function and the explanatory variables

$h_0(t)$ is the baseline hazard function

MCS is, depending on the model, the number of total credit sources, number of unique credit sources, or diversity index of credit sources at a certain point in time for a certain firm

$\beta_1 \dots \beta_{19}$ are the estimated coefficients in the model

The baseline hazard function corresponds to the probability of firm closure when all the explanatory variables are zero. The baseline hazard function is similar to the intercept in multiple regression. The regression coefficients (β s) are proportional changes in the hazard and are estimated with the maximum likelihood method. There are 19 independent and control variables included in each model.

The models are run for each of the three multiple credit source variables using time varying and time invariant variables, with the results presented in Table 34 and Table 35. There are 1,598 observations with 1,150 firms that survive and 378 firm that close during the data collection period⁴⁴. The Wald test is statistically significant for all the models, which indicates the explanatory variables included in the model make a statistical difference in the hazard function when comparing the model with the explanatory variables ($h(t)$) with the

⁴⁴ The number of firm closures in the survival analysis is less than the 383 firms that were indicated as being closed in the entire sample. The reason is that five firms that closed had data missing in variables that didn't allow the statistical analysis to be performed. In addition, 96 firms that indicated they were still operating were removed from the survival analysis due to missing data. The software removed these 101 observations, leaving 1,598 observations with 3878 firm closures to be examined in the survival analysis using Cox proportional hazard modeling.

baseline model ($h_0(t)$). The explained variation statistic, R^2 , ranged from 8.5% to 8.8% in the three models. In the first model, the number of total credit sources is not statistically significant with closure (0.214, $p = 0.487$). Education (-0.068, $p = 0.016$), type of education (-0.669, $p = 0.001$), and overall work experience (-0.020, $p = .001$) are negatively related to closure. This suggests that more overall education, business education, and more overall work experience are positively associated with firms that survive longer. Outstanding debt (0.016, $p = 0.011$) and new equity (0.042, $p < 0.001$) are positively associated with closure. Thus, firms with more outstanding debt and that receive more equity in the last full year of operations do not survive as long.

Table 34: Survival Analysis Results, Time Invariant Analysis

	Coefficient	z	Pr(> z)	Coefficient	z	Pr(> z)	Coefficient	z	Pr(> z)
Number of Total Credit Sources	0.214	0.696	0.487						
Number of Unique Credit Sources				0.213	2.413	0.016 **			
Diversity Index of Credit Sources							0.044	0.048	0.962
Number of Founders	-0.082	-1.000	0.317	-0.077	-0.940	0.347	-0.078	-0.948	0.343
Education of Founders	-0.068	-2.409	0.016 *	-0.069	-2.430	0.015 **	-0.068	-2.399	0.016 **
Type of Education of Main Founder	-0.669	-3.945	<0.001 ***	-0.655	-3.864	<0.001 ***	-0.666	-3.932	<0.001 ***
Work Experience of Founders (overall)	-0.020	-3.276	0.001 ***	-0.021	-3.408	0.001 ***	-0.020	-3.259	0.001 ***
Work Experience of Founders (start-up)	0.025	0.229	0.819	0.030	0.274	0.784	0.024	0.219	0.827
Amount of Outstanding Debt	0.016	2.555	0.011 **	0.008	1.088	0.277	0.017	0.634	0.526
Amount of New Equity	0.042	7.366	<0.001 ***	0.042	7.431	<0.001 ***	0.042	7.365	<0.001 ***
Age of Founders	0.008	1.522	0.128	0.009	1.580	0.114	0.008	1.528	0.126
Gender	0.054	0.404	0.686	0.056	0.424	0.671	0.052	0.393	0.694
Race	0.211	1.291	0.197	0.217	1.335	0.182	0.220	1.343	0.179
Citizenship	-0.492	-1.782	0.075	-0.487	-1.765	0.078	-0.488	-1.769	0.077
Technology Level	-0.020	-0.177	0.860	-0.022	-0.193	0.847	-0.016	-0.139	0.889
Product / Service	-0.069	-0.636	0.525	-0.083	-0.764	0.445	-0.069	-0.643	0.520
Incorporation (in year 1)	0.089	0.774	0.439	0.094	0.820	0.412	0.091	0.793	0.428
Commitment to Venture									
Number of Hours Worked in Venture	-0.005	-1.999	0.046 *	-0.005	-1.970	0.049 *	-0.005	-19.813	0.048 *
Founder Contributed Equity (in year 1)	-0.002	-0.246	0.806	-0.002	-0.271	0.786	0.002	0.253	0.800
Quality of Business Idea									
Intellectual Property (any year)	-0.356	-3.015	0.003 **	-0.364	-3.085	0.002 **	-0.356	-3.009	0.003 **
Competitive Advantage over Competitors (any year)	-0.517	-3.511	<0.001 ***	-0.498	-3.380	0.001 ***	-0.517	-3.511	<0.001 ***
R^2	0.085			0.088			0.085		
Wald Test	143.6			150.4			132.1		
df	19			19			19		
p-value	<0.001			<0.001			<0.001		

Statistical significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

N = 1,598 (36 observations deleted because of missingness)

Number of closures: 378

In the second model, the number of unique credit sources is positively related to closure and is statistically significant with closure (0.213, $p = 0.016$). The positive impact of the number of unique credit sources on the closure of firms in the analysis with the time invariant variables may indicate the firms are struggling and using whatever external funding

they can tap into so they can try to survive longer. This is the case even though they are destined to not survive based upon other reasons. For example, poor management and a poor business idea could contribute to survival, which has been found to be the case in past studies (e.g. Gifford, 1992a, 1992b; Penrose, 1959; Slater, 1980)). This is evident in the results as education and the quality of business idea are statistically significant and negatively related with closure. This is also what was seen in the OLS regression and Probit regression results. As mentioned when reporting the OLS and Probit regression results, the results don't support hypothesis 1. Rather, the results suggest that a negative relationship exists between multiple credit source usage and survival.

Figure 20 graphically illustrates how firms that use more unique credit sources have lower survival rates. The figure indicates the survival rates of firms based upon the number of unique credit sources they use. The baseline hazard rate is shown by the solid line where the number of unique credit sources is 0 (NUCS = 0), which exists for firms not using any credit sources. Each line in the graph represents the number of unique credit sources firms use. This graph indicates that firms with a higher number of unique credit sources in their last full year of operation have a lower survival rate over time. The line in the figure which indicates a firm using five unique credit sources (NUCS = 5) declines faster over time than the other lines in the figure that indicate lower levels of unique credit source usage.

Figure 20: Firm Survival Function for Number of Unique Credit Sources

As with the number of total credit sources model, education, type of education, overall work experience, hours worked in venture, intellectual property, and competitive advantage are all negatively associated with closure and statistically significant. In addition, the amount of new equity in the last full year of operations continues to be positively related with closure. However, unlike the number of total credit sources model, outstanding debt is not associated with closure.

The diversity index of credit sources is not statistically significant, as seen in the third model in Table 34. However, as with the number of total credit sources and number of unique credit sources models, education, type of education, overall work experience, hours worked in venture, intellectual property, and competitive advantage are negatively associated with closure and statistically significant. New equity is also statistically significant, and is

positively related with closure. This is the same as in the regression models with number of total credit sources and number of unique credit sources. Outstanding debt is not associated with closure.

The previous survival models were performed using time invariant variables for the variables: multiple credit source, debt, equity, and hours worked in the venture. These variables can change over time. The changes in these variables could affect the survival of a new firm. Thus, I also run survival analysis models that allow these variables to vary over time. This is done by using the data for each of the six years for the time varying variables (multiple credit sources, amount of outstanding debt, amount of new equity, number of hours worked in venture, and credit crisis) as opposed to the level of these variables in the last full year of operations of the firm. The results are provided in Table 35.

None of the multiple credit source variables are found to be statistically associated with survival. The number of total credit sources, number of unique credit sources, and the diversity index of credit sources have negative coefficients, which would suggest that as these variables increase over time that the chance of closure would decrease (i.e. the chance of survival would increase). i.e. this suggests that resourceful financing possibly helps a firm survive longer. However, the coefficients are not statistically significant. Thus, based upon these results, it cannot be said that resourceful financing in the form of credit improves the survival rate of new firms.

Like with the time invariant survival analysis results, education, type of education, and overall work experience are negatively related to closure and statistically significant. Thus, more education, business education, and more overall work experience (when a firm starts) improve the chance of survival of a new firms. Outstanding debt is found to be

positively related to closure for the models with number of total credit sources and number of unique credit sources variables – like the invariant analysis results. As with the time invariant survival analysis, hours worked in the venture, intellectual property, and competitive advantage are negatively related to closure for all three time varying models.

Table 35: Survival Analysis Results, Time Variant Analysis

	Coefficient	z	Pr(> z)	Coefficient	z	Pr(> z)	Coefficient	z	Pr(> z)
Number of Total Credit Sources	-0.041	-1.101	0.271						
Number of Unique Credit Sources				-0.070	-0.075	0.458			
Diversity Index of Credit Sources							-0.526	-0.601	0.548
Number of Founders	-0.084	-1.035	0.301	-0.088	-1.088	0.277	-0.091	-1.125	0.261
Education of Founders	-0.069	-2.477	0.013 **	-0.069	-2.463	0.014 **	-0.070	-2.490	0.013 **
Type of Education of Main Founder	-0.676	-4.001	<0.001 ***	-0.676	-3.999	<0.001 ***	-0.675	-3.992	<0.001 ***
Work Experience of Founders (overall)	-0.019	-3.152	0.002 **	-0.019	-3.136	0.002 **	-0.019	-3.180	0.001 ***
Work Experience of Founders (start-up)	0.024	0.222	0.824	0.024	0.220	0.826	0.024	0.221	0.825
Amount of Outstanding Debt	0.018	2.757	0.006 **	0.078	10.449	0.016 *	0.030	1.154	0.248
Amount of New Equity	0.011	1.792	0.073	0.011	1.817	0.069	0.011	1.848	0.065
Age of Founders	0.009	1.711	0.087	0.009	1.722	0.085	0.009	1.730	0.084
Gender	0.068	0.512	0.609	0.071	5.347	0.593	0.077	0.585	0.558
Race	0.294	1.818	0.069	0.291	1.803	0.071	0.298	1.840	0.066
Citizenship	-0.501	-1.835	0.066	-0.504	-1.847	0.065	-0.506	-1.854	0.064
Technology Level	-0.053	-0.473	0.636	-0.053	-0.482	0.630	-0.054	-0.483	0.629
Product : Service	-0.052	-0.476	0.634	-0.050	-0.466	0.642	-0.053	-0.492	0.623
Incorporation (in year 1)	0.170	1.472	0.141	0.169	1.462	0.144	0.166	1.435	0.151
Commitment to Venture									
Number of Hours Worked in Venture	-0.010	-3.851	<0.001 ***	-0.010	-3.899	<0.001 ***	-0.010	-3.942	<0.001 ***
Founder Contributed Equity (in year 1)	0.001	0.194	0.846	0.001	0.174	0.862	0.001	0.163	0.870
Quality of Business Idea									
Intellectual Property (any year)	-0.334	-2.837	0.005 **	-0.332	-2.818	0.005 **	-0.330	-2.797	0.005 **
Competitive Advantage over Competitors (any year)	-0.393	-2.673	0.008 **	-0.396	-2.690	0.007 **	-0.392	-2.666	0.008 **
R ²	0.012			0.012			0.012		
Wald Test	100.3			99.6			99.5		
df	19			19			19		
p-value	<0.001			<0.001			<0.001		

Statistical significance: p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001
N = 8,576 (519 observations deleted because of missingness)
Number of closures: 378

Growth Curve Analysis

Growth curve analysis is performed with the dependent variables being revenue and number of employees. The intraclass correlation coefficient is first calculated to determine if HLM is appropriate to use. Then unconditional models (without any predictors) are run to determine the best fitting curve. And finally, the conditional growth models are run and the results reported.

Intraclass Correlation Coefficient

Before adding the time component into the model, I first run null models on the entire sample to determine the amount of variance in multiple credit sources between each

observation. Null models are HLM models that build the 3-level model without covariates as follows⁴⁵:

Level 1 Model (time)

$$\text{GROWTH}_{t,f,l} = \pi_{0,f,l} + e_{t,f,l}$$

Level 2 Model (firm)

$$\pi_{0,f,l} = \beta_{0,0,l} + r_{0,f,l}$$

Level 3 Model (location)

$$\beta_{0,0,l} = \gamma_{0,0,0} + u_{0,0,l}$$

where,

$\text{GROWTH}_{t,f,l}$ is, depending on which model is being run, the expected (predicted) revenue or number of employees at time t for firm f for location l

$\pi_{0,f,l}$ is the intercept of the dependent variable at time 0 for location 0

$\beta_{0,0,l}$ is the parameter estimate for the intercept for location l

$\gamma_{0,0,0}$ is the parameter estimate for the intercept

e , r , and u are time specific random error terms (variance at each level)

The amount of variance in the revenue between each observation is measured by the intraclass correlation coefficient (ICC). The ICC at the firm level is 44.6 % for revenue and 52.1% for the number of employees. The ICC at the location level is close to 0% for revenue and is 1.2% for the number of employees. This indicates the variance between each observation is a non-trivial amount for both revenue and number of employees at the firm level and justifies building multilevel growth curve models to include firm at a separate level to extract away the variance at the firm level. However, the variance between observations is

⁴⁵ I use the notation of the HLM models as explained in (Raudenbush & Bryk, 2002).

a trivial amount of variance between the observations at the location level, which indicates that a third level is not warranted. Thus, 2-level models are run for the growth curve analysis, and not 3-level models.

Unconditional Model

To determine what growth curve shapes to model for revenue and number of employees, a series of growth curve models are tested in the hierarchical linear model (HLM, also called multi-level modeling) framework. The basic growth curve is a linear model. Hypothesis 2 posits a positive growth slope. When examining the graphs of the growth curves for a sampling of firms in the data set, there are firms with positive linear growth curves in the sample. There are also cases where the slopes are not linear. Rather, some slopes of multiple credit source usage have a curvilinear shape. In addition, a curvilinear, concave growth trend for revenue and number of employees is modeled. Such growth curves are modeled with the quadratic variable of TIME (i.e. $TIME^2$).

The linear and non-linear (quadratic) growth models are tested without any predictors (unconditional model). The data fit is then compared between these models to determine which estimate best depicts growth trends found in the data. Once the best fitting unconditional model is found, I build and test the conditional models which include the necessary covariates. I provide the equations to further explain how the estimation of the data is performed mathematically in the HLM framework.

The formulas for the unconditional model estimation in HLM for the growth model are as follows for level-1 and level-2 (Raudenbush & Bryk, 2002). In the formulas shown below, level 1 is the within firm model, level 2 is the between firm model, and level 3 is the between location model. The following is the **linear** model:

Level 1 Model (time)

$$\text{GROWTH}_{t,f} = \pi_{0,f} + \pi_{1,f}(\text{TIME}_{t,f}) + e_{t,f}$$

Level 2 Model (firm)

$$\pi_{0,f} = \beta_{0,0} + r_{0,f}$$

$$\pi_{1,f} = \beta_{1,0} + r_{1,f}$$

where,

$\text{GROWTH}_{t,f}$ is, depending on which model is being run, the revenue or number of employees at time t for firm f

$\pi_{0,f}$ is the intercept of the dependent variable at time 0

$\pi_{1,f}$ is the slope of the dependent variable over the time periods in the model

$\text{TIME}_{t,f}$ represents consecutive measurement time points (1 year) at time t for firm f
(0, 1, 2, 3, 4, 5)

$\beta_{0,0}$ is the parameter estimate for the intercept

$\beta_{1,0}$ is the parameter estimate for the slope

e and r are time specific random error terms (variance at each level)

The following is the **quadratic** (non-linear) model:

Level 1 Structural Model (time)

$$\text{GROWTH}_{t,f} = \pi_{0,f} + \pi_{1,f}(\text{TIME}_{t,f}) + \pi_{2,f}(\text{TIME}_{t,f}^2) + e_{t,f}$$

Level 2 Model (firm)

$$\pi_{0,f} = \beta_{0,0} + r_{0,f}$$

$$\pi_{1,f} = \beta_{1,0} + r_{1,f}$$

$$\pi_{2,f} = \beta_{2,0} + r_{2,f}$$

where, in addition to the variables in the linear model, the following variables are included in the non-linear model,

$\pi_{2,f}$ is the rate of acceleration (or decline) of the dependent variable over the time periods in the model

$\text{TIME}_{t,f}^2$ represents quadratic portion of consecutive measurement time points (1 year) at time t for firm f (0, 2, 4, 9, 16, 25)

$\beta_{2,0}$ is the parameter estimates for the rate of slope change

With two variables used for growth (revenue and number of employees), two different models are run with each of these dependent variables. First I discuss the results when revenue is the dependent variable.

The linear model for revenue has a deviance of 22,348, an AIC of 22,360 and a BIC of 22,400. The non-linear (quadratic) model has a deviance of 21,531, an AIC of 21,551, and a BIC of 21,519. The model fit figures are slightly lower for the non-linear model, suggesting the non-linear model fits the data better when the dependent variable is revenue.

Because this is time series data, there is a possibility of autocorrelation. The need to test for autocorrelation in growth curve models (which use time series data) arises because the level-1 variables (repeated measures from a firm) are ordered based upon time. When autocorrelation is present, an assumption of regression is violated and the estimates will be biased downward and t-statistics biased upward. In addition, significant autocorrelation might yield non-trivial estimates of the future observations in a time series data set (Levich & Rizzo, 1998). The correlation between the revenue each year is statistically significant and relatively high (maximum absolute correlation = 0.785). I also test for autocorrelation in the unconditional models by examining the parameter estimate of the correlation structure (the Phi coefficient). The Phi coefficient is 0.124. With the absolute level of the Phi coefficient being less than 0.3, this suggests there is little association between the repeated measures for

each the variables. Then I examine the variance homogeneity of revenue over time and see the variance is not stable. This would suggest autocorrelation could possibly be present with revenue. And finally, I examine the model fit in HLM models to compare models with and without autocorrelation. The model fit statistics (deviance = 21,521, AIC = 21,543, and BIC = 21,618) are all lower for the revenue model with autocorrelation than without autocorrelation (note: the deviance, AIC, and BIC for the model with autocorrelation is presented in the previous paragraph). The model fit statistics suggest that the model corrected for autocorrelation fits the data better for revenue. Thus, autocorrelation is corrected for the growth curve analysis where the dependent variable is revenue.

Mean levels of revenue of the intercept is 10.509 and is statistically significant (t-value = 203.282, p-value < 0.001). The slope is 0.688 and is statistically significant (t-value = 22.260, p-value < 0.001). The quadratic factor on the slope is -0.101 and is statistically significant (t-value = -19.377, p-value < 0.001). These results for the unconditional model indicate that revenue increases at a declining rate, resulting in a concave growth curve. Results are shown in Table 36.

Table 36: Growth Curve Analysis Results, Unconditional Model, Dependent Variable: Revenue

Fixed Effect	Coefficient	Std Error	t-value	Sig.
For Intercept				
Average ... ($\beta_{0,i}$)	10.509	0.052	203.282	<0.001 ***
For TIME (slope)				
Average ... ($\beta_{1,i}$)	0.688	0.031	22.260	<0.001 ***
For TIME ² (slope)				
Average ... ($\beta_{2,i}$)	-0.101	0.005	-19.377	<0.001 ***
Number of Level-1 units (observations)	6,711			
Number of Level-2 units (firms)	1,569			
df = 5,140				

Statistical significance: * p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Dependent variable: Revenue

The next analysis of growth uses number of employees as the dependent variable. As with the HLM models using revenue as the dependent variable, the linear and non-linear models are compared to find the best estimated model. The linear model for number of employees has a deviance of 49,472, an AIC of 49,484, and a BIC of 49,527. The non-linear (quadratic) model has a deviance of 49,125, an AIC of 49,146, and a BIC of 49,216. As with the revenue model, the model fit figures are lower for the non-linear model, suggesting the non-linear model fits the data better when the dependent variable is number of employees.

As with the revenue model, there is a possibility of autocorrelation because this is time series data. The correlation between the number of employees each year is statistically significant and relatively high (maximum absolute correlation = 0.953). I also test for autocorrelation in the unconditional models by examining the parameter estimate of the correlation structure (the Phi coefficient). The Phi coefficient is 0.066. The absolute level of the Phi coefficient being less than 0.3 suggests there is little association between the

repeated measures for each the variables. Then I examine the variance homogeneity of revenue over time and see the variance is not stable. This would suggest autocorrelation could possibly be present with number of employees. And finally, I examine the model fit in HLM models to compare models with and without autocorrelation. The model fit statistics (deviance = 49,120, AIC = 49,142, and BIC = 49,220) are all lower for the number of employees model with autocorrelation than without autocorrelation (note: the deviance, AIC, and BIC for the model with autocorrelation is presented in the previous paragraph). The model fit statistics suggest that the model corrected for autocorrelation fits the data better for number of employees. Thus, autocorrelation is corrected for the growth curve analysis where the dependent variable is number of employees.

Mean levels of employees of the intercept is -4.548 and is statistically significant (t-value = -38.291, p-value < 0.001). The slope is 1.383 and is statistically significant (t-value = 16.075, p-value < 0.001). The quadratic factor on the slope is -0.249 and is statistically significant (t-value = -15.643, p-value < 0.001). These results for the unconditional model indicate that the number of employees increases at a declining rate, resulting in a concave growth curve. This is similar to the shape of the estimated revenue growth curve. Results are shown in Table 37.

Table 37: Growth Curve Analysis Results, Unconditional Model, Dependent Variable: Number of Employees

Fixed Effect	Coefficient	Std Error	t-value	Sig.
For Intercept				
Average ... ($\beta_{0,i}$)	-4.548	0.119	-38.291	<0.001 ***
For TIME (slope)				
Average ... ($\beta_{1,i}$)	1.383	0.086	16.075	<0.001 ***
For TIME ² (slope)				
Average ... ($\beta_{2,i}$)	-0.249	0.016	-15.643	<0.001 ***
Number of Level-1 units (observations)	8,631			
Number of Level-2 units (firms)	1,633			
df = 6,996				

Statistical significance: † p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Dependent variable: Number of employees

Conditional Model

After determining the best fit for the growth of multiple credit sources using an unconditional model (no additional variables at level 1 or 2), a conditional model is created. To create a conditional growth model in HLM, predictor variables are added at levels 1 and 2 that represent independent and control variables. Independent variables are added, including the multiple credit sources (number of total credit sources, number of unique credit sources, and diversity index of credit sources). Control variables are added, including the number of founders, education of founders, type of education of main founder, overall work experience of founders, start-up work experience of founders, age of founders, gender, race, citizenship, technology level, product / service, incorporation, founder contributed equity at start-up, intellectual property, and competitive advantage over competitors. Age of founders, gender, race, citizenship, technology level, product / service, incorporation, founder contributed equity at start-up, intellectual property, and competitive advantage over competitors are time

varying variables and are thus included in level 2 of the model. The outstanding amount of debt and new equity obtained each year are time varying variables and thus are included in level 2 of the model.

Separate models are built for revenue and number of employees. The quadratic (non-linear) unconditional model (without the covariates except the TIME variables at level 1) has the best model fit. Therefore, the quadratic model is run with all the covariates (full model) with the notation as follows:

Level 1 Model (time)

$$\begin{aligned} \text{GROWTH}_{t,f} = & \pi_{0,f} + \pi_{1,f}(\text{TIME}_{t,f}) + \pi_{2,f}(\text{TIME}_{t,f}^2) + \pi_{3,f}(\text{MCS}_{t,f}) + \pi_{3,f} \\ & (\text{DEBT}_{t,f}) + \pi_{4,f}(\text{EQUITY}_{t,f}) + \pi_{5,f}(\text{HOURS}_{t,f}) + \pi_{6,f}(\text{ECONOMY}_{t,f}) + e_{t,f} \end{aligned}$$

Level 2 Model (firm)

$$\begin{aligned} \pi_{0,f} = & \beta_{0,0} + \beta_{0,1}(\text{SIZEFT}_f) + \beta_{0,2}(\text{EDU}_f) + \beta_{0,3}(\text{EDUT}_f) + \beta_{0,4}(\text{EXPW}_f) + \beta_{0,5} \\ & (\text{EXPS}_f) + \beta_{0,6}(\text{AGEF}_f) + \beta_{0,7}(\text{GENDER}_f) + \beta_{0,8}(\text{RACE}_f) + \beta_{0,9}(\text{CITIZEN}_f) + \beta_{0,10} \\ & (\text{TECH}_f) + \beta_{0,11}(\text{PROD_SERV}_f) + \beta_{0,12}(\text{INCORP}_f) + \beta_{0,13}(\text{EQUITYF}_f) + \beta_{0,14}(\text{IP}_f) + \\ & \beta_{0,15}(\text{COMADV}_f) + r_{0,f} \end{aligned}$$

$$\begin{aligned} \pi_{1,f} = & \beta_{1,0} + \beta_{1,1}(\text{SIZEFT}_f) + \beta_{1,2}(\text{EDU}_f) + \beta_{1,3}(\text{EDUT}_f) + \beta_{1,4}(\text{EXPW}_f) + \beta_{1,5} \\ & (\text{EXPS}_f) + \beta_{1,6}(\text{AGEF}_f) + \beta_{1,7}(\text{GENDER}_f) + \beta_{1,8}(\text{RACE}_f) + \beta_{1,9}(\text{CITIZEN}_f) + \beta_{1,10} \\ & (\text{TECH}_f) + \beta_{1,11}(\text{PROD_SERV}_f) + \beta_{1,12}(\text{INCORP}_f) + \beta_{1,13}(\text{EQUITYF}_f) + \beta_{1,14}(\text{IP}_f) + \\ & \beta_{1,15}(\text{COMADV}_f) + r_{1,f} \end{aligned}$$

$$\begin{aligned} \pi_{2,f} = & \beta_{2,0} + \beta_{2,1}(\text{SIZEFT}_f) + \beta_{2,2}(\text{EDU}_f) + \beta_{2,3}(\text{EDUT}_f) + \beta_{2,4}(\text{EXPW}_f) + \beta_{2,5} \\ & (\text{EXPS}_f) + \beta_{2,6}(\text{AGEF}_f) + \beta_{2,7}(\text{GENDER}_f) + \beta_{2,8}(\text{RACE}_f) + \beta_{2,9}(\text{CITIZEN}_f) + \beta_{2,10} \\ & (\text{TECH}_f) + \beta_{2,11}(\text{PROD_SERV}_f) + \beta_{2,12}(\text{INCORP}_f) + \beta_{2,13}(\text{EQUITYF}_f) + \beta_{2,14}(\text{IP}_f) + \\ & \beta_{2,15}(\text{COMADV}_f) + r_{2,f} \end{aligned}$$

$$\begin{aligned}\pi_{3,f} = & \beta_{3,0} + \beta_{3,1} (\text{SIZEFT}_f) + \beta_{3,2} (\text{EDU}_f) + \beta_{3,3} (\text{EDUT}_f) + \beta_{3,4} (\text{EXPW}_f) + \beta_{3,5} \\ & (\text{EXPS}_f) + \beta_{3,6} (\text{AGEF}_f) + \beta_{3,7} (\text{GENDER}_f) + \beta_{3,8} (\text{RACE}_f) + \beta_{3,9} (\text{CITIZEN}_f) + \beta_{3,13} \\ & (\text{TECH}_f) + \beta_{3,11} (\text{PROD_SERV}_f) + \beta_{3,12} (\text{INCORP}_f) + \beta_{3,13} (\text{EQUITYF}_f) + \beta_{3,14} (\text{IP}_f) + \\ & \beta_{3,15} (\text{COMADV}_f) + r_{3,f}\end{aligned}$$

$$\begin{aligned}\pi_{4,f} = & \beta_{4,0} + \beta_{4,1} (\text{SIZEFT}_f) + \beta_{4,2} (\text{EDU}_f) + \beta_{4,3} (\text{EDUT}_f) + \beta_{4,4} (\text{EXPW}_f) + \beta_{4,5} \\ & (\text{EXPS}_f) + \beta_{4,6} (\text{AGEF}_f) + \beta_{4,7} (\text{GENDER}_f) + \beta_{4,8} (\text{RACE}_f) + \beta_{4,9} (\text{CITIZEN}_f) + \beta_{4,14} \\ & (\text{TECH}_f) + \beta_{4,11} (\text{PROD_SERV}_f) + \beta_{4,12} (\text{INCORP}_f) + \beta_{4,13} (\text{EQUITYF}_f) + \beta_{4,14} (\text{IP}_f) + \\ & \beta_{4,15} (\text{COMADV}_f)\end{aligned}$$

$$\begin{aligned}\pi_{5,f} = & \beta_{5,0} + \beta_{5,1} (\text{SIZEFT}_f) + \beta_{5,2} (\text{EDU}_f) + \beta_{5,3} (\text{EDUT}_f) + \beta_{5,4} (\text{EXPW}_f) + \beta_{5,5} \\ & (\text{EXPS}_f) + \beta_{5,6} (\text{AGEF}_f) + \beta_{5,7} (\text{GENDER}_f) + \beta_{5,8} (\text{RACE}_f) + \beta_{5,9} (\text{CITIZEN}_f) + \beta_{5,15} \\ & (\text{TECH}_f) + \beta_{5,11} (\text{PROD_SERV}_f) + \beta_{5,12} (\text{INCORP}_f) + \beta_{5,13} (\text{EQUITYF}_f) + \beta_{5,14} (\text{IP}_f) + \\ & \beta_{5,15} (\text{COMADV}_f)\end{aligned}$$

$$\begin{aligned}\pi_{6,f} = & \beta_{6,0} + \beta_{6,1} (\text{SIZEFT}_f) + \beta_{6,2} (\text{EDU}_f) + \beta_{6,3} (\text{EDUT}_f) + \beta_{6,4} (\text{EXPW}_f) + \beta_{6,6} \\ & (\text{EXPS}_f) + \beta_{6,6} (\text{AGEF}_f) + \beta_{6,7} (\text{GENDER}_f) + \beta_{6,8} (\text{RACE}_f) + \beta_{6,9} (\text{CITIZEN}_f) + \beta_{6,10} \\ & (\text{TECH}_f) + \beta_{6,11} (\text{PROD_SERV}_f) + \beta_{6,12} (\text{INCORP}_f) + \beta_{6,13} (\text{EQUITYF}_f) + \beta_{6,14} (\text{IP}_f) + \\ & \beta_{6,15} (\text{COMADV}_f)\end{aligned}$$

where,

$\text{GROWTH}_{t,f}$ is, depending on which model is being run, the revenue or number of employees at time t for firm f

$\text{MCS}_{t,f}$ is, depending on which model is being run, the number of total credit sources, number of unique credit sources, or diversity index of credit sources used at time t for firm f

$\pi_{0,f}$ is the intercept of the dependent variable at time 0 for firm f

$\pi_{1,f}$ is the slope of the dependent variable over the time periods in the model for firm f

$\text{TIME}_{t,f}$ represents consecutive measurement time points (1 year) at time t for firm f
(0, 1, 2, 3, 4, 5)

$\pi_{2,f}$ is the rate of acceleration (or decline) of the dependent variable over the time periods in the model

$\text{TIME}_{t,f}^2$ represents quadratic portion of consecutive measurement time points (1 year) at time t for firm f (0, 2, 4, 9, 16, 25)

$\pi_{3,f}$ is the slope of the dependent variable over the time periods in the model as a result of the change in outstanding debt for firm f

$\text{DEBT}_{t,f}$ is the amount of outstanding debt at time t for firm f

$\pi_{4,f}$ is the slope of the dependent variable over the time periods in the model as a result of the change in new equity funds obtained for firm f

$\text{EQUITY}_{t,f}$ is the amount of new equity at time t for firm f

$\pi_{5,f}$ is the slope of the dependent variable over the time periods in the model as a result of the change in hours worked for firm f

$\text{HOURS}_{t,f}$ is the average hours worked by the founder / founding team at time t for firm f

$\pi_{6,f}$ is the slope of the dependent variable over the time periods in the model as a result of the change in the status of the economy (economy is in a credit crisis or not) for firm f

$\text{ECONOMY}_{t,f}$ is the status of the economy (economy is in a credit crisis or not) at time t for firm f

$\beta_{0,0} - \beta_{0,15}$ are the parameter estimates for the intercept

$\beta_{1,0} - \beta_{6,15}$ are the parameter estimates for the slope

SIZEFT_{*f*} is the founding team size for firm *f*

EDU_{*f*} is the average education level (based upon highest degree achieved) of the founding team for firm *f*

EDUT_{*f*} is the education type (non-business degree – 0, business degree –1) of the founding team for firm *f*

EXPW_{*f*} is the average work experience of the founding team for firm *f*

EXPS_{*f*} is a measure of if any of the members for firm *f* have startup experience (0 or 1)

AGEF_{*f*} is the average age of the founder / founding team squared for firm *f*

GENDER_{*f*} is the percentage of females on the founding team for firm *f*

RACE_{*f*} is the percentage of minority individuals on the founding team for firm *f*

CITIZEN_{*f*} is the percentage of non-American individuals on the founding team for firm *f*

TECH_{*f*} is the technology level (high or low) for firm *f*

PROD_SERV_{*f*} is if the firm offers a service (0) or a product (or both) (1) for firm *f*

INCORP_{*f*} is if firm *f* has incorporated in the first year of operations

EQUITYF_{*f*} is the amount of money the founder / founding team contributed to firm *f* at start-up

IP_{*f*} is if firm *f* has any intellectual property (patents, trademarks, or copyrights)

COMPADV_{*f*} is if firm *f* has a competitive advantage over its competitors

e and *r* are time specific random error terms (variance at each level)

The intercept is allowed to vary. In addition, the slopes are allowed to vary for TIME, TIME², MCS, and DEBT. The slopes for EQUITY and HOURS_W are not allowed to vary as the model did not converge when they were allowed to vary. The ECONOMY slope is not allowed to vary as the variable is not different between firms. Although the credit crisis changes over time for the new firms, all firms in the data set experience the credit crisis at the same level.

The shape of the growth curves for revenue and number of employees in the conditional models are similar to the shape of the growth curves in the unconditional models. The intercept and TIME variables are statistically significant and positive, with TIME² being statistically significant and negative. This indicates that revenue and number of employees initially increase, with the growth rates decreasing over time.

Although the time components are statistically significant, the variables of interest in this analysis, multiple credit sources, are not statistically significant with revenue and number of employees. Number of total credit sources (0.010, t-value = 0.174 p = 0.862), number of unique credit sources (-0.081, t-value = -0.545, p = -0.586), and diversity index of credit sources (-1.686, t-value = -1.079, p = 0.281) are not statistically significant with revenue. In addition, total credit sources (0.395, t-value = 1.898, p = 0.058), number of unique credit sources (0.862, t-value = 1.675, p = 0.094), and diversity index of credit sources (0.758, t-value = 0.140, p = 0.889) are not statistically significant with the number of employees.

Outstanding debt, new equity, hours worked, and credit crisis are the other time varying variables. Outstanding debt, new equity, and credit crisis are not statistically significant with revenue in all three models. Hours worked is statistically significant and positively related with revenue in all three models. Thus, a firm with a greater number of

hours worked by the founders is associated greater revenue. Larger founder teams decrease the effect of hours worked on the revenue growth. Overall work experience decreases the effect of hours worked on the revenue growth, although the effect size is small. This possibly indicates that founders with greater work experience are more efficient in their ability to grow revenue as founders with greater work experience do not have to spend as many hours working in the firm to generate revenue growth. The effect of hours worked on revenue growth is also decreased for firms with a greater competitive advantage. General education positively affects the effect of hours worked on revenue growth.

New equity is the only time varying variable that has an effect on employee growth. Firms that receive a greater amount of new equity experience higher employee growth rates. The effect of new equity on employee growth is decreases by firms with founders that have more education. Thus, new equity has less of an effect on employee growth for firms with founders that have more education.

Details of the results are provided in Table 38 and Table 39.

Table 38: Growth Curve Analysis Results, Conditional Model, Dependent Variable: Revenue

Parameter	Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources							
	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.				
Fixed Effects																
Initial status, π_{0j}																
Intercept	$\beta_{0,0}$	8.275	0.414	20.004	<0.001	***	8.392	0.436	19.252	<0.001	***	8.728	0.589	14.808	<0.001	***
Slope	$\beta_{0,1}$ (SIZEFT)	0.723	0.091	7.929	<0.001	***	0.696	0.096	7.263	<0.001	***	0.681	0.120	5.687	<0.001	***
	$\beta_{0,2}$ (EDU)	-0.032	0.036	-0.879	0.379		-0.046	0.038	-1.220	0.223		-0.109	0.050	-2.173	0.030	*
	$\beta_{0,3}$ (EDUT)	0.035	0.171	0.207	0.836		0.010	0.178	0.059	0.953		0.072	0.222	0.323	0.747	
	$\beta_{0,4}$ (EXPW)	0.034	0.007	4.582	<0.001	***	0.035	0.008	4.515	<0.001	***	0.039	0.010	3.854	<0.001	***
	$\beta_{0,5}$ (EXPS)	0.329	0.134	2.452	0.014	*	0.377	0.140	2.691	0.007	**	0.102	0.184	0.557	0.578	
	$\beta_{0,6}$ (AGEF)	-0.008	0.007	-1.195	0.232		-0.010	0.007	-1.312	0.190		-0.009	0.010	-0.936	0.349	
	$\beta_{0,7}$ (GENDER)	-0.375	0.169	-2.221	0.027	*	-0.437	0.177	-2.466	0.014	*	-0.488	0.238	-2.050	0.041	*
	$\beta_{0,8}$ (RACE)	-0.173	0.221	-0.780	0.436		-0.237	0.231	-1.027	0.305		-0.334	0.292	-1.142	0.254	
	$\beta_{0,9}$ (CITIZEN)	0.246	0.324	0.759	0.448		0.318	0.335	0.948	0.343		0.261	0.430	0.607	0.544	
	$\beta_{0,10}$ (TECH)	-0.224	0.137	-1.635	0.102		-0.196	0.143	-1.372	0.170		-0.293	0.184	-1.589	0.112	
	$\beta_{0,11}$ (PROD_SERV)	0.191	0.134	1.433	0.152		0.220	0.140	1.576	0.115		0.194	0.183	1.059	0.290	
	$\beta_{0,12}$ (INCORP)	0.589	0.144	4.107	<0.001	***	0.609	0.150	4.074	<0.001	***	0.800	0.187	4.284	<0.001	***
	$\beta_{0,13}$ (EQUITYF)	0.002	0.008	0.203	0.839		0.001	0.008	0.060	0.952		-0.003	0.011	-0.285	0.776	
	$\beta_{0,14}$ (IP)	-0.377	0.137	-2.754	0.006	**	-0.362	0.143	-2.529	0.012	*	-0.368	0.187	-1.975	0.049	*
	$\beta_{0,15}$ (COMADV)	0.541	0.210	2.576	0.010	*	0.517	0.222	2.324	0.020	*	0.845	0.319	2.649	0.008	**
Rate of change, π_{1j} (TIME)																
Intercept	$\beta_{1,0}$	0.733	0.230	3.187	0.001	**	0.740	0.229	3.235	0.001	**	0.733	0.230	3.187	0.001	**
Slope	$\beta_{1,1}$ (SIZEFT)	0.102	0.051	1.984	0.047	*	0.097	0.051	1.901	0.057		0.104	0.051	2.023	0.043	*
	$\beta_{1,2}$ (EDU)	-0.013	0.019	-0.657	0.511		-0.011	0.019	-0.575	0.565		-0.011	0.020	-0.578	0.563	
	$\beta_{1,3}$ (EDUT)	0.273	0.091	2.997	0.003	**	0.271	0.091	2.995	0.003	**	0.272	0.091	2.979	0.003	**
	$\beta_{1,4}$ (EXPW)	0.000	0.004	0.000	1.000		0.000	0.004	-0.083	0.934		-0.001	0.004	-0.160	0.873	
	$\beta_{1,5}$ (EXPS)	0.078	0.073	1.057	0.291		0.090	0.073	1.230	0.219		0.076	0.073	1.030	0.303	
	$\beta_{1,6}$ (AGEF)	-0.011	0.004	-2.768	0.006	**	-0.011	0.004	-2.818	0.005	**	-0.010	0.004	-2.650	0.008	**
	$\beta_{1,7}$ (GENDER)	-0.141	0.092	-1.525	0.127		-0.143	0.092	-1.560	0.119		-0.145	0.092	-1.576	0.115	
	$\beta_{1,8}$ (RACE)	-0.003	0.123	-0.028	0.977		0.014	0.123	0.112	0.911		0.000	0.123	-0.004	0.997	
	$\beta_{1,9}$ (CITIZEN)	-0.015	0.176	-0.087	0.931		-0.024	0.175	-0.134	0.893		-0.021	0.176	-0.117	0.907	
	$\beta_{1,10}$ (TECH)	0.004	0.074	0.058	0.954		0.001	0.074	0.014	0.989		0.000	0.074	0.006	0.995	
	$\beta_{1,11}$ (PROD_SERV)	0.010	0.072	0.142	0.887		0.011	0.072	0.152	0.880		0.017	0.072	0.229	0.819	
	$\beta_{1,12}$ (INCORP)	0.057	0.077	0.738	0.461		0.049	0.076	0.637	0.524		0.048	0.077	0.625	0.532	
	$\beta_{1,13}$ (EQUITYF)	0.006	0.004	1.453	0.146		0.006	0.004	1.440	0.150		0.006	0.004	1.459	0.145	
	$\beta_{1,14}$ (IP)	0.184	0.074	2.471	0.014	*	0.174	0.074	2.354	0.019	*	0.172	0.074	2.313	0.021	*
	$\beta_{1,15}$ (COMADV)	0.263	0.126	2.081	0.038	*	0.270	0.126	2.155	0.031	*	0.248	0.126	1.966	0.049	*
Rate of change ² , π_{2j} (TIME ²)																
Intercept	$\beta_{2,0}$	-0.105	0.038	-2.762	0.006	**	-0.109	0.038	-2.881	0.004	**	-0.106	0.038	-2.777	0.006	**
Slope	$\beta_{2,1}$ (SIZEFT)	-0.015	0.008	-1.842	0.066		-0.014	0.008	-1.690	0.091		-0.015	0.008	-1.830	0.067	
	$\beta_{2,2}$ (EDU)	0.004	0.003	1.257	0.209		0.004	0.003	1.226	0.220		0.004	0.003	1.193	0.233	
	$\beta_{2,3}$ (EDUT)	-0.047	0.015	-3.147	0.002	**	-0.045	0.015	-3.077	0.002	**	-0.046	0.015	-3.110	0.002	**
	$\beta_{2,4}$ (EXPW)	0.000	0.001	0.118	0.906		0.000	0.001	0.193	0.847		0.000	0.001	0.294	0.769	
	$\beta_{2,5}$ (EXPS)	-0.012	0.012	-1.035	0.301		-0.015	0.012	-1.239	0.215		-0.012	0.012	-0.997	0.319	
	$\beta_{2,6}$ (AGEF)	0.001	0.001	1.862	0.063		0.001	0.001	1.933	0.053		0.001	0.001	1.737	0.083	
	$\beta_{2,7}$ (GENDER)	0.027	0.015	1.777	0.076		0.028	0.015	1.824	0.068		0.028	0.015	1.835	0.067	
	$\beta_{2,8}$ (RACE)	-0.002	0.020	-0.118	0.906		-0.004	0.020	-0.196	0.845		-0.003	0.020	-0.152	0.879	
	$\beta_{2,9}$ (CITIZEN)	0.008	0.029	0.268	0.789		0.008	0.028	0.268	0.789		0.008	0.028	0.269	0.788	
	$\beta_{2,10}$ (TECH)	0.005	0.012	0.382	0.702		0.005	0.012	0.431	0.666		0.005	0.012	0.431	0.666	
	$\beta_{2,11}$ (PROD_SERV)	0.002	0.012	0.130	0.897		0.001	0.012	0.099	0.921		0.001	0.012	0.075	0.940	
	$\beta_{2,12}$ (INCORP)	-0.007	0.013	-0.587	0.557		-0.007	0.013	-0.535	0.593		-0.006	0.013	-0.501	0.616	
	$\beta_{2,13}$ (EQUITYF)	-0.001	0.001	-1.099	0.272		-0.001	0.001	-1.103	0.270		-0.001	0.001	-1.105	0.269	
	$\beta_{2,14}$ (IP)	-0.024	0.012	-1.945	0.052		-0.023	0.012	-1.866	0.062		-0.022	0.012	-1.825	0.068	
	$\beta_{2,15}$ (COMADV)	-0.042	0.021	-2.025	0.043	*	-0.043	0.021	-2.062	0.039	*	-0.041	0.021	-1.945	0.052	

Parameter	Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
MCS, π_{ij} (MCS)												
Intercept $\beta_{i,0}$	0.010	0.059	0.174	0.862	-0.081	0.149	-0.545	0.586	-1.686	1.563	-1.079	0.281
Slope $\beta_{i,1}$ (SIZEFT)	-0.014	0.010	-1.466	0.143	0.027	0.031	0.853	0.394	0.120	0.283	0.424	0.672
$\beta_{i,2}$ (EDU)	0.002	0.005	0.433	0.665	0.013	0.012	1.097	0.273	0.289	0.128	2.248	0.025 *
$\beta_{i,3}$ (EDUT)	0.046	0.021	2.148	0.032 *	0.108	0.054	2.014	0.044 *	0.074	0.526	0.140	0.888
$\beta_{i,4}$ (EXPW)	-0.001	0.001	-0.696	0.487	-0.003	0.003	-1.014	0.311	-0.023	0.026	-0.865	0.387
$\beta_{i,5}$ (EXPS)	-0.004	0.018	-0.201	0.841	-0.075	0.046	-1.623	0.105	0.796	0.460	1.730	0.084
$\beta_{i,6}$ (AGEF)	0.001	0.001	0.945	0.345	0.002	0.003	0.928	0.354	0.007	0.028	0.262	0.793
$\beta_{i,7}$ (GENDER)	-0.016	0.026	-0.629	0.530	0.034	0.061	0.560	0.576	0.345	0.620	0.555	0.579
$\beta_{i,8}$ (RACE)	-0.020	0.027	-0.724	0.469	0.038	0.071	0.539	0.590	0.539	0.660	0.817	0.414
$\beta_{i,9}$ (CITIZEN)	-0.025	0.031	-0.804	0.421	-0.091	0.093	-0.979	0.328	0.040	1.043	0.038	0.969
$\beta_{i,10}$ (TECH)	0.007	0.017	0.431	0.666	-0.012	0.045	-0.263	0.793	0.307	0.455	0.675	0.500 *
$\beta_{i,11}$ (PROD_SERV)	0.000	0.016	0.021	0.983	-0.026	0.045	-0.568	0.570	-0.030	0.460	-0.065	0.949
$\beta_{i,12}$ (INCORP)	-0.033	0.017	-1.978	0.048 *	-0.053	0.046	-1.152	0.249	-0.947	0.444	-2.135	0.033 *
$\beta_{i,13}$ (EQUITYF)	-0.001	0.001	-0.944	0.345	-0.001	0.003	-0.493	0.622	0.017	0.028	0.589	0.556
$\beta_{i,14}$ (IP)	-0.004	0.017	-0.232	0.816	-0.003	0.046	-0.057	0.954	0.005	0.460	0.011	0.991
$\beta_{i,15}$ (COMADV)	0.011	0.035	0.314	0.754	0.039	0.080	0.490	0.624	-1.008	0.866	-1.164	0.245
Debt, π_{ij} (DEBT)												
Intercept $\beta_{i,0}$	-0.010	0.011	-0.866	0.387	-0.005	0.013	-0.417	0.677	0.041	0.046	0.894	0.371
Slope $\beta_{i,1}$ (SIZEFT)	0.006	0.002	2.809	0.005 **	0.004	0.002	1.533	0.125	0.002	0.008	0.210	0.834
$\beta_{i,2}$ (EDU)	0.001	0.001	0.573	0.567	0.000	0.001	0.155	0.877	-0.008	0.004	-2.010	0.045 *
$\beta_{i,3}$ (EDUT)	-0.002	0.004	-0.553	0.580	-0.003	0.005	-0.711	0.477	-0.001	0.016	-0.042	0.967
$\beta_{i,4}$ (EXPW)	-0.0002	0.0002	-0.943	0.346	0.000	0.000	-0.615	0.539	0.000	0.001	0.475	0.635
$\beta_{i,5}$ (EXPS)	0.001	0.003	0.293	0.770	0.005	0.004	1.228	0.219	-0.022	0.014	-1.622	0.105
$\beta_{i,6}$ (AGEF)	0.000	0.000	-0.230	0.818	-0.0001	0.0002	-0.518	0.604	0.000	0.001	-0.227	0.820
$\beta_{i,7}$ (GENDER)	-0.003	0.005	-0.673	0.501	-0.006	0.005	-1.148	0.251	-0.014	0.018	-0.790	0.430
$\beta_{i,8}$ (RACE)	-0.003	0.005	-0.483	0.629	-0.007	0.006	-1.151	0.250	-0.021	0.020	-1.024	0.306
$\beta_{i,9}$ (CITIZEN)	0.002	0.008	0.286	0.775	0.006	0.009	0.644	0.520	0.000	0.032	0.011	0.992
$\beta_{i,10}$ (TECH)	-0.001	0.003	-0.349	0.727	0.000	0.004	0.035	0.972	-0.009	0.013	-0.698	0.485
$\beta_{i,11}$ (PROD_SERV)	0.003	0.003	1.028	0.304	0.005	0.004	1.280	0.201	0.004	0.014	0.325	0.745
$\beta_{i,12}$ (INCORP)	0.005	0.004	1.407	0.160	0.005	0.004	1.185	0.236	0.029	0.013	2.227	0.026 *
$\beta_{i,13}$ (EQUITYF)	0.0002	0.0002	0.871	0.384	0.0001	0.0002	0.626	0.532	0.000	0.001	-0.439	0.661
$\beta_{i,14}$ (IP)	-0.003	0.003	-0.844	0.399	-0.003	0.004	-0.834	0.404	-0.004	0.014	-0.263	0.793
$\beta_{i,15}$ (COMADV)	0.002	0.006	0.319	0.750	0.002	0.007	0.226	0.821	0.031	0.025	1.234	0.217
Equity, π_{ij} (EQUITY)												
Intercept $\beta_{i,0}$	-0.002	0.011	-0.151	0.880	-0.004	0.011	-0.368	0.713	-0.003	0.011	-0.243	0.808
Slope $\beta_{i,1}$ (SIZEFT)	-0.0001	0.002	-0.038	0.970	0.000	0.002	-0.054	0.957	0.000	0.002	0.115	0.909
$\beta_{i,2}$ (EDU)	-0.0005	0.001	-0.540	0.589	-0.0003	0.001	-0.335	0.738	-0.0004	0.0009	-0.486	0.627
$\beta_{i,3}$ (EDUT)	0.003	0.004	0.764	0.445	0.003	0.004	0.884	0.377	0.003	0.004	0.683	0.494
$\beta_{i,4}$ (EXPW)	-0.0001	0.0002	-0.357	0.721	-0.0001	0.0002	-0.346	0.729	-0.0001	0.0002	-0.598	0.550
$\beta_{i,5}$ (EXPS)	-0.002	0.003	-0.539	0.590	-0.002	0.003	-0.477	0.633	-0.002	0.003	-0.534	0.593
$\beta_{i,6}$ (AGEF)	0.0000	0.0002	0.254	0.800	0.000	0.000	0.207	0.836	0.0001	0.0002	0.457	0.647
$\beta_{i,7}$ (GENDER)	-0.001	0.004	-0.262	0.793	-0.001	0.004	-0.334	0.739	-0.002	0.004	-0.376	0.707
$\beta_{i,8}$ (RACE)	0.000	0.005	-0.088	0.930	-0.001	0.005	-0.124	0.902	0.000	0.005	-0.079	0.937
$\beta_{i,9}$ (CITIZEN)	-0.003	0.008	-0.401	0.689	-0.004	0.007	-0.471	0.638	-0.004	0.007	-0.539	0.590
$\beta_{i,10}$ (TECH)	-0.001	0.003	-0.294	0.769	-0.001	0.003	-0.312	0.755	-0.001	0.003	-0.418	0.676
$\beta_{i,11}$ (PROD_SERV)	-0.001	0.003	-0.421	0.674	-0.001	0.003	-0.449	0.653	-0.002	0.003	-0.530	0.596
$\beta_{i,12}$ (INCORP)	0.002	0.003	0.665	0.506	0.002	0.003	0.509	0.611	0.002	0.003	0.676	0.499
$\beta_{i,13}$ (EQUITYF)	-0.0003	0.0002	-1.763	0.078	0.000	0.000	-1.814	0.070	-0.0004	0.0002	-1.861	0.063
$\beta_{i,14}$ (IP)	0.002	0.003	0.550	0.582	0.002	0.003	0.585	0.559	0.002	0.003	0.491	0.623
$\beta_{i,15}$ (COMADV)	0.001	0.006	0.173	0.863	0.003	0.006	0.455	0.649	0.001	0.006	0.169	0.866
Hours Worked, π_{ij} (HRS)												
Intercept $\beta_{i,0}$	0.024	0.006	3.920	<0.001 ***	0.023	0.006	3.837	<0.001 ***	0.024	0.006	3.961	<0.001 ***
Slope $\beta_{i,1}$ (SIZEFT)	-0.005	0.001	-3.889	<0.001 ***	-0.005	0.001	-4.002	<0.001 ***	-0.005	0.001	-4.016	<0.001 ***
$\beta_{i,2}$ (EDU)	0.001	0.001	2.758	0.006 **	0.001	0.001	2.857	0.004 **	0.001	0.001	2.849	0.004 **
$\beta_{i,3}$ (EDUT)	-0.002	0.002	-0.715	0.475	-0.002	0.002	-0.796	0.426	-0.002	0.002	-0.746	0.456
$\beta_{i,4}$ (EXPW)	-0.0002	0.0001	-1.975	0.048 *	-0.0002	0.0001	-1.986	0.047 *	-0.0002	0.0001	-2.022	0.043 *
$\beta_{i,5}$ (EXPS)	-0.002	0.002	-1.074	0.283	-0.002	0.002	-1.008	0.314	-0.002	0.002	-0.927	0.354
$\beta_{i,6}$ (AGEF)	0.000	0.0001	1.467	0.142	0.0002	0.0001	1.594	0.111	0.0001	0.0001	1.441	0.150
$\beta_{i,7}$ (GENDER)	-0.003	0.003	-1.181	0.238	-0.003	0.003	-1.061	0.289	-0.003	0.003	-1.182	0.237
$\beta_{i,8}$ (RACE)	-0.001	0.003	-0.267	0.789	-0.001	0.003	-0.356	0.722	-0.001	0.003	-0.360	0.719
$\beta_{i,9}$ (CITIZEN)	0.002	0.005	0.355	0.723	0.001	0.005	0.301	0.764	0.001	0.005	0.229	0.819
$\beta_{i,10}$ (TECH)	0.003	0.002	1.360	0.174	0.002	0.002	1.278	0.201	0.003	0.002	1.381	0.167
$\beta_{i,11}$ (PROD_SERV)	-0.001	0.002	-0.709	0.478	-0.001	0.002	-0.753	0.452	-0.001	0.002	-0.749	0.454
$\beta_{i,12}$ (INCORP)	0.0001	0.002	0.066	0.947	-0.00004	0.002	-0.018	0.986	0.0003	0.002	0.135	0.892
$\beta_{i,13}$ (EQUITYF)	-0.0001	0.0001	-0.921	0.357	-0.0001	0.0001	-0.692	0.489	-0.0001	0.0001	-1.070	0.285
$\beta_{i,14}$ (IP)	-0.0002	0.002	-0.113	0.910	-0.0004	0.002	-0.194	0.846	-0.0004	0.002	-0.188	0.851
$\beta_{i,15}$ (COMADV)	-0.013	0.003	-3.649	<0.001 ***	-0.013	0.003	-3.679	<0.001 ***	-0.013	0.003	-3.682	<0.001 ***

Parameter		Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
		Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
Credit Crisis, π_7 (ECONOMY)													
Intercept	β_{-0}	-0.212	0.176	-1.205	0.228	-0.226	0.175	-1.297	0.195	-0.184	0.176	-1.047	0.295
Slope	β_{-1} (SIZEFT)	-0.014	0.038	-0.369	0.712	-0.015	0.038	-0.405	0.686	-0.023	0.038	-0.613	0.540
	β_{-2} (EDU)	0.005	0.015	0.322	0.748	0.003	0.015	0.236	0.814	0.004	0.015	0.266	0.791
	β_{-3} (EDUT)	-0.090	0.065	-1.393	0.164	-0.082	0.064	-1.281	0.200	-0.083	0.065	-1.269	0.204
	β_{-4} (EXPW)	0.003	0.003	0.956	0.339	0.003	0.003	1.035	0.301	0.003	0.003	0.876	0.381
	β_{-5} (EXPS)	-0.101	0.054	-1.872	0.061	-0.109	0.054	-2.032	0.042	-0.091	0.054	-1.673	0.094
	β_{-6} (AGEF)	0.003	0.003	0.984	0.325	0.003	0.003	1.146	0.252	0.003	0.003	0.847	0.397
	β_{-7} (GENDER)	0.058	0.070	0.827	0.408	0.062	0.069	0.899	0.369	0.053	0.070	0.759	0.448
	β_{-8} (RACE)	-0.030	0.090	-0.329	0.742	-0.039	0.090	-0.437	0.662	-0.032	0.091	-0.353	0.724
	β_{-9} (CITIZEN)	0.067	0.125	0.537	0.591	0.067	0.124	0.541	0.588	0.065	0.125	0.523	0.601
	β_{-10} (TECH)	0.031	0.054	0.566	0.571	0.027	0.054	0.501	0.617	0.032	0.054	0.589	0.556
	β_{-11} (PROD_SERV)	0.003	0.053	0.052	0.958	0.003	0.053	0.055	0.956	-0.010	0.054	-0.180	0.857
	β_{-12} (INCORP)	0.022	0.057	0.395	0.693	0.011	0.056	0.188	0.851	0.026	0.057	0.454	0.650
	β_{-13} (EQUITYF)	-0.003	0.003	-0.886	0.376	-0.002	0.003	-0.776	0.438	-0.002	0.003	-0.766	0.444
	β_{-14} (IP)	0.024	0.055	0.432	0.666	0.024	0.054	0.448	0.654	0.029	0.055	0.533	0.594
	β_{-15} (COMADV)	-0.095	0.096	-0.986	0.324	-0.087	0.095	-0.916	0.360	-0.085	0.096	-0.882	0.378
Number of Level-1 units (observations)		6,619				6,619				6,619			
Number of Level-1 units (firms)		1,562				1,562				1,562			
Deviance		20,312				20,287				20,320			
AIC		20,602				20,577				20,600			
BIC		21,587				21,562				21,551			

Statistical significance: $\cdot$ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Dependent variable: Number of employees

The third level (location) variables are not included in the results as none of the variables are statistically significant, and by leaving them out of the results it saves space for the more important results.

Table 39: Growth Curve Analysis Results, Conditional Model, Dependent Variable: Number of Employees

Parameter	Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources							
	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.				
Fixed Effects																
Initial status, π_{0j}																
Intercept	$\beta_{0,0}$	-8.343	1.057	-7.890	<0.001	***	-8.571	1.109	-7.732	<0.001	***	-8.160	1.783	-4.576	<0.001	***
Slope	$\beta_{0,1}$ (SIZEFT)	0.416	0.240	1.735	0.083		0.386	0.251	1.537	0.125		0.265	0.361	0.735	0.462	
	$\beta_{0,2}$ (EDU)	-0.009	0.092	-0.100	0.920		0.004	0.096	0.041	0.967		-0.114	0.150	-0.758	0.449	
	$\beta_{0,3}$ (EDUT)	-0.142	0.447	-0.318	0.751		-0.003	0.465	-0.007	0.995		0.058	0.673	0.086	0.932	
	$\beta_{0,4}$ (EXPW)	-0.021	0.019	-1.106	0.269		-0.023	0.020	-1.172	0.242		-0.009	0.031	-0.280	0.779	
	$\beta_{0,5}$ (EXPS)	-0.088	0.352	-0.251	0.802		0.029	0.368	0.080	0.936		0.551	0.557	0.989	0.323	
	$\beta_{0,6}$ (AGEF)	0.003	0.017	0.199	0.843		0.005	0.018	0.274	0.784		0.019	0.029	0.638	0.524	
	$\beta_{0,7}$ (GENDER)	-0.624	0.438	-1.425	0.154		-0.573	0.457	-1.254	0.210		-1.086	0.716	-1.517	0.130	
	$\beta_{0,8}$ (RACE)	-0.434	0.546	-0.795	0.427		-0.433	0.567	-0.765	0.445		-0.407	0.824	-0.494	0.622	
	$\beta_{0,9}$ (CITIZEN)	1.214	0.788	1.542	0.123		0.995	0.820	1.213	0.226		1.787	1.235	1.447	0.148	
	$\beta_{0,10}$ (TECH)	-0.403	0.358	-1.128	0.259		-0.430	0.372	-1.156	0.248		-0.717	0.561	-1.278	0.202	
	$\beta_{0,11}$ (PROD_SERV)	0.014	0.353	0.040	0.968		-0.084	0.370	-0.228	0.820		-0.028	0.560	-0.050	0.960	
	$\beta_{0,12}$ (INCORP)	2.102	0.383	5.491	<0.001	***	2.044	0.399	5.125	<0.001	***	2.473	0.571	4.329	<0.001	***
	$\beta_{0,13}$ (EQUITYF)	0.013	0.021	0.620	0.536		0.021	0.022	0.971	0.332		0.008	0.033	0.234	0.815	
	$\beta_{0,14}$ (IP)	0.056	0.366	0.153	0.879		0.082	0.382	0.214	0.831		0.115	0.576	0.200	0.841	
	$\beta_{0,15}$ (COMADV)	1.570	0.527	2.980	0.003	**	1.611	0.559	2.884	0.004	**	1.079	0.961	1.122	0.262	
Rate of change, π_{1j} (TIME)																
Intercept	$\beta_{1,0}$	2.317	0.674	3.439	0.001	***	2.392	0.673	3.554	<0.001	***	2.371	0.673	3.524	<0.001	***
Slope	$\beta_{1,1}$ (SIZEFT)	0.017	0.155	0.110	0.912		0.013	0.155	0.085	0.932		0.008	0.155	0.050	0.960	
	$\beta_{1,2}$ (EDU)	-0.014	0.056	-0.255	0.798		-0.018	0.056	-0.326	0.744		-0.016	0.056	-0.289	0.772	
	$\beta_{1,3}$ (EDUT)	-0.020	0.268	-0.073	0.942		-0.018	0.268	-0.069	0.945		-0.021	0.268	-0.079	0.937	
	$\beta_{1,4}$ (EXPW)	0.007	0.012	0.641	0.521		0.008	0.012	0.649	0.516		0.009	0.012	0.739	0.460	
	$\beta_{1,5}$ (EXPS)	0.418	0.216	1.937	0.053		0.427	0.216	1.982	0.048	*	0.437	0.216	2.023	0.043	*
	$\beta_{1,6}$ (AGEF)	-0.031	0.011	-2.910	0.004	**	-0.032	0.011	-2.923	0.004	**	-0.032	0.011	-3.008	0.003	**
	$\beta_{1,7}$ (GENDER)	-0.564	0.269	-2.094	0.036		-0.576	0.269	-2.143	0.032	*	-0.561	0.269	-2.084	0.037	*
	$\beta_{1,8}$ (RACE)	0.785	0.330	2.381	0.017		0.773	0.329	2.351	0.019	*	0.785	0.329	2.388	0.017	*
	$\beta_{1,9}$ (CITIZEN)	0.258	0.481	0.536	0.592		0.267	0.480	0.556	0.578		0.310	0.479	0.646	0.518	
	$\beta_{1,10}$ (TECH)	0.513	0.217	2.363	0.018	*	0.521	0.216	2.408	0.016	*	0.515	0.217	2.378	0.017	*
	$\beta_{1,11}$ (PROD_SERV)	0.334	0.214	1.561	0.119		0.316	0.214	1.479	0.139		0.327	0.214	1.529	0.126	
	$\beta_{1,12}$ (INCORP)	-0.286	0.229	-1.248	0.212		-0.278	0.228	-1.217	0.224		-0.277	0.229	-1.209	0.227	
	$\beta_{1,13}$ (EQUITYF)	0.023	0.013	1.833	0.067		0.023	0.013	1.805	0.071		0.023	0.013	1.806	0.071	
	$\beta_{1,14}$ (IP)	-0.006	0.222	-0.025	0.980		0.005	0.221	0.021	0.984		0.018	0.221	0.080	0.936	
	$\beta_{1,15}$ (COMADV)	0.282	0.345	0.817	0.414		0.242	0.345	0.702	0.483		0.270	0.345	0.782	0.434	
Rate of change ² , π_{2j} (TIME ²)																
Intercept	$\beta_{2,0}$	-0.350	0.120	-2.917	0.004	**	-0.362	0.120	-3.020	0.003	**	-0.362	0.120	-3.018	0.003	**
Slope	$\beta_{2,1}$ (SIZEFT)	0.017	0.027	0.622	0.534		0.017	0.027	0.633	0.527		0.018	0.027	0.674	0.500	
	$\beta_{2,2}$ (EDU)	-0.003	0.010	-0.303	0.762		-0.002	0.010	-0.242	0.809		-0.002	0.010	-0.236	0.814	
	$\beta_{2,3}$ (EDUT)	0.003	0.047	0.068	0.946		0.002	0.047	0.037	0.970		0.002	0.047	0.050	0.960	
	$\beta_{2,4}$ (EXPW)	0.000	0.002	-0.013	0.990		0.000	0.002	-0.053	0.958		0.000	0.002	-0.139	0.890	
	$\beta_{2,5}$ (EXPS)	-0.073	0.038	-1.922	0.055		-0.076	0.038	-1.979	0.048	*	-0.078	0.038	-2.033	0.042	
	$\beta_{2,6}$ (AGEF)	0.004	0.002	2.071	0.038	*	0.004	0.002	2.094	0.036		0.004	0.002	2.166	0.030	
	$\beta_{2,7}$ (GENDER)	0.110	0.048	2.313	0.021		0.112	0.048	2.350	0.019	*	0.111	0.048	2.317	0.021	*
	$\beta_{2,8}$ (RACE)	-0.100	0.059	-1.701	0.089		-0.098	0.059	-1.660	0.097		-0.098	0.059	-1.675	0.094	
	$\beta_{2,9}$ (CITIZEN)	-0.076	0.085	-0.892	0.372		-0.076	0.085	-0.893	0.372		-0.088	0.084	-1.038	0.300	
	$\beta_{2,10}$ (TECH)	-0.087	0.038	-2.272	0.023		-0.089	0.038	-2.313	0.021		-0.087	0.038	-2.278	0.023	*
	$\beta_{2,11}$ (PROD_SERV)	-0.062	0.038	-1.627	0.104		-0.058	0.038	-1.522	0.128		-0.060	0.038	-1.573	0.116	
	$\beta_{2,12}$ (INCORP)	0.049	0.040	1.199	0.230		0.049	0.040	1.203	0.229		0.046	0.040	1.143	0.253	
	$\beta_{2,13}$ (EQUITYF)	-0.003	0.002	-1.351	0.177		-0.003	0.002	-1.346	0.178		-0.003	0.002	-1.333	0.183	
	$\beta_{2,14}$ (IP)	0.022	0.039	0.564	0.573		0.020	0.039	0.513	0.608		0.017	0.039	0.443	0.658	
	$\beta_{2,15}$ (COMADV)	-0.057	0.062	-0.932	0.352		-0.050	0.061	-0.820	0.412		-0.054	0.062	-0.879	0.379	

Number of Total Credit Sources					Number of Unique Credit Sources					Diversity Index of Unique Credit Sources				
Parameter	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.		
MCS, π_{cs} (MCS)														
Intercept	β_{cs0}	0.395	0.208	1.898	0.058	0.862	0.514	1.675	0.094	0.758	5.428	0.140	0.889	
Slope	β_{cs1} (SIZEFT)	-0.061	0.035	-1.743	0.081	-0.062	0.112	-0.559	0.576	0.343	1.044	0.328	0.743	
	β_{cs2} (EDU)	-0.023	0.016	-1.415	0.157	-0.049	0.042	-1.186	0.236	0.293	0.455	0.643	0.520	
	β_{cs3} (EDUT)	0.032	0.071	0.456	0.648	-0.141	0.191	-0.738	0.461	-0.621	1.915	-0.324	0.746	
	β_{cs4} (EXPW)	0.004	0.004	1.235	0.217	0.011	0.009	1.223	0.221	-0.023	0.093	-0.251	0.802	
	β_{cs5} (EXPS)	0.058	0.061	0.945	0.345	-0.017	0.162	-0.106	0.915	-2.004	1.632	-1.228	0.220	
	β_{cs6} (AGEF)	-0.001	0.004	-0.253	0.800	-0.004	0.008	-0.506	0.613	-0.059	0.092	-0.644	0.520	
	β_{cs7} (GENDER)	-0.029	0.092	-0.310	0.757	-0.116	0.207	-0.561	0.575	1.522	2.123	0.717	0.473	
	β_{cs8} (RACE)	-0.049	0.088	-0.557	0.577	-0.058	0.238	-0.242	0.809	-0.377	2.240	-0.168	0.867	
	β_{cs9} (CITIZEN)	0.005	0.107	0.044	0.965	0.230	0.329	0.699	0.485	-2.025	3.632	-0.558	0.577	
	β_{cs10} (TECH)	-0.006	0.060	-0.092	0.927	-0.009	0.158	-0.057	0.955	0.967	1.628	0.594	0.553	
	β_{cs11} (PROD_SERV)	-0.024	0.057	-0.421	0.674	0.116	0.160	0.728	0.467	0.169	1.635	0.103	0.918	
	β_{cs12} (INCORP)	-0.021	0.059	-0.355	0.723	0.028	0.163	0.170	0.865	-1.432	1.618	-0.885	0.376	
	β_{cs13} (EQUITYF)	-0.002	0.004	-0.476	0.634	-0.013	0.009	-1.408	0.159	0.016	0.098	0.167	0.867	
	β_{cs14} (IP)	0.086	0.062	1.385	0.166	0.114	0.163	0.699	0.485	0.149	1.671	0.089	0.929	
	β_{cs15} (COMADV)	-0.130	0.121	-1.075	0.283	-0.203	0.271	-0.749	0.454	1.268	3.019	0.420	0.674	
Debt, π_{dt} (DEBT)														
Intercept	β_{dt0}	0.000	0.040	-0.007	0.995	-0.009	0.044	-0.199	0.843	0.011	0.160	0.071	0.943	
Slope	β_{dt1} (SIZEFT)	0.008	0.008	1.075	0.283	0.006	0.009	0.655	0.513	-0.007	0.030	-0.230	0.818	
	β_{dt2} (EDU)	0.004	0.003	1.080	0.280	0.004	0.004	1.031	0.303	-0.007	0.013	-0.521	0.602	
	β_{dt3} (EDUT)	-0.011	0.015	-0.739	0.460	-0.001	0.016	-0.047	0.962	0.009	0.057	0.158	0.874	
	β_{dt4} (EXPW)	-0.001	0.001	-0.972	0.331	-0.001	0.001	-1.056	0.291	0.000	0.003	0.149	0.881	
	β_{dt5} (EXPS)	-0.029	0.012	-2.428	0.015	-0.022	0.014	-1.587	0.113	0.036	0.048	0.744	0.457	
	β_{dt6} (AGEF)	0.000	0.001	-0.344	0.731	0.000	0.001	-0.147	0.883	0.001	0.003	0.505	0.614	
	β_{dt7} (GENDER)	-0.004	0.016	-0.281	0.779	-0.001	0.018	-0.078	0.938	-0.051	0.063	-0.799	0.425	
	β_{dt8} (RACE)	-0.013	0.018	-0.697	0.486	-0.014	0.021	-0.681	0.496	-0.006	0.069	-0.088	0.930	
	β_{dt9} (CITIZEN)	0.027	0.027	1.003	0.316	0.018	0.030	0.594	0.553	0.089	0.110	0.808	0.419	
	β_{dt10} (TECH)	0.010	0.012	0.847	0.397	0.010	0.014	0.718	0.473	-0.020	0.048	-0.418	0.676	
	β_{dt11} (PROD_SERV)	-0.022	0.012	-1.867	0.062	-0.030	0.014	-2.212	0.027	-0.028	0.048	-0.582	0.561	
	β_{dt12} (INCORP)	0.009	0.012	0.753	0.451	0.007	0.014	0.536	0.592	0.050	0.048	1.042	0.298	
	β_{dt13} (EQUITYF)	0.001	0.001	1.175	0.240	0.001	0.001	1.769	0.077	0.000	0.003	0.095	0.924	
	β_{dt14} (IP)	-0.017	0.012	-1.378	0.168	-0.016	0.014	-1.143	0.253	-0.014	0.049	-0.288	0.773	
	β_{dt15} (COMADV)	0.046	0.021	2.196	0.028	0.046	0.023	1.966	0.049	0.000	0.088	0.001	1.000	
Equity, π_{eq} (EQUITY)														
Intercept	β_{eq0}	0.078	0.036	2.162	0.031	0.080	0.036	2.230	0.026	0.075	0.036	2.097	0.036	
Slope	β_{eq1} (SIZEFT)	-0.001	0.008	-0.138	0.890	-0.001	0.008	-0.180	0.857	-0.001	0.008	-0.103	0.918	
	β_{eq2} (EDU)	-0.009	0.003	-3.079	0.002	-0.009	0.003	-2.979	0.003	-0.009	0.003	-2.962	0.003	
	β_{eq3} (EDUT)	-0.004	0.014	-0.305	0.761	-0.004	0.014	-0.313	0.754	-0.004	0.014	-0.311	0.756	
	β_{eq4} (EXPW)	0.000	0.001	-0.523	0.601	0.000	0.001	-0.561	0.575	0.000	0.001	-0.587	0.557	
	β_{eq5} (EXPS)	0.008	0.011	0.740	0.459	0.008	0.011	0.737	0.461	0.008	0.011	0.681	0.496	
	β_{eq6} (AGEF)	0.0001	0.001	0.209	0.834	0.0001	0.001	0.094	0.925	0.0001	0.001	0.229	0.819	
	β_{eq7} (GENDER)	0.005	0.015	0.349	0.727	0.004	0.015	0.267	0.790	0.004	0.015	0.295	0.768	
	β_{eq8} (RACE)	0.020	0.017	1.156	0.248	0.019	0.017	1.119	0.263	0.020	0.017	1.146	0.252	
	β_{eq9} (CITIZEN)	-0.024	0.025	-0.978	0.328	-0.023	0.025	-0.919	0.358	-0.026	0.025	-1.066	0.286	
	β_{eq10} (TECH)	0.023	0.011	2.055	0.040	0.023	0.011	1.998	0.046	0.023	0.011	1.994	0.046	
	β_{eq11} (PROD_SERV)	-0.006	0.011	-0.578	0.563	-0.006	0.011	-0.527	0.598	-0.007	0.011	-0.600	0.549	
	β_{eq12} (INCORP)	-0.004	0.012	-0.374	0.709	-0.004	0.012	-0.342	0.733	-0.004	0.012	-0.363	0.717	
	β_{eq13} (EQUITYF)	-0.001	0.001	-1.640	0.101	-0.001	0.001	-1.673	0.094	-0.001	0.001	-1.650	0.099	
	β_{eq14} (IP)	0.006	0.011	0.545	0.586	0.006	0.011	0.564	0.573	0.006	0.011	0.497	0.619	
	β_{eq15} (COMADV)	-0.007	0.019	-0.386	0.700	-0.008	0.019	-0.419	0.675	-0.007	0.019	-0.370	0.712	
Hours Worked, π_{hr} (HRS)														
Intercept	β_{hr0}	0.027	0.017	1.567	0.117	0.027	0.018	1.527	0.127	0.029	0.018	1.648	0.099	
Slope	β_{hr1} (SIZEFT)	-0.002	0.004	-0.440	0.660	-0.002	0.004	-0.393	0.695	-0.002	0.004	-0.464	0.643	
	β_{hr2} (EDU)	0.004	0.001	2.438	0.015	0.004	0.001	2.411	0.016	0.004	0.001	2.423	0.015	
	β_{hr3} (EDUT)	0.009	0.007	1.261	0.207	0.009	0.007	1.296	0.195	0.009	0.007	1.232	0.218	
	β_{hr4} (EXPW)	0.0005	0.0003	1.588	0.112	0.0005	0.0003	1.535	0.125	0.0005	0.0003	1.561	0.119	
	β_{hr5} (EXPS)	0.006	0.006	0.999	0.318	0.005	0.006	0.931	0.352	0.005	0.006	0.898	0.369	
	β_{hr6} (AGEF)	0.000	0.000	0.260	0.795	0.0001	0.0003	0.323	0.747	0.0001	0.0003	0.242	0.809	
	β_{hr7} (GENDER)	0.002	0.007	0.305	0.761	0.003	0.007	0.355	0.722	0.002	0.007	0.304	0.761	
	β_{hr8} (RACE)	0.000	0.008	-0.051	0.959	-0.001	0.008	-0.075	0.941	-0.001	0.008	-0.066	0.947	
	β_{hr9} (CITIZEN)	-0.006	0.013	-0.441	0.659	-0.005	0.013	-0.363	0.717	-0.006	0.013	-0.441	0.659	
	β_{hr10} (TECH)	-0.002	0.006	-0.319	0.750	-0.002	0.006	-0.279	0.780	-0.001	0.006	-0.219	0.827	
	β_{hr11} (PROD_SERV)	0.003	0.006	0.478	0.633	0.002	0.006	0.423	0.672	0.002	0.006	0.405	0.685	
	β_{hr12} (INCORP)	-0.006	0.006	-0.976	0.329	-0.006	0.006	-0.968	0.333	-0.006	0.006	-0.977	0.329	
	β_{hr13} (EQUITYF)	0.0000	0.0003	-0.068	0.946	0.0000	0.0003	-0.022	0.982	0.0000	0.0003	-0.072	0.943	
	β_{hr14} (IP)	-0.001	0.006	-0.208	0.835	-0.002	0.006	-0.278	0.781	-0.002	0.006	-0.277	0.782	
	β_{hr15} (COMADV)	-0.028	0.010	-2.851	0.004	-0.027	0.010	-2.839	0.005	-0.027	0.010	-2.843	0.005	

Parameter	Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
Credit Crisis: $\pi_j(\text{ECONOMY})$												
Intercept β_{-0}	-1.180	0.653	-1.806	0.071	-1.186	0.654	-1.814	0.070	-1.192	0.650	-1.833	0.067
Slope	β_{-1} (SIZEFT)	0.101	0.146	0.695	0.487	0.112	0.146	0.768	0.443	0.116	0.145	0.798
	β_{-2} (EDU)	-0.049	0.055	-0.905	0.366	-0.051	0.055	-0.928	0.354	-0.055	0.054	-1.013
	β_{-3} (EDUT)	0.139	0.251	0.556	0.578	0.142	0.250	0.568	0.570	0.153	0.249	0.616
	β_{-4} (EXPW)	0.005	0.011	0.461	0.645	0.006	0.011	0.538	0.591	0.004	0.011	0.384
	β_{-5} (EXPS)	-0.084	0.206	-0.408	0.683	-0.080	0.206	-0.385	0.700	-0.088	0.206	-0.426
	β_{-6} (AGEF)	0.015	0.011	1.365	0.172	0.014	0.011	1.302	0.193	0.016	0.011	1.471
	β_{-7} (GENDER)	0.200	0.259	0.771	0.441	0.211	0.259	0.814	0.416	0.198	0.258	0.767
	β_{-8} (RACE)	-0.247	0.322	-0.766	0.444	-0.234	0.322	-0.727	0.467	-0.250	0.321	-0.777
	β_{-9} (CITIZEN)	-0.425	0.457	-0.929	0.353	-0.462	0.456	-1.013	0.311	-0.497	0.455	-1.092
	β_{-10} (TECH)	-0.340	0.207	-1.640	0.101	-0.357	0.207	-1.723	0.085	-0.329	0.206	-1.597
	β_{-11} (PROD_SERV)	0.104	0.204	0.511	0.610	0.120	0.204	0.590	0.556	0.094	0.203	0.460
	β_{-12} (INCORP)	-0.035	0.217	-0.160	0.873	-0.050	0.217	-0.230	0.818	-0.047	0.217	-0.216
	β_{-13} (EQUITYF)	-0.014	0.012	-1.208	0.227	-0.014	0.012	-1.166	0.244	-0.014	0.012	-1.160
	β_{-14} (IP)	-0.068	0.211	-0.324	0.746	-0.080	0.211	-0.379	0.705	-0.079	0.210	-0.377
	β_{-15} (COMADV)	0.082	0.340	0.241	0.810	0.106	0.340	0.311	0.756	0.081	0.339	0.239
Number of Level-1 units (observations)	8,496				8,496				8,496			
Number of Level-1 units (firms)	1,626				1,626				1,626			
Deviance	20,312				47,651				47,663			
AIC	20,602				47,941				47,953			
BIC	21,587				48,963				48,975			

Statistical significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$
Dependent variable: Number of employees

The third level (location) variables are not included in the results as none of the variables are statistically significant, and by leaving them out of the results it saves space for the more important results.

Endogeneity

Endogeneity is an issue that researchers need to examine when performing statistical analyses (Parker & Van Praag, 2006; e.g. Parker, 2009). If endogeneity is prevalent in the statistical model and not controlled for in the analysis, the coefficient estimates and their statistical significant levels could be biased. Endogeneity can arise due to several reasons. One of those reasons is due causal direction. With the decision to use multiple credit sources being a choice for founders, and the founders have a goal for their firms to survive and possibly grow, the possibility of endogeneity exists. In the statistical analyses, I test the relationship between multiple credit source usage and firm performance. Multiple credit source variables are the independent variables in the statistical models, and firm performance variables are the dependent variables. This setup implies that multiple credit source usage by new firms leads to a change in firm performance. However, the causal direction of the relationship between multiple credit source usage and firm performance could be in the

opposite causal direction. For example, a firm that is already growing could resort to the use of multiple credit sources as they need more funds to fuel the growth. Or a firm that is performing poorly and thus is having difficulty obtaining funds from a bank will resort to using multiple credit sources to try to survive longer.

The endogeneity resulting from the bimodal causal direction can be addressed through theory and statistical methods. Theory explains “why” a relationship exists between the variables. In the theory development section, I built a theory that explains the causal direction being that multiple credit source usage leads to growth. In addition, statistical methods can be used to control for this source of endogeneity by including an instrumental variable. An instrumental variable is a variable that is correlated with the independent variables but not with the error of the equation. In the case of this study, an instrumental variable would need to be correlated with each of the multiple credit source variables, but not correlated with the error of the equation for each of the firm performance variables (survival, growth in revenue, and growth in number of employees). A viable instrumental variable was not found in the data set. Thus, an instrumental variable cannot be used to mitigate the possibility of endogeneity in the statistical analyses of the study. This issue is included in Chapter 5 when discussing the limitations of this study.

Theory and instrumental variables do not take into account another endogeneity issue, omitted variable bias, also known as unobserved heterogeneity. Omitted variable bias results in a covariate variable not being included in the statistical analysis that could affect the dependent variable. I have included a large number of variables in the statistical analysis, which lessens the probability that an important variable is missing.

Even though I have included a large number of variables in the statistical analyses, there are several variables that are not present in the analyses that could affect the results. One possible variable that is missing that could have an impact on firm performance is the availability of credit and risk propensity of creditors. I control for that partially via the credit crisis. However, it is assumed that the credit crisis occurs for all firms, but over different time periods. Thus, the credit crisis variable is not firm or location specific. I then included a location variable that would try to control for the location being a factor (assuming that different locations have different amounts of credit supply). When running the HLM analysis with location as the 3rd level, the ICC was trivial, which indicated that location was not a factor. In addition, the estimates including location as a 3rd level and the estimates not including the 3rd level with location did not differ significantly. This suggests that location is not a factor, and possibly that the supply of credit is not a factor. Location might not be a factor because firms are able to obtain credit from creditors that are not located near them. In other words, credit is not obtained from a creditor in the same location – a new firm in Austin, Texas can obtain credit from a bank in Chicago, Illinois. In addition, many banks operate across states and across the country. Thus, their credit availability is measured by the entire country. Moreover, the data set that I used for this study is national (United States). This is also true for non-bank financial institutions, especially large one. With individuals able to easily move around the country (fluid labor movement in the United States), family and friends also might not be located in the same location as the firm.

Another omitted variable that could be an issue, is personal wealth of the founders. If the founders have a higher amount of wealth, which includes tangible assets (for example, a large amount of equity in their home), they can possibly use that wealth as collateral when

obtaining credit. A larger amount of collateral could possibly increase the amount that the new firm can obtain from one credit source, thus affecting the reason to use additional credit sources to obtain the necessary funds the new firm needs to survive and possibly grow.

However, the assumption is that most entrepreneurs are liquidity constrained. In other words, they don't have enough of the funds personally to adequately fund their business, nor do they have enough personal assets to fund their business. Other factors not included in the analysis that could influence firm performance could be personal wealth of the founder(s), risk propensity of creditors in the area of the firm, and supply of credit in the area.

Even though some statistical analysis has been performed, and a large number of theoretically supported variables are included in the model, the possibility of omitted variable bias still might exist. Some might argue that not enough has been done to address the possibility of omitted variable bias in the analysis. From one perspective, omitted variable bias can be overcome by including a large number of variables in the model with the hope that there is less of a chance that an important variable is missing – which I have done in the previous analyses. However, by including a large number of variables in the model, there is more of a chance that one of those variables is correlated with an important variable that has been left out of the model. Thus, I perform additional analyses to address this concern.

Panel data regression is a longitudinal statistical method embedded in the econometric framework that helps eliminate the possibility of unobserved heterogeneity when the omitted variables are constant over time. For example, personal wealth when starting a new firm is constant, and doesn't change since it is the personal wealth at the time the firm started and the analysis is performed over time (i.e. the other variables change over time).

A statistical method for growth analysis that handles unobserved heterogeneity is panel data regression. Panel data regression is an econometric approach to analyzing panel data, while hierarchical linear modeling is an approach derived from the discipline of statistics. Statistical researchers tend to focus on finding the best model that fits the data, while econometric researchers tend to focus on minimizing the endogenous aspects of a statistical model.

Panel Data Regression

Panel data regression is performed for two different dependent variables: revenue and number of employees. The three multiple credit source variables (number of total credit sources, number of unique credit sources, and diversity index of credit sources) are individually included as independent variables in each of the models. 19 control variables are included (number of founders, education of founders, type of education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology level, product / service, incorporation, number of hours worked in venture, founder contributed equity, intellectual property, competitive advantage over competitors).

There are two types of models that can be used in panel data regression: 1) fixed effects models, and 2) random effects models. The fixed effects model controls for time invariant differences between the firms, so the estimated coefficients of the fixed effects model are not biased because of omitted time invariant characteristics of the firms. This means fixed effects models cannot examine time invariant characteristics of the firms. Fixed effects models are designed to study the causes of changes within a firm (or entity, or individual) (Kohler & Kreuter, 2008). In more detail, the fixed effects model restricts the slope coefficients and the variance to be the same across firms while letting the intercepts

differ, and treats all between firm covariances as 0. The random effects model allows for time invariant variables to be included among the regressors. In the fixed effect model, these variables are included in the intercept.

Fixed and random effects models are compared using the Hausman test to determine if to use a fixed effects model or a random effects model (Hausman, 1978). The null hypothesis of the Hausman test is that the errors from the equation and the estimators are not correlated. All of the Hausman tests indicate a statistical difference between the models, as shown in Table 40. This suggests that the null hypothesis is rejected in all the Hausman tests and that the random effects model is inconsistent. Thus, the fixed effects model should be used.

Table 40: Results of Hausman Tests between Fixed Effects Models and Random Effects Models

	χ^2	p-value
Dependent Variable: Revenue		
Independent Variable		
Number of Total Credit Sources	455.08	<0.001
Number of Unique Credit Sources	518.97	<0.001
Diversity Index of Credit Sources	668.64	<0.001
Dependent Variable: Number of Employees		
Independent Variable		
Number of Total Credit Sources	66.40	<0.001
Number of Unique Credit Sources	101.45	<0.001
Diversity Index of Credit Sources	109.81	<0.001

The notation for a fixed effects model in panel data regression is as follows:

$$\text{GROWTH}_{f,t} = \beta_0 + \beta_1 (\text{MCS}_{f,t}) + \dots + \beta_{20} (\text{COMPADV}_{f,t}) + \varepsilon_{f,t}$$

where,

$\text{GROWTH}_{f,t}$ is, depending on the model, the revenue or number of employees at time t for firm f

$\text{MCS}_{f,t}$ is, depending on the model, the number of total credit sources, number of unique credit sources, or diversity index of credit sources at time t for firm f

$\beta_0 \dots \beta_{20}$ are the estimated coefficients in the model

u_f is the between firm error

$\varepsilon_{f,t}$ is the error term at time t for firm f

Table 41: Panel Data Regression Results – Dependent Variable: Revenue

	Estimate	t-value	Pr(> t)		Estimate	t-value	Pr(> t)		Estimate	t-value	Pr(> t)
Number of Total Credit Sources	0.035	3.868	<0.001 ***		0.094	3.646	<0.001 ***				
Number of Unique Credit Sources									0.038	0.143	0.886
Diversity Index of Credit Sources									0.005	0.689	0.491
Amount of Outstanding Debt	0.003	1.776	0.076		0.002	0.720	0.471				
Amount of New Equity	-0.023	-13.654	<0.001 ***		-0.023	-13.749	<0.001 ***		-0.023	-13.696	<0.001 ***
Commitment to Venture											
Number of Hours Worked in Venture	0.012	10.707	<0.001 ***		0.012	10.702	<0.001 ***		0.012	10.755	<0.001 ***
Credit Crisis	0.333	12.289	<0.001 ***		0.336	12.396	<0.001 ***		0.335	12.348	<0.001 ***
R ²	0.095				0.095				0.093		
Adjusted R ²	0.073				0.072				0.071		
F-statistic	106.361				105.994				103.069		
df	5,052				5,052				5,052		
p-value	<0.001				<0.001				<0.001		

Statistical significance: * p < 0.10; ** p < 0.05; *** p < 0.01; **** p < 0.001
Dependent variable: Revenue
Unbalanced panel
n = 1562, T=1-6, N=6,619

Table 41 shows the panel data regression results when the dependent variable is revenue. Two of the multiple credit source variables are statistically significant. The number of total credit sources is positively associated with revenue (0.035, t-value = 3.868, p < 0.001). The number of unique credit sources is also positively associated with revenue (0.094, t-value = 3.646, p < 0.001). Thus, when number of total and unique credit sources increase over time, revenue of a firm also is found to increase. The diversity index of credit

sources is not statistically significant with revenue (0.038, t-value = 0.143, p = 0.886). This suggests that the diversity index of credit sources is not associated with changes in revenue.

Table 42: Panel Data Regression Results – Dependent Variable: Number of Employees

	Estimate	t-value	Pr(> t)		Estimate	t-value	Pr(> t)		Estimate	t-value	Pr(> t)
Number of Total Credit Sources	0.079	2.757	0.006 **								
Number of Unique Credit Sources					0.219	2.703	0.007 **				
Diversity Index of Credit Sources									1.242	1.480	0.139
Amount of Outstanding Debt	0.030	4.788	<0.001 ***		0.025	3.585	<0.001 ***		0.001	0.027	0.978
Amount of New Equity	-0.015	-2.769	0.006 **		-0.015	-2.864	0.004 **		-0.015	-2.863	0.004 **
Commitment to Venture											
Number of Hours Worked in Venture	0.027	8.262	<0.001 ***		0.027	8.220	<0.001 ***		0.027	8.347	<0.001 ***
Credit Crisis	0.288	3.302	<0.001 ***		0.296	3.393	<0.001 ***		0.293	3.356	<0.001 ***
R ²	0.021				0.021				0.020		
Adjusted R ²	0.017				0.017				0.016		
F-statistic	29.174				29.114				28.070		
df	6,865				6,865				6,865		
p-value	<0.001				<0.001				<0.001		

Statistical significance: * p < 0.10; ** p < 0.05; *** p < 0.01; **** p < 0.001

Dependent variable: Number of employees

Unbalanced panel

n = 1626, T=1-6, N=8,496

Table 42 shows the panel data regression results when the dependent variable is number of employees. The results with the number of employees as the dependent variable are similar to the results seen when the dependent variable is revenue. Number of total credit sources and number of unique credit sources are statistically significant and positively associated with number of employees. The number of total credit sources is positively associated with number of employees (0.079, t-value = 2.757, p < 0.001). The number of unique credit sources is also positively associated with number of employees (0.219, t-value = 2.703, p < 0.001). Thus, when number of total and unique credit sources increase over time, the number of employees in a firm also is found to increase. The diversity index of credit sources is not statistically significant with revenue (1.242, t-value = 1.480, p = 0.139). This suggests that the diversity index of credit sources is not associated with changes in the number of employees.

Summary of Results for Entire Sample

The results presented for OLS regression, Probit regression, survival analysis, growth curve analysis, and panel data regression need an explanation when examining the results

together since the results are not completely consistent with each other. Examining the results together also helps form a better understanding of what they mean in the aggregate and thus helps answer the research question posed in this study. All the statistical analysis tools except growth curve analysis report some form of statistical significance between the multiple credit source variables and performance (survival and growth). Table 43 presents the summary of the results for all the statistical analyses provided up to this point, highlighting the statistical significance and relationship direction for the multiple credit source variables.

Table 43: Summary of Results for Entire Sample

	Dependent Variable	Number of Total Credit Sources		Number of Unique Credit Sources		Diversity Index of Credit Sources	
H1: Survival Hypothesis							
OLS Regression: Last Year Levels	Age at 2009	NS		Neg	***	NS	
OLS Regression: End of First Year Levels	Age at 2009	Neg	**	Neg	***	NS	
Probit Regression: Last Year Levels	Closure (0, 1)	NS		Pos ¹	*	NS	
Probit Regression: End of First Year Levels	Closure (0, 1)	Pos ¹	**	Pos ¹	***	NS	
Cox Proportional Hazard Modeling: Time Invariant Variables	Closure Event	NS		Pos ¹	*	NS	
Cox Proportional Hazard Modeling: Time Varying Variables	Closure Event	NS		NS		NS	
H2: Growth Hypothesis							
Revenue							
OLS Regression: Last Year Levels	Revenue - Last Full Year of Operations	Pos	***	Pos	***	Neg	**
OLS Regression: End of First Year Levels	Revenue - Last Full Year of Operations	NS		NS		Neg	***
Hierarchical Linear Modeling	Revenue Each Year	NS		NS		NS	
Panel Data Regression	Revenue Each Year	Pos	***	Pos	***	NS	
Number of Employees							
OLS Regression: Last Year Levels	# of Employees - Last Full Year of Operations	NS		Pos	*	Neg	*
OLS Regression: End of First Year Levels	# of Employees - Last Full Year of Operations	NS		NS		Neg	*
Hierarchical Linear Modeling	# of Employees Each Year	NS		NS		NS	
Panel Data Regression	# of Employees Each Year	Pos	**	Pos	**	NS	

Neg = negatively related with dependent variable; Pos = positively related with the dependent variable; NS = not statistically significant

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Control variables include: number of founders, education of founders, type of education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology level, incorporation (in year 1), number of hours worked in venture, founder contributed equity (in year 1), intellectual property (any year), and competitive advantage over competitors (any year). Credit crisis is included in survival analysis, growth curve analysis, and panel data regression. Location is not included in growth curve analysis as third-level variable.

¹ The survival analysis "Pos" result is similar to the "Neg" results in the OLS regression since the dependent variable is coded opposite between OLS regression and survival analysis

Hypothesis 1 posited a positive relationship between multiple credit sources and survival. The summary of the results suggests hypothesis 1 is not supported. Rather than a positive relationship, the results suggest there is a negative relationship between survival and at least one of the multiple credit source variables. Number of credit sources is negative and

statistically significant with survival only in the OLS regression analysis and only when using the first year variable levels. This suggests that using too many credit sources during the first year is not beneficial for survival. Number of unique credit sources is negative and statistically significant in all the statistical results except in Cox proportional hazard modeling when the variables are allowed to vary over time. This suggests that the number of unique credit sources, a form of diversity of credit sources based on a count method, is negatively associated with survival. In other words, when a firm uses a wider variety of unique credit sources, no matter how much it borrows from each unique credit source, the survival rate is lower. The diversity index of credit sources, a form of diversity of credit sources based on dollar value of each credit source that is used, is not statistically significant in any of the statistical methods that examine survival.

Hypothesis 2 posited a positive relationship between multiple credit sources and growth. Growth is measured by revenue and number of employees. The summary of the results suggests partial support for hypothesis 2. The number of total credit sources is positive and statistically significant with revenue in OLS regression when using the levels in the last full years of operations and in panel data regression. In OLS regression when using the first year levels and growth curve modeling, number of total credit sources is not statistically significant with revenue. The same is the case for the number of unique credit sources. The number of unique credit sources is positive and statistically significant with revenue in OLS regression when using the levels in the last full year of operations and in panel data regression.

These results suggest that multiple credit source usage is positively associated with revenue growth. However, when examining the relationship between multiple credit sources

and growth in the form of number of employees, there is a weaker relationship. The number of total credit sources is positive and statistically significant with number of employees only in the panel data regression. The number of unique credit sources is positive and statistically significant with number of employees in OLS regression using the last full year of operations and in panel data regression. Firms maybe borrowing more to generate revenue or invest in tangible assets rather than hire new employees.

The diversity index of credit sources has a different relationship with growth. Diversity index of credit sources is negative and statistically significant with revenue in both OLS regression analyses for both revenue and number of revenue and number of employees. This suggests that a diversity of credit source usage in the form of dollar value is negatively associated with firm growth.

Examining Surviving and Growth Firms Separately

The previous analyses in this section used survival and growth as the dependent variables on the entire data set. However, there are different variations of growth rates among new firms as some firms grow quickly and others don't. This could be attributed to the goals of the founders (Cassar, 2004; Vos et al., 2007). Some founders want to build firms that grow quickly while others want to start firms that stay small and are stable (i.e. lifestyle businesses). Firms that grow tend to survive longer (e.g. Phillips & Kirchhoff, 1989). The results in the previous analyses, in general, indicate multiple credit source usage has a positive relationship with growth, but a negative relationship with survival. With the two relationships being in opposite directions for the different performance measures, this suggests that nuances exist within the firms that grow faster and survive longer than other firms. Thus, I split up the data into four subsets based upon survival and growth. I perform additional analyses on each of the four quadrants in the 2x2 framework (see Figure 23). In

this case, survival and growth are used as the grouping variables as opposed to the dependent variables when using the 2x2 framework.

Firms are allocated into the four quadrants of the 2x2 box framework, surviving / non-surviving and medium-to-high growth / low-to-medium growth firms⁴⁶. Medium-to-high growth, surviving firms (quadrant 4) are defined as firms that are still operating independently after six years and are above the mean of the growth parameter (revenue, employees) for at least two years or in year six. Low-to-medium growth, surviving firms (quadrant 3) are determined to be below the mean of the growth parameter (revenue, employees). Low-to-med growth, non-surviving firms (quadrant 2) are defined as firms in the data set that close before or in year six and are not above the mean for the growth parameters (revenue, employees) for less than two years. Medium-to-high growth, non-surviving firms (quadrant 1) are defined as firms that close before or in year six in the data set and are above the mean for the growth parameters (revenue, employees) for less than two years. Figure 21 and Figure 22 provide graphical illustrations of the grouping criteria using the growth rates in revenue and employees for five example firms. The trends of each firm can be compared to the mean growth trend to show why each firm is placed into each of the four quadrants. Figure 23 presents the number of firms in each quadrant based upon the selected growth parameter (revenue, employees).

⁴⁶ The categorization of growth is based upon the mean of the revenue and number of employee variables for the firms in the dataset. Using the mean to split high and low growth firms is similar to how a competitive advantage is defined by Besanko, Dranove, Shanley, and Schaefer (2009). They define a firm having a competitive advantage if the firm earns a higher rate of economic profit than the average rate of economic profit of other firms competing in the same market.

Figure 21: Graphical Illustration of Revenue Grouping Criteria

Figure 22: Graphical Illustration of Employee Grouping Criteria

Figure 23: 2x2 Framework – # of Firms in each Quadrant

		Firm Survival	
		Closed	Survive
Firm Growth	Low to Med	2 Rev: 340 firms, 1,404 obs Emp: 274 firms 1,155 obs	3 Rev: 943 firms 5,658 obs Emp: 804 firms 4,824 obs
	Med to High	1 Rev: 43 firms 185 obs Emp: 109 firms 434 obs	4 Rev: 308 firms 1,848 obs Emp: 447 firms 2,682 obs

Total sample: 1,634 firms, 9,095 obs

Data sets: 8 (2 for each quadrant)

Grouping criteria:

Survival: survive or close during 6 year period

Growth: growth above or below the mean for at least any two years or above mean the last year of operations

Growth is measured in 2 ways: 1) by revenue (Rev), 2) by number of employees (Emp)

Analysis is performed on each of these data sets for both revenue and number of employees, along with analysis on only surviving / non-surviving firms and medium-to-high growth / low-to-med growth firms. Table 44 presents the summary of these results.

Table 44: Summary of Results by Survival, Growth, and Quadrants

Multiple Credit Source Variable	OLS Regression						Survival Analysis		Growth Curve Analysis		Panel Data Regression	
	Independent Variables: Last Year Levels			Independent Variables: End of First Year Levels			w/ Time Invariant Vars	w/ Time Varying Vars	DV: Rev	DV: Emps	DV: Rev	DV: Emps
	DV: Age	DV: Rev	DV: Emps	DV: Age	DV: Rev	DV: Emp	Event: Closure	Event: Closure				
Only Surviving Firms (N = 1,251)												
Number of Total Credit Sources	N/A	Pos ***	NS	N/A	NS	NS	N/A	N/A	NS	Neg *	Pos **	Pos ***
Number of Unique Credit Sources	N/A	Pos **	NS	N/A	NS	NS	N/A	N/A	NS	NS	Pos *	Pos *
Diversity Index of Credit Sources	N/A	NS	NS	N/A	NS	NS	N/A	N/A	NS	NS	Neg ***	Neg ***
Only Non-Surviving Firms (N = 383)												
Number of Total Credit Sources	Neg *	NS	NS	NS	NS	Pos *	Pos ¹ *	NS	NS	NS	Pos *	NS
Number of Unique Credit Sources	Neg ***	NS	NS	Neg *	NS	Pos **	Pos ¹ ***	NS	NS	NS	NS	NS
Diversity Index of Credit Sources	Neg **	NS	NS	NS	NS	NS	NS	NS	Neg *	NS	Neg ***	Neg **

Independent Variables Multiple Credit Source Variable	OLS Regression						Survival Analysis		Growth Curve Analysis		Panel Data Regression	
	Covariates: Last Year Levels			Covariates: End of First Year Levels			Time Invariant Variables	Time Varying Variables	DV: Rev	DV: Emps	DV: Rev	DV: Emps
	DV: Age	DV: Rev	DV: Emps	DV: Age	DV: Rev	DV: Emp	Event: Closure	Event: Closure				
Only Med-to-High Growth Firms: Revenue (N = 351; Closed = 43)												
Number of Total Credit Sources	NS	Pos ***	NS	Neg *	NS	NS	NS	NS	NS	Neg *	NS	Pos ***
Number of Unique Credit Sources	NS	Pos *	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Diversity Index of Credit Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Neg ***	NS
Only Low-to-Med Growth Firms: Revenue (N = 1,283; Closed = 240)												
Number of Total Credit Sources	Neg **	Pos ***	NS	Neg **	Neg **	NS	NS	NS	NS	Neg *	Pos ***	NS
Number of Unique Credit Sources	Neg ***	NS	NS	Neg ***	Neg *	NS	Pos ¹ *	NS	NS	NS	Pos *	NS
Diversity Index of Credit Sources	Neg ***	Neg *	Pos *	Neg *	Neg ***	NS	NS	NS	NS	NS	NS	NS
Only Med-to-High Growth Firms: Number of Employees (N = 556; Closed = 109)												
Number of Total Credit Sources	NS	Pos ***	NS	Neg *	NS	NS	NS	NS	NS	Neg *	NS	Pos ***
Number of Unique Credit Sources	Neg **	Pos *	NS	Neg *	NS	NS	NS	NS	NS	NS	NS	NS
Diversity Index of Credit Sources	Neg **	NS	NS	NS	NS	NS	NS	NS	NS	NS	Neg ***	Neg **
Only Low-to-Med Growth Firms: Number of Employees (N = 1,089; Closed = 174)												
Number of Total Credit Sources	Neg *	Pos ***	Pos *	Neg **	NS	NS	NS	NS	NS	Neg *	Pos ***	Pos **
Number of Unique Credit Sources	Neg ***	NS	Pos *	Neg ***	NS	NS	Pos ¹ **	NS	NS	NS	Pos **	Pos ***
Diversity Index of Credit Sources	Neg ***	Neg **	NS	Neg *	NS	Neg **	NS	NS	NS	NS	Neg *	Pos *

Independent Variables Multiple Credit Source Variable	OLS Regression						Survival Analysis		Growth Curve Analysis		Panel Data Regression	
	Covariates: Last Year Levels			Covariates: End of First Year Levels			Time Invariant Variables	Time Varying Variables	DV: Rev	DV: Emps	DV: Rev	DV: Emps
	DV: Age	DV: Rev	DV: Emps	DV: Age	DV: Rev	DV: Emp	Event: Closure	Event: Closure				
Quad 4a: Surviving, Med-to-High Growth Firms - Revenue (N = 308)												
Number of Total Credit Sources	N/A	Pos ***	NS	N/A	NS	NS	N/A	N/A	NS	Neg **	NS	Pos ***
Number of Unique Credit Sources	N/A	Pos *	NS	N/A	NS	NS	N/A	N/A	NS	NS	NS	NS
Diversity Index of Credit Sources	N/A	NS	NS	N/A	NS	NS	N/A	N/A	NS	NS	Neg ***	NS
Quad 3a: Surviving, Low-to-Med Growth Firms - Revenue (N = 943)												
Number of Total Credit Sources	N/A	Pos ***	NS	N/A	Neg **	NS	N/A	N/A	NS	NS	Pos ***	NS
Number of Unique Credit Sources	N/A	NS	NS	N/A	Neg *	NS	N/A	N/A	NS	NS	Pos *	NS
Diversity Index of Credit Sources	N/A	NS	Pos *	N/A	Neg ***	NS	N/A	N/A	NS	NS	NS	NS
Quad 2a: Non-Surviving, Low-to-Med Growth Firms - Revenue (N = 340)												
Number of Total Credit Sources	Neg **	Pos *	Pos ***	NS	NS	NS	Pos ¹ *	NS	NS	Pos **	NS	NS
Number of Unique Credit Sources	Neg ***	NS	NS	Neg *	Pos *	Pos *	Pos ¹ **	NS	NS	NS	NS	NS
Diversity Index of Credit Sources	Neg ***	Neg *	Pos *	NS	NS	NS	NS	NS	Neg *	NS	Pos *	NS
Quad 1a: Non-Surviving, Med-to-High Growth Firms - Revenue (N = 43)												
Number of Total Credit Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Number of Unique Credit Sources	NS	NS	NS	NS	NS	NS	Pos ¹ *	NS	Neg *	NS	NS	NS
Diversity Index of Credit Sources	Pos *	NS	NS	NS	NS	NS	NS	NS	Neg *	NS	Neg *	Neg **

Independent Variables	OLS Regression						Survival Analysis		Growth Curve Analysis		Panel Data Regression		
	Covariates: Last Year Levels			Covariates: End of First Year Levels			Time Invariant Variables	Time Varying Variables	DV: Rev	DV: Emps	DV: Rev	DV: Emps	
	DV: Age	DV: Rev	DV: Emps	DV: Age	DV: Rev	DV: Emp	Event: Closure	Event: Closure					
Multiple Credit Source Variable													
Quad 4b: Surviving, Med-to-High Growth Firms - Number of Employees (N = 447)													
Number of Total Credit Sources	N/A	Pos ***	NS	N/A	NS	NS	N/A	N/A	NS	Neg *	NS	Pos ***	
Number of Unique Credit Sources	N/A	Pos *	NS	N/A	NS	NS	N/A	N/A	NS	NS	NS	NS	
Diversity Index of Credit Sources	N/A	NS	NS	N/A	NS	NS	N/A	N/A	NS	NS	Neg ***	Neg *	
Quad 3b: Surviving, Low-to-Med Growth Firms - Number of Employees (N = 804)													
Number of Total Credit Sources	N/A	Pos ***	NS	N/A	NS	NS	N/A	N/A	NS	NS	Pos ***	Pos **	
Number of Unique Credit Sources	N/A	NS	Pos *	N/A	NS	NS	N/A	N/A	NS	NS	Pos *	Pos ***	
Diversity Index of Credit Sources	N/A	Neg **	NS	N/A	NS	Neg **	N/A	N/A	NS	Neg ***	Neg *	Pos **	
Quad 2b: Non-Surviving, Low-to-Med Growth Firms - Number of Employees (N = 274)													
Number of Total Credit Sources	Neg **	NS	NS	NS	NS	NS	Pos ¹ *	NS	Pos *	Pos *	NS	NS	
Number of Unique Credit Sources	Neg ***	NS	NS	Pos **	NS	NS	Pos ¹ **	NS	NS	NS	NS	Pos *	
Diversity Index of Credit Sources	Neg *	NS	NS	NS	NS	NS	NS	NS	Neg *	NS	NS	NS	
Quad 1b: Non-Surviving, Med-to-High Growth Firms - Number of Employees (N = 109)													
Number of Total Credit Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Number of Unique Credit Sources	Neg **	NS	NS	NS	NS	Pos *	Pos ¹ **	NS	Neg *	NS	NS	NS	
Diversity Index of Credit Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Neg **	Neg *	

DV = dependent variables; Neg = negatively related with dependent variable; Pos = positively related with the dependent variable; NS = not statistically significant; N/A = not applicable

Statistical significance: * p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Control variables include: number of founders, education of founders, type of education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology level, incorporation (in year 1), number of hours worked in venture, founder contributed equity (in year 1), intellectual property (any year), and competitive advantage over competitors (any year). Credit crisis is included in survival analysis, growth curve analysis, and panel data regression. Location is not included in growth curve analysis as third-level variable.

¹ The survival analysis "Pos" result is similar to the "Neg" results in the OLS regression since the dependent variable is coded opposite between OLS regression and survival analysis

I highlight some of the important results as they relate to the analyses that use the full dataset of firms. In quadrant 3b, for panel data regression, all six of the analyses are statistically significant. Number of total credit sources and number of unique credit sources are both positively associated with revenue and number of employees. This supports the hypothesis that usage of multiple credit sources positively affects growth, when measured as the growth in the number of employees for growing firms that survive. However, the diversity index of credit sources result is strange because the result for revenue is opposite of the result for number of employees. The diversity index of credit sources is negatively associated with revenue, which suggests that more diversity of credit sources is associated with lower revenue. Therefore, diversity of credit sources is not good for a firm. Or firms with less revenue are unable to diversify their usage of credit over multiple credit sources or are able to obtain all they need from one credit source (i.e. they do not experience credit

rationing). Since the panel data regression handles the longitudinal data, we can say that diversity of credit sources is associated with lower revenue, especially when lagging the multiple credit source variables⁴⁷. This analysis is not reported in the table, but when I performed the analysis with lagging the diversity index of credit source variable, the result is still negative and statistically significant. Thus, of the firms that don't grow very much, diverse usage of credit sources is not a prudent financing strategy. It could be that these firms are the living dead, and are just hanging on, when they should be closing. And to explain the positive association between diversity of credit sources and number of employees, the results might be suggesting that firms at the top end of the spectrum of slow growth firms (i.e. the fastest growth firms within the group of low-to-medium growth firms) implement a diverse use of credit sources to not be reliant upon any one credit source to fund labor costs when they are not growing quickly (i.e. when they are growing slowly).

In quadrant 1a, the quadrant for non-surviving, medium-to-high growth firms (amount of revenue), in the OLS regression, there is only one relation that is statistically significant. The last year diversity index of credit sources is positively related to age at 2009 (the proxy for survival in the OLS regression). This relationship is statistically significant at the $p < 0.05$ level. This indicates that the more diverse the usage of credit sources the last year, the longer the firm that will ultimately close within 6 years will live. In other words, firms that will ultimately close within six years try to stay alive by tapping into other types of credit sources. However, the diverse use of credit sources does not stop the firm from eventually closing.

⁴⁷ By lagging the multiple credit source variables, there is a stronger case for causation rather than only association with the dependent variables (survival and growth). However, I still say "associate" because I am not able to control for all other plausible explanations since I am not running an experiment.

Quadrant 1a only has this one statistically significant relationship in the OLS regression results. The lack of statistical significance in quadrant 1a could be due to the low number of observations (43 firms).

Statistical Testing for Reasoning of the Hypotheses

The reasoning for my original two hypotheses is that being resourceful in financing by using multiple credit sources leads to an increase in survival and growth rates because using multiple credit sources provides additional funds for the new firm. Hypothesis 1, which dealt with survival rates, is not supported. However, hypothesis 2, which dealt with growth rates, is supported. To determine if the reasoning is correct for hypothesis 2, it is necessary to perform additional analysis. The logic presented to predict that multiple credit source usage leads to growth is that using multiple credit sources leads to the firm being able to access additional funds, and these additional funds improves firm performance. However, another reason why multiple credit usage leads to growth could be so that new firms are not reliant upon the survival or market power of one financing source when using multiple credit sources (Detragiache et al., 2000) and new firms could possibly have more pricing power when using multiple credit sources (Pfeffer & Salancik, 1978) (resource dependence argument).

The resource dependency argument could possibly be the reason why new firms use multiple credit sources. Even though banks are the most used credit source by new and young firms, entrepreneurs may be hesitant to solely use one bank as they mistrust banks (Howorth, 2001). Even though most entrepreneurs don't switch banks (Howorth, Peel, & Wilson, 2003), they are not trusting of banks because the entrepreneur fears the possible loss of control in his/her business (Binks, 1991; J. E. Bolton, 1971; Cosh & Hughes, 1994). Entrepreneurs start firms because they want to be autonomous (N. M. Carter, Gartner,

Shaver, & Gatewood, 2003), so they are hesitant to take any form of external funding if possible. However, entrepreneurs are financially constrained and thus they need to take external funding if they are to operate their firm (e.g. Evans & Jovanovic, 1989; Evans & Leighton, 1989; Holtz-Eakin et al., 1994b; Lindh & Ohlsson, 1996). The lack of trust in banks is especially evident when banks use heavy monitoring tactics, as entrepreneurs perceive heavy monitoring as an indication of a lack of trust (Howorth & Moro, 2006). A lack of trust in the banks by entrepreneurs leads to new firms possibly taking less in funds from a bank than they need to be properly capitalized, and instead working with multiple credit sources.

Detragiache et al. (2000) suggest that firms may have an incentive to diversify across many relationships. This is especially the case when the risk of losing a given creditor relationship is high. In investigating Italian firms, Detragiache et al. (2000) find that to guarantee its survival, a firm will insure itself against the loss of a credit source by maintaining multiple credit relationships. Thus, multiple banking relationships protect the borrower against a sudden deterioration of the liquidity position of the bank (Detragiache et al., 2000).

Guiso & Minetti (2004, 2010) find that a firm is able to allocate information rights across multiple banks to prevent the banks from controlling the relationship. Firms with more valuable and more homogenous assets are able to differentiate borrowing across creditors. Borrowing differentiation is inversely related to restructuring costs and positively related to the informational transparency of the firm. Their main conclusion is that the structure of credit relationships is used to keep creditors and borrowers in check so to not abuse the relationship. This is also the reason that Houston & James (1996) suggest when

they find a negative relationship between the number of banking relationships and growth with large publicly traded firms, but a positive relationship between the number of non-bank financial relationships and growth.

Young firms pay higher average interest rates than old firms (M. A. Petersen & Rajan, 1995). However, competition from additional credit sources eliminates these excessive rents (Rajan, 1992; Sharpe, 1990). This is also seen by Bonfim, Dai, & Franco (2008) in a data set of small, medium, and large firms in Portugal that spanned from 1996 to 2004. Their analysis shows that when a firm borrows from more than one bank, the interest rate on bank loans becomes 12 to 33 basis points lower on average. In addition, as long as firms limit their search to just a few creditors, firms seeking financing from multiple banks reduce the chance of being denied credit (Thakor, 1996).

To determine if multiple credit sources are being used to obtain additional funds, I run OLS regression, growth curve analysis, and panel data regression analyses using outstanding debt as the dependent variable and multiple credit sources as the independent variables. When running OLS regression, and using the last year of full operation variables, all three multiple credit source variables are positive and statistically significant with outstanding debt. Growth curve analysis also indicates a positive and statistically significant relationship between multiple credit sources and outstanding debt. When running panel data regression with debt as the dependent variable, the same result is obtained. All three multiple credit variables are positive and statistically significant with outstanding debt. These results support the reason why multiple credit sources are used – to obtain additional funds. Table 45, Table 46, and Table 47 show the results for the OLS regression, growth curve analysis, and panel data regression.

Table 45: OLS Regression Results – Dependent Variable: Outstanding Debt

	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.	Standardized Coefficient	t-value	Sig.
Number of Total Credit Sources	0.288	11.668	<0.001 ***	0.407	17.498	<0.001 ***	0.657	34.915	<0.001 ***
Number of Unique Credit Sources							0.057	2.846	0.004 **
Diversity of Index of Credit Sources							-0.078	-3.835	<0.001 ***
Number of Founders	0.049	1.859	0.063	0.065	2.622	0.009 **	0.032	1.495	0.135
Education of Founders	-0.087	-3.250	0.001 **	-0.092	-3.622	<0.001 ***	0.032	1.631	0.103
Type of Education of Main Founder	0.037	1.464	0.144	0.044	1.831	0.067 *	0.001	0.072	0.943
Work Experience of Founders (overall)	0.041	1.451	0.147	0.021	0.772	0.440	-0.006	-0.230	0.818
Work Experience of Founders (start-up)	0.043	1.678	0.094 *	0.047	1.924	0.055 *	0.008	0.322	0.747
Amount of New Equity	0.042	1.695	0.090 *	0.040	1.702	0.089 *	-0.025	-1.039	0.299
Age of Founders	-0.038	-1.377	0.169	-0.024	-0.902	0.367	-0.034	-1.728	0.084 *
Gender	0.011	0.454	0.650	0.008	0.322	0.747	-0.009	-0.468	0.640
Race	-0.041	-1.602	0.109	-0.025	-1.039	0.299	-0.006	-0.310	0.757
Citizenship	0.003	0.123	0.902	0.008	0.322	0.747	0.134	6.893	<0.001 ***
Technology Level	-0.029	-1.153	0.249	-0.037	-1.542	0.123	0.022	1.158	0.247
Product / Service	0.155	6.103	<0.001 ***	0.143	5.923	<0.001 ***			
Incorporation (in year 1)	0.035	1.401	0.161	0.047	1.986	0.047 *			
Commitment to Venture									
Number of Hours Worked in Venture	0.097	3.811	<0.001 ***	0.091	3.792	<0.001 ***	0.056	2.896	0.004 **
Founder Contributed Equity (in year 1)	0.062	2.358	0.019 *	0.049	1.973	0.049 *	0.067	3.374	0.001 **
Quality of Business Idea									
Intellectual Property (any year)	0.000	0.018	0.985	-0.008	-0.330	0.742	-0.006	-0.314	0.753
Competitive Advantage over Competitors (any year)	-0.007	-0.294	0.769	0.011	0.457	0.648	0.004	0.210	0.834
Revenue	0.050	1.496	0.135	0.033	1.072	0.284	0.064	2.546	0.011 *
Number of Employees	0.046	1.422	0.155	0.055	1.768	0.077 *	-0.006	-0.230	0.818
R ²	0.190			0.271			0.526		
Adjusted R ²	0.178			0.261			0.519		

Statistical significance: * p < 0.10; ** p < 0.05; *** p < 0.01; **** p < 0.001

N = 1,643

Dependent variable: Amount of outstanding debt in last full year

Table 46: Growth Curve Analysis Results – Dependent Variable: Outstanding Debt

		Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
Parameter		Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
Fixed Effects													
Initial status, π_{0j}													
Intercept	$\beta_{0,0}$	-5.007	4.151	-1.206	0.228	-8.532	3.829	-2.228	0.026	-9.257	0.721	-12.840	0.000
Slope	$\beta_{0,1}$ (SIZEFT)	-1.920	1.076	-1.785	0.075	-1.402	0.987	-1.420	0.156	-0.089	0.189	-0.468	0.640
	$\beta_{0,2}$ (EDU)	-0.326	0.364	-0.896	0.370	-0.141	0.335	-0.421	0.674	0.060	0.062	0.958	0.338
	$\beta_{0,3}$ (EDUT)	-0.816	1.631	-0.500	0.617	-0.186	1.488	-0.125	0.900	-0.071	0.281	-0.251	0.802
	$\beta_{0,4}$ (EXPW)	-0.113	0.072	-1.576	0.115	-0.102	0.066	-1.554	0.120	-0.017	0.012	-1.349	0.178
	$\beta_{0,5}$ (EXPS)	-0.383	1.375	-0.279	0.781	-0.139	1.262	-0.110	0.913	0.174	0.235	0.738	0.460
	$\beta_{0,6}$ (AGEF)	0.021	0.068	0.301	0.763	0.034	0.062	0.539	0.590	-0.004	0.012	-0.355	0.722
	$\beta_{0,7}$ (GENDER)	2.310	1.723	1.341	0.180	2.661	1.569	1.697	0.090	0.267	0.293	0.912	0.362
	$\beta_{0,8}$ (RACE)	1.506	2.193	0.686	0.493	0.968	2.015	0.480	0.631	-0.326	0.387	-0.842	0.400
	$\beta_{0,9}$ (CITIZEN)	-3.316	3.150	-1.053	0.293	-3.410	2.874	-1.186	0.236	0.117	0.503	0.234	0.815
	$\beta_{0,10}$ (TECH)	0.551	1.374	0.401	0.689	0.749	1.259	0.595	0.552	-0.126	0.235	-0.533	0.594
	$\beta_{0,11}$ (PROD_SERV)	-1.608	1.387	-1.160	0.246	-2.235	1.271	-1.759	0.079	-0.259	0.239	-1.083	0.279
	$\beta_{0,12}$ (INCORP)	-2.407	1.551	-1.552	0.121	-1.717	1.424	-1.206	0.228	-0.269	0.265	-1.016	0.310
	$\beta_{0,13}$ (EQUITYF)	-0.032	0.083	-0.387	0.699	-0.005	0.075	-0.064	0.949	0.015	0.014	1.092	0.275
	$\beta_{0,14}$ (IP)	-0.483	1.362	-0.355	0.723	0.392	1.249	0.314	0.754	0.104	0.236	0.439	0.661
	$\beta_{0,15}$ (COMADV)	2.555	2.112	1.209	0.227	2.214	1.939	1.142	0.254	-0.096	0.359	-0.268	0.789
Rate of change, π_{1j} (TIME)													
Intercept	$\beta_{1,0}$	0.643	1.426	0.451	0.652	1.453	1.293	1.123	0.262	-0.106	0.306	-0.347	0.729
Slope	$\beta_{1,1}$ (SIZEFT)	-0.399	0.322	-1.240	0.215	-0.328	0.290	-1.131	0.258	0.053	0.069	0.769	0.442
	$\beta_{1,2}$ (EDU)	0.004	0.121	0.029	0.977	-0.004	0.110	-0.036	0.972	-0.006	0.026	-0.229	0.819
	$\beta_{1,3}$ (EDUT)	0.262	0.565	0.463	0.643	0.094	0.508	0.185	0.853	-0.058	0.119	-0.484	0.629
	$\beta_{1,4}$ (EXPW)	0.045	0.025	1.815	0.070	0.033	0.022	1.504	0.133	0.008	0.005	1.449	0.147
	$\beta_{1,5}$ (EXPS)	0.227	0.453	0.502	0.616	0.331	0.409	0.809	0.419	0.024	0.096	0.251	0.802
	$\beta_{1,6}$ (AGEF)	-0.022	0.023	-0.950	0.342	-0.023	0.021	-1.083	0.279	-0.001	0.005	-0.260	0.795
	$\beta_{1,7}$ (GENDER)	0.227	0.569	0.400	0.689	0.028	0.516	0.053	0.957	0.094	0.122	0.772	0.440
	$\beta_{1,8}$ (RACE)	-1.174	0.754	-1.558	0.119	-0.644	0.685	-0.941	0.347	0.124	0.164	0.755	0.450
	$\beta_{1,9}$ (CITIZEN)	0.871	1.081	0.806	0.420	0.317	0.976	0.324	0.746	0.124	0.234	0.532	0.595
	$\beta_{1,10}$ (TECH)	0.348	0.458	0.761	0.447	0.365	0.413	0.884	0.377	0.116	0.097	1.194	0.233
	$\beta_{1,11}$ (PROD_SERV)	-0.496	0.447	-1.108	0.268	-0.658	0.404	-1.628	0.104	0.008	0.095	0.087	0.931
	$\beta_{1,12}$ (INCORP)	0.680	0.480	1.415	0.157	0.625	0.433	1.443	0.149	0.162	0.101	1.599	0.110
	$\beta_{1,13}$ (EQUITYF)	-0.019	0.027	-0.692	0.489	-0.002	0.024	-0.070	0.944	-0.006	0.006	-1.093	0.274
	$\beta_{1,14}$ (IP)	0.411	0.460	0.894	0.372	0.242	0.415	0.582	0.561	-0.042	0.098	-0.434	0.664
	$\beta_{1,15}$ (COMADV)	-0.201	0.774	-0.260	0.795	-0.556	0.708	-0.785	0.432	-0.106	0.167	-0.634	0.526
Rate of change ² , π_{2j} (TIME ²)													
Intercept	$\beta_{2,0}$	-0.045	0.254	-0.177	0.859	-0.210	0.229	-0.917	0.359	0.021	0.055	0.388	0.698
Slope	$\beta_{2,1}$ (SIZEFT)	0.040	0.056	0.705	0.481	0.044	0.050	0.871	0.384	-0.006	0.012	-0.479	0.632
	$\beta_{2,2}$ (EDU)	0.001	0.021	0.048	0.962	0.004	0.019	0.229	0.819	0.002	0.005	0.370	0.712
	$\beta_{2,3}$ (EDUT)	-0.013	0.099	-0.132	0.895	0.025	0.088	0.284	0.776	0.020	0.021	0.966	0.334
	$\beta_{2,4}$ (EXPW)	-0.007	0.004	-1.643	0.101	-0.006	0.004	-1.433	0.152	-0.002	0.001	-1.656	0.098
	$\beta_{2,5}$ (EXPS)	-0.033	0.080	-0.414	0.679	-0.053	0.072	-0.731	0.465	-0.008	0.017	-0.475	0.635
	$\beta_{2,6}$ (AGEF)	0.004	0.004	0.845	0.398	0.004	0.004	0.974	0.330	0.000	0.001	0.204	0.839
	$\beta_{2,7}$ (GENDER)	-0.027	0.101	-0.266	0.791	-0.010	0.091	-0.107	0.915	-0.013	0.022	-0.609	0.543
	$\beta_{2,8}$ (RACE)	0.165	0.134	1.231	0.219	0.096	0.120	0.797	0.425	-0.026	0.029	-0.882	0.378
	$\beta_{2,9}$ (CITIZEN)	-0.099	0.189	-0.525	0.600	-0.002	0.170	-0.015	0.988	-0.020	0.041	-0.497	0.619
	$\beta_{2,10}$ (TECH)	-0.072	0.081	-0.888	0.375	-0.077	0.072	-1.066	0.287	-0.016	0.017	-0.915	0.360
	$\beta_{2,11}$ (PROD_SERV)	0.059	0.079	0.743	0.458	0.088	0.071	1.239	0.215	-0.003	0.017	-0.174	0.862
	$\beta_{2,12}$ (INCORP)	-0.085	0.085	-1.005	0.315	-0.068	0.076	-0.891	0.373	-0.030	0.018	-1.653	0.098
	$\beta_{2,13}$ (EQUITYF)	0.003	0.005	0.649	0.517	0.001	0.004	0.180	0.857	0.001	0.001	0.907	0.364
	$\beta_{2,14}$ (IP)	-0.059	0.081	-0.727	0.467	-0.045	0.073	-0.612	0.541	0.006	0.018	0.333	0.740
	$\beta_{2,15}$ (COMADV)	0.039	0.137	0.283	0.777	0.112	0.124	0.899	0.369	0.015	0.030	0.489	0.625

		Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
Parameter		Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
MCS, π_{3f} (MCS)													
Intercept	$\beta_{3,0}$	6.481	0.798	8.126	0.000	11.246	1.108	10.151	0.000	32.680	0.980	33.339	0.000
Slope	$\beta_{3,1}$ (SIZEFT)	-0.480	0.163	-2.952	0.003	-0.335	0.240	-1.397	0.162	0.654	0.207	3.164	0.002
	$\beta_{3,2}$ (EDU)	-0.163	0.066	-2.454	0.014	-0.384	0.092	-4.159	0.000	0.170	0.083	2.055	0.040
	$\beta_{3,3}$ (EDUT)	-0.198	0.297	-0.665	0.506	-0.097	0.423	-0.230	0.818	-0.305	0.375	-0.813	0.416
	$\beta_{3,4}$ (EXPW)	-0.024	0.014	-1.716	0.086	-0.032	0.019	-1.700	0.089	0.024	0.017	1.443	0.149
	$\beta_{3,5}$ (EXPS)	0.343	0.245	1.402	0.161	0.736	0.347	2.123	0.034	0.106	0.304	0.350	0.727
	$\beta_{3,6}$ (AGEF)	0.017	0.013	1.263	0.207	0.000	0.019	-0.006	0.995	0.000	0.016	-0.023	0.981
	$\beta_{3,7}$ (GENDER)	0.805	0.326	2.469	0.014	0.450	0.445	1.011	0.312	-0.657	0.389	-1.688	0.092
	$\beta_{3,8}$ (RACE)	0.221	0.374	0.590	0.555	0.982	0.539	1.820	0.069	-1.040	0.464	-2.240	0.025
	$\beta_{3,9}$ (CITIZEN)	-1.239	0.528	-2.345	0.019	-1.078	0.767	-1.406	0.160	-0.472	0.699	-0.676	0.499
	$\beta_{3,10}$ (TECH)	-0.121	0.245	-0.493	0.622	-0.493	0.346	-1.423	0.155	-0.304	0.305	-0.998	0.318
	$\beta_{3,11}$ (PROD_SERV)	0.010	0.242	0.041	0.968	0.183	0.341	0.535	0.593	0.660	0.299	2.204	0.028
	$\beta_{3,12}$ (INCPORP)	-0.378	0.248	-1.523	0.128	-0.104	0.355	-0.293	0.769	0.170	0.314	0.542	0.588
	$\beta_{3,13}$ (EQUITYF)	-0.019	0.015	-1.284	0.199	0.003	0.020	0.124	0.901	-0.028	0.018	-1.566	0.117
	$\beta_{3,14}$ (IP)	0.099	0.249	0.395	0.693	-0.070	0.350	-0.199	0.842	-0.735	0.309	-2.378	0.018
	$\beta_{3,15}$ (COMADV)	-0.712	0.427	-1.665	0.096	-0.396	0.578	-0.686	0.493	-0.187	0.507	-0.369	0.712
Equity, π_{4f} (EQUITY)													
Intercept	$\beta_{4,0}$	0.013	0.070	0.191	0.849	0.031	0.064	0.478	0.633	0.004	0.013	0.303	0.762
Slope	$\beta_{4,1}$ (SIZEFT)	0.002	0.015	0.148	0.882	0.004	0.014	0.284	0.776	0.002	0.003	0.715	0.474
	$\beta_{4,2}$ (EDU)	0.011	0.006	1.860	0.063	0.008	0.005	1.594	0.111	0.000	0.001	-0.394	0.694
	$\beta_{4,3}$ (EDUT)	0.062	0.025	2.438	0.015	0.067	0.023	2.868	0.004	0.006	0.005	1.223	0.222
	$\beta_{4,4}$ (EXPW)	0.003	0.001	2.279	0.023	0.002	0.001	2.129	0.033	0.000	0.000	0.781	0.435
	$\beta_{4,5}$ (EXPS)	-0.006	0.021	-0.279	0.780	0.012	0.019	0.640	0.522	-0.004	0.004	-1.131	0.258
	$\beta_{4,6}$ (AGEF)	-0.002	0.001	-1.418	0.156	-0.002	0.001	-1.867	0.062	0.000	0.000	-0.813	0.416
	$\beta_{4,7}$ (GENDER)	0.037	0.028	1.349	0.177	0.029	0.025	1.145	0.252	-0.002	0.005	-0.423	0.672
	$\beta_{4,8}$ (RACE)	-0.033	0.034	-0.946	0.344	-0.033	0.032	-1.043	0.297	-0.006	0.006	-0.852	0.395
	$\beta_{4,9}$ (CITIZEN)	0.089	0.049	1.828	0.068	0.061	0.044	1.370	0.171	0.004	0.009	0.487	0.627
	$\beta_{4,10}$ (TECH)	-0.017	0.021	-0.808	0.419	-0.011	0.019	-0.545	0.586	0.006	0.004	1.521	0.128
	$\beta_{4,11}$ (PROD_SERV)	-0.010	0.021	-0.492	0.623	-0.004	0.019	-0.192	0.848	-0.001	0.004	-0.151	0.880
	$\beta_{4,12}$ (INCPORP)	0.033	0.022	1.476	0.140	0.035	0.020	1.718	0.086	0.003	0.004	0.686	0.493
	$\beta_{4,13}$ (EQUITYF)	0.000	0.001	0.128	0.898	0.000	0.001	0.276	0.783	0.000	0.000	0.225	0.822
	$\beta_{4,14}$ (IP)	0.038	0.021	1.748	0.081	0.035	0.020	1.804	0.071	0.003	0.004	0.658	0.510
	$\beta_{4,15}$ (COMADV)	-0.049	0.038	-1.290	0.197	-0.051	0.035	-1.461	0.144	0.000	0.007	-0.060	0.952
Hours Worked, π_{5f} (HRS)													
Intercept	$\beta_{5,0}$	0.036	0.034	1.044	0.296	0.020	0.031	0.649	0.516	-0.001	0.006	-0.156	0.876
Slope	$\beta_{5,1}$ (SIZEFT)	0.008	0.007	1.052	0.293	0.005	0.006	0.840	0.401	0.001	0.001	0.535	0.593
	$\beta_{5,2}$ (EDU)	-0.001	0.003	-0.213	0.831	0.003	0.003	1.093	0.274	0.000	0.000	-0.296	0.768
	$\beta_{5,3}$ (EDUT)	-0.010	0.013	-0.803	0.422	-0.017	0.012	-1.427	0.154	-0.001	0.002	-0.634	0.526
	$\beta_{5,4}$ (EXPW)	0.001	0.001	1.927	0.054	0.001	0.000	2.330	0.020	0.000	0.000	0.486	0.627
	$\beta_{5,5}$ (EXPS)	-0.011	0.010	-1.116	0.264	-0.011	0.009	-1.180	0.238	0.000	0.002	0.053	0.958
	$\beta_{5,6}$ (AGEF)	-0.0006	0.001	-1.085	0.278	-0.0006	0.001	-1.288	0.198	0.0000	0.000	-0.077	0.939
	$\beta_{5,7}$ (GENDER)	0.005	0.013	0.376	0.707	0.004	0.012	0.301	0.763	0.000	0.002	-0.083	0.934
	$\beta_{5,8}$ (RACE)	0.016	0.016	0.975	0.330	0.018	0.015	1.203	0.229	0.005	0.003	1.675	0.094
	$\beta_{5,9}$ (CITIZEN)	-0.041	0.024	-1.717	0.086	-0.041	0.022	-1.881	0.060	-0.004	0.004	-0.972	0.331
	$\beta_{5,10}$ (TECH)	-0.006	0.010	-0.575	0.566	-0.013	0.010	-1.361	0.174	0.000	0.002	-0.192	0.848
	$\beta_{5,11}$ (PROD_SERV)	-0.012	0.010	-1.189	0.235	-0.003	0.009	-0.272	0.786	0.000	0.002	0.189	0.850
	$\beta_{5,12}$ (INCPORP)	0.009	0.011	0.831	0.406	0.007	0.010	0.644	0.519	0.001	0.002	0.478	0.633
	$\beta_{5,13}$ (EQUITYF)	0.000	0.001	-0.103	0.918	0.000	0.001	0.424	0.672	0.000	0.000	0.748	0.454
	$\beta_{5,14}$ (IP)	0.002	0.010	0.178	0.859	-0.003	0.010	-0.333	0.739	0.001	0.002	0.533	0.594
	$\beta_{5,15}$ (COMADV)	-0.001	0.019	-0.034	0.973	-0.002	0.017	-0.136	0.892	0.001	0.003	0.368	0.713
Revenue, π_{6f} (REVENUE)													
Intercept	$\beta_{6,0}$	-0.327	0.387	-0.845	0.398	-0.213	0.355	-0.600	0.548	0.039	0.065	0.600	0.549
Slope	$\beta_{6,1}$ (SIZEFT)	0.204	0.093	2.200	0.028	0.157	0.086	1.839	0.066	-0.003	0.016	-0.184	0.854
	$\beta_{6,2}$ (EDU)	0.028	0.033	0.824	0.410	0.006	0.031	0.209	0.834	-0.005	0.006	-0.892	0.372
	$\beta_{6,3}$ (EDUT)	0.170	0.144	1.178	0.239	0.130	0.132	0.989	0.323	0.010	0.025	0.389	0.697
	$\beta_{6,4}$ (EXPW)	0.0024	0.0064	0.374	0.708	0.0011	0.0058	0.190	0.850	0.0008	0.0011	0.733	0.464
	$\beta_{6,5}$ (EXPS)	0.037	0.124	0.301	0.763	0.013	0.113	0.111	0.912	-0.014	0.021	-0.678	0.498
	$\beta_{6,6}$ (AGEF)	0.000	0.006	0.059	0.953	0.0015	0.0058	0.266	0.791	0.0002	0.0011	0.220	0.826
	$\beta_{6,7}$ (GENDER)	-0.275	0.160	-1.711	0.087	-0.255	0.145	-1.760	0.079	-0.029	0.026	-1.118	0.264
	$\beta_{6,8}$ (RACE)	-0.119	0.194	-0.612	0.541	-0.147	0.177	-0.829	0.407	-0.005	0.033	-0.147	0.883
	$\beta_{6,9}$ (CITIZEN)	0.374	0.281	1.329	0.184	0.427	0.253	1.685	0.092	-0.008	0.045	-0.170	0.865
	$\beta_{6,10}$ (TECH)	-0.066	0.123	-0.539	0.590	-0.049	0.112	-0.432	0.666	0.004	0.021	0.204	0.838
	$\beta_{6,11}$ (PROD_SERV)	0.259	0.125	2.064	0.039	0.283	0.115	2.467	0.014	0.018	0.021	0.863	0.388
	$\beta_{6,12}$ (INCPORP)	0.163	0.138	1.179	0.238	0.105	0.127	0.826	0.409	0.018	0.023	0.781	0.435
	$\beta_{6,13}$ (EQUITYF)	0.0060	0.0073	0.828	0.408	0.0000	0.0066	-0.003	0.998	-0.0009	0.0012	-0.718	0.473
	$\beta_{6,14}$ (IP)	-0.001	0.122	-0.007	0.995	-0.042	0.112	-0.374	0.708	-0.005	0.021	-0.240	0.810
	$\beta_{6,15}$ (COMADV)	-0.203	0.196	-1.033	0.302	-0.162	0.179	-0.906	0.365	0.009	0.032	0.284	0.777

Parameter	Number of Total Credit Sources				Number of Unique Credit Sources				Diversity Index of Unique Credit Sources			
	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.	Coefficient	Std Error	t-value	Sig.
Number of Employees, $\pi_{\gamma}(\text{EMPS})$												
Intercept $\beta_{\gamma,0}$	0.036	0.133	0.268	0.789	-0.057	0.122	-0.469	0.639	0.014	0.023	0.619	0.536
Slope $\beta_{\gamma,1}$ (SIZEFT)	0.007	0.030	0.227	0.820	0.021	0.027	0.755	0.450	0.003	0.005	0.478	0.632
$\beta_{\gamma,2}$ (EDU)	0.000	0.011	0.028	0.978	0.002	0.010	0.215	0.830	0.000	0.002	0.058	0.954
$\beta_{\gamma,3}$ (EDUT)	0.021	0.051	0.415	0.678	0.034	0.047	0.733	0.464	0.002	0.009	0.192	0.848
$\beta_{\gamma,4}$ (EXPW)	0.000	0.002	-0.128	0.898	-0.002	0.002	-0.904	0.366	0.000	0.000	-0.553	0.581
$\beta_{\gamma,5}$ (EXPS)	0.003	0.041	0.080	0.936	0.011	0.038	0.286	0.775	0.009	0.007	1.227	0.220
$\beta_{\gamma,6}$ (AGEF)	-0.001	0.002	-0.372	0.710	0.001	0.002	0.527	0.598	0.000	0.000	-0.562	0.574
$\beta_{\gamma,7}$ (GENDER)	-0.021	0.052	-0.413	0.679	-0.005	0.047	-0.103	0.918	-0.003	0.009	-0.319	0.750
$\beta_{\gamma,8}$ (RACE)	-0.142	0.070	-2.043	0.041	-0.097	0.064	-1.510	0.131	-0.015	0.013	-1.211	0.226
$\beta_{\gamma,9}$ (CITIZEN)	-0.038	0.097	-0.388	0.698	-0.014	0.089	-0.158	0.875	0.011	0.017	0.637	0.524
$\beta_{\gamma,10}$ (TECH)	-0.001	0.042	-0.013	0.990	0.002	0.038	0.059	0.953	0.001	0.007	0.138	0.890
$\beta_{\gamma,11}$ (PROD_SERV)	-0.014	0.041	-0.335	0.738	-0.042	0.037	-1.111	0.267	-0.002	0.007	-0.302	0.763
$\beta_{\gamma,12}$ (INCORP)	0.040	0.045	0.905	0.366	0.040	0.041	0.991	0.322	0.003	0.008	0.412	0.680
$\beta_{\gamma,13}$ (EQUITYF)	0.002	0.002	0.852	0.394	0.004	0.002	1.689	0.091	0.000	0.000	0.070	0.944
$\beta_{\gamma,14}$ (IP)	-0.053	0.042	-1.261	0.207	-0.046	0.038	-1.211	0.226	0.000	0.007	-0.010	0.992
$\beta_{\gamma,15}$ (COMADV)	0.120	0.074	1.629	0.103	0.087	0.067	1.301	0.193	-0.005	0.013	-0.413	0.680
Credit Crisis, $\pi_{\alpha}(\text{ECONOMY})$												
Intercept $\beta_{\alpha,0}$	-1.441	1.416	-1.018	0.309	-0.930	1.289	-0.722	0.471	-0.290	0.277	-1.048	0.295
Slope $\beta_{\alpha,1}$ (SIZEFT)	0.856	0.309	2.773	0.006	0.676	0.279	2.425	0.015	0.065	0.060	1.082	0.280
$\beta_{\alpha,2}$ (EDU)	0.032	0.119	0.270	0.787	-0.021	0.108	-0.196	0.844	-0.005	0.023	-0.229	0.819
$\beta_{\alpha,3}$ (EDUT)	-0.293	0.530	-0.553	0.580	-0.184	0.481	-0.382	0.703	0.058	0.103	0.560	0.576
$\beta_{\alpha,4}$ (EXPW)	-0.013	0.024	-0.553	0.580	0.006	0.022	0.264	0.792	0.001	0.005	0.272	0.785
$\beta_{\alpha,5}$ (EXPS)	-0.170	0.439	-0.386	0.699	-0.132	0.399	-0.332	0.740	0.060	0.085	0.699	0.485
$\beta_{\alpha,6}$ (AGEF)	0.006	0.023	0.256	0.798	-0.001	0.021	-0.033	0.974	0.004	0.005	0.924	0.355
$\beta_{\alpha,7}$ (GENDER)	-0.211	0.566	-0.373	0.709	0.110	0.515	0.214	0.831	-0.168	0.110	-1.521	0.128
$\beta_{\alpha,8}$ (RACE)	1.322	0.723	1.828	0.068	0.986	0.660	1.495	0.135	0.154	0.143	1.079	0.281
$\beta_{\alpha,9}$ (CITIZEN)	-0.453	1.000	-0.453	0.651	-0.549	0.906	-0.606	0.544	0.059	0.194	0.305	0.761
$\beta_{\alpha,10}$ (TECH)	-0.097	0.442	-0.220	0.826	-0.319	0.401	-0.794	0.427	-0.131	0.086	-1.520	0.129
$\beta_{\alpha,11}$ (PROD_SERV)	0.575	0.434	1.327	0.185	0.599	0.394	1.520	0.129	0.095	0.085	1.118	0.264
$\beta_{\alpha,12}$ (INCORP)	-0.807	0.461	-1.749	0.080	-0.889	0.418	-2.124	0.034	-0.211	0.089	-2.357	0.019
$\beta_{\alpha,13}$ (EQUITYF)	-0.021	0.026	-0.818	0.413	-0.016	0.023	-0.668	0.504	0.000	0.005	0.040	0.968
$\beta_{\alpha,14}$ (IP)	-0.387	0.444	-0.872	0.383	-0.171	0.404	-0.423	0.672	-0.004	0.086	-0.045	0.964
$\beta_{\alpha,15}$ (COMADV)	0.209	0.762	0.274	0.784	0.215	0.698	0.308	0.758	0.149	0.150	0.990	0.322
Number of Level-1 units (observations)												
	8,496				8,496				8,496			
Number of Level-1 units (firms)												
	1,626				1,626				1,626			
Deviance												
	20,312				47,651				47,663			
AIC												
	20,602				47,941				47,953			
BIC												
	21,587				48,963				48,975			

Statistical significance: $^{\dagger} p < 0.10$; $^* p < 0.05$; $^{**} p < 0.01$; $^{***} p < 0.001$

Dependent variable: Number of employees

The third level (location) variables are not included in the results as none of the variables are statistically significant, and by leaving them out of the results it saves space for the more important results

Table 47: Panel Data Regression – Dependent Variable: Outstanding Debt

	Estimate	t-value	Pr(> t)	Estimate	t-value	Pr(> t)	Estimate	t-value	Pr(> t)
Number of Total Credit Sources	1.859	30.703	<0.001 ***	6.940	52.660	<0.001 ***	32.989	300.518	<0.001 ***
Number of Unique Credit Sources							-0.001	-0.388	0.698
Diversity Index of Credit Sources	0.018	1.433	0.152	0.004	0.323	0.747			
Amount of New Equity									
Commitment to Venture	0.023	2.727	0.006 **	0.016	2.201	0.028 *	0.006	3.086	0.002 **
Number of Hours Worked in Venture	0.116	0.579	0.563	0.263	1.494	0.135	0.076	1.523	0.128
Credit Crisis	0.125	1.191	0.234	0.028	0.310	0.757	0.019	0.709	0.479
Revenue	0.109	3.764	<0.001 ***	0.073	2.896	0.004 **	0.001	0.106	0.915
Number of Employees									
R ²	0.168			0.364			0.948		
Adjusted R ²	0.128			0.277			0.722		
F-statistic	168.078			476.516			15227.700		
df	5.003			5.003			5.003		
p-value	<0.001			<0.001			<0.001		

Statistical significance: * p < 0.10; ** p < 0.05; *** p < 0.01; **** p < 0.001
 Dependent variable: Outstanding debt
 Unbalanced panel
 n = 1560 T=1-6, N=6,569

Individual Credit Sources Analysis

The analyses so far have bundled the sources together as the study is focused on multiple credit sources. However, it could be that one individual credit source is driving the results. Thus, I performed the same analyses (OLS regression, Probit regression, survival analysis, growth curve modeling, and panel data regression) by unpacking the credit sources and including each credit source individually in each analysis.

Credit obtained from family members, when measured by the number of total credit sources (i.e. total number of family members which provided credit to the firm), is statistically significant and negatively associated with survival. This suggests that new firms that obtain credit from a large number of family members have a lower rate of survival.

When measuring credit sources by unique credit source used by a new firm (i.e. a dichotomous measurement of credit source – 0 or 1), credit card institutions, owners, and family members are statistically significant and negatively associated with survival. Thus, if new firms use credit cards, have owners that provide credit to the firm, or use credit provided by a family member, the firms experience lower survival rates. Credit obtained from non-bank financial institutions is statistically significant and negatively associated with survival

only when the credit is obtained in the first year. This different to the findings in Astebro and Bernhardt (2003), where they find a loan obtained from a bank in the first year is negatively related to survival.

For growth, when the dependent variable is revenue and number of employees, credit obtained from banks is statistically significant and positively related for both measurements – number of total credit sources and number of unique credit sources. This suggests that financing from banks can be helpful in growing new firms (e.g. Huyghebaert et al., 2007). In addition, bank credit obtained in the first year is associated with growth. This result provides an interesting scenario based upon credit from banks in the first year also being negatively associated with survival (as mentioned in the previous paragraph).

Credit from non-bank financial institutions is statistically significant positively associated with revenue growth when measured by the number of total credit sources (in the growth curve analysis). Credit from employees is statistically significant and positively associated with revenue growth for both number of total credit sources and number of unique credit sources (in the growth curve analysis). Credit card usage in the first year, as measured by the number of unique credit sources, is statistically significant and negatively related with revenue growth (in OLS regression).

Table 48 provides a summary of the results for the analysis using individual credit sources.

Table 48: Summary of Results for Individual Credit Sources

	OLS Regression						Probit Regression		Survival Analysis		Growth Curve Analysis		Panel Data Regression	
	Independent Variables			Independent Variables			Independent Vars	Independent Vars	w/ Time	w/ Time				
	Last Year Levels	End of First Year Levels	End of First Year Levels	Last Year Levels	End of First Year Levels	End of First Year Levels	Last Year	End of First Year	Invariant Vars	Varying Vars	DV: Rev	DV: Emps	DV: Rev	DV: Emps
	DV: Age	DV: Rev	DV: Emps	DV: Age	DV: Rev	DV: Emps	DV: Closure	DV: Closure	Event: Closure	Event: Closure				
Number of Total Credit Sources														
..Bank	NS	Pos ***	Pos *	NS	Pos **	Pos *	NS	NS	NS	NS	Pos ***	NS	Pos ***	Pos *
..Non-bank	NS	NS	NS	Neg **	NS	NS	NS	NS	NS	NS	Pos *	NS	Pos **	NS
..Credit Card	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Pos *	Pos ***
..Other Businesses	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Government	NS	Pos *	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Owners	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Employees	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Pos *	NS	NS	NS
..Family	Neg ***	NS	NS	NS	NS	NS	Pos ¹	Pos ¹	Pos ¹	***	NS	NS	NS	NS
..Other Individuals	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Other Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Number of Unique Credit Sources														
..Bank	NS	Pos ***	Pos ***	NS	Pos **	Pos *	NS	NS	NS	NS	Pos ***	NS	Pos ***	Pos ***
..Non-bank	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Credit Card	Neg ***	NS	NS	Neg ***	Neg **	NS	Pos ¹	Pos ¹	Pos ¹	***	NS	NS	NS	NS
..Other Businesses	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Government	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Owners	Neg *	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Employees	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Family	Neg ***	NS	NS	Neg *	NS	NS	Pos ¹	Pos ¹	Pos ¹	***	NS	NS	NS	NS
..Other Individuals	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
..Other Sources	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

DV = dependent variable; Neg = negatively related with dependent variable; Pos = positively related with the dependent variable; NS = not statistically significant

Statistical significance: * p = 0.05; ** p = 0.01; *** p = 0.001

Control variables include: number of founders, education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology, level, incorporation (in year 1), number of hours worked in venture, founder contributed equity (in year 1), intellectual property (any year), and competitive advantage over competitors (any year). Credit crisis is included in survival analysis, growth curve analysis, and panel data regression. Location is not included in growth curve analysis as third-level variable.

¹ The "Pos" result in Probit regression and survival analysis is similar to the "Neg" results in the OLS regression since the dependent variable is coded opposite between OLS regression and Probit regression / survival analysis

These results suggest a couple of individual credit sources are associated with survival and performance. However, individual credit source usage is not a measure of resourceful financing. Rather, being resourceful in a financing strategy is in the form of using a combination of sources. Thus, the analysis using individual credit sources only provides additional information about which individual credit sources might be more important than others (i.e. to better understand which individual credit source might be driving the multiple credit source results).

Formal vs. Informal Credit Sources Analysis

The individual credit sources might not be associated with survival and growth. Moreover, after seeing the multiple credit sources associated with survival and growth, it might be interesting to see what bundles of multiple credit sources are most important. Past research has examined credit sources based upon formal and informal structures (e.g. Ayyagari et al., 2010; Beck et al., 2008; Cassar, 2004). Formal credit sources are banks, non-bank financial institutions, credit card institutions, governments, and other businesses;

whereas informal credit sources are owners, employees, family members, friends, and other individuals. I perform the same analyses (OLS regression, survival analysis, growth curve modeling, and panel data regression) replacing the multiple credit source variables into just two categories: formal and informal credit sources.

In OLS regression, with the variables for the last full year of operations, both formal and informal credit sources are negative and statistically significant with age at 2009 (the survival proxy). This is similar to the results from the analyses using the initial multiple credit sources variables. When the dependent variable is revenue, only the formal multiple credit source variable is statistically significant. The association between the formal multiple credit source variable and revenue is positive. This suggests the combination of formal credit sources is driving the association with revenue growth in the last full year of operations. This is the same story that the main analysis is indicating. When the dependent variable is number of employees, the formal multiple credit source variable is positive and statistically significant. In the main analysis, this relationship was not statistically significant. These results with formal multiple credit sources indicate the relationship is stronger with the formal multiple credit source variable than the initial multiple credit source variable.

When using the first year levels of the variables, both the formal and informal multiple credit sources are negative and statistically significant with age at 2009. This is similar to the last full year of operations variables and the main analyses. The formal and informal multiple credit source variables are not statistically significant with revenue and number of employees. This is consistent with the results when using the initial multiple credit source variables as independent variables.

Table 49: Summary of Results for Formal vs. Informal Credit Sources

	OLS Regression				Probit Regression				Survival Analysis		Growth Curve Analysis		Panel Data Regression	
	Independent Variables: Last Year Levels		Independent Variables: End of First Year Levels		Independent Vars: Last Year	Independent Vars: End of First Year		w/ Time Invariant Vars Event: Closure	w/ Time Varying Vars Event: Closure	DV: Rev	DV: Emps	DV: Rev	DV: Emps	
	DV: Age	DV: Rev DV: Emps	DV: Age	DV: Rev DV: Emps	DV: Closure	DV: Closure								
Number of Total Credit Sources														
... Formal Credit Sources	NS	Pos ***	NS	Neg **	NS	NS	Pos ¹	**	NS	NS	Pos ***	Pos **	Pos ***	Pos ***
... Informal Credit Sources	Neg ***	NS	NS	NS	NS	NS	NS		Pos ¹	*	NS	NS	NS	NS
Number of Unique Credit Sources														
... Formal Credit Sources	NS	Pos ***	Pos ***	Neg **	NS	NS	Pos ¹	*	NS	NS	Pos ***	NS	Pos ***	Pos ***
... Informal Credit Sources	Neg ***	NS	NS	Neg *	NS	NS	Pos ¹	**	Pos ¹	***	NS	NS	NS	NS

DV = dependent variable; Neg = negatively related with dependent variable; Pos = positively related with the dependent variable; NS = not statistically significant

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Control variables include: number of founders, education of founders, type of education of main founder, work experience of founders (overall), work experience of founders (start-up), amount of outstanding debt, amount of new equity, age of founders, gender, race, citizenship, technology level, incorporation (in year 1), number of hours worked in venture, founder contributed equity (in year 1), intellectual property (any year), and competitive advantage over competitors (any year). Credit crisis is included in survival analysis, growth curve analysis, and panel data regression. Location is not included in growth curve analysis as third-level variable.

¹ The "Pos" result in Probit regression and survival analysis is similar to the "Neg" results in the OLS regression since the dependent variable is coded opposite between OLS regression and Probit regression - survival analysis

Robustness Checks with the Credit Crisis Variable

The exact time period during which the great recession of 2008-2009 affected firms' ability to raise capital might not coincide with the exact time of the recession. The NBER indicated the recession was 18 months from December 2007 through June 2009. The recession could be more of a factor than the credit crisis. Therefore, I ran a robustness check removing the credit crisis variable and replacing it with the recession variable, which is similar to the credit crisis variable in the analyses that included the variable (i.e. survival analysis, growth curve modeling, and panel data regression). The variable is a dichotomous variable, but has 1 for years 2008 and 2009 rather than 2007 and 2008. Years 2004-2007 are 0. The results are similar to the analyses which used the credit crisis variable. This would indicate that it doesn't make a difference is the credit crisis or the recession variable is used in terms of the findings related to multiple credit source usage.

Conclusion of the Results

In this section, I presented the results of several analyses using OLS regression, Probit regression, survival analysis, growth curve analysis, and panel data regression. These additional analyses were performed to check the robustness of the results of the main analysis. Hypothesis 1 and 2 are not fully supported when using the entire sample.

However, when performing additional analyses based upon grouping the firms by survival and growth, hypothesis 2 is supported for firms that survive and have medium-to-high growth. Hypothesis 1 is still not supported in the additional analyses. Rather than finding a positive relationship between multiple credit sources and survival, the results indicate a negative relationship.

In conclusion, when examining the results of OLS regression, Probit regression, survival analysis, growth curve analysis, and panel data regression, the results indicate that firms that use multiple credit sources are associated with a lower chance of survival. Overall, however, for those firms that survive, higher multiple credit source usage is associated with higher growth rates. These results suggest that being resourceful in financing in the form of multiple credit source usage is beneficial to new firms that are already growing faster than average, but not new firms that are growing slower than average. This could indicate the multiple credit source financing strategy should be used because the firm wants to use multiple credit sources, not because it has to use multiple credit sources. The use of multiple credit sources cannot be used by creditors as a signal to determine the survival and growth of firms during the early years of operations. It is only after the third or fourth year that the use of multiple credit sources provides a positive or negative signal to external entities such as creditors.

Robustness checks were performed for various purposes. First, statistical analyses were performed to determine if the logic behind the theory is correct. The results suggest the logic that multiple credit sources are used to obtain additional funds as opposed to lowering the dependence on one resource. In addition, additional statistical analyses indicate that several banks are still a large influence on firm performance. However, the combination of

the individual credit source analysis and the main analysis performed in this study on multiple credit sources indicate that non-traditional credit sources used in combination have an affect on firm performance. This is further supported in the additional analyses performed between formal and information credit sources. The number of total formal credit sources has a positive influence on growth, while the number of total formal credit sources has no effect on survival unless used in the first year. In that case, formal credit sources have a negative influence on survival. The number of unique informal credit sources has a negative effect on survival.

CHAPTER 5

DISCUSSION AND CONCLUSION

In this study, I pose the question if being resourceful in financing by using multiple credit source usage affects the performance of new firms. The results do not provide a simple answer to the question. Rather, the results suggest that survival and growth factors play a role in answering the question. Although there are strengths in the study that help answer the research question, there are limitations that could call into question the conclusions and that require further research to fully answer the research question, including the possibility of endogeneity being present in the model. In this chapter, I discuss the results, the strengths and limitations of the study, and provide suggestions for further research.

Theoretical arguments presented in Chapter 2 lead to two hypotheses that predict a positive relationship between multiple credit source usage and performance. However, the results suggest this theory is contingent on whether a new firm is growing or not. Thus, if the new firm is growing above average, then the theory holds for growth but not for the relationship between multiple credit sources and survival. The results of the analysis suggest that using multiple credit sources is beneficial for growth firms, as using multiple credit sources leads to additional funds that are used to help them grow faster. This is shown in the results as multiple credit sources are associated with higher growth for this set of firms. The need for additional credit (external funds) for growth firms, along with the presence of credit

rationing, fuels the need to use multiple credit sources. By using multiple credit sources, these firms are able to obtain additional funds. However, using multiple credit sources is detrimental for new firms that are not growing, as the use of multiple credit sources is associated with lower survival rates. Firms that are not growing and use multiple credit sources are shown to have lower survival rates. Thus, a boundary condition needs to be added to the theory that stipulates that the theory only applies to firms that are growing above average. In addition, the theory should be modified to only exist for the relationship between multiple credit sources and growth and not survival.

The results suggest that the reason that new firms use multiple credit sources is important in determining if such a financing strategy is beneficial for new firms. It could be that using multiple credit sources when growing is planned, whereas the use of multiple credit sources when not growing quickly is a reactionary financing decision. Such reasoning is supported in a study by Howorth (2001). She finds through several case studies that a major difference between growing firms and stagnant firms is not the preference for a certain type of financing, but the planning of cash flow and the forward thinking of where the next source of funding is going to come from. Firms in her sample that grow are firms that perform cash flow planning and have an idea of where their next source of funding will come from. Thus, firms that are reactionary in their financing strategy are less successful than firms that understand their cash flow and plan for their next round of financing.

Such reasoning is also supported by Cassar (2004). He uses an ex-ante measure of growth, the intention of the major decision maker to grow. He finds that firms that intend to grow use more bank financing but do not have higher leverage (debt/assets), long-term leverage, or total outside financing. This is because they use the debt efficiently and use

more equity. Cassar suggests new firms use banks in the first place because new firms have the increased incentive to establish relationships with creditors as early as possible. In addition, banks require better value for their money: ensuring growth-oriented borrowers wisely use the asset that is bought with the borrowed money. This supports banks being strong disciplinary forces for growth-oriented firms. Thus, growth-oriented borrowers are able to use the debt better by planning and managing future cash flows, whereas non-growth or low-growth-oriented firms do not.

I hypothesized that the use of multiple credit sources would be positively associated with survival. However, the use of multiple credit sources was found to be negatively associated with survival for a portion of the firms. There could be several explanations for this which support why the use of multiple credit sources could actually hinder new firms. First, when new firms use non-bank credit sources that provide credit at higher costs, new firms may be increasing their financing costs. These higher financing costs could decrease the survival probability (cost argument). Second, using multiple credit sources forces founders to maintain more relationships with creditors, which leaves less time for them to focus on the primary operations of the firm (relationship management argument). Third, the use of multiple credit sources could result in firms being less disciplined with their cash (discipline argument). If a firm is less disciplined with its cash, it will not use the funds to effectively improve performance. Fourth, potential funders might be deterred from providing funds in the future because multiple credit sources create a poor signal to the market about the firm's future cash flow potential (signaling argument). Higher financial costs, the increased time needed to maintain additional relationships with creditors, emitting a negative signal, and being less disciplined with the additional funds could lead to a decrease in

survival probability of new firms. Or, banks might be correct in their assessment of new firms that are not able to sustain their operations.

Obtaining credit from too many sources when using multiple credit sources could result in an increase in costs for new firms. Higher capital costs could result since the lenders are not able to capitalize on economies of scale. Economies of scale are important for lenders to small and new firms since it costs more to gather information from these firms. Possibly the firm has to tap a second creditor at a higher interest rate, after the first creditor says “no more”. Petersen and Rajan (1994) find that additional relationships with banks result in higher interest rates, while providing access to additional funds. They also find the firms that borrow more tend to have more late payments. This suggests that firms with multiple bank lending relationships are in financial distress more often and thus are performing worse. This might suggest that lower quality firms are the firms using multiple credit sources (several banks). However, in performing sensitivity analyses, they find that the number of banking relationships does not always predict the quality of a firm.

Using multiple credit sources requires establishing and maintaining more relationships than if only one credit source is used. Multiple relationships could be detrimental to a new firm. Relationships take time to keep in good standing. New firms have limited resources. An increase in the number of credit sources over time for new firms requires additional resources to maintain the relationships. Even though multiple credit sources can result in the benefit of obtaining additional funds, multiple credit sources could also over extend the limited resources of new firms. This could lead to a less than optimal usage of the resources and could lead to firm failure. An optimal number of credit sources might exist for new firms, with the optimal level changing over time as the firm evolves.

Using multiple credit sources could result in less discipline by both creditors and borrowers. There is a common thought in the finance literature that debt improves managerial decision making. Jensen (1986) argues that by issuing debt, managers are effectively promising to pay out future cash flows, which is to say that debt controls managerial discretion. This argument is also formalized by Harris and Raviv (1990) and Stulz (1990) based upon legally mandated, unalterable payments to creditors. The threat of default in paying the creditors and losing everything in the firm is a strong motivator for firms to be disciplined in its operating and financial decisions. Using multiple credit sources could result in firms being less disciplined in their behavior. Foglia, Laviola and Marullo Reedtz (1998) find that there is less discipline exercised by lenders when a borrower uses multiple banking relationships. Creditors are less strict and possibly piggy back off of the lead creditor. Along these lines, Foglia et al (1998) examine Italian firms and find that multiple banking relationships are significantly associated with greater fragility of the borrower. In addition, Ongena and Smith (2000) survey 1,079 firms across Europe and find firms tend to use more creditors in countries that have poor enforcement of creditor rights. It has been observed that when there is no controlling shareholder, there is not one single shareholder that has a sufficient incentive to monitor and control management (Stiglitz, 1985). The research tends to treat the banks' function as being similar to shareholders (Ciocca, 1997). It is costly for creditors to monitor borrowers as they must acquire and assess data on the borrower's behavior. When there are multiple creditors, this information acts more like a public good where no one creditor has an incentive for monitoring. This is because the cost of monitoring is borne by just one creditor and the benefits will be enjoyed by all the creditors, including the inactive creditors (Diamond, 1984; Foglia et al., 1998).

These findings and arguments suggest that borrowers could “get away with” being less disciplined with how they use their funds and overall operations when using multiple credit sources. With less discipline by the creditors, which results in less discipline by the new firms, new firms should see a higher rate of failure.

Using numerous credit sources could send a bad signal to the market. Banks are often considered to be the best financial intermediary to determine if firms will be viable entities – they do a good job in screening and assessing (Diamond, 1984, 1991a; Fama, 1985; Ramakrishnan & Thakor, 1984). They are the primary source of debt capital for new firms (e.g. T. Bates, 1990; Berger & Udell, 1998) and they are often cheaper than other alternatives (e.g. Astebro & I. Bernhardt, 2003; Huyghebaert & Van de Gucht, 2007). Therefore, when banks decide not to provide credit to a firm, it could be a sign that the firm really is not a viable entity and should face the reality that it is unlikely to exist in its present form (signaling argument). Such signaling could reduce information asymmetry, as was demonstrated in Spence’s (1973) seminal work on labor markets where a job applicant might be able to distinguish him- or her-self from other job applicants by engaging in behaviors (e.g. obtaining more education) that reduce information asymmetry between the prospective employer and the job applicant. Spence’s signaling theory has been used to explain how firm debt (Ross, 1977) and issuance of dividends (Bhattacharya, 1979) signal the quality of firms. However, the results in this study suggest that multiple credit source usage is a negative signal to future financiers. The market might think the firm has to use numerous credit sources since they cannot obtain funds from the main credit source. Thus, the market would think the firm is a high risk. Firms try to build a reputation that can provide certification to raise funds in the future (Diamond, 1991b). Hence, the financing decisions made today

affect the ability to access financing in the future. For established firms, the existence or renewal of a banking relationship is a positive signal to the stock market (James, 1987; Lummer & McConnell, 1989; Shockley & Thakor, 1997). Being resourceful might be a positive signal in the eyes of equity investors. However, for creditors, who are usually more risk averse than equity investors, being resourceful in the use of credit sources before establishing a history of above average growth could be a bad signal. Thus, potential creditors might be unwilling to contribute additional funds in the future. If the firm approaches numerous credit sources to obtain additional funds, then the probability of obtaining funds from one of them possibly decreases if it sends a negative signal to the market. Return on equity and return on assets have been found to be negatively associated with the number of banking relationships (Castelli et al., 2010). In addition, Cole (2011) finds that firms with multiple banking relationships are more likely to be denied credit and he argues that this is the case because multiple banking relationships provide a negative signal to the market. However, the results in this study don't suggest that the usage of multiple credit sources initially provides a negative signal to the market. Multiple credit source usage doesn't signal if a new firm will survive or grow until the third or fourth year of operations.

Finally, it could be that banks are in fact rational in limiting credit to new firms properly as those new firms they limit credit to are those more likely to eventually fail. By using additional credit sources, the firms just fail at a later stage than if they had not received additional debt from additional credit sources. This would suggest that new firms should cease operations when banks limit credit to them since they are not pursuing a positive net present value project. The bank is doing these new firms a favor by not providing debt financing to these negative net present value entities. The bank is rationally assessing the

viability of the firm, but the founders are overly optimistic and persistent. Thus we see the irrational pursuit of a negative present value project by founders.

Banks tend to be better at monitoring and handling information asymmetry issues as compared to non-bank institutions (Diamond, 1984). Other credit sources have not developed the tools in as much detail as banks and thus have less sophisticated means of obtaining information from, and monitoring of, new firms concerning their ability to service their debt. This would mean that banks are rational in their reasons for not lending additional money to new firms when the new firms are asking for additional funds. From my results, this is the case for new firms that are not growing. Therefore, with new firms that acquire additional funds from multiple credit sources to overcome credit limits imposed by banks, the survival and growth rates should be lower if banks are more rational and have better information than other credit sources to determine the quality of firms. It would also suggest that new firms that are not growing should use only one credit source for debt financing.

In times of distress, multiple creditor relationships could be especially a disadvantage. New firms are often in financial distress. And as shown in the results of this study, multiple credit sources are not beneficial for survival of new firms when the firm is not growing above average and possibly doesn't represent a positive net positive value project in the eyes of the creditors. This is supported by other studies which have found that with established firms, multiple relationships are a disadvantage when borrowers are in distress because it is difficult to coordinate their actions (e.g. Gertner & Scharfstein, 1991).⁴⁸ This might not be an issue with new firms as their assets are small compared to established firms. Hence creditors would be fighting over a bigger pie with established firms than with new firms. Established

⁴⁸ Brunner & Krahnen (2008) did not find any support for multiple banking relationships having difficulty in restructuring debt when examining firms and banks in Germany.

firms might try to continue if pushed into bankruptcy, whereas new firms usually cease operations when faced with bankruptcy.

The argument I make in the theory development section is that credit rationing takes place and that one credit source (i.e. a bank) will not give a new firm all of the funds its needs (Type I credit rationing). Thus, the new firm looks at alternate credit sources to obtain additional funds that the bank would not provide. However, there could be an alternative explanation. It could be that the bank is willing to provide more funds to the firm and that the new firm does not want to rely solely on one bank or credit source. They want to distribute the power of the external financiers and do not want to have one funding source be too powerful. If the one credit source becomes too powerful then that could possibly result in the one source increasing the interest rate or calling in the debt. This could increase the new firm's costs and/or force the firm to shut down. However, if that is the case we would have seen an increase also in the number of banks used per firm over time. When looking at the raw data most firms did not increase the number of banks from which they borrowed money. In addition, the additional analysis performed with the dependent variable as debt indicated that multiple credit sources are positively associated with the amount of debt a firm has outstanding. If the resource dependency argument was to be supported, the use of multiple credit sources would not have been positively associated with the amount of debt outstanding. Rather, the amount of outstanding debt would have remained stable (or possibly decreased) when there was an increase in multiple credit source usage (i.e. a substitution effect).

One of the major assumptions of the theory is that credit rationing exists with new firms. However, there are arguments in the literature which suggest that credit rationing does

not exists and thus a funding gap does not exist. As such, credit rationing has been contested by Coelho, de Meza, & Reyniers (2004), de Meza & D. C. Webb (1987, 2000), de Meza (2002), Cressy (1996b), and more recently by Vos et al. (2007). These studies argue that there is an oversupply of entrepreneurs starting firms due to unrealistic optimism by entrepreneurs. This unrealistic optimism by entrepreneurs may be responsible for credit rationing (Coelho et al., 2004). Government subsidies and tax lending could be exacerbating the problem rather than lowering credit rationing issues by providing undue incentives for entrepreneurs to start firms (De Meza & D. C. Webb, 2000). In addition, the funding gap might not exist because few small and new firms are interested in growth and do not request external financing (Vos et al., 2007). If credit rationing is not prevalent for new firms, my arguments are weakened and other arguments (other than the capital constraint argument) might explain why new firms use multiple credit sources and why the usage of multiple credit sources affect new firm performance. However, Vos et al's (2007) work supports my findings that multiple credit sources doesn't help the performance of slow growing firms since many firms do not grow quickly and thus don't need much in the way of external credit.

Strengths

The strengths of the study include being a cohort longitudinal study, using multiple and sophisticated statistical methods in the form of survival analysis, growth curve analysis, and panel data regression, and perform various robustness checks, and additional analysis. First, this study is a cohort longitudinal study of new firms. There are few longitudinal studies on new firms in which the researchers are able to examine the change of multiple financial variables. This study helps address that void. Because I studied a cohort for six years from the time the firms started in 2004, the study does not suffer from survival bias that

so many existing entrepreneurship studies suffer from. The survival bias is solved by having firms monitored from the first year they are formed until they close or the data collection is finished, whichever comes first. Second, the use of multiple statistical methods to analyze the longitudinal data is appropriate. OLS regression and Probit regression are simple statistical methods that past studies have used. They use difference scores for the varying variables. Data is lost when using difference scores. Therefore, using statistical methods that use the longitudinal data provides a more meaningful result. The use of these multiple statistical methods help paint a better picture of the relationship between multiple credit sources and new firm performance. Each statistical method served a purpose in explaining the association between multiple credit sources and new firm performance. This would not have been captured if static or cross-sectional analysis was used. Using growth curve analysis, I was able to examine the long-term changes from an overall trend point of view. Three, I perform multiple robustness checks to insure what is being seen in the results does not account for other reasoning than what I theorized. I also performed additional analysis to better understand which credit sources are the most important in the multiple credit source equation.

Limitations

As with any study, this study has limitations. One limitation relates to causality. Although my data is longitudinal, the multiple credit source – debt model cannot convincingly interpret causality. One prerequisite for interpreting causality is the time order effect. I interpret the results of the multiple credit source – debt model as the number of credit sources affecting the debt level change. However, debt level could affect the change of multiple credit sources.

Another limitation of the study is the possibility of endogeneity. There are two main sources of endogeneity: 1) endogeneity due to reverse causality, and 2) endogeneity due to omitted variables. I theorize that a change in multiple credit sources leads to a change in new firm performance. But, as mentioned earlier, it is possible for a change in new firm performance to lead to a change in multiple credit sources. Statistical and research methods can be used to minimize the endogeneity issue. However, I was not able to empirically test the causal direction via the traditional statistical method of using an instrumental variable since a viable instrumental variable was not available. A controlled random experiment would be the best research method to use so to be able to control for causal direction as well as other factors that could influence the relationship of the variables. Performing a controlled random experiment would be cost prohibitive, especially when performing a longitudinal study. Endogeneity due to omitted variables is addressed by using a large number of control variables and by using panel data regression.

The closure rate in the data set is lower than past studies. With the differences, the generalizability of the findings might be limited. The lower closure rate seen in the data set could be due to firms not reporting that they have failed but rather deciding to not respond (i.e. a factor of attrition). The Kauffman Foundation, and the firm that administered the survey, Mathematica, try to determine if firms really close or were still operating and didn't respond. However, the survey administrators might not have been able to accurately determine if a firm closed or was still operating and didn't respond. In this study, I removed firms from the data set based upon missing data and non-response. When running a t-test on the survival variable between the sample of firms that were removed and the firms that were kept in the sample for analysis, there was a statistical significance difference (see Appendix C for the

result of the t-test on AgeAt2009 to see the difference in means for survival between the firms that were removed and the firms that were kept in the sample for analysis). In addition, there is a large number of “living dead” firms – firms that are not showing signs of life as they have little to no revenue, little to no costs, and the founders spending a low number of hours working in the venture, however, the firms do not officially stop operations. With the lower closure rate compared to the full sample, the results of the study might be different than if the entire sample was analyzed. In addition, the closure rate in the entire data set is much lower than past studies (e.g. Bruderl et al., 1992; Cressy, 2006b; Evans, 1987a, 1987b; Mata & Portugal, 1994; Phillips & Kirchhoff, 1989). The past studies could have included positive closures. The Small Business Administration (SBA), which some of the past studies used data from the SBA, includes any change in a business to be a closure. For example, if the company merges with another entity, bought by another entity, or even when a firm changes the type of incorporation. When a company changes from being a limited liability corporation (LLC) to being an S corporation (firms would do this to be able to offer shares to investors), the original LLC firm is considered closed. The closure rate increases to 31% in this study if positive closures are included. However, as explained in Chapter 3, including positive closures would contradict the negative aspect of closure that I am examining in this study. Finally, the closure rate might be lower because firms that failed in the first year are not included in the data set. The survey administrators survey firms after the first year to get the first year data. Firms that were initially to be included in the data set, but close before the end of the first year, are not included. The annual closure rate is highest in the first year of a firm’s operations (Cressy, 2006a).

Certain firms were removed from the data set based upon various criteria. There were logical and theoretical reasons for removing observations, as explained in Chapter 3. However, removing observations could affect the results. I compare the means between the sample that was kept for the analysis and the sample of the firms that were removed to if there are material differences between the two samples. I find that many of the variables are different (see Appendix C for the results of the t-tests). This would support that the sample analyzed is different than the entire data set that has firms that are randomly selected from the general population of firms started in 2004 in the United States. Thus, the findings possibly are limited to the sample being analyzed and the generalizability could be limited.

One of the strengths of the study is that it controlled for age since all of the firms were from the same cohort (i.e. started in 2004). However, I only looked at one period that is 2004-2009. This period could be different than other periods because of unique economic issues during 2004-2009. For example, the average interest rate varied from 3.87% to 5.03%⁴⁹, which is low historically for the United States within the past 40 years. Since debt is tied to the interest rate, a change in interest rates could affect the financing decision made by founders when starting new firms. Therefore, the sample could be biased to debt since the interest rates were historically low.

This is also the case with any other period-specific factors that affected the multiple credit source usage in the entire sample, but would not have affected a sample of firms that began in another year. It is difficult to then generalize that certain propositions or theories are valid or invalid in general. A set of economic macro factors affected the financing decisions of all the firms in the sample, and the actions of different lenders. In turn this

⁴⁹ Source: treasurydirect.gov. The average interest rate is based upon the total of marketable and non-marketable interest-bearing debt.

affects the multiple credit source usage at the same time that the forces I hypothesize affect multiple credit source usage were also at work.

The period that the data set covers includes the recent credit crisis. It is likely that during the crisis period many new firms may have been forced to borrow more than usual to improve their survival. This is what Heshmati (2002) finds in a study of Swedish small and medium-sized firms in the early 1990s. I try to control for the credit crisis with a simple control variable. However, by including only a control variable might not completely take into consideration the effect of the credit crisis. In summary of these last several limitations, with the data used in this study, I cannot distinguish between cohort and age effects.

Further Research

One of the biggest limitations of the study is the causality issue. Multiple credit sources could lead to a change in performance or firm performance could lead to a change in the multiple credit source usage. This issue can be addressed in further research. Obtaining an instrumental variable which can alleviate the econometrics issue of endogeneity will ensure unbiased results and better answer the research question. In addition, performing interviews with entrepreneurs to find out why and when they used multiple credit sources could be helpful in better answering the research question.

Further research needs to examine credit sources used in personal debt to finance new firms. In this study, I only examine the business debt of new firms. However, new firms do not have a financial or operational track record, nor do we see owners and managers separate from one another. The personal collateral of the owner-managers is used by new firms to access debt. It could be that new firms use personal debt to get initial debt or to access additional debt since banks have limited the firm from borrowing additional amounts.

Multiple credit sources from personal debt should be examined to determine the role it plays in a new firm's capital structure and alleviating credit limits imposed by banks.

Sequencing of financing might be important to a new firm's survival and growth. For example, Astebro & I. Bernhardt (2003) find that obtaining a bank loan first leads to a lower survival rate of new firms. In addition, Mason & Harrison (1996), Florin & Schulze (2000), and Van Osnabrugge & R. J. Robinson (2000) find that sequencing in funding sources is critical in determining subsequent investment by equity investors. Mason & Harrison (1996) find that angel investment increases the probability that a firm will receive venture capital investment, while Florin & Schulze (2000) find that venture capital improves the odds of obtaining funds from an initial public offering. In addition, angel investors can provide loan guarantees for the firms they invest in (Van Osnabrugge & R. J. Robinson, 2000), leading to additional access to credit. But does the use of one particular credit source lead to obtaining funds from another credit source in the future? Further research needs to be performed to answer this question.

By focusing on only the credit side in this study, I was able to get into more detail of the arguments and understand the vast credit literature. However, by doing that, I left out the equity financing option and the total credit and equity effects. Apart from credit, equity is the other main external funding source. Combining both credit and equity sources (i.e. looking at all external financing sources new firms use) could be important. For example, Westhead & Cowling (1995) include in their study the number of finance sources that a firm uses during the start-up period when they examine growth of high technology firms in Great Britain. Performing correlation analyses, they find that new firms that have access to and use multiple sources of finance tend to grow faster. They do not discuss the results as it was not

the main focus of their study, and they only examine high tech firms and only focus on growth as a dependent variable. A study on all types of firms' use of multiple financing sources for both survival and growth is warranted.

This study uses data only from the United States, which is a developed country. Thus the results might not be able to be generalized to undeveloped and developing countries. Debt and equity are the two most important forms of external financing for new firms in developed countries. For example, in the United States, debt and equity are equally used. However, this is not the case in undeveloped or developing countries as equity is less available in undeveloped and developing countries (e.g. Ayyagari et al., 2010; T. Bates, 1997; B. S. Black & Gilson, 1998). Debt is used more often as a means of financing in these types of countries. Thus, the use of multiple credit sources might affect performance of new firms differently in undeveloped and developing countries. As such, further research on the use of multiple credit sources in developing and undeveloped countries is needed. In addition, with the economic factors affecting all the firms in the sample, a second cohort of new firms would provide data that could assist in further answering the research question presented herein.

Finally, to follow-up on being resourceful in a constraining environment, a recent book by Collins et al (2010) has highlighted how even poor individuals – individuals that supposedly do not have a large amount of financial resources – are resourceful in their financing activities. The authors study individuals in South Africa and India who earn less than \$100 per month as a household. Many of these individuals own their own business. The findings indicate that the individuals use a portfolio of financing vehicles to ensure they have enough money to live on each month. The individuals use alternative funding sources

even when such sources of funding are more expensive than other funding sources that are available to them. Contrary to rich households, Collins et al (2010) find that poor households instead manage their finances to ensure that funds can be obtained in the desired amounts at the desired point in time. The authors make the comparison to firms in their research of individual households by saying that wealthy households manage their finances like established corporations and poor households manage their finances like new firms. Poor households find it difficult to locate appropriate financing instruments and sources, and thus turn to small-scale borrowing from relatives, friends, neighbors, and employees to obtain the necessary funds. This is often hard work and can involve high costs that often involve not only economic costs, but also social and psychological costs. Therefore, resourceful financing has bigger implications than just with businesses, and can be further researched at the individual level to better understand the consequences of being resourceful in one's financing activities.

Conclusion

This study posed the research question, does resourceful financing in the form of multiple credit source usage affect the performance (survival and growth) of new firms. The results suggest that the use of multiple credit sources is positively related to growth rates for firms that are growing above average, thus supporting the theoretical framework proposed in the study. However, for firms that are growing below average, multiple credit source usage is found to be negatively associated with the survival rates. This suggests that founders should be resourceful in their financing options only when they are growing quickly and they should not use multiple credit sources when they are not growing or as a means to get out of a dire financial situation. The use of multiple credit sources cannot be used by creditors as a signal to determine the survival and growth of firms during their early years of operations. It

is only after the third or fourth year that the use of multiple credit sources provides a positive or negative signal to external entities such as creditors.

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APPENDIX

Appendix A: Correlations between Variables

This appendix presents the correlations between the variables used in all the analyses in this study. There are 64 variables. Many of the correlations are statistically significant at the $p < 0.05$ level or lower. The highest correlation in absolute terms is 0.953 (between number of employees in 2008 and in 2009). As can be expected, many of the highest correlations are between the different years of the same variable (e.g. between revenue in 2004, 2005, 2006, 2007, 2008, and 2009). However, the correlations are not very high on average. The average correlation is 0.116 (using the absolute correlations).

An interesting side note pertaining to the examination of the correlations is to determine if hiring employees precedes an increase in revenue (i.e. does growth in number of employees precede growth in revenue or vice versa). This is interesting as I use both employees and revenue to measure growth when examining the relationship between multiple credit sources and growth. The results are different for each of the two measures of growth. This would indicate that they are measuring different types of growth, and thus support the notion that growth is multi-dimensional (Parker, 2009). When examining the correlations between revenue and credit, there is statistical significance for all but one of the 36 relationships in the correlations. The correlations between these 36 relationships range between 0.083 and 0.801. When examining the correlations between revenue and credit in the previous year, there is a low correlation between most of the variables (ranging 0.121 to

0.392), except between debt in 2008 and revenue in 2007 (0.705). This suggests that firms do not use an increase in revenue to retire debt, but rather need to use more debt to fund growth. This is important to understand since one of the dependent variables in the analyses in this study is revenue. Revenue is a means for firms to gain funds through operations as opposed to external financing. With the funds generated through revenue, a firm might not need as much external funding (including credit). Therefore, if the firm first grows operations (e.g. buys machinery, hires more employees) rather than growing revenue, then the examination of credit is of interest as we want to see if credit is used to support revenue growth or if additional revenue results in retiring debt. If revenue precedes operations growth, then credit is less likely to be used as the firm will be look to use retained earnings before tapping into debt or equity (Myers & Majluf, 1984; e.g. Myers, 1984). That is, unless the founders want to leverage their operations rather than use the cash generated from revenue to fund their future operations.

If firms use retained earnings more, then it could weaken my theoretical argument presented in the theory development section. It was argued in the theory development section that new firms do not have a large amount of retained earnings they can draw upon, and thus debt becomes the first sizeable option to use based upon the pecking order theory. Along with a high amount of information asymmetry prevalent in new firms, this would lead to credit rationing. With credit rationing being prevalent, new firms are not able to obtain all the necessary credit from one creditor. Based upon the pecking order theory, new firms then exhaust all their debt options, which leads to the usage of multiple credit sources. The pecking order theory also says that if given the option to use retained earnings or credit, firms would use retained earnings. If new firms select to use retained earnings as opposed to

credit, this would diminish the usage of multiple credit source usage. If retained earnings are used as a substitute to multiple credit source usage, then the decrease in multiple credit source usage over time would coincide with firm being able to sustain itself through internal funds as opposed to external funds. This would go against the argument that over time new firms have less info asymmetry, and thus are rationed credit less, and are able to obtain all the necessary credit from one credit source (e.g. one bank) as opposed to having to use multiple credit sources.

Table 50: Correlations

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Age at 2009	----									
2. Revenue 2004	.036	----								
3. Revenue 2005	.038	.664 ***	----							
4. Revenue 2006	.067 *	.457 ***	.635 ***	----						
5. Revenue 2007	.048	.324 ***	.694 ***	.785 ***	----					
6. Revenue 2008	.040	.351 ***	.568 ***	.696 ***	.674 ***	----				
7. Revenue 2009	.024	.333 ***	.567 ***	.698 ***	.687 ***	.881 ***	----			
8. Number of Employees 2004	.024	.416 ***	.386 ***	.230 ***	.214 ***	.242 ***	.259 ***	----		
9. Number of Employees 2005	.023	.329 ***	.513 ***	.420 ***	.382 ***	.363 ***	.492 ***	.597 ***	----	
10. Number of Employees 2006	.059 *	.344 ***	.466 ***	.393 ***	.399 ***	.400 ***	.474 ***	.559 ***	.760 ***	----
11. Number of Employees 2007	.040	.244 ***	.511 ***	.421 ***	.384 ***	.458 ***	.580 ***	.500 ***	.758 ***	.842 ***
12. Number of Employees 2008	.040	.149 ***	.422 ***	.386 ***	.365 ***	.517 ***	.649 ***	.430 ***	.678 ***	.765 ***
13. Number of Employees 2009	.025	.104 ***	.392 ***	.382 ***	.353 ***	.496 ***	.657 ***	.416 ***	.662 ***	.731 ***
14. Number of Total Credit Sources 2004	-.124 ***	.101 **	.136 ***	.094 **	.113 ***	.058	.068 *	.148 ***	.109 ***	.128 ***
15. Number of Total Credit Sources 2005	-.017	.185 ***	.153 ***	.078 **	.128 ***	.091 **	.085 **	.186 ***	.145 ***	.164 ***
16. Number of Total Credit Sources 2006	.004	.219 ***	.314 ***	.118 ***	.200 ***	.119 ***	.179 ***	.162 ***	.206 ***	.315 ***
17. Number of Total Credit Sources 2007	.050	.082 *	.128 ***	.072 *	.097 **	.057	.108 ***	.042	.123 ***	.150 ***
18. Number of Total Credit Sources 2008	.019	.257 ***	.281 ***	.190 ***	.188 ***	.139 ***	.166 ***	.131 ***	.203 ***	.200 ***
19. Number of Total Credit Sources 2009	.008	.043	.142 ***	.170 ***	.219 ***	.146 ***	.182 ***	.062 *	.152 ***	.111 ***
20. Number of Unique Credit Sources 2004	-.142 ***	.070 *	.092 **	.073 *	.090 **	.039	.025	.158 ***	.092 ***	.088 ***
21. Number of Unique Credit Sources 2005	.057 *	.106 ***	.111 ***	.094 **	.114 ***	.092 **	.090 **	.148 ***	.155 ***	.164 ***
22. Number of Unique Credit Sources 2006	.205 ***	.099 ***	.160 ***	.165 ***	.168 ***	.137 ***	.156 ***	.105 ***	.184 ***	.166 ***
23. Number of Unique Credit Sources 2007	.302 ***	.097 **	.130 ***	.152 ***	.140 ***	.117 ***	.145 ***	.083 ***	.138 ***	.137 ***
24. Number of Unique Credit Sources 2008	.291 ***	.112 ***	.114 ***	.126 ***	.127 ***	.087 **	.121 ***	.063 *	.136 ***	.108 ***
25. Number of Unique Credit Sources 2009	.301 ***	.087 **	.111 ***	.158 ***	.149 ***	.138 ***	.148 ***	.057 *	.133 ***	.120 ***
26. Diversity Index of Credit Sources 2004	-.109 ***	.069 *	.064 *	.086 **	.074 *	.051	.036	.164 ***	.126 ***	.103 ***
27. Diversity Index of Credit Sources 2005	.041	.070 *	.064 *	.111 ***	.122 ***	.086 **	.070 *	.157 ***	.147 ***	.161 ***
28. Diversity Index of Credit Sources 2006	.143 ***	.067 *	.058 *	.095 **	.097 ***	.093 **	.086 **	.086 ***	.129 ***	.124 ***
29. Diversity Index of Credit Sources 2007	.241 ***	.088 ***	.097 ***	.123 ***	.129 ***	.104 ***	.115 ***	.116 ***	.172 ***	.162 ***
30. Diversity Index of Credit Sources 2008	.265 ***	.067 *	.077 **	.097 ***	.104 ***	.058	.075 *	.108 ***	.114 ***	.090 ***
31. Diversity Index of Credit Sources 2009	.260 ***	.016	.119 ***	.105 ***	.124 ***	.112 ***	.123 ***	.084 ***	.129 ***	.135 ***
32. Amount of Outstanding Debt 2004	.006	.734 ***	.345 ***	.415 ***	.345 ***	.276 ***	.266 ***	.270 ***	.204 ***	.183 ***
33. Amount of Outstanding Debt 2005	.039	.221 ***	.504 ***	.404 ***	.412 ***	.419 ***	.436 ***	.357 ***	.311 ***	.338 ***
34. Amount of Outstanding Debt 2006	.040	.525 ***	.392 ***	.563 ***	.491 ***	.426 ***	.392 ***	.180 ***	.212 ***	.183 ***
35. Amount of Outstanding Debt 2007	.013	.063	.406 ***	.384 ***	.701 ***	.343 ***	.341 ***	.148 ***	.159 ***	.172 ***
36. Amount of Outstanding Debt 2008	.026	.135 ***	.585 ***	.735 ***	.705 ***	.801 ***	.756 ***	.166 ***	.297 ***	.286 ***
37. Amount of Outstanding Debt 2009	.008	.083 *	.107 ***	.125 ***	.154 ***	.158 ***	.169 ***	.053	.083 **	.075 **
38. Amount of New Equity 2004	.025	.161 ***	.140 ***	.118 ***	.104 ***	.100 **	.121 ***	.234 ***	.178 ***	.194 ***
39. Amount of New Equity 2005	.022	.018	.093 **	.056	.069 *	.064 *	.085 **	.168 ***	.148 ***	.171 ***
40. Amount of New Equity 2006	.023	-.002	.046	.024	.032	.061 *	.084 **	.169 ***	.126 ***	.135 ***
41. Amount of New Equity 2007	.011	-.005	.057	.066 *	.050	.044	.056	.131 ***	.103 ***	.122 ***
42. Amount of New Equity 2008	.019	.022	.033	.013	.032	.064 *	.115 ***	.099 ***	.089 **	.101 ***
43. Amount of New Equity 2009	.010	-.006	.072 *	.082 **	.077 *	.061	.096 **	.136 ***	.160 ***	.135 ***
44. Number of Founders	.030	.151 ***	.140 ***	.099 ***	.138 ***	.140 ***	.160 ***	.150 ***	.161 ***	.139 ***
45. Education of Founders	.078 **	-.025	-.019	-.014	-.013	-.010	.017	-.015	.012	.021
46. Type of Education of Main Founder	.156 ***	.031	.074 *	.099 ***	.106 ***	.054	.058 *	.023	.086 ***	.062 *
47. Work Experience of Founders (overall)	.070 **	.072 *	.036	.078 **	.061 *	.070 *	.078 **	.021	.054 *	.051 *
48. Work Experience of Founders (start-up)	.018	.084 **	.100 ***	.052	.047	.051	.083 **	.086 ***	.133 ***	.133 ***
49. Age of Founders	-.004	.009	.006	-.004	-.003	-.009	-.001	.002	-.010	-.025
50. Gender	-.047	-.061	-.090 **	-.083 **	-.079 **	-.089 **	-.097 ***	-.040	-.078 **	-.085 ***
51. Race	-.024	-.029	.020	.002	.008	-.001	.040	.035	.088 ***	.075 **
52. Citizenship	.021	-.005	-.008	-.005	.005	.015	.020	.032	.036	.027
53. Technology Level	.056 *	-.009	-.005	.001	.019	.029	.065 *	-.040	.006	.030
54. Product / Service	.007	.086 **	.128 ***	.085 **	.110 ***	.099 **	.083 **	.063 *	.073 **	.034
55. Incorporation (in year 1)	-.010	.090 **	.058 *	.075 **	.077 **	.041	.078 **	.138 ***	.119 ***	.101 ***
56. Number of Hours Worked in Venture 2004	.040	.049	.086 **	.079 **	.070 *	.057	.082 **	.139 ***	.112 ***	.124 ***
57. Number of Hours Worked in Venture 2005	.222 ***	.091 **	.086 **	.102 ***	.080 **	.093 **	.112 ***	.106 ***	.173 ***	.145 ***
58. Number of Hours Worked in Venture 2006	.434 ***	.144 ***	.063 *	.139 ***	.087 **	.110 ***	.125 ***	.098 ***	.145 ***	.139 ***
59. Number of Hours Worked in Venture 2007	.546 ***	.095 **	.109 ***	.105 ***	.093 **	.088 **	.120 ***	.099 ***	.130 ***	.165 ***
60. Number of Hours Worked in Venture 2008	.595 ***	.076 *	.093 **	.110 ***	.084 **	.095 **	.102 ***	.075 **	.095 ***	.124 ***
61. Number of Hours Worked in Venture 2009	.590 ***	.091 **	.097 ***	.110 ***	.088 **	.117 ***	.125 ***	.096 ***	.105 ***	.127 ***
62. Founder Contributed Equity (in year 1)	.008	.037	.017	.007	.019	.044	.049	.043	.013	.057 *
63. Intellectual Property (any year)	.113 ***	.056	.031	.031	.067 *	.028	.064 *	.082 **	.104 ***	.090 ***
64. Competitive Advantage over Competitors (any year)	.137 ***	.021	-.008	-.029	-.012	-.031	-.017	.034	.045	.049

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
11. Number of Employees 2007	---									
12. Number of Employees 2008	.904 ***	---								
13. Number of Employees 2009	.895 ***	.953 ***	---							
14. Number of Total Credit Sources 2004	.107 ***	.073 **	.069 *	---						
15. Number of Total Credit Sources 2005	.141 ***	.109 ***	.103 ***	.187 ***	---					
16. Number of Total Credit Sources 2006	.226 ***	.229 ***	.197 ***	.193 ***	.358 ***	---				
17. Number of Total Credit Sources 2007	.123 ***	.118 ***	.106 ***	.149 ***	.148 ***	.218 ***	---			
18. Number of Total Credit Sources 2008	.169 ***	.162 ***	.136 ***	.112 ***	.212 ***	.318 ***	.203	---		
19. Number of Total Credit Sources 2009	.108 ***	.105 ***	.104 ***	.078 **	.101 ***	.094 ***	.160 ***	.380 ***	---	
20. Number of Unique Credit Sources 2004	.087 **	.035	.024	.793 ***	.182 ***	.145 ***	.103 ***	.062 *	.044	---
21. Number of Unique Credit Sources 2005	.156 ***	.133 ***	.135 ***	.134 ***	.677 ***	.233 ***	.132 ***	.117 ***	.067 *	.159 ***
22. Number of Unique Credit Sources 2006	.176 ***	.154 ***	.141 ***	.056 *	.203 ***	.645 ***	.136 ***	.172 ***	.103 ***	.055 *
23. Number of Unique Credit Sources 2007	.131 ***	.118 ***	.115 ***	.052 *	.125 ***	.164 ***	.641 ***	.194 ***	.183 ***	.044
24. Number of Unique Credit Sources 2008	.120 ***	.130 ***	.123 ***	.010	.106 ***	.144 ***	.148 ***	.655 ***	.204 ***	-.014
25. Number of Unique Credit Sources 2009	.102 ***	.112 ***	.105 ***	.013	.059 *	.063 *	.135 ***	.170 ***	.665 ***	.006
26. Diversity Index of Credit Sources 2004	.110 ***	.074 **	.063 *	.593 ***	.162 ***	.094 ***	.083 **	.067 *	.057 *	.690 ***
27. Diversity Index of Credit Sources 2005	.143 ***	.124 ***	.122 ***	.143 ***	.521 ***	.180 ***	.120 ***	.129 ***	.088 **	.143 ***
28. Diversity Index of Credit Sources 2006	.104 ***	.073 **	.064 *	.063 *	.199 ***	.433 ***	.115 ***	.137 ***	.095 ***	.059 *
29. Diversity Index of Credit Sources 2007	.149 ***	.126 ***	.108 ***	.062 *	.147 ***	.160 ***	.444 ***	.149 ***	.121 ***	.042
30. Diversity Index of Credit Sources 2008	.078 **	.087 **	.082 **	.027	.118 ***	.109 ***	.152 ***	.417 ***	.193 ***	.028
31. Diversity Index of Credit Sources 2009	.111 ***	.124 ***	.124 ***	.031	.100 ***	.090 ***	.134 ***	.171 ***	.421 ***	.029
32. Amount of Outstanding Debt 2004	.173 ***	.124 ***	.097 ***	.146 ***	.107 ***	.108 ***	.033	.092 ***	.138 ***	.168 ***
33. Amount of Outstanding Debt 2005	.304 ***	.321 ***	.329 ***	.149 ***	.144 ***	.202 ***	.112 ***	.179 ***	.174 ***	.120 ***
34. Amount of Outstanding Debt 2006	.188 ***	.176 ***	.147 ***	.136 ***	.097 ***	.119 ***	.051	.126 ***	.191 ***	.120 ***
35. Amount of Outstanding Debt 2007	.166 ***	.165 ***	.143 ***	.115 ***	.090 ***	.159 ***	.079 **	.151 ***	.232 ***	.109 ***
36. Amount of Outstanding Debt 2008	.323 ***	.322 ***	.305 ***	.099 ***	.031	.109 ***	.047	.148 ***	.167 ***	.068 *
37. Amount of Outstanding Debt 2009	.112 ***	.110 ***	.080 **	.020	.010	.031	.047	.038	.064 *	.006
38. Amount of New Equity 2004	.220 ***	.217 ***	.205 ***	.101 ***	.051 *	.060 *	.066 *	.028	.063 *	.046
39. Amount of New Equity 2005	.181 ***	.180 ***	.162 ***	.058 *	.027	.058 *	.040	.046	.046	.019
40. Amount of New Equity 2006	.164 ***	.148 ***	.130 ***	.017	.012	.015	.034	.033	.016	.002
41. Amount of New Equity 2007	.157 ***	.165 ***	.143 ***	.048	.019	.048	.034	.023	.034	.008
42. Amount of New Equity 2008	.100 ***	.098 ***	.087 **	-.015	.002	.022	.037	.057 *	.022	-.030
43. Amount of New Equity 2009	.171 ***	.171 ***	.184 ***	.114 ***	.038	.076 **	.042	.093 ***	.075 **	.053
44. Number of Founders	.152 ***	.136 ***	.124 ***	.077 **	.054 *	.098 ***	.053 *	.109 ***	.097 ***	.035
45. Education of Founders	.013	.041	.037	-.004	-.049	-.022	-.066 *	.009	.035	-.012
46. Type of Education of Main Founder	.055 *	.054 *	.045	-.016	.013	.016	.006	.063 *	.039	-.025
47. Work Experience of Founders (overall)	.054 *	.057 *	.052	.019	.009	.016	.000	.022	.042	.013
48. Work Experience of Founders (start-up)	.112 ***	.114 ***	.100 ***	.014	.057 *	.049	.019	.053	.020	-.021
49. Age of Founders	-.029	-.019	-.029	.000	-.037	-.054 *	-.059 *	-.056 *	-.030	-.023
50. Gender	-.082 **	-.088 **	-.081 **	-.024	-.042	-.059 *	-.068 **	-.023	-.045	-.018
51. Race	.098 ***	.088 **	.095 ***	-.003	.023	.055 *	.042	.014	.070 *	.002
52. Citizenship	.015	.018	.009	.017	.045	.066 *	-.014	.014	.039	-.011
53. Technology Level	.044	.055 *	.057 *	-.060 *	-.007	-.004	.031	.063 *	.058 *	-.067 **
54. Product / Service	.025	.018	.015	.027	.053 *	.000	.021	-.003	.022	.004
55. Incorporation (in year 1)	.091 ***	.082 **	.081 **	.087 ***	.055 *	.093 ***	.069 **	.110 ***	.072 **	.059 *
56. Number of Hours Worked in Venture 2004	.114 ***	.117 ***	.105 ***	.086 ***	.112 ***	.074 **	.042	.046	.022	.062 *
57. Number of Hours Worked in Venture 2005	.113 ***	.100 ***	.086 **	.038	.139 ***	.113 ***	.083 **	.097 ***	.030	-.003
58. Number of Hours Worked in Venture 2006	.119 ***	.099 ***	.083 **	-.031	.147 ***	.126 ***	.108 ***	.113 ***	.069 *	-.056 *
59. Number of Hours Worked in Venture 2007	.129 ***	.128 ***	.104 ***	-.010	.106 ***	.113 ***	.135 ***	.148 ***	.101 ***	-.057 *
60. Number of Hours Worked in Venture 2008	.121 ***	.124 ***	.114 ***	-.042	.090 ***	.062 *	.099 ***	.113 ***	.076 **	-.078 **
61. Number of Hours Worked in Venture 2009	.126 ***	.145 ***	.132 ***	-.051 *	.078 **	.063 *	.112 ***	.123 ***	.093 **	-.068 **
62. Founder Contributed Equity (in year 1)	.054 *	.084 **	.085 **	.036	.065 **	.038	.035	.052	.015	.051 *
63. Intellectual Property (any year)	.074 **	.069 *	.067 *	-.030	.014	.033	-.025	.040	.032	-.029
64. Competitive Advantage over Competitors (any year)	.038	.026	.028	-.020	.029	.025	.025	.042	.047	-.051 *

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
21. Number of Unique Credit Sources 2005	----									
22. Number of Unique Credit Sources 2006	.239 ***	----								
23. Number of Unique Credit Sources 2007	.162 ***	.274 ***	----							
24. Number of Unique Credit Sources 2008	.119 ***	.227 ***	.329 ***	----						
25. Number of Unique Credit Sources 2009	.082 ***	.152 ***	.276 ***	.310 ***	----					
26. Diversity Index of Credit Sources 2004	.142 ***	.049 *	.065 **	.020	.025	----				
27. Diversity Index of Credit Sources 2005	.679 ***	.203 ***	.164 ***	.142 ***	.073 **	.226 ***	----			
28. Diversity Index of Credit Sources 2006	.212 ***	.687 ***	.239 ***	.187 ***	.078 **	.125 ***	.287 ***	----		
29. Diversity Index of Credit Sources 2007	.166 ***	.242 ***	.685 ***	.239 ***	.171 ***	.131 ***	.236 ***	.331 ***	----	
30. Diversity Index of Credit Sources 2008	.116 ***	.221 ***	.329 ***	.672 ***	.272 ***	.104 ***	.194 ***	.284 ***	.361 ***	----
31. Diversity Index of Credit Sources 2009	.108 ***	.174 ***	.276 ***	.315 ***	.624 ***	.089 ***	.159 ***	.219 ***	.309 ***	.439 ***
32. Amount of Outstanding Debt 2004	.081 **	.048	.088 ***	.069 **	.082 ***	.172 ***	.093 ***	.078 **	.088 ***	.054 *
33. Amount of Outstanding Debt 2005	.144 ***	.105 ***	.138 ***	.089 ***	.103 ***	.114 ***	.154 ***	.081 **	.124 ***	.087 ***
34. Amount of Outstanding Debt 2006	.101 ***	.123 ***	.127 ***	.112 ***	.117 ***	.119 ***	.119 ***	.116 ***	.120 ***	.090 ***
35. Amount of Outstanding Debt 2007	.090 ***	.103 ***	.134 ***	.092 ***	.079 **	.069 **	.118 ***	.064 *	.140 ***	.101 ***
36. Amount of Outstanding Debt 2008	.038	.100 ***	.080 **	.064 *	.088 **	.050	.049	.074 **	.096 ***	.067 *
37. Amount of Outstanding Debt 2009	.002	.019	.055	.010	.017	.006	.009	.006	.029	.012
38. Amount of New Equity 2004	.073 **	.052 *	.078 **	.014	.057 *	.041	.081 **	.037	.070 **	.057 *
39. Amount of New Equity 2005	.048	.044	.080 **	.015	.022	.012	.069 **	.050 *	.087 ***	.046
40. Amount of New Equity 2006	.019	.025	.066 **	.007	.014	-.018	.042	.018	.062 *	.043
41. Amount of New Equity 2007	.031	.038	.056 *	-.007	.007	.002	.039	.045	.063 *	.027
42. Amount of New Equity 2008	.008	.018	.071 **	.047	.019	-.034	.019	.026	.046	.061 *
43. Amount of New Equity 2009	.044	.059 *	.068 *	.015	.037	.020	.044	.048	.051	.040
44. Number of Founders	.041	.049 *	.030	.039	.020	.042	.049 *	.024	.069 **	.050 *
45. Education of Founders	-.034	-.017	-.021	.047	.058 *	-.016	-.052 *	-.047	-.061 *	.005
46. Type of Education of Main Founder	.036	.076 **	.072 **	.104 ***	.058 *	-.004	.059 *	.070 **	.097 ***	.102 ***
47. Work Experience of Founders (overall)	.027	.059 *	.052 *	.069 **	.092 ***	-.032	-.035	.042	.014	.026
48. Work Experience of Founders (start-up)	.048	.020	.038	.062 *	.002	-.003	.062 *	.031	.080 **	.054 *
49. Age of Founders	-.036	-.030	-.047	-.023	-.021	-.029	-.054 *	-.035	-.050 *	-.041
50. Gender	-.057 *	-.071 **	-.086 ***	-.029	-.056 *	.034	-.034	-.058 *	-.047	-.019
51. Race	.010	.060 *	.018	-.015	-.008	.045	.027	.078 **	.021	.036
52. Citizenship	.001	.062 *	-.007	.040	.001	.002	-.013	.052 *	-.020	.035
53. Technology Level	-.006	-.010	.057 *	.070 **	.059 *	-.080 **	-.047	-.026	.006	.017
54. Product / Service	.058 *	.039	.043	.005	.050 *	.045	.098 ***	.026	.055 *	.020
55. Incorporation (in year 1)	.056 *	.083 ***	.080 **	.084 ***	.015	.050 *	.067 **	.106 ***	.063 *	.074 **
56. Number of Hours Worked in Venture 2004	.113 ***	.068 **	.097 ***	.075 **	.039	.101 ***	.142 ***	.109 ***	.102 ***	.109 ***
57. Number of Hours Worked in Venture 2005	.188 ***	.159 ***	.144 ***	.103 ***	.082 ***	.025	.199 ***	.167 ***	.148 ***	.128 ***
58. Number of Hours Worked in Venture 2006	.144 ***	.250 ***	.229 ***	.203 ***	.154 ***	-.019	.176 ***	.252 ***	.240 ***	.207 ***
59. Number of Hours Worked in Venture 2007	.121 ***	.206 ***	.293 ***	.247 ***	.228 ***	-.005	.141 ***	.173 ***	.267 ***	.251 ***
60. Number of Hours Worked in Venture 2008	.104 ***	.170 ***	.257 ***	.289 ***	.241 ***	-.032	.117 ***	.152 ***	.231 ***	.287 ***
61. Number of Hours Worked in Venture 2009	.087 ***	.170 ***	.251 ***	.294 ***	.309 ***	-.021	.090 ***	.129 ***	.221 ***	.294 ***
62. Founder Contributed Equity (in year 1)	.063 *	.045	.011	.049 *	.027	.063 *	.041	.037	.000	.032
63. Intellectual Property (any year)	.010	.064 **	.054 *	.066 **	.068 **	-.005	.028	.061 *	.035	.073 **
64. Competitive Advantage over Competitors (any year)	.050 *	.059 *	.050 *	.067 **	.049 *	-.015	.037	.053 *	.064 **	.075 **

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
31. Diversity Index of Credit Sources 2009	----									
32. Amount of Outstanding Debt 2004	.018	----								
33. Amount of Outstanding Debt 2005	.094 ***	.399 ***	----							
34. Amount of Outstanding Debt 2006	.069 **	.742 ***	.582 ***	----						
35. Amount of Outstanding Debt 2007	.104 ***	.368 ***	.519 ***	.506 ***	----					
36. Amount of Outstanding Debt 2008	.097 ***	.299 ***	.468 ***	.494 ***	.449 ***	----				
37. Amount of Outstanding Debt 2009	.038	.162 ***	.179 ***	.219 ***	.219 ***	.180 ***	----			
38. Amount of New Equity 2004	.020	.113 ***	.222 ***	.118 ***	.125 ***	.117 ***	.063 *	----		
39. Amount of New Equity 2005	.018	.016	.206 ***	.058 *	.098 ***	.087 **	.078 **	.827 ***	----	
40. Amount of New Equity 2006	-.002	.007	.154 ***	.030	.088 ***	.086 **	.065 *	.831 ***	.830 ***	----
41. Amount of New Equity 2007	.022	.015	.120 ***	.049	.074 **	.080 **	.080 **	.771 ***	.805 ***	.811 ***
42. Amount of New Equity 2008	.006	.005	.141 ***	.013	.062 *	.065 *	.069 *	.373 ***	.407 ***	.664 ***
43. Amount of New Equity 2009	.016	.031	.136 ***	.081 **	.054	.079 **	.030	.602 ***	.618 ***	.681 ***
44. Number of Founders	.037	.127 ***	.122 ***	.123 ***	.102 ***	.077 **	.081 **	.187 ***	.174 ***	.166 ***
45. Education of Founders	.027	.001	-.024	-.005	-.005	-.001	.000	.026	.044	.013
46. Type of Education of Main Founder	.086 ***	.044	.052 *	.070 **	.073 **	.063 *	.002	-.005	.001	-.016
47. Work Experience of Founders (overall)	.048	.050 *	.054 *	.061 *	.035	.051	.015	.005	.003	.010
48. Work Experience of Founders (start-up)	.052 *	.059 *	.078 **	.053 *	.066 *	.035	.062 *	.077 **	.076 **	.046
49. Age of Founders	-.019	.010	.006	.022	.014	.011	.004	-.030	-.009	-.040
50. Gender	-.041	-.050 *	-.069 **	-.054 *	-.058 *	-.052	-.031	-.066 **	-.048	-.036
51. Race	.014	-.003	-.012	.007	-.010	-.003	-.008	.039	.026	.039
52. Citizenship	.025	-.009	-.027	-.012	-.010	-.007	-.010	.018	-.006	-.006
53. Technology Level	.009	-.036	-.003	.015	-.001	.012	.044	.038	.052 *	.063 *
54. Product / Service	.051 *	.064 **	.079 **	.101 ***	.075 **	.089 **	.062 *	.083 ***	.057 *	.063 *
55. Incorporation (in year 1)	.061 *	.023	.047	.055 *	.039	-.002	.001	.087 ***	.084 ***	.084 ***
56. Number of Hours Worked in Venture 2004	.085 ***	.012	.023	.013	.019	.034	-.015	.018	.017	.002
57. Number of Hours Worked in Venture 2005	.131 ***	.031	.029	.059 *	.011	.035	-.006	.008	-.002	-.024
58. Number of Hours Worked in Venture 2006	.215 ***	.077 **	.034	.107 ***	.028	.031	.009	.022	.029	.031
59. Number of Hours Worked in Venture 2007	.266 ***	.024	.068 **	.057 *	.060 *	.043	.016	.046	.034	.040
60. Number of Hours Worked in Venture 2008	.287 ***	.006	.021	.055 *	.018	.024	.008	.001	-.011	-.014
61. Number of Hours Worked in Venture 2009	.325 ***	.018	.047	.065 *	.026	.040	.019	.065 **	.067 **	.055 *
62. Founder Contributed Equity (in year 1)	.023	.051 *	.029	.035	.049	-.009	.040	.045	-.013	-.019
63. Intellectual Property (any year)	.068 **	.029	-.001	.012	.017	.030	.047	.095 ***	.092 ***	.091 ***
64. Competitive Advantage over Competitors (any year)	.058 *	.017	.015	.027	.024	-.048	.018	.027	.013	.026

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
41. Amount of New Equity 2007	----									
42. Amount of New Equity 2008	.474 ***	----								
43. Amount of New Equity 2009	.804 ***	.564 ***	----							
44. Number of Founders	.118 ***	.109 ***	.107 ***	----						
45. Education of Founders	.065 *	.043	.079 **	-.059 *	----					
46. Type of Education of Main Founder	-.009	-.006	.008	.028	.253 ***	----				
47. Work Experience of Founders (overall)	.024	.002	.021	-.089 ***	.058 *	-.003	----			
48. Work Experience of Founders (start-up)	.042	.024	.010	.213 ***	.057 *	.105 ***	.033	----		
49. Age of Founders	.008	-.047	-.009	-.073 **	.165 ***	.047	.388 ***	.142 ***	----	
50. Gender	-.044	-.041	-.032	.034	.031	-.025	-.166 ***	-.028	.031	----
51. Race	.013	.007	.027	.006	.094 ***	.062 *	-.086 ***	.022	-.149 ***	.034
52. Citizenship	-.013	-.016	-.016	.015	.128 ***	.023	-.083 ***	.068 **	.024	-.019
53. Technology Level	.048	.070 *	.052	.014	.182 ***	.057 *	.208 ***	.025	.063 *	-.086 ***
54. Product / Service	.067 *	.036	.069 *	.078 **	-.092 ***	-.025	-.083 ***	.098 ***	-.013	.007
55. Incorporation (in year 1)	.064 *	.063 *	.073 **	.181 ***	.037	.030	.020	.107 ***	-.048	-.005
56. Number of Hours Worked in Venture 2004	.012	-.002	-.002	-.100 ***	-.069 **	.052 *	.074 **	.049 *	-.074 **	-.070 **
57. Number of Hours Worked in Venture 2005	-.025	-.009	-.013	-.028	-.070 **	.086 ***	.083 ***	.028	-.085 ***	-.121 ***
58. Number of Hours Worked in Venture 2006	.028	.029	.033	.008	-.059 *	.097 ***	.080 ***	.036	-.057 *	-.089 ***
59. Number of Hours Worked in Venture 2007	.044	.036	.045	.030	-.025	.128 ***	.096 ***	.029	-.081 **	-.088 ***
60. Number of Hours Worked in Venture 2008	-.005	.012	.016	.022	-.001	.111 ***	.105 ***	.001	-.056 *	-.082 ***
61. Number of Hours Worked in Venture 2009	.056 *	.038	.033	.028	.005	.089 ***	.109 ***	.040	-.057 *	-.082 **
62. Founder Contributed Equity (in year 1)	-.002	.033	.010	.063 *	.076 **	.062 *	.036	.045	.070 **	-.046
63. Intellectual Property (any year)	.097 ***	.101 ***	.104 ***	.121 ***	.143 ***	.037	-.005	.072 **	-.018	-.013
64. Competitive Advantage over Competitors (any year)	.023	.028	.028	.013	-.006	.032	.025	.029	-.046	.019

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
51. Race	----									
52. Citizenship	.256 ***	----								
53. Technology Level	.027	.047	----							
54. Product / Service	-.027	-.012	-.020	----						
55. Incorporation (in year 1)	.036	.053 *	.059 *	.019	----					
56. Number of Hours Worked in Venture 2004	.074 **	-.003	-.004	.063 *	.071 **	----				
57. Number of Hours Worked in Venture 2005	.032	-.015	.008	.066 **	.080 **	.604 ***	----			
58. Number of Hours Worked in Venture 2006	.031	-.017	.012	.025	.092 ***	.484 ***	.632 ***	----		
59. Number of Hours Worked in Venture 2007	-.004	-.027	.042	.041	.069 **	.422 ***	.555 ***	.709 ***	----	
60. Number of Hours Worked in Venture 2008	-.007	-.002	.059 *	.000	.034	.362 ***	.498 ***	.647 ***	.770 ***	----
61. Number of Hours Worked in Venture 2009	.012	.002	.045	.047	.038	.348 ***	.435 ***	.578 ***	.693 ***	.804 ***
62. Founder Contributed Equity (in year 1)	-.024	.024	.020	.040	.063 *	.088 ***	.093 ***	.036	.024	.039
63. Intellectual Property (any year)	.044	.014	.102 ***	.193 ***	.084 ***	.063 *	.090 ***	.079 **	.090 ***	.078 **
64. Competitive Advantage over Competitors (any year)	.024	.004	.090 ***	.131 ***	.030	.168 ***	.161 ***	.181 ***	.188 ***	.158 ***

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Variable	(61)	(62)	(63)	(64)
61. Number of Hours Worked in Venture 2009	----			
62. Founder Contributed Equity (in year 1)	.018	----		
63. Intellectual Property (any year)	.112 ***	.020	----	
64. Competitive Advantage over Competitors (any year)	.156 ***	.014	.163 ***	----

Statistical significance: * p < 0.05; ** p < 0.01; *** p < 0.001

Appendix B: t-Tests of the Multiple Credit Source Variables between Quadrants

An additional analysis I perform is in the form of t-tests to compare the means of the multiple credit source variables for each of the four quadrants. Comparing the means between the four quadrants (as part of the 2x2 framework that is explained in the main portion of the document) for each year will show if there are different levels of multiple credit source usage between firms based upon survival and growth rates. Figure 24, Figure 25, and Figure 26 show the means for each of the quadrants for each of the three multiple credit source variables for six years, with the growth grouping parameter based on revenue. Presenting these figures in graphical format provides a better understanding about how multiple credit source usage changes for new firms over time based upon their survival and growth classification. The results of the t-tests are reported in Table 51.

As a reminder, the four quadrants are based upon survival and growth 2x2 box framework, surviving / non-surviving and medium-to-high growth / low-to-medium growth firms⁵⁰. Medium-to-high growth, surviving firms (quadrant 4) are defined as firms that are still operating independently after six years and are above the mean of the growth parameter (revenue, employees) for at least two years or in year six. Low-to-medium growth, surviving firms (quadrant 3) are determined to be below the mean of the growth parameter (revenue, employees). Low-to-med growth, non-surviving firms (quadrant 2) are defined as firms in the data set that close before or in year six and are not above the mean for the growth parameters (revenue, employees) for less than two years. Medium-to-high growth, non-surviving firms (quadrant 1) are defined as firms that close before or in year six in the data

⁵⁰ The categorization of growth is based upon the mean of the revenue and number of employee variables for the firms in the dataset. Using the mean to split high and low growth firms is similar to how a competitive advantage is defined by Besanko, Dranove, Shanley, and Schaefer (2009). They define a firm having a competitive advantage if the firm earns a higher rate of economic profit than the average rate of economic profit of other firms competing in the same market.

set and are above the mean for the growth parameters (revenue, employees) for less than two years. The quadrants divided by growth of revenue are marked with an “a” (e.g. 4a, 3a, 2a, and 1a). The quadrants divided by employee growth are marked with a “b” (e.g. 4b, 3b, 2b, and 1b). Figure 23 from Chapter 3 illustrates the number of firms in each quadrant.

For the number of total credit sources, initially, the trends of the medium-to-high growth firms (comparing quadrants 4a and 1a) are similar, although the first year levels are statistically different between the two groups of firms. Then after year three (after 2006), both groups of firms decrease their number of total credit sources, although the medium-to-high growth firms that close (don’t survive) decrease their number of total credit sources quicker (even though their means are not statistically different).

The changes in the multiple credit sources over time for firms in quadrant 4a and 1a firms are similar in terms of the number of unique credit source usage, but with less pronunciation in the changes over time. This is confirmed in the statistical significance level of the t-tests between quadrants 4a and 1a, as the means between these two groups of firms are not statistically different for most of the years of multiple credit source variables. The multiple credit source usage in the first year is not different between quadrants 4a and 2a firms. Thus, the multiple credit source variables do not distinguish themselves between firms that grow or firms that survive in each year of operation. The difference in the means for quadrants 4a and 3a is statistically significant for all three multiple credit source variables for every year. Surviving firms that grow exhibit higher means for number of total credit sources, and number of unique credit sources, and the diversity index of credit sources for all six years.

When comparing non-surviving firms based upon growth (comparing quadrants 2a and 1a), many of the means of the multiple credit source variables are statistically different and negative, as shown in Table 51. The medium-to-high growth firms that don't survive have a higher usage of total credit sources, unique credit sources, and diversity of credit sources.

When comparing low-to-medium growth firms based upon survival (quadrant 3a and 2a), there is not a statistical difference between the means of the multiple credit source variables except for the first year (2004). In the first year, low-to-medium growth firms that don't survive exhibit a higher level of multiple credit source usage.

Quadrant 2a firms, low-to-medium growth firms that do not survive, exhibit a declining trend in multiple credit sources usage as all three multiple credit source variables show a negative trend in their means over time.

Quadrant 3a firms, low-to-medium growth firms that survive, exhibit a constant level of multiple credit source usage over time. In other words, there is not much change over time in the multiple credit source usage for firms that don't grow, but survive.

Figure 24: Comparison of the Means for the Number of Total Credit Sources between Quadrants, Grouping based upon Revenue

Figure 25: Comparison of the Means for the Number of Unique Credit Sources between Quadrants, Grouping based upon Revenue

Figure 26: Comparison of the Means for the Diversity Index of Credit Sources between Quadrants, Grouping based upon Revenue

Table 51: t-Test Results between the Quadrants, Grouping based on Revenue

	Quad 4a			Quad 3a			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	308	1.062	1.409	943	.742	1.149	.319	.080	3.992	<0.001
2005	308	1.682	2.765	943	.896	1.287	.786	.116	6.770	<0.001
2006	308	1.961	3.000	943	.871	1.358	1.090	.125	8.751	<0.001
2007	308	1.747	2.483	943	1.034	1.930	.713	.136	5.223	<0.001
2008	308	1.783	3.361	943	.753	1.520	1.030	.140	7.379	<0.001
2009	308	1.302	2.099	943	.788	1.622	.514	.115	4.471	<0.001
Number of Unique Credit Sources (6 years)										
2004	308	.685	.758	943	.556	.676	.129	.046	2.828	.005
2005	308	.883	.895	943	.602	.679	.281	.048	5.800	<0.001
2006	308	.961	.849	943	.576	.676	.385	.047	8.125	<0.001
2007	308	.935	.836	943	.602	.697	.333	.048	6.909	<0.001
2008	308	.854	.847	943	.471	.659	.383	.047	8.222	<0.001
2009	308	.734	.799	943	.486	.640	.248	.045	5.539	<0.001
Diversity Index of Credit Sources (6 years)										
2004	308	.196	.263	943	.148	.244	.048	.016	2.949	.003
2005	308	.262	.292	943	.160	.248	.102	.017	5.969	<0.001
2006	308	.278	.293	943	.165	.255	.113	.017	6.501	<0.001
2007	308	.250	.285	943	.171	.256	.079	.017	4.555	<0.001
2008	308	.272	.284	943	.163	.257	.109	.017	6.275	<0.001
2009	308	.256	.286	943	.152	.245	.104	.017	6.207	<0.001

	Quad 4a			Quad 2a			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	308	1.062	1.409	340	1.068	1.432	-.006	.112	-.053	.958
2005	308	1.682	2.765	296	1.034	1.737	.648	.189	3.434	.001
2006	308	1.961	3.000	228	.947	1.521	1.014	.217	4.675	<0.001
2007	308	1.747	2.483	138	.826	1.295	.921	.224	4.111	<0.001
2008	308	1.783	3.361	62	.516	.844	1.266	.430	2.945	.003
2009	308	1.302	2.099	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	308	.685	.758	340	.756	.750	-.071	.059	-1.194	.233
2005	308	.883	.895	296	.669	.702	.214	.066	3.264	.001
2006	308	.961	.849	228	.614	.644	.347	.067	5.167	<0.001
2007	308	.635	.836	138	.536	.685	.399	.081	4.912	<0.001
2008	308	.854	.847	62	.355	.515	.499	.112	4.471	<0.001
2009	308	.734	.799	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	308	.196	.263	340	.201	.265	-.005	.021	-.245	.806
2005	308	.262	.292	296	.191	.271	.071	.023	3.100	.002
2006	308	.278	.293	228	.196	.262	.082	.025	3.328	.001
2007	308	.250	.285	138	.136	.237	.114	.028	4.119	<0.001
2008	308	.272	.284	62	.133	.230	.138	.038	3.605	<0.001
2009	308	.256	.286	N/A						N/A

	Quad 4a			Quad 1a			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	308	1.062	1.409	43	1.674	2.101	-.613	.246	-2.493	.013
2005	308	1.682	2.765	40	2.000	2.935	-.318	.468	-.680	.497
2006	308	1.961	3.000	28	2.357	3.974	-.396	.610	-.649	.517
2007	308	1.747	2.483	22	1.455	2.064	.292	.542	.539	.590
2008	308	1.783	3.361	9	1.556	1.944	.227	1.127	.201	.841
2009	308	1.302	2.099	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	308	.685	.758	43	.977	.913	-.292	.127	-2.302	.022
2005	308	.883	.895	40	1.025	.800	-.142	.149	-.954	.341
2006	308	.961	.849	28	.893	.875	.068	.168	.406	.685
2007	308	.635	.836	22	.727	.767	.208	.184	1.132	.259
2008	308	.854	.847	9	.778	.667	.076	.285	.267	.790
2009	308	.734	.799	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	308	.196	.263	43	.227	.295	-.031	.043	-.710	.478
2005	308	.262	.292	40	.299	.281	-.037	.049	-.761	.447
2006	308	.278	.293	28	.367	.294	-.089	.058	-1.540	.124
2007	308	.250	.285	22	.259	.299	-.009	.063	-.136	.892
2008	308	.272	.284	9	.281	.267	-.010	.096	-.099	.921
2009	308	.256	.286	N/A						N/A

	Quad 3a			Quad 2a			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	943	.742	1.149	340	1.068	1.432	-.325	.078	-4.180	<.001
2005	943	.896	1.287	296	1.034	1.737	-.138	.094	-1.469	.142
2006	943	.871	1.358	228	.947	1.521	-.077	.103	-.747	.455
2007	943	1.034	1.930	138	.826	1.295	.208	.170	1.225	.221
2008	943	.753	1.520	62	.516	.844	.237	.195	1.214	.225
2009	943	.788	1.622	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	943	.556	.676	340	.756	.750	-.200	.044	-4.544	<.001
2005	943	.602	.679	296	.669	.702	-.067	.046	-1.460	.144
2006	943	.576	.676	228	.614	.644	-.038	.049	-.773	.440
2007	943	.602	.697	138	.536	.685	.066	.063	1.043	.297
2008	943	.471	.659	62	.355	.515	.116	.085	1.359	.174
2009	943	.486	.640	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	943	.148	.244	340	.201	.265	-.053	.016	-3.371	.001
2005	943	.160	.248	296	.191	.271	-.031	.017	-1.815	.070
2006	943	.165	.255	228	.196	.262	-.031	.019	-1.661	.097
2007	943	.171	.256	138	.136	.237	.036	.023	1.543	.123
2008	943	.163	.257	62	.133	.230	.030	.033	.890	.374
2009	943	.152	.245	N/A						N/A

	Quad 3a			Quad 1a			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	943	.742	1.149	43	1.674	2.101	-.932	.188	-4.959	<.001
2005	943	.896	1.287	40	2.000	2.935	-1.104	.224	-4.919	<.001
2006	943	.871	1.358	28	2.357	3.974	-1.487	.287	-5.186	<.001
2007	943	1.034	1.930	22	1.455	2.064	-.421	.417	-1.009	.313
2008	943	.753	1.520	9	1.556	1.944	-.803	.511	-1.572	.116
2009	943	.788	1.622	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	943	.556	.676	43	.977	.913	-.421	.107	-3.925	<.001
2005	943	.602	.679	40	1.025	.800	-.423	.110	-3.828	<.001
2006	943	.576	.676	28	.893	.875	-.317	.131	-2.423	.016
2007	943	.602	.697	22	.727	.767	-.125	.151	-.829	.407
2008	943	.471	.659	9	.778	.667	-.307	.221	-1.391	.165
2009	943	.486	.640	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	943	.148	.244	43	.227	.295	-.079	.038	-2.059	.040
2005	943	.160	.248	40	.299	.281	-.139	.040	-3.445	.001
2006	943	.165	.255	28	.367	.294	-.202	.049	-4.118	<.001
2007	943	.171	.256	22	.259	.299	-.087	.055	-1.575	.116
2008	943	.163	.257	9	.281	.267	-.118	.086	-1.373	.170
2009	943	.152	.245	N/A						N/A

	Quad 2a			Quad 1a			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	340	1.068	1.432	43	1.674	2.101	-.607	.246	-2.465	.014
2005	296	1.034	1.737	40	2.000	2.935	-.966	.323	-2.994	.003
2006	228	.947	1.521	28	2.357	3.974	-1.410	.388	-3.637	<.001
2007	138	.826	1.295	22	1.455	2.064	-.628	.326	-1.926	.056
2008	62	.516	.844	9	1.556	1.944	-1.039	.369	-2.819	.006
2009	N/A			N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	340	.756	.750	43	.977	.913	-.221	.215	-1.029	.077
2005	296	.669	.702	40	1.025	.800	-.356	.120	-2.958	.003
2006	228	.614	.644	28	.893	.875	-.279	.135	-2.072	.039
2007	138	.536	.685	22	.727	.767	-.191	.160	-1.195	.234
2008	62	.355	.515	9	.778	.667	-.423	.191	-2.216	.030
2009	N/A			N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	340	.201	.265	43	.227	.295	-.026	.043	-.594	.553
2005	296	.191	.271	40	.299	.281	-.108	.046	-2.361	.019
2006	228	.196	.262	28	.367	.294	-.171	.053	-3.205	.002
2007	138	.136	.237	22	.259	.299	-.123	.057	-2.171	.031
2008	62	.133	.230	9	.281	.267	-.148	.084	-1.771	.081
2009	N/A			N/A						N/A

Notes:

Quad4a: medium-to-high growth, surviving firms
Quad3a: low-to-medium growth, surviving firms
Quad2a: low-to-medium growth, non-surviving firms
Quad1a: medium-to-high growth, non-surviving firms

The previous results used revenue as the grouping variable for the growth dimension. The number of employees is the other grouping variable used for the growth dimension. Figure 27, Figure 28, and Figure 29 show the means for each of the quadrants for each of the three multiple credit source variables when using number of employees as the grouping variable for the growth dimension. The results of the t-tests are reported in Table 52.

The trends and differences in means statistically are similar to the t-tests where the grouping variable for the growth dimension was revenue. The noticeable difference is in the change between 2007 and 2008 for quadrants 2b and 2a, which are firms that don't survive and have a low-to-medium growth rate. When using revenue as the grouping variable, the multiple credit source variables increased from 2007 to 2008; whereas, when using number of employees as the grouping variable, the multiple credit source variables continue to decrease from 2007 to 2008 as they did from 2006 to 2007.

Figure 27: Comparison of Means between Quadrants, Number of Total Credit Sources, Grouping based upon Number of Employees

Figure 28: Comparison of Means between Quadrants, Number of Unique Credit Sources, Grouping based upon Number of Employees

Figure 29: Comparison of Means between Quadrants, Number of Unique Credit Sources, Grouping based upon Number of Employees

Table 52: t-Test Results between the Quadrants, Grouping based on Number of Employees

	Quad 4b			Quad 3b			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	447	.982	1.351	804	.731	1.141	.251	.072	3.483	.001
2005	447	1.470	2.401	804	.878	1.310	.592	.105	5.640	<0.001
2006	447	1.591	2.403	804	.888	1.602	.703	.114	6.181	<0.001
2007	447	1.635	2.588	804	.973	1.731	.663	.123	5.405	<0.001
2008	447	1.459	2.797	804	.755	1.678	.704	.127	5.558	<0.001
2009	447	1.192	1.967	804	.760	1.623	.432	.103	4.180	<0.001
Number of Unique Credit Sources (6 years)										
2004	447	.671	.785	804	.541	.643	.130	.041	3.165	.002
2005	447	.823	.874	804	.587	.652	.236	.044	5.417	<0.001
2006	447	.855	.830	804	.568	.665	.286	.043	6.658	<0.001
2007	447	.875	.835	804	.578	.671	.296	.043	6.843	<0.001
2008	447	.723	.828	804	.478	.651	.245	.042	5.772	<0.001
2009	447	.676	.766	804	.475	.634	.200	.040	4.968	<0.001
Diversity Index of Credit Sources (6 years)										
2004	447	.204	.269	804	.135	.234	.069	.015	4.704	<0.001
2005	447	.250	.287	804	.149	.242	.101	.015	6.600	<0.001
2006	447	.262	.290	804	.154	.248	.108	.016	6.916	<0.001
2007	447	.252	.283	804	.157	.249	.095	.015	6.159	<0.001
2008	447	.254	.287	804	.154	.250	.100	.016	6.421	<0.001
2009	447	.239	.284	804	.143	.238	.096	.015	6.352	<0.001

	Quad 4b			Quad 2b			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	447	.982	1.351	274	.982	1.297	.000	.102	.003	.997
2005	447	1.470	2.401	242	.963	1.681	.507	.174	2.920	.004
2006	447	1.591	2.403	194	.820	1.117	.771	.018	42.713	<0.001
2007	447	1.635	2.588	119	.815	1.334	.820	.246	3.340	.001
2008	447	1.459	2.797	52	.596	.934	.862	.391	2.208	.028
2009	447	1.192	1.967	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	447	.671	.785	274	.712	.685	-.041	.057	-.706	.481
2005	447	.823	.874	242	.661	.706	.013	.162	.080	.013
2006	447	.855	.830	194	.588	.623	.267	.067	4.013	<0.001
2007	447	.875	.835	119	.529	.699	.345	.083	4.141	<0.001
2008	447	.723	.828	52	.385	.530	.338	.118	2.875	.004
2009	447	.676	.766	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	447	.204	.269	274	.176	.251	.028	.020	1.414	.158
2005	447	.250	.287	242	.176	.267	.074	.022	3.328	.001
2006	447	.262	.290	194	.179	.254	.083	.024	3.434	.001
2007	447	.252	.283	119	.132	.238	.120	.028	4.228	<0.001
2008	447	.254	.287	52	.139	.234	.114	.041	2.766	.006
2009	447	.239	.284	N/A						N/A

	Quad 4b			Quad 1b			Mean Difference	Std. Error Difference	t	Sig (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	447	.982	1.351	109	1.523	1.956	-.541	.159	-3.402	.001
2005	447	1.470	2.401	94	1.628	2.427	-.158	.273	-.578	.563
2006	447	1.591	2.403	62	1.984	3.380	-.393	.443	-.887	.254
2007	447	1.635	2.588	41	1.195	1.677	.440	.412	1.068	.286
2008	447	1.459	2.797	19	.790	1.437	.669	.646	1.036	.301
2009	447	1.192	1.967	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	447	.671	.785	109	.954	.937	-.283	.087	-3.244	.001
2005	447	.823	.874	94	.840	.752	-.017	.097	-.177	.860
2006	447	.855	.830	62	.823	.800	.032	.112	.286	.775
2007	447	.875	.835	41	.659	.693	.216	.135	1.607	.109
2008	447	.723	.828	19	.474	.612	.249	.646	.385	.196
2009	447	.676	.766	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	447	.204	.269	109	.276	.297	-.072	.029	-2.453	.014
2005	447	.250	.287	94	.276	.279	-.026	.032	-.811	.418
2006	447	.262	.290	62	.326	.292	-.064	.039	-1.637	.102
2007	447	.252	.283	41	.212	.274	.040	.046	.865	.388
2008	447	.254	.287	19	.186	.250	.068	.067	1.017	.310
2009	447	.239	.284	N/A						N/A

	Quad 3b			Quad 2b			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	804	.731	1.141	274	.982	1.297	-.250	.083	-3.027	.003
2005	804	.878	1.310	242	.963	1.681	-.085	.103	-.823	.411
2006	804	.888	1.602	194	.820	1.117	.068	.122	.563	.573
2007	804	.973	1.731	119	.815	1.334	.158	.166	.952	.342
2008	804	.755	1.678	52	.596	.934	.159	.235	.676	.499
2009	804	.760	1.623	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	804	.541	.643	274	.712	.685	-.171	.046	-3.731	<.001
2005	804	.587	.652	242	.661	.706	-.074	.049	-1.520	.129
2006	804	.568	.665	194	.588	.623	-.019	.053	-.366	.715
2007	804	.578	.671	119	.529	.699	.049	.066	.738	.461
2008	804	.478	.651	52	.385	.530	.093	.092	1.008	.314
2009	804	.475	.634	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	804	.135	.234	274	.176	.251	-.040	.017	-2.408	.016
2005	804	.149	.242	242	.176	.267	-.026	.018	-1.451	.147
2006	804	.154	.248	194	.179	.254	-.025	.020	-1.260	.208
2007	804	.157	.249	119	.132	.238	.025	.024	1.014	.311
2008	804	.154	.250	52	.139	.234	.014	.036	.407	.684
2009	804	.143	.238	N/A						N/A

	Quad 3b			Quad 1b			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	804	.731	1.141	109	1.523	1.956	-.792	.129	-6.128	<.001
2005	804	.878	1.310	94	1.628	2.427	-.750	.160	-4.690	<.001
2006	804	.888	1.602	62	1.984	3.380	-1.096	.235	-4.654	<.001
2007	804	.973	1.731	41	1.195	1.677	-.222	.277	-.804	.422
2008	804	.755	1.678	19	.790	1.437	-.035	.388	-.089	.929
2009	804	.760	1.623	N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	804	.541	.643	109	.954	.937	-.413	.070	-5.916	<.001
2005	804	.587	.652	94	.840	.752	-.253	.072	-3.507	<.001
2006	804	.568	.665	62	.823	.800	-.254	.089	-2.855	.004
2007	804	.578	.671	41	.659	.693	-.080	.108	-.745	.457
2008	804	.478	.651	19	.474	.612	.004	.151	.026	.979
2009	804	.475	.634	N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	804	.135	.234	109	.276	.297	-.141	.025	-5.684	<.001
2005	804	.149	.242	94	.276	.279	-.127	.027	-4.740	<.001
2006	804	.154	.248	62	.326	.292	-.172	.033	-5.191	<.001
2007	804	.157	.249	41	.212	.274	-.055	.040	-1.378	.168
2008	804	.154	.250	19	.186	.250	-.032	.058	-.549	.583
2009	804	.143	.238	N/A						N/A

	Quad 2b			Quad 1b			Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	N	Mean	Std. Deviation	N	Mean	Std. Deviation				
Number of Total Credit Sources (6 years)										
2004	274	.982	1.297	109	1.523	1.956	-.792	.129	-6.128	<.001
2005	242	.963	1.681	94	1.628	2.427	-.750	.160	-4.690	<.001
2006	194	.820	1.117	62	1.984	3.380	-1.096	.235	-4.654	<.001
2007	119	.815	1.334	41	1.195	1.677	-.222	.277	-.804	.422
2008	52	.596	.934	19	.790	1.437	-.035	.388	-.089	.929
2009	N/A			N/A						N/A
Number of Unique Credit Sources (6 years)										
2004	274	.712	.685	109	.954	.937	-.413	.070	-5.916	<.001
2005	242	.661	.706	94	.840	.752	-.253	.072	-3.507	<.001
2006	194	.588	.623	62	.823	.800	-.254	.089	-2.855	.004
2007	119	.529	.699	41	.659	.693	-.080	.108	-.745	.457
2008	52	.385	.530	19	.474	.612	.004	.151	.026	.979
2009	N/A			N/A						N/A
Diversity Index of Credit Sources (6 years)										
2004	274	.176	.251	109	.276	.297	-.141	.025	-5.684	<.001
2005	242	.176	.267	94	.276	.279	-.127	.027	-4.740	<.001
2006	194	.179	.254	62	.326	.292	-.172	.033	-5.191	<.001
2007	119	.132	.238	41	.212	.274	-.055	.040	-1.378	.168
2008	52	.139	.234	19	.186	.250	-.032	.058	-.549	.583
2009	N/A			N/A						N/A

Notes:

Quad4b: medium-to-high growth, surviving firms
Quad3b: low-to-medium growth, surviving firms
Quad2b: low-to-medium growth, non-surviving firms
Quad1b: medium-to-high growth, non-surviving firms

Appendix C: Comparing Firms in Sample with Firms removed from Sample

Firms were removed from the longitudinal population (3,297 firms in the longitudinal population) when building the sample for which the main analysis was run. The reason why firms were removed from the starting longitudinal population was because: 1) the firm was not started as a new independent business, 2) the firm had zero capital in year one, 3) the firm had no founding team members, 4) the credit source variables were missing data, 5) the firm didn't use credit within six years, 6) the firm was sold or merged, or 7) the firm was an outlier or had incorrect data. The removal of firms for these reasons resulted in a 1,631 firms being removed, which represents about half of the longitudinal population. Removing half of the initial sample brings into question the results on the main analysis as the firms that were removed could be different from the firms that were left in the sample. If the firms that were removed are different from the 1,634 firms that were kept in the sample, then further analysis needs to be performed to determine if the differences affect the main results and thus the findings of this study.

To determine the difference between the two sets of firms, t-tests are performed on each of the variables in the analysis. The results of the t-tests are presented in Table 53.

Table 53: t-Tests between Firms in Sample and Firms Removed from Sample

	Firms in Sample (n=1,634)		Firms removed from Sample (n=1,631) ¹		Mean Difference	Std. Error Difference	t	Sig. (2-tailed)
	Mean	Std. Deviation	Mean	Std. Deviation				
Age at 2009 ²	6.332	1.359	5.389	1.984	.942	.060	15.828	<.001
Revenue (6 years)								
2004	147614.751	599433.120	247453.875	1390659.993	-99839.123	48733.225	-2.049	.041
2005	372812.043	1257827.444	331252.226	1689531.673	41559.817	64713.176	.642	.521
2006	547946.478	2008170.369	767872.390	9022321.445	-219925.912	272619.345	-.807	.420
2007	714617.559	2610852.811	1380607.164	13451999.080	-665989.605	410379.095	-1.623	.105
2008	754383.544	2633628.419	773653.663	6973454.989	-19270.120	243937.326	-.079	.937
2009	675949.480	2352387.372	619668.848	2762928.475	56280.632	126316.459	.446	.656
Number of Employees (6 years)								
2004	1.631	4.037	1.624	6.311	.007	.188	.037	.971
2005	2.961	6.989	2.665	7.417	.295	.269	1.097	.273
2006	3.508	8.696	3.051	8.124	.458	.338	1.356	.175
2007	3.771	10.682	2.890	10.021	.882	.443	1.991	.047
2008	3.945	11.956	2.656	7.383	1.288	.462	2.790	.005
2009	3.909	12.758	2.694	8.621	1.215	.526	2.312	.021
Number of Total Credit Sources (6 years)								
2004	.895	1.310	.299	.888	.596	.039	15.195	<.001
2005	1.102	1.830	.362	1.014	.740	.056	13.113	<.001
2006	1.133	1.959	.296	.884	.836	.064	13.159	<.001
2007	1.174	2.037	.334	.875	.841	.071	11.846	<.001
2008	.987	2.127	.303	.947	.683	.078	8.740	<.001
2009	.912	1.757	.308	.974	.604	.070	8.652	<.001
Number of Unique Credit Sources (6 years)								
2004	.633	.721	.205	.516	.428	.022	19.465	<.001
2005	.660	.740	.190	.512	.471	.022	21.110	<.001
2006	.614	.724	.136	.416	.479	.021	23.159	<.001
2007	.580	.728	.124	.400	.456	.021	22.151	<.001
2008	.455	.685	.098	.368	.356	.019	18.497	<.001
2009	.424	.649	.087	.353	.338	.018	18.443	<.001
Diversity Index of Credit Sources (6 years)								
2004	.170	.254	.065	.178	.106	.008	13.736	<.001
2005	.184	.264	.057	.167	.126	.008	16.370	<.001
2006	.181	.264	.045	.149	.136	.008	18.101	<.001
2007	.161	.254	.040	.143	.122	.007	16.893	<.001
2008	.153	.251	.037	.140	.116	.007	16.311	<.001
2009	.138	.241	.033	.134	.105	.007	15.348	<.001
Number of Founders	1.416	.698	1.341	.677	.075	.024	3.112	.002
Education of Founders	6.418	1.994	6.196	2.093	.222	.072	3.094	.002
Type of Education of Main Founder	.189	.392	.124	.330	.065	.013	5.129	<.001
Work Experience of Founders (overall)	13.116	10.140	11.931	10.435	1.185	.362	3.275	.001
Work Experience of Founders (start-up)	.474	.499	.450	.498	.025	.017	1.412	.158
Amount of Outstanding Debt (6 years)								
2004	27752.547	189189.896	27289.174	362002.694	463.373	10111.344	.046	.963
2005	34058.429	304152.612	18245.642	185648.018	15812.787	9581.345	1.650	.099
2006	39645.906	378016.255	52341.994	1160064.042	-12696.088	31999.660	-.397	.692
2007	63069.973	597176.256	27304.037	323386.510	35765.936	21453.805	1.667	.096
2008	42753.088	298024.353	38885.252	417750.773	3867.837	15407.508	.251	.802
2009	36962.679	241630.353	22538.210	255184.704	14424.468	11383.970	1.267	.205
Amount of New Equity (6 years)								
2004	48841.094	271358.987	111319.545	2517073.921	-62478.450	62668.974	-.997	.319
2005	46532.969	380444.244	40591.210	376970.850	5941.759	14111.751	.421	.674
2006	43253.149	457046.312	35445.907	517996.076	7807.242	19218.109	.406	.685
2007	41615.075	456544.670	17171.787	200544.906	24443.288	15945.883	1.533	.125
2008	33006.577	330369.568	20361.547	150499.403	12645.030	12185.378	1.038	.300
2009	50074.114	520206.275	13012.664	97786.227	37061.449	19182.650	1.932	.053
Age of Founders	44.942	10.813	44.646	12.435	.296	.410	.723	.470
Gender	.259	.391	.305	.422	-.046	.014	-3.240	.001
Race	.130	.325	.167	.362	-.037	.012	-3.046	.002
Citizenship	.062	.224	.067	.238	-.005	.008	-.608	.543
Technology Level	.440	.497	.409	.492	.032	.017	1.824	.068
Product / Service	.521	.500	.502	.500	.019	.018	1.085	.278
Incorporation (in year 1)	.314	.464	.262	.440	.052	.016	3.303	.001
Number of Hours Worked in Venture (6 years)								
2004	42.423	22.212	33.810	23.870	8.613	.811	10.624	<.001
2005	41.393	22.523	28.612	25.118	12.781	.839	15.236	<.001
2006	38.840	23.799	23.221	25.341	15.619	.865	18.060	<.001
2007	36.464	24.581	18.438	23.822	18.026	.851	21.182	<.001
2008	33.352	25.131	17.060	23.573	16.292	.860	18.955	<.001
2009	30.637	24.949	14.232	22.364	16.405	.835	19.637	<.001
Founder Contributed Equity (in year 1)	27411.668	66349.279	87372.085	2491825.406	-59960.417	61666.004	-.972	.331
Intellectual Property (any year)	.384	.486	.324	.468	.060	.017	3.589	<.001
Competitive Advantage over Competitors (any year)	.889	.315	.784	.412	.105	.013	8.171	<.001

¹ The "Firms removed from Sample" does not include observations that are outliers and have incorrect data entry issues. Thus, the total number of firms in the t-test (3,265 = 1,634 + 1,631) is less than the total number of firms available in the longitudinal population (3,297).

² "Age at 2009" is a proxy for survival that is used in the additional analysis (OLS regression). The variable represents how old the firm is in 2009. If the firm is still living when the data collection stops in 2009, the age is 7. If the firm closed in 2009 or before, the age of the firm at which it closed is the age of the firm in 2009.

The age of the firm at 2009 (a proxy for survival) is statistically significant between the two groups. The firms that were removed had a lower age on average, which means that more of firms which were removed from the sample closed than the firms that were kept in the sample. With less closures in the sample, this probably means there is less statistical significance in the survival analysis, thus representing a conservative result in the main analysis (i.e. possibly a bias towards a Type II error, as opposed to a bias towards a Type I error). For the growth variables, the difference in revenue and number of employees are not statistically significant for most of the years. Only revenue is statistically different in the first year between the two sets of firms, and only years 2007-2009 are statistically different for number of employees. The three years of statistical differences with the number of employees might affect the number of employee analyses, as the firms that were removed had a lower number of employees on average and a lower standard deviation on average. Again, this would suggest the results are conservative regarding the analyses when using the number of employees.

For the multiple credit source variables, all three of the variables show a large statistical difference in the means between the two groups. This is disturbing because these are the main variables that are used in this study. This is unusual, since the outstanding debt and new equity are not statistically different between the two sets of firms and one would expect there to be a correlation between these two figures and the multiple credit source variables. This could be the case because a majority of the firms that were removed from the sample didn't use credit in any of the six years (756 firms). In examining the subset of firms that were removed not because they didn't use credit during the six years and not because

they didn't answer the multiple credit source questions (139 firms), there is less of a difference in these variables.

For the control variables, there are several variables that are statistically different between the two sets of firms. Gender, race, incorporation, hours worked in the venture, intellectual property, and competitive advantage are statistically different between the groups. Firms that were removed had a higher percentage of female and non-white founders on their team. This would suggest that the results are conservative with regards to these two factors being statistically significant in the analyses. In other words, the analyses might not pick up the nuances associated with female and non-white founders. Firms that were removed had a lower rate of incorporation, the founders worked less hours in the venture, had less intellectual property, and the founders felt they had less of a competitive advantage. The higher incorporation rate in the sample used in the main analyses means more formal firms are in the analysis. The variance of the firms in the sample is still high for the incorporation rate, which provides for a richer analysis. Firms that incorporate more are going to be able to use more formal credit sources than firms that are not incorporated, but this should not bias the results. To ensure this is the case, I ran a simple regression where I regress the multiple credit source variables on the incorporation variable and compare the results between the two sets of firms. The results are similar with incorporation being statistically significant for both and have similar coefficients.

For hours worked in the venture, the lower number of hours indicates the founders were running the firm as a second job possibly and not fully committed to making the new firm a success. I want to analyze firms that are creditable and not firms which are second jobs for individuals. Thus, it is good that these firms were removed from the analyses.

The intellectual property and competitive advantage variables are proxies for the quality of the business idea. With these two variables being lower for the firms that were removed from the sample, it would suggest that firms with poorer quality business ideas are not being included in the analyses. Firms with poorer business ideas would tend to not be able to obtain credit, at least from formal creditors. That would make sense since a majority of the firms that were removed from the sample didn't use credit in any of the six years.

Age of owners, citizenship, technology level, product / service, and owner contributed equity at startup are not statistically different between the groups. Even with the statistical differences in some of the control variables, the results should not be discounted. These variables are control variables in the analyses and thus are not the main focus of the study. However, with the statistical differences between the two groups of firms, the differences need to be taken into account when understanding the findings of the study.

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RESEARCH

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Dissertation Resourceful Financing by New Firms: The Use of Multiple Credit Sources
[*Proposal Defense: October 27, 2011 | Final Defense: November 15, 2012*]

My dissertation examines if being resourceful in financing in the form of multiple credit source usage is beneficial to the performance (survival and growth) of new firms. A theory of resourceful financing by new firms using multiple credit sources is developed based upon financial constraints, credit rationing, and capital structure theories (pecking order theory and financial growth cycle theory). The study incorporates a six year longitudinal design and mixed statistical methods to test hypotheses and perform sensitivity analyses to better understand this specific form of resourceful financing activities of new firms.

The results suggest that the use of multiple credit sources is positively related to growth rates for firms that are growing above average, thus supporting the theoretical framework proposed in the study with boundary conditions. However, for firms that are growing below average, multiple credit source usage is found to be negatively associated with the survival rates. This suggests that founders should be resourceful in their financing options only when they are growing quickly and they should not use multiple credit sources when they are not growing or as a means to get out of a dire financial situation. The use of multiple credit sources cannot be used by creditors as a signal to determine the survival and growth of firms during their early years of operations. It is only after the third or fourth year that the use of multiple credit sources provides a positive or negative signal to external entities such as creditors. Limitations to the study apply.

PAPERS

Publications

“Debt-Based Financing,” in *Encyclopedia of New Venture Management*. Matt Marvel and J. Geoffrey Golson, editors. Thousand Oaks, California. Sage Publishing (2012).

Working Papers – Submitted and Targeted to Journals

“IT Control Weakness and Company Financial Health,” with Manju Ahuja and J. Randy Kuhn. (*2nd round review at International Journal of Accounting and Information Management*)

“Strategic Value of IT: A Resource Based View Empirical Study,” with Rafi Ashrafi. (*2nd round revision at Information Systems Management*)

“Examining Factors Affecting Competitive Balance in Professional Golf,” with Marion Hambrick. (*2nd round review at Journal of Sports Management*)

“Wynkoop Brewing Company: Leveraging Counterculture in the US to Compete,” with Clay Dibrell. (*under review for the Global Entrepreneurship Casebook*)

“Post-IPO Changes in Entrepreneurial Orientation and Performance,” with Greg Bell and David Dubofsky. (*targeted to Journal of Management*)

“Entrepreneurial Orientation and IPO Performance,” with Greg Bell and Tyge Payne. (*targeted to Strategic Management Journal*)

“Methodological Advances in Designing Event Studies Related to IT Value,” with Manju Ahuja and J. Randy Kuhn. (*targeted to Management Information Systems Quarterly*)

“IT Control Weakness and the Market Value of Firms,” with Manju Ahuja and J. Randy Kuhn. (*targeted to Information Systems Research*)

“Management of Earnings by Production and Inventory Management in Private Companies,” with Ben Foster and Trimbak Shastri. (*targeted to The Accounting Review*).

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“Gender Differences in Entrepreneurship: Assessing Perceptions of Entrepreneurial Outcomes for Men and Women Franchises,” with Bill Meek and Diane Sullivan. (*targeted to Entrepreneurship Theory and Practice*)

“Opportunity Discovery and Entrepreneurs: An Attention-Based Perspective” (*targeted to Journal of Business Venturing*)

Work in Progress

“Entrepreneurial Orientation and Internal Control Weaknesses”, with J. Randy Kuhn

“Immigrants, Innovation, and New Firms”, with Tray Kushev

“Entrepreneurs and Responsibility”, with Michael Crum

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PRESENTATIONS

“Management of Earnings by Production and Inventory Management in Private Companies,” with Ben Foster and Trimbak Shastri. American Accounting Association Annual Meeting, Washington, D.C. (2012).

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“Modeling the Relationship of Employee Salary Deferral and New Firm Survival,” with J. Randy Kuhn. Babson College Entrepreneurship Conference, Fort Worth, Texas (2012).

“Impact of Assurance Level on Production Management to Manage Earnings,” with Ben Foster and Trimbak Shastri. American Accounting Association Ohio Region Meeting, Cincinnati, Ohio (2012).

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“Wynkoop Brewing Company: Leveraging Counterculture in the US to Compete,” with Clay Dibrell and Zhaohui Wu. 5th Annual Conference on Business & Sustainability. Portland, Oregon (2011).

“Using Simulation Experiments to Build and Test Entrepreneurship Theories,” PDW co-organized with Christopher Crawford. AOM. San Antonio, Texas (2011).

“Entrepreneurial Orientation and IPO Performance,” with Greg Bell. Babson College Entrepreneurship Research Conference. Syracuse, New York (2011).

“Multiple Credit Sources and New Firms,” with David Dubofsky. AOM Kauffman Firm Survey Workshop. Montreal, Canada (2010).

“Outsourcing in Young Firms: A Stepping Stone in Building a Resource or a Method of Survival.” USASBE Conference. Nashville, Tennessee (2010).

“Opportunity Discovery and Novice Entrepreneurs: An Attention-Based Perspective.” Southern Management Association Conference. Asheville, North Carolina (2009).

HONORS AND AWARDS

- Awarded Kauffman-sponsored grant to access the Kauffman Firm Survey in the NORC enclave (2010-current)
- Best / Outstanding reviewer – Southern Management Association (2010), USASBE (2011)
- Awarded Young Scholars grant to attend the Association of Private Enterprise Education Conference in Las Vegas, Nevada (2012)
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TEACHING

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- FIN 490 – Entrepreneurial Finance, new course, created syllabus
 - o Fall 2011 – Section 01 (Rating: 4.8 out of 5)
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Colorado Software Architects, Inc. Colorado
Owner, Director 2004 - 2008

A software development company specializing in backup and storage aggregation applications

SmartBond, Inc. Colorado / South Africa / Russia / Ukraine
Founder, Director 2000 - 2008

An outsource software development company, a 'virtual-shore' company

Paragon Construction International (Golden Bear Golf) Florida
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- o Global Consult, Kuwait, Middle East Manager, 1994 – 1995
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- Illinois MBA, Tech Transfer Office, & National Center for Supercomputing Applications (NCSA) Research Team
- Free Market Development Advisers Program (IIE and USAID - South Africa)
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