Small Business Growth, Finance and Innovation

by

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Abstract

The purpose of this thesis was to investigate a potential systemic missing variables problem in the literature involving growth, finance and innovation. Until now, these three constructs have not been modeled simultaneously possibly resulting in omitted variable bias in the regression coefficients. To address this problem, this thesis developed an integrated model of growth, one in which growth, finance and innovation are treated as mutually dependent endogenous variables that share a set of exogenous variables. This model is then empirically analysed using a large, representative, weighted sample of Canadian small and medium enterprises that combines information gathered from a national survey with longitudinal firm-specific taxation data. In addition to empirically analysing the sample as a whole, the sample was also divided and analysed based on six groups: growth rate, exporter/non-exporter, innovator/non-innovator, use of government support versus not, financially constrained and not-constrained, and based on firm size (number of employees).

When analysing the SME sample as a whole, no significant relationships were found between growth, finance and innovation, but when the sub-groups were analysed relationships were found. This research illustrates the importance of analysing sub-groups of SMEs in order to reveal distinct characteristics. The assumption of linearity (one model fits all SMEs) is not tenable. Targeting sub-groups not only applies to researchers but to policy as well. Effective policy needs to be focussed on specific types of SMEs if it is to be effective. For employment growth policy, this research has found that it is young and larger firms that have higher growth rates not small firms per se. From a financial constraint perspective, it was found that innovating firms with 20 or more employees

experienced financial constraint rather than smaller firms. Policies such as tax incentives for venture capital targeting this group are suggested. Access to funding supports growth. It was found that for innovating SMEs that could borrow more funds had higher growth rates. Lastly, as a positive finding for government support programs, they were shown to be associated with higher growth rates (both employment and sales) and with higher rates of innovation.

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1.0 Introduction

1.1 Summary

Ever since David Birch found that small and medium enterprises (SMEs) were an important engine of employment growth (Birch, 1981), governments have pursued public policies that have attempted to aid and encourage them (Picot & Dupuy, 1996). Though it has been recently determined that it is new firms which happen to be small that are the engine of job growth (not small firms per se) (Dixon & Rollin, forthcoming; Haltiwanger, Jarmin, & Miranda, 2010), supporting these new, predominantly small firms will continue to be a priority. In parallel with and in support of these policy initiatives, researchers have created a large body of work which has investigated SMEs' characteristics, behaviours, and needs, including their financing, innovation and growth. The SME research investigating growth[1], finance, and innovation typically considers one or two of these variables at a time and from paper to paper, direction of causality is seldom clear. Moreover, this assumes that a firm's growth, finance, and innovation decisions are not interrelated. It seems more reasonable to expect that growth, finance, and innovation are inextricably linked. If so, by only investigating one or two factors, a partial and possibly inaccurate picture might result. Furthermore, the interactions of these variables arguably vary depending on the relative growth rate of the firm, its size, or its export orientation. It would seem more fruitful, therefore, to investigate all three

[1] Strictly speaking, growth is an increase in amount while growth rate is the relative amount by which the firm is growing. In the context of this research, growth refers to growth rate.

variables simultaneously to understand better the drivers of job-creating enterprise growth. This is a sample of the questions which this thesis attempted to answer.

Before going further, it is necessary to give a brief definition of growth, finance, and innovation in the context of this research. In the academic literature, these three concepts have many definitions and interpretations and they therefore need to be defined in the context of this study before proceeding. Growth, for the purposes of this research, is not the broad Penrose definition where she states that growth "sometimes denotes merely increase in amount" or "an increase in size or an improvement in quality as a result of a process development" (Penrose, 1959, p1). For this study, growth is defined as the much more specific rate of increase of both year over year revenues employees for the firm. Maintaining a clear definition of growth is important for comparative purposes, since employment growth differs from sales growth and relative growth differs from absolute growth (Delmar, Davidsson, & Gartner, 2003; Shepherd & Wiklund, 2009). The rate of revenue increase is also among the most frequently used definitions of growth in the research literature (Davidsson, Steffens, & Fitzsimmons, 2009; Shepherd & Wiklund, 2009). Innovation, as defined here, is investment in research and development (R&D). Finance is reflected by the firm's degree of financial leverage. Each of these concepts are discussed in more detail later.

Up until now, there have been no published empirical business studies which have investigated the interrelationship among growth, finance, and innovation as mutually dependent endogenous variables for either publicly traded firms or private SMEs. In order to extend the academic literature in this area, this study used a Statistics Canada dataset titled "2007 Survey of Financing of Small-and Medium-Enterprises (SFSME)".

This dataset combined data from a survey of approximately 15,000 private incorporated and unincorporated SMEs (defined as less than 500 employees) with each firms' tax data filed with the Canada Revenue Agency (CRA). Furthermore, the dataset was properly weighted to represent the Canadian SME sector based on size, age, industry, and geographic region. Together, these data provided a comprehensive and representative perspective of Canadian SMEs. Only incorporated firms were used in this study since unincorporated firms do not file balance sheet information with the CRA.

Given the apparent gap in the literature with regards to the interdependent relationship among growth, finance, and innovation, this thesis investigates this potential systemic missing variables problem. In order to account for these potential missing variables, a conceptual model was developed that incorporated both finance and innovation with growth as non-recursive dependent variables (by non-recursive it is meant that all three dependent variables are assumed to be endogenous to each other). Besides identifying that growth, finance, and innovation are potentially endogenous to each other, a review of the empirical research literature determined a set of factors which affect a firm's growth, finance (capital structure represented by leverage), and innovation. These factors were then incorporated into the conceptual model. A further objective of this study was to test the validity of this model using the aforementioned Statistics Canada dataset.

The thesis is organized as follows. The next two subsections present a brief overview of the research objectives and the reasons why this research is important to academics, public policy and practitioners. The second chapter reviews the current research literature of business growth, finance, and innovation. This chapter explores the theories of growth,

finance, and innovation, as well as presenting the factors which the empirical literature has identified as affecting these three concepts. The third chapter uses the theory and empirical research presented in the second chapter to develop a conceptual model with growth, finance, and innovation as mutually dependent variables. This chapter also contains a subsection which takes the theory and prior empirical research presented in chapter two and synthesizes it into a set of basic underlying ideas and SME behaviours with regards to growth, finance and innovation. This set of underlying ideas is then used to develop a set of hypotheses resulting from comparing six different groups of SMEs. This assumes that fitting the full dataset to the conceptual model implies a linearity of the model for the data which due to the inherent heterogeneity of SMEs is unlikely to hold. The fourth chapter provides a detailed overview of the Statistics Canada dataset that was used for this research as well as descriptions of the proxies that were employed for each of the concepts in the conceptual model and the rationale for their use. Chapter four also details the statistical methods that were used in the research as well as the dataset's descriptive statistics. The fifth chapter presents the results of the research, first performing endogeneity tests with the three dependent variables which is then followed by regressions of the full sample using ordinary least squares (OLS) and structural equation modeling (SEM). The six group comparisons are performed using multi-group SEM. The sixth and final chapter presents an overview of the results along with the limitations, future research directions and the conclusions.

1.2 Overview of Research Objectives

This research had three objectives with the third objective divided into six sub-objectives. In the previous section a novel conceptual model was introduced according to

which growth, finance, and innovation are mutually dependent, endogenous variables. The first objective was to develop this conceptual model and the second objective was to test it to determine to what extent it was supported by the data on SMEs. The third objective was to determine how the relationship between growth, finance, and innovation differs across different groups of SMEs. Six different group comparisons were performed based on growth rates, firm size, export orientation, relative level of innovation, use of government financing and whether they are financially constrained or not (had they been turned down for a finance request).

1.3 Importance of Topic

Investigating the relationship among growth, finance, and innovation for Canadian SMEs has value for academia, governments at various levels (municipal, provincial and federal), and SMEs themselves.

From an academic perspective, this study has benefits from several different perspectives. First, it is the first study to investigate the potential systemic missing variable problem of innovation and finance simultaneously not being included in firm growth analyses. In an attempt to solve this problem, the study develops a conceptual model that treats growth, finance (capital structure as represented by leverage), and innovation as mutually endogenous variables, which provides new insights into the dynamics of SME growth. Second, by testing the model using a large comprehensive survey linked to tax data that is weighted to represent Canada's variety of businesses and regions, it provides an accurate and representative view of Canada's SMEs thereby increasing the reliability and reproducibility of the findings. Finally, by comparing different groups of SMEs (e.g. those that have faster growth to those that don't, those that

export to those that don't), the study reveals those factors that differentiate these groups. This knowledge will create a better understanding of these different sub-groups which can then inform future research programs.

Governments at every level have programs in place to support SMEs. In Canada at the federal level four examples are loan guarantees made under the Canada Small Business Financing (CSBF) program, the Business Development Bank (BDC), the National Research Council's (NRC) Industrial Research Assistance Program (IRAP) and the Canada Revenue Agency's (CRA) Scientific Research and Experimental Development (SRED) Tax Incentive Program. An example at the provincial level is the Ontario Research and Development Tax Credit which is based on the federal government's SRED program. Invest Ottawa is an example where municipal, provincial and federal government funding is combined to help SMEs at a local level. It is not by random coincidence that four of the six programs just listed have innovation or research in their name. Governments are aware that research and innovation drives growth (Baldwin, Chandler, Le, & Papailladis, 1994) and they develop programs to assist firms in pursuing innovative activities. By developing a more comprehensive model of growth, finance, and innovation, this research should provide various levels of government with more detailed information which they can use to better assist and encourage SME growth. Furthermore, by comparing different groups of SMEs (e.g. exporters versus non-exporters, large SMEs versus small SMEs etc.), the information determined can be used to tailor programs to suit the different groups of SMEs. Finally, by understanding better the characteristics of high growth SMEs versus low growth ones, governments can use this information to selectively support those that have a greater potential for growth.

SMEs whose owners would like to grow will find the research of value since it will provide them with the characteristics of those SMEs which have successfully grown. Growth for the purposes of this study is measured over a five year time span. Since the survey covers a large, representative sample of Canadian SMEs, the uncovered characteristics should be broadly applicable and as mentioned earlier are likely to be repeatable.

2.0 Background Literature

The literature survey is divided into five main subsections. The first subsection presents a brief overview of SME characteristics in general and how they differ from larger firms and how this relates to the research of growth, finance and innovation. Following this, the next three subsections present the literature on firm growth, finance and innovation respectively and the final subsection summarizes the main findings from the literature pointing out where the gaps are and how this research attempts to address them.

2.1 SME Characteristics

As stated earlier, new SMEs are an important part of the economy from a job growth perspective. Furthermore, SMEs in sheer numbers make up a substantive proportion of the firms in all developed economies. In the United Kingdom (UK) 99.3% of the firms have 50 employees or less (Curran, 2006). However, this raises the question of "what are SMEs"? Other than size, what differentiates them from large companies? This has been a source of debate in the academic literature where it has been argued for and against SMEs having specific characteristics (see for example Curran, 2006; Torres & Julien,

2005). The general consensus is that SMEs have unique characteristics and are not just small versions of large businesses.

2.1.1 General SME Characteristics

In contrast to large firms, SMEs generally have flexible and nimble organization structures with highly centralized decision making (Carrier, 1994), limited resources (Carrier, 1994; Raymond & St-Pierre, 2005; Welsh & White, 1981) and minimal planning processes (Atkins & Lowe, 1997). Raymond and St-Pierre (2005, p. 515) list SME differences in how they "relate to their environment (greater uncertainty, dependency upon business partners), structure (simplicity, resource «poverty»), strategy and decision process (reactive, short term, focused on material rather than information flows)". From an environment scanning perspective, SMEs don't analyse competitors' services or products closely due to time and financial constraints (Fann & Smeltzer, 1989; Pearce, Chapman, & David, 1982; Raymond, Julien, & Ramangalahy, 2001). SMEs are more sensitive to their business environment such that they perform poorly in the absence of property rights and financial infrastructure in comparison to large firms which continue to do well (Beck & Demirgüç-Kunt, 2006; Beck, Demirgüç-Kunt, & Maksimovic, 2008). These same researchers also found that unless the appropriate legal and financial infrastructures are in place, a large SME population doesn't create the job and economic growth that Birch (1981) reported. For manufacturing SMEs, the technology they adopt (known as advanced manufacturing systems) is more than likely "imposed upon them by the prime contractors or large customers" (Raymond & St-Pierre, 2005, p. 515).

2.1.2 SME Growth Characteristics

SME growth is idiosyncratic such that for most SMEs it is just a short term phase that they go through and then they stop growing. If you were to pick two different two-year time periods with the same group of SMEs separated by a couple of years, the group of growing SMEs in each period would almost have no overlap (Dobbs & Hamilton, 2007).

Growth has been shown to be beneficial to the SME itself. In a study of SMEs created between 1976 and 1978 and tracked through 1984, Phillips and Kirchhoff (1989) found that SMEs which grow are twice as likely to survive as those that didn't grow (66.3% versus 27.5%). Nevertheless, even with this evidence, many SMEs choose not to grow (Wiklund & Shepherd, 2003). As an example, "expectations of changed work conditions is a primary concern for small business managers, which in turn affects their motivation to expand their businesses" (ibid, p 192). Some business owners simply like the business the way it is and don't want the extra work that comes with expanding it. It is not surprising then that the desire to grow has been shown to be an important influence on whether a firm grows or not (ibid).

2.1.3 SME Finance Characteristics

A study comparing the financial characteristics of private and publicly traded firms in the UK by Brav (2009) found that private firms had higher debt loads and that their capital structure fluctuates with the performance of the firm unlike publically traded firms. Consistent with this finding, Robb and Robinson (2008) found in a study of SMEs three years old or younger that debt was the primary source of capital. Baldwin, Gellatly, and Gaudreault (2002, p. 19) found that high and low growth SME "(p)erformance histories have little bearing on average financing profiles".

SMEs suffer more from asymmetric information issues than larger firms which may result in credit constraints, especially for growth-oriented enterprises (Binks & Ennew, 1996). SMEs are unlikely to switch banks due to a lack of time as well as a lack of experience and skill in finance (Howorth, Peel, & Wilson, 2003). Interestingly, those SMEs which have stronger relationships with their banks receive lower interest rates (Berger & Udell, 1995) and have less late payment charges with their suppliers (Uzzi & Gillespie, 2002). Reduced access to growth capital results in SMEs being dependent on cash flow which creates working capital challenges (Welsh & White, 1981). Due to these credit constraints and the fear of losing control of their firm, SME owners rely more on current liabilities than large firms (Hughes, 1994).

Further compounding the problem is that an SME balance sheet is often not what it appears to be since the business owner's personal finances are often intertwined with that of the business (Ang, 1991; Levin & Travis, 1987). Finally, SME capital structures vary widely due in some part to the lack of scrutiny that comes with not being publicly traded - as well as the diversity of SME businesses (Van der Wijst, 1989).

2.1.4 SME Innovation Characteristics

Entrepreneurial orientation is associated with innovation (Messeghem, 2003). Though both SMEs and large firms can have entrepreneurial orientations, SMEs are thought to have an innovation advantage since they lack the inertia and bureaucratic structures of large firms and are considered to be more flexible and adaptable with centralized (therefore quicker) decision making (Carrier, 1994). The one negative aspect with regards to SMEs innovating is their limited resources which restricts the amount of innovation

that can be performed as well as the risk that the firm can tolerate (Carrier, 1994; Rosenbusch, Brinckmann, & Bausch, 2011).

2.2 Firm Growth

In recent years there has been much focus in the literature on firm growth and the lack of integrative theory (Dobbs & Hamilton, 2007; Gibb, 2000; Leitch, Hill, & Neergaard, 2010; McKelvie & Wiklund, 2010; Shepherd & Wiklund, 2009; Stam, 2010). Recently journals have dedicated whole issues to firm growth in the hope of spurring the academic community to do better (see Leitch et al. (2010) and Stam (2010)). Other authors have shown that firm growth is "very nearly random" (Geroski, 2005, p. 129) and that the "R^2 statistic in growth rate regressions is characteristically low" (Coad, 2007, pp. 56-57) which doesn't offer much support for the standard growth theories. With this as the context, the next subsection presents the most common theories of growth, limited as they are. This subsection is followed by one that presents the literature dealing with the independent variables associated with growth.

2.2.1 Theory of Firm Growth

The growth of the firm has been studied from both a theoretical and empirical viewpoint. This research has resulted in numerous theories of firm growth. A review of the most popular growth theories can be found in papers by Oser & Hogarth-Scott (2002) and Coad (2007). Between these two papers the authors describe numerous theories of which seven will be covered here. These seven theories are: stages of growth theory; macro-economic activity theory which is also known as ecology theory (not to be confused with population ecology) (Lohmann, 1998); economic or neoclassical theory; disequilibrium or evolutionary theory; population ecology theory; managerial theory; and

resource-based view (RBV) based on Penrose's (1959) seminal book "The Theory of the Growth of the Firm". The relationship between these theories for firm growth will be discussed in more depth after first giving a brief description of each theory.

The stages of growth theory based models have the firm progressing through various set stages as they grow. The biological model has the lifecycle of a firm follow that of human development from conception through multiple steps finally reaching maturity and decline (Churchill & Lewis, 1983). In contrast to a biological model, Greiner (1998) has five different organization structures which firms go through based on evolution and revolution as they get larger. One cited issue with the stage of growth theories is that they are proposed as unidirectional and do not take into account that firms in reality may regress to earlier stages (Coad, 2007). More problematic than their unidirectional restriction is that stage of growth models are not supported by the empirical research (Orser & Hogarth-Scott, 2002). Coad (2007) doesn't consider stage of growth models to be growth theories per se; rather, Coad considers stage of growth models to be descriptive of "how" firms grow rather than "why" they grow. For Coad, a growth theory has to answer the question "why".

Macro-economic or ecology theory has as its tenet that growth is determined by the economic environment (or the "ecology" the firm exists in) in which the firm is located (Lohmann, 1998; Orser & Hogarth-Scott, 2002). There is no doubt that the economic environment has an influence as a confounding variable in affecting firm growth but it is not the main factor deciding if a firm will grow, stagnate or fail (Baldwin, 1995; Baldwin, Bian, Dupuy, & Gellatly, 2000).

Economic or neoclassical growth theory has profit maximization as the impetus driving growth (Orser & Hogarth-Scott, 2002; Rugman & Verbeke, 2004). Firms consciously make decisions and tradeoffs based on which path will lead to the greatest profits. If successful, a firm in pursuit of maximum profits grows. Closely related to economic growth theory is transaction theory which dictates when a firm should grow by either upward or downward integration (Coad, 2007). Transaction theory states that a firm should grow (generally by acquisition) when more profits are obtained if the good or service is produced by the firm rather than purchasing it. This is all under the umbrella of profit maximization. Economic theory implies that those firms producing the same good or service should all reach the same optimal size since they are all trying to achieve maximum profits (Coad, 2007). Given the diversity of firm sizes that can be found in every industry, there must be something else causing or inhibiting firm growth other than just profit maximization. Though economic theory is valid in the sense that firms need to make profits in order to remain in existence and that firms make decisions that they will hope will lead to profits, it doesn't adequately explain all the variables which cause one firm to grow and another to stagnate or fail given the vast majority of firms start out with the best intentions of making a profit.

Disequilibrium theory (also known as dynamic capitalism) (Kirchhoff, 1994) and evolution theory (Coad, 2007) are a refinement of Schumpeter's (1954) creative destruction theory. Schumpeter (1954, p. 83) defined creative destruction as a process that "incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one." There are many examples of this occurring in the world: the Swiss watch industry being overtaken by digital watches in

the 1970s; minicomputer manufactures like DEC and Wang being overtaken by PCs in the 1980s; the ascendance of mini-mills in the steel industry during the 1980s; and the adoption of advanced, quality winemaking by the new world causing dramatic economic upheaval for the Bordeaux wine makers in the 1990s. Kirchhoff's disequilibrium theory has entry, exit and growth of firms driven by disruptions due to Schumpeterian causes. With disequilibrium theory, markets are explicitly not in the neoclassical equilibrium state. Evolutionary theory (Coad, 2007) is more Darwinian in its application of Schumpeter's creative destruction theory. Evolutionary theory believes in the survival of the fittest. The Schumpeterian disruptions are the genetic perturbations that cause new firms to be created, with the successful ones surviving and the weak ones dying. Though the Schumpeter based theories explain the dramatic industry shifts as illustrated above, it doesn't provide an adequate explanation for the day to day growth (or decline) of the average firm. As Coad (2007, p. 37) points out, the "empirical work on the principle of 'growth of the fitter' does not provide encouraging results. It may be better to suppose that selection works only by elimination of the weaker".

As an interesting footnote, Schumpeter thought that capitalism would eventually fail because innovation would be the exclusive domain of the large firms which would then shut out the entrepreneurs, eliminating creative destruction which in turn would lead to socialism in order to facilitate wealth distribution (Kirchhoff, 1994). Kirchhoff (1994; Kirchhoff & Greene, 1995) points out that creative destruction as well as capitalism is still alive and well more than 50 years after Schumpeter predicted its demise. Kirchhoff argues that small businesses are the engine of job growth and that their ability to innovate more than the large firms is the reason.

Population ecology theory originates from the work by Hannan and Freeman (1977). They theorized that organizations had inertia based on their structure and processes and that this inertia limits the rate at which the organization can adapt and change. Drawing parallels to the biological world, Hannan and Freeman also theorized that unsuccessful organizational forms would either adapt or be selected out. They also empirically showed that small firms had a greater chance of failing which was contrary to pure neoclassical economic thought (Aldrich & Fiol, 1994). In addition, population ecology borrowed from institutional theory the concept of organization legitimacy based on the need for the people in new organizations to become effective functioning units as well as having the external market accept the legitimacy of the business and how it operates (Aldrich & Fiol, 1994; Shane & Foo, 1998). Population ecology brought sociological thought into business research as was encouraged by Granovetter (1985) and it helped in explaining real world situations that economic theory could not (Aldrich & Fiol, 1994; Shane & Foo, 1998). Population ecology theory provides explanations for organizational forms, survival rates and why industries have clusters of similarly structured firms, but it is not in and of itself a growth theory since it doesn't delve into why firms grow in an encompassing way.

Managerial theory or Marris theory (Coad, 2007; Marris, 1963) attributes the growth of the firm to the managers increasing the size of the firm in order to achieve "salary, power and prestige" (Marris, 1963, p. 188). It can be viewed as an extension of agency theory to that of a firm growth theory. According to the theory, the manager when not the owner of the firm is motivated to increase the size of the firm whether or not it is in the stockholders' interests since a "manager's compensation, bonuses, and other perquisites

are very often increasing with firm size" (Coad, 2007, p. 34). Though managerial theory may explain some corporation growth, it clearly doesn't account for the growth of SMEs where for the most part the owner is the manager.

The resource based view (RBV) of firm growth originated with Edith Penrose's (1959) seminal book titled "The Theory of the Growth of the Firm". The term RBV will be used to refer to this theory throughout this paper rather than resourced based theory. Lohmann (1998) lists RBV and strategic management as separate theories of growth while Rugman & Verbeke (2002; 2004), Kor & Mahoney (2004) and Lockett & Thompson (2004) present RBV as a theory for strategic management rather than separate from it. This view is corroborated by Coad (2007, p. 33) where he states that "Penrose's resource based perspective has been quite influential in the strategic management literature." I much prefer this latter definition since RBV is a more encompassing way in which to view firm growth. It has also been noted that RBV is the predominant growth theory (McKelvie & Wiklund, 2010).

Penrose (1959) approaches firm growth using the premise that growth is determined by resources both internal and external to the firm. Her theory takes into account organic growth such as increasing sales of existing products, adding new products, changing product focus all together, forward and backward integration, mergers and acquisitions as well as international expansion. The resources that are included in her theory are not restricted to tangible assets such as building, equipment, land etc. but include the traits of the entrepreneur and/or management, the collective knowledge and skill of the management team and their ability to combine the tangible and intangible resource at their disposal in a manner that will generate profits for the firm. Penrose takes into

account the company's strategies, the people and their skills that make up the company and the business environment in which it operates.

It is my belief that Penrose's initial work provides the framework in which the other growth theories reside. Penrose agreed with Schumpeter's (1954) (and therefore Kirchhoff (1994)) process of creative destruction when she stated that firm research is carried out as a "logical response of the individual firm to the challenge inherent in the Schumpeterian 'process of creative destruction'" (Penrose, 1959, p. 112). From a macro-economic viewpoint, Penrose acknowledges its influence while at the same time tempering its overall affect. This is best illustrated by her statement: "Therefore, except within very broad limits, one cannot adequately explain the behaviour of firms or predict the likelihood of success merely by examining the nature of environmental conditions" (Penrose, 1959, p. 42).

The viewpoint of neoclassical economic theory that the profit motive drives all business growth doesn't explain why some businesses grow and others fail. Something else must be occurring as well which causes some firms to grow and others not to grow. The following quote best sums it up: "At all times the productive opportunity of a firm is being shaped by.....internal and external inducements, and internal and external obstacles. In a certain sense each one is decisive, but nothing can be determined by looking at one of them in isolation" (Penrose, 1959, p. 87).

Population ecology considers the organizational structure of the firm and investigates its structure and effectiveness and implicitly its survivability. The basic ideas of population ecology theory, that of inherited structure and effectiveness of an organization and its ability to overcome its own inertia, is covered by Penrose's theory of growth as

illustrated by the statement describing "an appropriate form of organization inherited from the past and operated by people, also inherited from the past, who share a common tradition, who are accustomed to the organization and to each other, and who thus form and entity which works with sufficient consistency and efficiency in broad areas" (Penrose, 1959, p. 18). The structure of an organization is also a resource consistent with RBV.

Even the stages of growth theories as well as managerial theory (agency theory) can be viewed through the RBV lens if one considers that they are resources which the firm has. Much as organizational form is inherited from the past, so is the age and size of the firm. It is yet another characteristic or "resource" which the firm has. Attitudes and behaviours of managers (agency or otherwise) are part of the managerial resource pool.

So in summary, after investigating the various growth theories it is my opinion that they all continue to build upon the foundation created by Edith Penrose (1959) and her concept of how a firm's resources internally and externally, tangible and intangible determine its growth. I view the other theories described above as subtending theories which explain the internal workings of a greater whole. Therefore I have chosen RBV as the theoretical underpinning for growth in this study.

The next subsection presents a survey of the resources which have been identified by the research literature as contributing to firm growth.

2.2.2 Factors Affecting Firm Growth

In searching for factors affecting firm growth, the literature investigating firm failure was considered in addition to that of firm growth. Factors learned from the study of failure are important as well since their presence or absence will certainly affect the

prospects for growth even though they don't necessarily predict growth. The survey of the empirical research on business growth and failure found eleven factors that had an effect on firm growth. The eleven factors in the order they will be described are finance, innovation, intention to grow, management competency, marketing competency, macroeconomic activity, financial constraint, size of the firm, age of the firm, cash flow, export, and government financial support.

2.2.2.1 Finance and Growth

Most firms require money to get started and to fund ongoing operations. Admittedly, a pure service firm such as a management consultant with the owner working out of his or her home using a pre-existing household printer and computer likely requires little if any initial capital. More typically, new firms require capital to pay rent, buy equipment and pay salaries until revenue covers these costs. If a firm wants to expand production, undertake R&D, or expand into new markets, capital is required to perform these activities. If the firm doesn't already have this money, it will need to borrow it or sell shares to fund it. The money and type of funds which a firm uses to finance its operations is its capital structure.

The capital structure of a firm consists of the types and amounts of internal and external funding which are used to operate the business. Internal financing is retained earnings. This is the money which the firm has earned through its profits. External financing is borrowed money (e.g. credit cards, lines of credit, loans, bonds etc.) and share equity. Share equity can come from the public and/or the founders and their friends and relations. Borrowed money generally has fixed payment schedules attached to it and if the company doesn't meet these obligations, the lender can force the business into

bankruptcy. Share equity is only worth what the market or the firm is willing to pay for it. Equity holders cannot force a company into bankruptcy. The majority shareholder(s) control the business and its business decisions. For this reason, SME owners predominantly control the majority of the voting shares in their business. A more detailed discussion of this last point as well as a broader discussion of capital structure in general is provided in section 2.3 Firm Finance on page 40.

A key consideration when looking at a firm's balance sheet is the ratio between its liabilities and equity. This is known as the firm's leverage. A firm's leverage can provide insight into its health. A firm with a disproportionate amount of debt does not have the financial flexibility to withstand economic shocks. If the firm has had a bad quarter, it doesn't have the flexibility to borrow additional money to pay expenses. The empirical research shows that successful firms have a balance between the two types of financing with proportionally more financing being equity (share equity and retained earnings).

When Johnson et al. (1997) compared faster-growing firms to slower-growing firms they found that the faster-growing firms placed higher importance on financial flexibility in meeting unforeseen circumstances ($p < 0.05$), used proportionally less debt only financing ($p < 0.05$) and made more use of a mixture of debt and equity financing ($p < 0.10$). These three pieces of information when put all together make intuitive sense. The more successful firms use a combination of debt and equity financing rather than exclusively debt. Not relying solely on debt financing buffers the firm from having all its capital called at an inopportune time allowing it to meet unforeseen circumstances.

Baldwin et al. (1997) report, that of all failures, 71% were attributed to poor financial planning. Thornhill and Amit (2003), using a subset of the same data which Baldwin et

al. (1997) did, found that the primary cause of failure was undercapitalization and that this was independent of age, industry or size of firm.

A number of researchers have explicitly looked at the affect finance has on growth (Baldwin et al., 1994; Becchetti & Trovato, 2002; Carpenter & Petersen, 2002). The findings from this literature with growth as a dependent variable are that growth is mostly funded by retained earnings but the faster growing firms are able to make more use of other sources including debt and equity. Only one paper was found that had leverage (rather than cash flow) in a regression (rather than a mean comparison) as an independent variable (Becchetti & Trovato, 2002). The researchers found leverage to be a positive but not significant predictor of growth.

To summarize the effects that finance has on growth, having sufficient capital and having it come from a mixture of sources together with adequate financial competence and planning are important. Furthermore, retained earnings are the predominant source of growth financing and leverage is a positive but not significant predictor of growth.

2.2.2.2 Innovation and Growth

The entrepreneur who creates a new product, finds a unique way of combining a service or creates a new selling paradigm is being innovative. It seems intuitively obvious that in order to be successful and grow, a business must do something different than its competitors. What motivates a customer to buy a product or service from one firm over another? There has to be something innovative in one or more of the four Ps- Product, Price, Place or Promotion.

The intuitive belief that innovation is a factor influencing growth is not always borne out by the research but in a meta-analysis of 42 different innovation/growth studies, the

conclusion was that it did increase growth (Rosenbusch et al., 2011). In a couple of other studies not included in this meta-analysis, both found innovation to be a positive predictor of growth. Using a cross-sectional group comparison with innovation as the group differentiator, Freel (2000) found that the innovators had a much higher sales growth rate. Innovators were defined as those firms which introduced 20% or more new products in their product base over a three year period. Audretsch (1995b) found that the growth rate for new SMEs was significantly higher in industries that had higher rates of innovation, but the odds of survival for these new SMEs was lower than for less innovative industries. But if the new entrant survived in the highly innovative industry, it had a higher rate of survival after eight years.

Statistics Canada has produced four works (Baldwin et al., 1994; Baldwin, 1995; Gellatly, 1999; Johnson et al., 1997) which together show the positive correlation between innovation and small firm growth, as well as differentiating the characteristics of innovative firms.

Baldwin (1995, p. 2) says it most succinctly in his statement "Innovative activities are the most important determinants of success; that is, for a wide range of industries, they serve to discriminate between the more- and the less-successful firms better than any other variable". The paper was based on a survey in 1988 of small firms which had less than 500 employees and less than $100 million assets in 1984 and had grown in the subsequent four-year period. The firms were asked questions about their strategies and activities including innovating activities. The response group was divided into two equal groups based on which firms had grown the most in market share and profitability. The research found that the group of more successful companies had a 41% higher mean

score ($p < 0.0001$) on the value R&D innovation contributed to their success than the less successful companies. Using the same dataset, Baldwin et al. (1994) found that the more successful group devoted a greater percentage of their total investment to R&D than the less successful one. For this comparison all firms were considered even those which did not invest in R&D. Further insight was provided when the same researchers performed the same comparison but this time only considering those firms which made some investment in R&D. In this comparison the more successful firms (gaining market share and profitability) didn't invest a significantly greater percentage in R&D than the less successful firms. These findings highlight an important subtlety of R&D investment. By investing in R&D a firm increases its likelihood of success when compared to those firms which don't invest, but the act of investing in R&D isn't a guarantee the firm will do as well as a competitor investing a comparable amount. Similar to the jingle used to market lottery tickets, you have to play the game in order to have a chance at winning. Nevertheless, the effectiveness of converting the innovation inputs (R&D investment) into outputs (successful innovations) is important and by far from guaranteed.

In the Statistics Canada study by Johnson et al. (1997, p. 13), it was found that "faster-growing successful entrants are almost twice as likely to innovate as slow-growing firms". This finding was based on a study of growing firms that were created between 1983 and 1986 and were surveyed in 1996. The surveyed companies were divided into two groups based on their respective growth rates. Innovation for the purpose of the study was considered to be creating or modifying a product or process.

The purpose of the Statistics Canada paper by Gellatly (1999) was to study how innovative and non-innovative firms differ in order to better understand what other

characteristics are associated with an innovative firm. While the previous two studies looked at a cross-section of all industries, this paper considered only business service firms. It found that innovative firms placed more importance on financial management, capital acquisition, recruiting skilled labour and incentive-based compensation. These findings are consistent with the papers described in the section on Management Competency on page 27. Management competency and innovation are both found in growing firms. This is also consistent with RBV since these are resources which contribute to business success. The paper did make an additional finding that innovative firms "are more likely to report difficulties related to market success, imitation, and skill restrictions" (Gellatly, 1999, p. v). The paper presents evidence to show that innovators are more aware of these issues than non-innovators which leads to their higher growth rates. This adds empirical credence to the motto "Only the paranoid survive" of Andrew Grove, former CEO of Intel (Grove).

Further insight into the innovation and growth relationship was provided by Coad and Rao (2010). In their paper, the authors investigated the longitudinal relationship among sales growth, employment growth, profit growth and R&D expenditure (innovation measure) using a panel vector autoregression model with data from American publicly traded manufacturing companies spanning the years 1973 to 2004. In this study, the authors were investigating the effects of R&D within firms rather than between firms as the previous cited studies had done. Coad and Rao found that R&D expenditures at the firm level grew at a constant rate with increasing sales but were less likely to be reduced for negative growth in sales. To add further support for not reducing R&D investment for reduced sales, innovating companies perform better than non-innovating companies

during an economic downturn. In a study of UK manufacturing firms it was found that those companies that had introduced an innovation in the previous 10 years grew at 6% versus a decline of 1% for those that had not introduced an innovation (Gerorski & Machin, 1992). So in general, a firm that invests more in R&D is expected to grow faster, but firms tend to invest in R&D at a constant rate based on a percentage of sales.

Another factor influencing the observed behaviour of investing in innovation at a constant rate is the need to maintain a constant or increasing growth rate. The growth rate attributed to the introduction of a new innovation does not last (Gerorski & Machin, 1992). Gerorski and Machin found that when a firm introduces a new innovation it will increase its sales but the sales will not continue to increase unless further innovations are introduced.

So in summary, innovation has been found to be an important factor affecting growth and it needs to be invested in at a constant or growing rate but it is by no means sufficient in and of itself to determine growth. Without the ability to market the innovation, the capital to productize it or the management acumen to operate the company, the firm will invariably fail.

2.2.2.3 Intention to Grow and Growth

The intention to grow on the part of the small business owner is an important predictor of firm growth. This point was made by Penrose (1959, p. 34) when she stated that for some people the ambition that would lead others "to expand their operations in an unending search for more profit, and perhaps greater prestige, may be lacking". Studies by Orser & Hogarth-Scott (2002), Orser & Riding (2003) and Delmar & Wiklund (2008)

in addition to several citations made by Carter (1998) and Wiklund et al. (2009) show that this is indeed the case.

Orser & Hogarth-Scott (2002) in their study investigated both change in employment and change in revenues over a five-year period. They determined that those small business owners who wanted to grow increased their number of employees at almost twice the rate and their revenues at over twice the rate when compared to those business owners who did not want to grow. These findings "were statistically significant at p-value of less than 0.025" (Orser & Hogarth-Scott, 2002, p. 292).

Using MANCOVA (Multivariate Analysis of Covariance), Orser and Riding (2003) were able to show that the intention to grow is significantly associated with revenue growth ($p < 0.05$) for those business owners who wanted to grow. Furthermore, using multiple regression they determined that intention to grow was a significant positive coefficient (0.013, $p < 0.005$) of revenue growth (management diversity and self-fulfillment had significant coefficient estimates as well).

In a study by Delmar and Wiklund (2008), the authors investigated the effect that employment growth motivation and sales growth motivation had on future employment and sales growth respectively. Their study looked at Swedish firms between 1994 and 1999. They report that sales growth (previous three years) and sales growth motivation both measured at the initial survey were equal in magnitude and significance as predictors of growth measured at the follow-up survey (3 to 4 years later). In contrast, previous employment growth was not a significant predictor of future employment growth, though employment growth motivation was. The finding that previous sales growth is an equivalent predictor to that of sale growth motivation is quite beneficial. For

studies where growth motivation wasn't part of the initial survey for a longitudinal study but sales history was, the sales history can be used as a substitute for growth motivation.

2.2.2.4 Management Competency and Growth

Management competency is another dimension which seems intuitively obvious as a factor influencing firm growth. As expected there are numerous papers in the empirical literature which show the causality between management competency and firm growth as well as papers which show that a lack of management competency is associated with firm failure. Those papers showing the causality between management competency and growth will be discussed first followed by the papers showing that firm failure is often the result of poor management.

Lohmann (1998) studied the management characteristics of high-growth firms in Hawaii, a business environment that he showed to be quite adverse. As a part of his study he compared the responses of CEOs of high-growth firms to that of non-high-growth firms against various management behaviour/competency questions. For every question where there was a significant statistical difference ($p < 0.05$) between the scores, Lohmann (1998) found that the CEOs of the high-growth firms placed more importance on that behaviour/competency than their counterparts in the non-high-growth firms. The behaviours and competencies that were found to be different were internal communications, strong leadership, entrepreneur's personal impact, taking initiative, rapid response, managing growth, customer satisfaction focus, attention to detail, and internal locus of control. Lohmann (1998) showed that the CEOs of high-growth firms are distinct in some of their management characteristics with the implication being that these differences are an important contributing factor to firm growth.

Johnson et al. (1997) in their comparison of faster- and slower-growing successful entrants found similar behaviour/competency differences to that of Lohmann (1998). Specifically, Johnson et al. (1997) found ($p < 0.05$) that the faster-growing firms placed more emphasis on customer service, flexibility in responding to customer needs, innovation, the use of information technology, financial flexibility in meeting unforeseen circumstances, recruiting skilled employees, and providing incentive compensation plans.

Orser and Riding (2003) in their multiple regression analysis of firm growth found that management diversity had a significant (0.100, $p = 0.093$) coefficient estimate. In their study, management diversity was a composite variable created by taking the respondents answers to 25 management related questions and converting it to a binary (0,1) scale and then summing them. Originally each question had been answered using a 5 point scale. Answers which scored 4 or 5 were converted to a 1 and the remainder to 0. The 25 questions came from the following functional areas of management: networking; personal care; general management; planning; marketing; operations management; finance; human resource; and management of technology.

Rumball (2000) investigated the management competencies required by high growth firms in Ontario during different stages of growth as defined by the number of employees (size). Only firms with less than 200 employees, a minimum of $2 million in gross operating revenue and with revenue having grown by at least 50% during the 1993-1996 period were considered. The data for the paper was obtained via a detailed questionnaire which the CEOs of the firms in question responded to. The paper divided the firms into six groups based on number of employees. The employee size of each group was 0-9, 10-19, 20-29, 30-49, 50-99, and 100+. As expected the management competencies exhibited

by each firm varied depending on its size. For the small-sized firms, the CEO is running the whole show, hasn't got time to plan and the biggest concern is access to capital. As the firm grows through the six stages, CEOs progressively delegate more, plan more, and develop themselves and their employees more while building a full, well-rounded management organization. Rumball's (2000) study gives further support to the Baldwin et al. (1997) findings presented below, that young firms must master basic management skills and as they grow they must then learn to manage complexity, to delegate and to consult outside advisors.

Given that the above four studies all found that growth of firms is related to superior management competency, it should not come as a big surprise that the next two papers to be discussed show that the failure of firms is related to a lack of management competency.

Thornhill and Amit (2003) in their paper investigated 339 Canadian bankruptcies to determine if new and old firms fail for different reasons and if these reasons can be attributed to a resourced based explanation. Questionnaires were filled out by the bankruptcy trustee assigned to the bankrupt business. Using a linear regression model, they showed that a correlate of new firm failure was a lack of management competency. Management competency in their study was measured by asking three, 5-point scale questions. The questions asked to what extent was the failure caused by deficiencies in breadth of management knowledge, depth of management knowledge and lack of control.

Baldwin et al. (1997) looked at why firms fail using an individual firm resource based approach while not controlling for age as Thornhill and Amit (2003) did. Baldwin et al. (1997) found that inexperienced management was the prime cause of failure and that

management's knowledge and vision were critical to its success. The paper found that the number of failures was almost equally split between those due to external and internal causes. One of the internal reasons for failure was found to be weakness in management due to inexperience. The paper states that of all failures, 71% were attributed to poor financial planning and then goes on to make the connection that poor financial planning is just another indicator of lack of management experience. Furthermore the paper states that even the external reasons can partially be attributed to internal reasons since the companies don't have the management competencies or experience to handle the external shocks which caused their eventual demise. Not surprisingly, the paper states that in order for a young firm to survive it must master basic management skills and as the firm ages and grows it must then learn to manage complexity, to delegate and to consult outside advisors. The study found a general reluctance within the failed firms to consult outside advisors whom could have potentially provided the necessary information to prevent the firms' eventual failing.

From the above investigation of the empirical papers that study growth and failure, management competency has been shown to be an important factor leading to firm growth when it is present (dependent on other factors) and firm failure when it is not (independent of other factors). With respect to an encompassing model of growth, it is apparent that management competency is required for a firm to grow but it is not the main factor causing growth. Furthermore, following from Thornhill and Amit's (2003) research, management competency is positively correlated with the age of the firm.

2.2.2.5 Marketing Competency and Growth

The empirical literature has shown that lack of marketing competency is a significant detriment to SME success. Entrepreneurs often start a business because they are passionate about the product or service but lack the marketing knowledge or interest to effectively sell it.

Johnson et al. (1997) in their paper analysing the characteristics differentiating faster and slower growing firms found that the faster growing firms were significantly ($p < 0.05$) more likely to follow marketing strategies that target new foreign markets, improve position in existing markets, promote company or product reputation and use third-party distributors. It is interesting to note that the paper did not find a statistically significant difference for satisfying existing customers.

Baldwin et al. (1997) in their study of firm failures found that lack of marketing skill was the third most important factor for why firms failed with 50% of the failed firms suffering from this deficiency. They found that bankrupt firms "fail to establish a market niche" and that they fail "to get the basic product strategy correct from the very start" (Baldwin et al., 1997, p. 30). Other factors that they found contributed to poor product strategy were poor pricing strategies and a poor location for the business.

In their study of growth strategies for small and medium enterprises, Orser and Riding (2003) found (using factor analysis) that a market development factor was the third of three growth factors that contributed to the variance. The market development factor consisted of the responses to the following three questions: seeking new international markets; selling over the internet; and expanding advertising and promotion. When ranking each firms revenue growth based on which factor was dominant, Orser and

Riding (2003) found that the market development factor was a close second. The value of marketing and market development cannot be underestimated as major contributing influence to the growth of a firm.

It is important to note that marketing competency is different than marketing innovation. As described earlier, innovation is the most important factor determining growth of a firm. If the innovation is a marketing innovation, within the conceptual model this would be represented as an innovation not marketing competency. Nevertheless, there would most likely be a high correlation between someone who has a great marketing innovation and scoring well on a marketing competency measure.

2.2.2.6 Macroeconomic Activity and Growth

In his comparative study of high- and low-growth businesses in Hawaii, Lohmann (1998) found that there are distinct environmental differences separating the industries with high- and low-growth firms. The results were consistent across factor, discriminant, and regression analysis. Consistently those industries which had a large number of firms, high total sales, high total employees, and a younger average firm age were more likely to contain high-growth firms. This intuitively makes sense because any industry that has undergone some profound innovation that has changed the market stability will have a large number of young firms which are all eagerly trying to satisfy the new market. Only once the market matures does it begin to consolidate into fewer firms with better operational efficiencies.

Thornhill and Amit (2003) in their study of business failures looked at a measure of industry change to explain why older firms fail. Their hypothesis was that a firm having survived through infancy had at least managed to obtain some minimal management

competencies for survival and that other factors would contribute to its demise as it aged. This thought is very similar to population ecology theory and its concept of inertia and the inability of a company to change course to confront adversity (Hannan & Freeman, 1977). Thornhill and Amit's (2003) measure for industry change considered change of technology, change in market conditions and change in labour or industrial relations legislation. The study did find that there was a statistically significant coefficient ($p < 0.01$) for the industry change predictor in the regression. Therefore industry change is a macroeconomic factor which contributes to a firm's demise. If industry change can shorten one firm's life expectancy, it most probably will affect another firm's prospect for growth.

Baldwin et al. (2000) in their analysis of new firm failure rates looked at the effect of increased rates of GDP output on the survival rates of new firms. Their analysis confirmed what one would intuitively expect: that survival does "vary cyclically with the business cycle – a higher growth rate in real output leads to more survival" (Baldwin et al., 2000, p. 12).

So in summary, the empirical research on macroeconomic factors show that the growth stage that an industry is currently undergoing, the amount of change in an industry (regulatory or innovation) and GDP growth rates all affect a firm's ability to grow.

2.2.2.7 Financial Constraint and Growth

A firm states that it is financially constrained when it would like to obtain additional financing yet is unable to. As previously discussed, small firm growth is for the most part constrained by its cash flow or rather internal finance (Carpenter & Petersen, 2002).

Some firms accept this limitation while others would rather obtain additional financing to pursue their growth objectives. These firms would say they are financially constrained. Several researchers have investigated the financial constraint and growth relationship obtaining somewhat mixed results.

Two sets of researchers (both using Italian data) found firms that expressed financial constraints did indeed have lower growth rates, yet one found it for firms less than 50 employees (Angelini & Generale, 2008) and the other found it for firms with more than 100 employees (Becchetti & Trovato, 2002). Both sets of researchers used ordinary least squares (OLS) and the relative increase in number of employees for growth except Angelini and Generale (2008) used the natural logarithm of the relative employee growth.

For a different perspective, Binks and Ennew (1996) used United Kingdom (UK) data and ordered probit with financial constraint as the dependent (3-point scale). They found that the actual growth rate (binary variable more than 5%) was a weaker predictor of financial constraint ($p<0.1$) than expected growth rate (binary variable more than 5%) ($p<0.01$). Note that for their research, turnover and not employee growth rate was used as the measure of growth.

The Binks and Ennew research is not really comparable to that of the previous researchers for several reasons. First, they are only considering if constraints differ based on dividing their sample into high and low growth firms. They state that 48% of their sample had negative growth and 9.4% had over 20% growth, but there is no overall growth mean or percentage of the sample that had greater than 5% growth given. Secondly, they are using turnover growth rate and the Italian researchers used employee growth rate. No correlation between employee and turnover growth rate was given, which

makes comparisons problematic (Shepherd & Wiklund, 2009). Thirdly, their data was collected while the UK was in a recession which would no doubt affect the financial constraint distribution. No summary statistics were given for their constraint variable. Lastly, they inversed the predictive relationship from what the other researchers had. The Italian researchers had financial constraint as a predictor of growth while Binks and Ennew had it in the opposite direction.

Similar to the Binks and Ennew (1996) work, Freel (2007), using percentage of loan approved as the dependent variable representing financial constraint, found a negative relationship ($p<0.05$) for growth rate (% turnover change) as a predictor.

Though the empirical results for the effect of financial constraints on firm growth are a bit mixed, the overall impression is that one would expect to see a negative relationship between financial constraint and growth.

2.2.2.8 Firm Size and Growth

As opposed to other things in life, when it comes to business growth and survival, size (based on the number of employees) actually does matter. In the section on management competency and growth it was shown that managers need to exhibit different skills depending on the size of the firm in order to grow successfully. But from a pure size growth relationship, research has shown that there is a relationship between size and growth and that survival rates improve based on a firm's relative size to its peers in the same industry. Each of these relationships will be discussed in turn.

The most studied relationship involving firm size is with growth. This relationship has been considered for many years starting with Gibrat's law from 1931 stating that a size of a firm (as measured by the number of employees) and its growth rate are

independent (Angelini & Generale, 2008). If the law actually held, there would be no reason to include the size as a predictor of growth. As it turns out, research has shown that the law does not hold. Depending on how firm size is measured, it can be either a negative or positive predictor. When firm size is measured as the number of employees at the start of the measurement period, it is a negative predictor of growth (Angelini & Generale, 2008; Becchetti & Trovato, 2002). This negative result has been shown to be due to regression to the mean which is prevalent in small firm growth (Haltiwanger et al., 2010). Taking the average between the starting size and final size avoids this problem and results in a positive coefficient for size as a predictor of growth when controlling for age (Haltiwanger et al., 2010).

When considering firm survival and size, a Baldwin et al. (2000, p. 52) study of Canadian firm failures found that firms in an industry increased their survival rate as they became larger "relative to the first-year entrant average within that firm's industry". Therefore new firms (even mature firms for that matter) that are larger than the average new firm have a greater likelihood of surviving. Baldwin et al. (2000) also found that the larger the average entrant size is, relative to the incumbents in an industry, also increases the survival rates. From an SME perspective, this means that so long as a business comes into existence close to the same size as the other businesses in its industry, size should not be a determining factor for its survival and growth so long as the owner has the management skills and cash flow to operate a business of that size.

In summary, when measuring firm size as the average over the growth period, small firms grow slower than large firms and firms that have attained a size (in number of

employees) similar to or greater than the average industry size have greater odds of survival.

2.2.2.9 Firm Age and Growth

As previously described, Thornhill and Amit (2003) found that new firms fail for different reasons than older firms. They found that new firms failed due to a lack of management competencies while older firms failed because they were unable to keep up with the changes in their industry. Therefore age and firm survival are related and by extension so is growth since a failing firm isn't growing.

The findings of Baldwin et al. (2000) showed that new firms were more likely to fail than older firms. This is a well known and documented occurrence and "reflects what Stinchcombe (1965) called the liability of newness" (Hannan & Freeman, 1977, p. 959). As described earlier, this age effect has been shown to be caused by a lack of management competencies (Baldwin et al., 1997). As a firm ages it gains more experience thereby decreasing the likelihood that it will fail. But as has been pointed out earlier by both Baldwin et al. (1997) and Thornhill and Amit (2003), even though the likelihood of failure decreases with age, it is still present. Older firms have to develop the skills to manage greater complexity (Baldwin et al., 1997) as well as overcome their own internal inertia (Hannan & Freeman, 1977) to deal with industry change (Thornhill & Amit, 2003).

Johnson et al. (1997, p. 15) in their study of successful entrant firms found by "the time the firm has reached an established stage, its management and human resources capabilities are typically quite developed, and growth is more closely associated with innovation". As Johnson et al. (1997) point out; their findings are complimentary to the

previous findings of Baldwin (1995) and Baldwin et al. (1997; 2000). Many competencies are required for a firm to survive and grow but without innovation it will most likely stagnate. In other words, a firm that has managed to survive for a number of years has at one time innovated but will not grow unless it continues to innovate. Therefore, age is not in and of itself a direct contributor to growth but can act as a proxy for other factors such as acquired management competencies and resources which contribute to firm growth. Acknowledging that not all possible age dependent predictors of growth will be indentified, age is used as predictor of growth.

From a regression perspective, of the numerous researchers that have investigated the age and growth relationship all have found a negative relationship (Angelini & Generale, 2008; Becchetti & Trovato, 2002; Freel & Robson, 2004; Smallbone & North, 1995). Smallbone and North (1995) note that SMEs generally grow quickly when they start and this growth rate slows down within several years. This is similar to the size/growth relationship discussed above. When using relative growth rate, the effort to increase sales or employees from a small value is much easier than from a large value. Furthermore, given that age and size are positively correlated, the inverse relationship between age and growth is not a surprise.

2.2.2.10 Cash Flow and Growth

Even though cash flow and profitability are fundamentally stochastic and show a reversion to the mean for SMEs (Baldwin et al., 1994), both nevertheless have been found to be predictors of growth. Several researchers have found cash flow/profitability to be a positive predictor of growth (Angelini & Generale, 2008; Carpenter & Petersen, 2002; Myers, 2001). Carpenter and Petersen (2002) found that for most publicly traded

small firms (assets between $5 million and $100 million), growth was constrained by the availability of internal finance. In their study, lagged cash flow was used as a predictor of growth. Researchers argue that this internal finance constraint is due to the lack of other forms of financing. SMEs are in all likelihood even more constrained due to their small size and information asymmetry (Binks & Ennew, 1996).

2.2.2.11 Export and Growth

The positive relationship between export and growth has been well established (Becchetti & Trovato, 2002; McMahon, 2000; Smallbone & North, 1995). By exporting, firms broaden their market reach beyond their local markets allowing them to reach a larger customer base which in turn should increase their sales. This makes sense so long as they're reaching out to new markets.

2.2.2.12 Government Financial Support and Growth

With regards to the relationship between government financial support and firm growth only one paper was found that had used government financial support as a predictor of growth (Becchetti & Trovato, 2002). This is interesting within the Canadian context where the federal government gives out grants through IRAP and tax credits via SRED. Do these programs actually help growth? Do the programs which other governments have help growth? In Italy, Becchetti and Trovato (2002) found a positive relationship between receiving a subsidy (soft loans or grants) and growth. This is an interesting finding. Did the subsidy cause the firm to have a higher growth rate or was it the selection process by which firms received the subsidy such that only those firms with the potential for higher growth rates were selected? Unfortunately without having a controlled experiment it is not possible to determine causality. Nevertheless, it appears at

least in this particular situation government financial support is a correlated with higher firm growth.

2.3 Firm Finance

From a balance sheet perspective, when a firm seeks money to finance its operations, the firm has a choice of only three basic forms of finance: debt, equity, and/or retained earnings. Warrants, convertible debt and other instruments are just combinations of these three basic forms. Debt is money loaned to the company that needs to be repaid at some point (in the next year – short term debt or in more than one year – long term debt) and can be from the owner (cash or from a personal credit card), friends and relations of the owner, financial institution, governments, the public market (bonds), or other businesses (loans or as accounts payable). Equity represents ownership in the company. Retained earnings are the profits (losses) that the company has made that remain with the company and haven't been given to shareholders via dividends. The proportion of each of these forms of finance which a firm uses is known as the firm's capital structure. Given that there are only three basic types of finance available to a firm, one would think that the literature dealing with the selection of financing and the proportion of each a company has would be straight forward. In fact the amount of academic literature devoted to the theory of capital structure and the correlates which affect it dwarfs either of the literatures dealing with growth or innovation.

The remainder of this literature review of firm finance is divided into three sections. The first subsection presents the theories of capital structure which is followed by a subsection which presents empirical findings from the research of capital structure with a focus on the differences between SMEs and large publicly traded companies. The final

section presents the predictors that have been shown to affect the capital structure of SMEs.

2.3.1 Theories of Capital Structure

The starting point for every literature review of capital structure is the two papers by Modigliani and Miller (1958; 1963). These papers will be referred to as MM for the remainder of this thesis. They were the first to provide formal mathematical proofs to explain cost of capital and firm valuation. Their first paper used a partial-equilibrium model and the following assumptions: complete and frictionless markets; investors and corporations can borrow at the same interest rate; firms yield an expected return (though randomly distributed); interest rate is independent of debt level; and firms can be divided into equivalent return classes such that one can substitute one for another within the same class. With these assumptions, they were able to show that the value of the firm was independent of its captial structure (proposition I). Furthermore, as debt is added to a firm's capital structure, the cost of equity increases to account for the additional risk of adding debt (proposition II). In their first paper, they argued that an investor could arbitrage between two firms in the same class with different leverages creating their own leverage by borrowing money. Their first paper had one fundamental flaw with how they handled debt interest deductibility. Simply stated, the distribution of returns of two firms in an equivalent class with different leverages is not proportional such that they cannot be arbitraged. This resulted in the value of a firm changing from simply its unlevered value independent of debt to its unlevered value plus the total debt multiplied by the corporate tax rate. This implied that firms should leverage themselves as much as possible in order

to maximize firm value. Needless to say the real world risks of bankruptcy limit the leverage that firms can actually take on.

In a subsequent paper, Miller (1977) pointed out that tax rate increases over the years have not caused the leverage ratios to change as predicted by MM. Miller makes the argument that a truly encompassing theory of capital structure requires a complete equilibrium model such that personal taxes as well as the tax rates of bond purchasers (individual, institution, public and private) are taken into account as well. The need for a complete equilibrium model is also made by Stiglitz (1988). Nevertheless, MM's theory provided the foundation that all subsequent capital structure research was built on.

The remainder of this section presents the various theories that have been proposed to explain the capital structures that are seen in practice that differ from that predicted by MM.

2.3.1.1 Agency Theory

The agency theory for capital structure was proposed by Jensen and Meckling (1976) when they hypothesized that capital structure selection is not purely an exercise in maximizing firm value but can also be a means of controlling for agency cost. Agency cost is the situation where the managers of the firm are concerned more with their own perquisites (e.g. salary, stock options, status, etc.) than maximizing shareholder value. Needless to say if all debt and equity belongs to the owner-manager, as is the case in many SMEs, agency cost is not an issue. In the case where there are outside investors, the authors make the point that when the owner-manager of a small firm "hold(s) a fraction of the total debt equal to his fractional ownership of the total equity he would have no incentive whatsoever to reallocate wealth from the debt holders to the stockholders."

(ibid, p. 352) In this situation the ratio of debt and equity held by the owners and investors is the same such that their interests are aligned. The authors also list other situations where outside investment is more likely to be either all equity or all debt due to agency concerns. For instance they suggest that debt is preferable in firms where monitoring costs are high (e.g. restaurants) and "it is relatively easy for managers to lower the mean value of the outcomes" (ibid, p. 355). They suggest equity is preferable in firms "like conglomerates, in which it would be easy to shift outcome distributions adversely for bondholders" (ibid, p. 355).

Another application of agency theory to capital structure was proposed by Titman (1984) in his paper on how capital structure affects a firm's liquidation decision. The thesis of his argument is that a company which produces goods that incur ongoing maintenance costs needs to account for this in their capital structure decisions. Titman includes the costs to suppliers and employees as well, but only customer maintenance costs will be discussed here. The primary concern is that customers whom buy products that require ongoing maintenance will pay less for the product if they think the company will go bankrupt. With the company no longer in business, the customers will have to find other maintenance options that will invariably be more expensive. Titman argues that in order to avoid a price reduction in the firm's products, the firm must not take on more debt than the liquidation value of the firm minus the costs imposed on customers if they had to maintain the product on their own. In addition, Titman says the company should issue preferred shares for the customer cost differential. Issuing preferred shares for the remainder of the value serves two purposes. First, it maximizes the firm's debt using an instrument that can't force the company into bankruptcy. Secondly, by

maximizing the firm's debt with this type of instrument, it prevents the firm from borrowing more callable debt that could prematurely force them into bankruptcy. Prematurely means before the value of the company is below its liquidation value minus the somewhat hidden cost to the customer. One can view the customer cost as a hidden debt. By using a combination of debt and preferred shares in the capital structure while the firm is doing well, prevents the firm from making a decision later (i.e. take on more debt) that would reduce the value of the product to the customer. The agency aspect of Titman's theory is the firm taking on more debt at a later point when it is not in either the firm's or customer's interest. The firm in taking on Titman's proposed capital structure would prevent this from occurring.

In a subsequent empirical paper, Titman found partial support for this application of agency theory in that firms that produced "unique" products had lower leverage (Titman & Wessels, 1988). Unique was proxied as R&D and selling expenses as well as quit rates for the industry. The assumption is that unique products are not interchangeable and that customers would incur higher costs if the firm went out of business.

2.3.1.2 Static Trade-off Theory

Static trade-off theory is a refinement of the capital structure theory proposed by MM. Static trade-off theory has the firm balancing its debt and equity in order to maximize firm value (Myers, 1984). Where MM predict that a firm should be funded by almost 100% debt, static trade-off recognizes the increasing risk of bankruptcy (financial distress) as the percentage of debt increases. Beyond a certain level of debt, the value of a firm will not continue to increase but will decrease due to the increased risk of bankruptcy. In order for firms to realize increased value from holding debt, they must

have taxable income. Therefore firms will only borrow to the point that the interest payments are not more than their taxable income. Note that even firms generating large cash flows might not need to borrow money because other deductions reduce their taxable income such as capital cost allowances and loss carry forwards.

2.3.1.3 Pecking Order and Modified Pecking Order Theory

The pecking order theory of capital structure doesn't have the firm trying to optimize its value based on achieving an optimal balance between debt and equity but rather the firm chooses its financing options in a preferential order based on cost (Myers, 1984). As previously mentioned in the introduction, firms have three basic sources of finance: internal (retained earnings), debt and equity. The cost to the firm of each of these sources is not the same. Retained earnings are the least expensive since they are generally priced at the risk free rate though others argue they should be priced the same as equity since it is owned by the equity holders. Debt costs more than retained earnings since a premium above the risk free rate is added by the lender to account for the risk of default. Equity is generally the most expensive form of finance since it cannot petition a firm into bankruptcy and its claims on the assets of the firm come after that of the secured creditors such as debt holders. Therefore according to the pecking order firms will finance projects first using retained earnings, then debt and equity last. A firm's capital structure will be an outcome of the number of projects it has invested in and how often it has needed to fund these projects using external funds.

Myers (1984), citing that the empirical evidence does a poor job of supporting either static trade-off theory or pecking order theory, created the modified pecking order theory. Neither static trade-off nor pecking order theory adequately explains why so little equity

is actually issued. For example, "(e)xternal financing in most years covers less than 20 percent of real investment, and most of that financing is debt." (Myers, 2001, p. 82) Myers goes on to state that "(n)et stock issues are frequently *negative*" (ibid, p. 82). This reluctance to issue equity has been attributed to the cost of equity to the firm due to asymmetric information (Myers & Majluf, 1984).

Asymmetric information theory is based on the difference in the information known to the managers of the firm and the investors. When a firm issues equity, buyers of the equity do not know if the firm is issuing equity because the managers think the equity is overvalued or that they truly have a positive net present value (NPV) project. This difference in knowledge between the managers of the firm and potential equity buyers is known as information asymmetry. Information asymmetry theory predicts that the stock price will fall when a firm announces that it will issue equity. Myers and Majluf (1984) cite evidence to support this. Given that the stock price is reduced on equity issue, this results in a decrease in value for existing shareholders. This value reduction provides further disincentive for firms to issue equity as a source of finance unless the NPV of the project is very high. For this reason, modified pecking order theory argues that firms are even less likely to issue equity to fund positive-NPV projects when outside financing is required. Furthermore, in certain cases where the NPV is not sufficient to make up for the anticipated stock price decrease and debt is not an option, the authors argue that the company may not undertake the NPV positive project.

The difference between the modified pecking order theory and the static trade-off theory is that a firm's capital structure is driven by its need for financing to fund positive-NPV projects rather than balancing debt and equity to maximize firm value. Myers points

out that "an unusually profitable firm" with few growth prospects will have a "low debt ratio compared to its industry's average, *and it won't do much of anything about it.*" (Myers, 1984, p. 589, italics in original text) The point Myers is making is that capital structure is a natural outcome of the firm's business history rather than actively managed to hit a specific target that static trade-off predicts. Modified pecking order differs from pecking order in that firms, due to asymmetric information, may not issue stock for positive-NPV projects when they don't have sufficient retained earnings and debt is not available. Furthermore, companies will manage their retained earnings, dividend payments, and borrowing such that they will retain financial slack so they don't have "the dilemma of either passing by positive-NPV projects or issuing stock at a price they think is too low." (ibid, p. 589)

2.3.1.4 Free Cash Flow Theory

In response to the leveraged buyouts and debt equity swaps which were occurring in the early 1980s, Jensen (1986) proposed the free cash flow theory of corporate finance. Free cash flow theory is a natural extension of agency theory. The theory applies to firms that are generating large cash flows without enough positive net present value projects to invest in (i.e. low growth prospects). According to agency theory the tendency of corporate managers is to continue to invest in projects even when they may be negative net present value rather than disgorging the profits to the shareholders. By keeping the money in the firm, the managers continue to grow the firm, albeit at a capital inefficient rate. The managers want to grow the firm in order to increase their status and perquisites contrary to the interests of the shareholders. In order to restrict the manager from taking on negative net present value projects, companies highly leverage themselves using the

cash to buy back stock. With the high leverage, the company is then forced to use its free cash flow to make debt payments rather than taking on inefficient projects. Besides solving agency problems, Jensen states that the free cash flow theory also explains how debt substitutes for dividends (debt payments rather the dividend payments) and can force companies to become more efficient. Efficiency improvement is required when the level of debt is such that the existing level of cash flow isn't sufficient to cover the debt payments. The firm must improve efficiency in order to increase its cash flow to meet its debt payments.

2.3.1.5 Growth and Capital Structure

Myers (1977) developed theory which predicted that the amount of debt which a firm has in its capital structure is inversely related to the proportion of its value attributed to future growth opportunities. Therefore, as the number and value of future growth opportunities increases for a company, the percentage of debt which it has in its capital structure will decrease. Myers likened future growth opportunities to call options with the future growth opportunities requiring future investments in order to be realized. The future investments will only be made if the return is sufficient to cover the initial investment and make the payment on the debt. Without debt, the required return is simply a positive NPV on the investment. The obligation to make debt payments may result in cases where the firm with debt won't make the required investment while the pure equity firm will. For this reason a firm with growth opportunities that has debt in its capital structure will be valued less than a pure equity firm since its future growth call options will be valued less due to the requirement to make debt payments. Myers proposes that growth firms use more short-term debt which needs to be rolled-over providing a

frequent assessment of the firm by outside parties that will ensure the firm invests appropriately in its growth opportunities.

Another theoretical argument in favour of reduced debt for growth firms is the limitation in the amount of interest that can be written off against earnings for growth firms. Growth can be due to increased sales and/or the result of inflation. Ross et al. (2003) show that a firm whose earnings before interest and taxes (EBIT) is growing at 5% per year with a 50% tax rate and 10% interest rate, will only need to borrow 50% of its value to have zero taxable income. Borrowing more than this will reduce the firm's value. Therefore the higher the growth rate for a firm, the lower its leverage will be since additional debt will reduce overall firm value.

In summary, a firm's growth rate provides an upper limit on the amount of leverage that is beneficial to it and the nature of growth opportunities as future call options reduces this natural leverage limit further still. So from a theoretically perspective, growth reduces the amount of leverage that a firm will have.

2.3.1.6 Bankruptcy and Capital Structure

One of the theories for why firms do not hold as much debt as MM's theory predicts is that the cost of bankruptcy (if the firm actually enters bankruptcy) is a large percentage of the firm's value (Miller, 1977). Bankruptcy costs reduce the amount a firm can borrow since these costs have to be accounted for by the equity. Though this is true for individual bankruptcies which have averaged 20% of realizations (Baxter, 1967), this isn't the case for large corporations where costs have been found to be only 5% at time of filing (firm value when it entered bankruptcy) and 1% if measured 7 years before filing (Warner,

1977). So bankruptcy costs are a factor in reducing SME leverage but are not a significant influence on leverage for large companies.

2.3.2 Differences between SME and Large Firm Finance

When investigating the finance characteristics of firms, it is important to understand that there are fundamental differences between SMEs and large firms. Even for publicly traded firms there are differences between the larger and smaller ones. Since much of the academic finance literature is based on large publicly traded companies, it is necessary to keep these differences in mind when considering their findings. An example of a finance difference between SMEs and large firms is the difference in bankruptcy costs. Large publicly traded firms have lower bankruptcy costs than small owner operated firms as was described in the previous section. The availability of a publicly traded bond market is an example of a difference between large and small publicly traded companies. Large publicly traded companies have their bonds rated by bond rating agencies enabling access to this type of funds. Small publicly traded firms do not have a large enough value of debt such that it is not worth the bond rating agency's time to rate them. Therefore, smaller publicly traded firms have to rely on other sources of debt and can't use internal and external sources of funds interchangeably (Fazzari, Hubbard, & Petersen, 1988). Furthermore, firms which have bond ratings and therefore access to this market have been found to have 35% higher leverage ratios as a result (Faulkender & Petersen, 2006). Given the difficulty of small firms obtaining external funds, it comes as no surprise that their growth is constrained by their internal finance (i.e. retained earnings) (Carpenter & Petersen, 2002; Myers, 2001). This difficulty in obtaining external funds is the probable cause of Brav's (2009) finding that the leverage of private firms with 50 or more

employees (therefore medium sized firms) were much more sensitive to the firms' performance (cash flow) than publicly traded firms (-0.368 for private firms versus -0.2 for public – OLS regression coefficients).

Small firms are also known as owner/operator firms since the owner is often the operator of the company as opposed to companies where the management team is not the majority owner. For this reason, when investigating small firm finance the balance sheet cannot be read like that of a publicly traded company. One has to consider both the assets and lifestyle of the owner (Levin & Travis, 1987). A number of researchers have investigated the different considerations and factors that affect the capital structures of SMEs (Ang, 1991; Brav, 2009; Hughes, 1994; Levin & Travis, 1987; Robb & Robinson, 2008; D. Walker, 1989; E. Walker & Petty, 1978). These researchers have found that for SMEs: high retained earnings may just be a way to avoid personal taxes; high expenses might be a way to distribute wealth to the family; when new, their primary source of capital is the owner's personal savings, borrowing from friends, family and local banks, and sweat equity in the form of unpaid overtime and reduced pay; when they are older (reasonably successful since they have survived) they have established track records and more assets in place to obtain greater outside capital; limited liability is reduced even if the SME is incorporated due to banks requiring personal collateral; SMEs face higher financing costs due to information opaqueness/asymmetry and ownership concentration; the tax advantage of debt isn't really applicable due to reduced taxes for SMEs below specific income levels ($500,000 in most provinces); short-term debt (trade credit and bank loans) are used proportionally more (64% of debt versus 37% for publicly traded (Brav, 2009)) and long-term liabilities proportionally less than for large companies

(SMEs have limited access to long-term debt); and debt is preferred over equity since equity would result in some loss of control which contributes to SMEs having higher leverage (33.7% versus 22.7% for publicly traded firms (Brav, 2009)).

One method which researchers have used to analyse the differences between SMEs and large firms is comparing the capital structures of companies before and after they have gone public (Brav, 2009; Van Auken & Holman, 1995). One change that comes with going public is the firm has to adopt more rigorous accounting and financial practices. No longer can the owner/operator manage the finances of the company as a personal bank. What do companies do with the new funds that are raised by the initial public offering (IPO)? Brav (2009) found that on average, leverage decreased from 30% to 21% when a firm went public. Therefore, IPO funds are used to reduce debt. Interestingly, even though leverage decreases when a firm goes public, its relative ranking with respect to other firms' leverages remains unchanged (Lemmon, Roberts, & Zender, 2008). Therefore, a firm that ranks in the top quartile for leverage remains in the top quartile for leverage when compared to public firms. So firms reduce their leverage on going public but their relative leverage ratio rankings remain the same. This tendency of firms to have a set leverage over long durations is known as persistence in capital structure. This persistence has been interpreted as support for the static trade-off theory of capital structure (Hovakimian, Opler, & Titman, 2001), but its time-invariant nature is inconsistent with the static trade-off theory which suggests the target leverage should vary with the fortunes of the firm (Lemmon et al., 2008).

In summary of this subsection, the most important points to keep in mind when investigating the differences between SME and large firm finance are that an SME's

balance sheet is subject to much more variability depending on the owner/operator's lifestyle and objectives and that SMEs have less access to long term capital be it share capital or long-term debt.

2.3.3 Factors Affecting Firm Finance

As described in the previous section, there are a large number of personal considerations of the owner/operator that need to be taken into account when modeling an SME's capital structure. With this in mind, one could argue the best model of an SMEs capital structure would be a unique utility function tailored to the specific SME, its owner and his or her objectives (Myers, 2001). Given the untenable nature of this as a general solution, this section presents the factors that empirical research has shown to influence a firm's leverage in general. Leverage is a proxy for how a firm is financed, whether it is through debt or share capital/retained earnings. Subsequently these factors will be used to create a model of firm finance that will no doubt be constrained by the aforementioned caveats.

2.3.3.1 Growth and Finance

From a theoretical perspective, as already discussed in section 2.3.1.5 Growth and Capital Structure, growth is predicted to have a negative influence on leverage. From an empirical perspective, numerous research papers were found that investigated the relationship between growth (either past or anticipation for the future) as an independent variable and a firm's leverage as the dependent variable (Baldwin et al., 1994; Baldwin et al., 2002; Beck et al., 2008; Brav, 2009; Faulkender & Petersen, 2006; Frank & Goyal, 2009; Gellatly, Riding, & Thornhill, 2003; Lemmon et al., 2008; Rajan & Zingales, 1995; Titman & Wessels, 1988; Van der Wijst, 1989). When reading this extensive empirical

literature, it is important to be aware of the context each is working within. The papers are subtly different from each other in the measures they use for leverage and growth and the type of firms considered.

The majority of the papers were investigating publicly traded firms while a few considered only SMEs while still others considered both types of firms. For those papers that investigated publicly traded firms, some used market value for leverage, some used book value and others used both. Market value of leverage divides the total liabilities by the market value of shareholder equity plus total liabilities rather than the book value of shareholder equity (i.e. from the balance sheet) plus total liabilities. Some papers, rather than investigating the relationship between growth and leverage, considered the effect which growth had on long-term and short-term debt. These papers were investigating Myers (1977) effect that growth would reduce long-term debt and increase short-term debt. The most common growth predictor used by papers investigating publicly traded firms was market-to-book ratio. Market-to-book ratio is considered a measure of future growth opportunities. If the market believes that the firm has plenty of opportunities for future growth, its market value will be higher than its book value in anticipation of this future growth. Therefore the higher the market-to-book ratio the better the firm's growth opportunities are considered to be. Growth measures for previous firm performance were either growth in assets or sales. Duration for these past growth measures varied from one to three years.

Needless to say, market-to-book ratio was only used in those papers that investigated publicly traded firms. In all cases market-to-book ratio was a negative predictor of market value leverage (Faulkender & Petersen, 2006; Frank & Goyal, 2009; Lemmon et al.,

2008; Rajan & Zingales, 1995). With regards to book leverage, two found market-to-book to be a negative predictor (Lemmon et al., 2008; Rajan & Zingales, 1995) and one found it to be positive (Frank & Goyal, 2009). This difference is due to the time periods which the papers considered. Frank and Goyal used data from 1950 through 2003 for their overall positive result. When they broke it down into different decades, 1970 through 1999 market-to-book was a negative predictor. Interestingly, their largest and most significant positive effect was in the 2000 to 2003 period. Was this an early indication of the looming financial crisis that would later hit the U.S.? Has the predictor returned to a negative value subsequent to 2008? Lemmon et al. used data spanning 1965 through 2003 and Rajan and Zingales used data from 1991.

When using past growth history as a predictor for leverage in public companies, one paper using yearly change in assets as the predictor found it to be a negative predictor for both market and book leverage (Frank & Goyal, 2009) and another paper (Brav, 2009) using yearly change in sales found it not to be a significant predictor of book leverage (data from 1993 to 2003).

Three papers were found that had investigated the effects of growth (past and expected) on leverage (book by definition) for SMEs. In two studies investigating SMEs that had survived 10 years in Canada, those expecting to grow had greater leverage (Baldwin et al., 2002; Gellatly et al., 2003) while past growth history did not have a significant effect. The average firm size was well below 10 employees for these studies. In contrast to this, a study of private firms with 50 employees or more in the United Kingdom found sales growth was a significant positive predictor of leverage (Brav, 2009). Brav's significant finding could be a result of the size of firms being considered.

Small firms start out with as much debt that both the firm and the lenders are comfortable with. After a certain size (perhaps greater than 50 employees), a firm may be able to start taking on proportionally more debt in order to support growth assuming the risk of the increased debt is mitigated due to their larger size. Note that private firms don't have access to equity markets. Another possible factor for the increasing debt with growth rate is that lending institutions might be more willing to lend to them due to a combination of their size and successful growth record.

In a study of leverage spanning SMEs from multiple countries, no significant relationship was found between sales growth and leverage (Beck et al., 2008). Given the considerable differences in the regulatory situation between countries and their different stages of economic development, it does not come as a surprise that a relationship between leverage and growth was not found that spanned all countries. Differences in capital structure between countries is discussed in section 2.3.3.11 Finance and Country Specific Considerations.

Of the three papers that considered the effect of growth on long-term debt, one used asset growth, publicly traded companies in the U.S.A., and long-term debt scaled by book value of equity (Titman & Wessels, 1988) and the other two used sales growth, one investigating SMEs in the Netherlands and Germany (Van der Wijst, 1989) and SMEs in Canada (Baldwin et al., 1994). Sales growth was found to be a negative predictor of long-term debt for the European SMEs and a positive predictor for Canadian SMEs. Assets growth was a positive predictor of long-term debt for the publicly traded firms. Comparing these results is difficult because their samples were substantially different.

To summarize the findings of the above papers: market anticipated growth and actual growth are predominantly a negative predictor of leverage (book and market) for public companies; owner anticipated growth is a positive predictor of leverage for SMEs in Canada; and past sales growth is not a significant predictor of leverage for a representative sample of Canadian SMEs (overwhelmingly less than 10 employees) but was a positive predictor for medium size and larger (greater than 50 employees) private firms in the U.K. So high growth public firms have less leverage while private firms 50 employees and larger that are growing quickly have greater leverage probably due to their lack of access to equity markets.

2.3.3.2 Innovation and Finance

There is considerable evidence to support the proposition that innovation is financed with funds other than debt since unsuccessful innovation has limited residual value. Limited residual value combined with the inherent risk of achieving a successful innovation requires that equity be used since the upside benefit of a successful innovation will accrue to the equity holders. For debt holders there is considerable downside risk with minimal upside benefit. It is no surprise then that researchers universally have found a negative relationship when regressing debt on innovation (Baldwin et al., 2002; Bradley, Jarrell, & Kim, 1984; Faulkender & Petersen, 2006; Gellatly et al., 2003; Hall, 2002; Hovakimian et al., 2001; O'Brien, 2003; O'Brien, 2003; Titman & Wessels, 1988). This negative relationship appears to be robust to the different proxies used for both leverage and innovation. This negative relationship has been found in SMEs and large publicly traded firms alike and independent of whether book or market value leverage was used. Furthermore, the negative relationship of leverage on innovation was found

when using different measures of innovation such as straight R&D/sales, R&D/sales relative to industry means or ranked within an industry, and as a percentage of total investment in R&D.

2.3.3.3 Tangible Assets and Finance

Numerous academic papers have found the ratio of tangible assets to be a positive predictor of a firm's leverage (Brav, 2009; Faulkender & Petersen, 2006; Hovakimian et al., 2001; Lemmon et al., 2008; Myers, 1984; O'Brien, 2003; Rajan & Zingales, 1995). This makes intuitive sense since those firms that have tangible assets (buildings, land, equipment, etc.) can borrow money using the tangible assets as collateral. Those firms specializing in R&D have the bulk of their value in patents which may or may not have tangible value. Any work in progress for an R&D firm is unlikely to be of much worth.

2.3.3.4 Earnings Volatility and Finance

Earnings volatility is an inverse predictor of a firm's leverage as documented by the research literature (Bradley et al., 1984; Faulkender & Petersen, 2006; Lemmon et al., 2008; O'Brien, 2003; Rajan & Zingales, 1995; Titman & Wessels, 1988). This literature has used only publicly traded firms but the theory applies equally to SMEs (E. Walker & Petty, 1978). A firm must have enough revenue to cover its interest expenses and if this revenue is always fluctuating it will limit the amount that it can borrow.

2.3.3.5 Cash flow and Finance

In contrast to the positive relationship between cash flow/profitability and growth described earlier, researchers have found a negative relationship between cash flow and leverage for publicly traded firms (Beck et al., 2008; Brav, 2009; Faulkender & Petersen, 2006; Hovakimian et al., 2001; O'Brien, 2003; Rajan & Zingales, 1995; Titman &

Wessels, 1988). One paper was found that investigated the relationship between profitability (return on assets) and leverage for both publicly traded and private firms. Again, profitability was a negative predictor of leverage for both private and public firms (Brav, 2009). The negative relationship between leverage and cash flow/profitability can be attributed to firms using cash flow to pay down debt or simply the accumulation of retained earnings passively moving the leverage ratio lower (ibid). This ubiquitous finding of cash flow as a negative predictor of leverage does not support the static trade-off theory of capital structure. Static trade-off theory predicts profitability should not affect leverage since the firm should (all else equal) retain the same leverage in order to maximize its value by achieving the maximum interest tax relief. Cash flow as a negative predictor of leverage is more in keeping with the pecking order theory of capital structure.

2.3.3.6 Size and Finance

Like the relationship between growth and leverage many researchers have investigated the effect size has on leverage. (Baldwin et al., 2002; Brav, 2009; Faulkender & Petersen, 2006; Frank & Goyal, 2009; Hovakimian et al., 2001; Lemmon et al., 2008; O'Brien, 2003; Rajan & Zingales, 1995; Titman & Wessels, 1988). Also in keeping with the previously discussed growth/leverage relationship, it is important to be aware of the proxies that are used for size. Size is most commonly measured using the natural logarithm (log) of the firm's book assets but is also measured using the log of the market value of the firm's assets, log of sales or the number of employees untransformed or log. Leverage is commonly book and/or market leverage but can also be the proportion of long- or short-term debt as well.

Researchers investigating publicly traded firms, including firms whether they had debt or not, using either book or market leverage and log total assets as the proxy for size have found a positive relationship between leverage and size (Brav, 2009; Frank & Goyal, 2009; Hovakimian et al., 2001; O'Brien, 2003). The reasoning given for this result is that a firm is able to take on more debt as it becomes larger due to the risk and cost of bankruptcy decreasing. There was a notable exception to log assets as a positive predictor of leverage for public firms. This exception was Faulkender and Petersen (2006) when they only included firms which had debt and used log market value of assets. The other researchers had included firms with and without debt. When only firms with debt were included, log market assets became a negative predictor of leverage. When they reran the regression including firms without debt as well, log assets became a positive predictor. Faulkender and Petersen (2006, p. 60) point out that "conditional on having some debt, larger firms are less levered."

When looking at the literature using log sales as a proxy for size, the findings were mixed. Two papers found log sales to be a positive predictor of both book and market leverage (Lemmon et al., 2008; Rajan & Zingales, 1995) while one paper found it to be negative (Titman & Wessels, 1988). Though Rajan and Zingales (1995) found log sales to be a positive predictor of leverage in most countries (United States, Japan, United Kingdom, Canada), they did find it to be a negative predictor in Germany and not significant in either France or Italy. Titman and Wessels (1988) finding of a negative relationship for both long-term and short-term debt using book leverage could be a result of their methodology. They were using structural equation modeling (SEM) and their indicators for size were the natural logarithm of sales and quit rates. Quit rate is a unique

proxy for size. Furthermore, they separated leverage into long- and short-term debt divided by book value of assets rather than combining them into one value for leverage. Nevertheless, their latent variable size was a negative predictor for both. Their paper was in the early days of SEM and no model fit indicators were provided.

Only two papers were found that investigated the size/leverage relationship for SMEs (Baldwin et al., 2002; Brav, 2009). Brav's (2009) sample included private firms of 50 employees and higher (therefore medium sized) and found log book assets to be a positive predictor of book leverage. Baldwin et al. (2002) using number of employees for size and a representative, weighted sample of Canadian SMEs found size to be a negative though not significant predictor of leverage. The average size of firm in the Baldwin et al. study was considerably smaller than the Brav study with 75% of the firms having less than 10 employees. This difference in firm size might explain the different results more than the use of different proxies.

So in summary, the findings for the size/leverage relationship vary depending on the proxies and methodology used. Log assets are a positive predictor of leverage in public firms and medium sized private firms when firms with and without debt are included. Log assets are a negative predictor of public firms when only those firms with debt are considered. Log sales also appear to be a positive predictor of leverage for public firms with the findings of Titman and Wessels (1988) notwithstanding. Lastly, only one paper used employees as a size proxy for truly small SMEs and this was found to be a not significant negative predictor of leverage. It appears that the effect that size has on leverage varies as the firm becomes larger, possibly switching from negative to positive.

2.3.3.7 Age and Finance

When considering the age and leverage relationship, an intuitive argument can be made that older firms may have more leverage since older firms have an established track record that they can use when obtaining capital (assuming the track record is positive). This also makes sense from a static trade-off theory perspective since the firm will want to maximize its value by minimizing its taxes. A counter argument can be made that older firms may have less leverage since they have many years to establish a financial base and pay off debt. This logic follows the pecking order theory of capital structure. This logic implies that the younger firms have more debt since they don't have the retained earnings to operate the business and will need to borrow and failing that, issue equity. The research literature supports this latter logic. For both publicly traded firms and SMEs, researchers have found that age is a negative predictor of both book and market leverage. (Brav, 2009; Faulkender & Petersen, 2006; Van Auken & Doran, 1989). In other words, younger firms have more debt and that it decreases as they get older. It appears that firms go into debt when they first start out and as their revenues and cash flow increase they use the excess cash to reduce debt which in turn reduces their risk of bankruptcy. Paying down debt can also occur when the company doesn't have any available NPV projects to invest in.

2.3.3.8 Export and Finance

Researchers have also found a positive relationship between exporting and leverage (Beck et al., 2008). Specifically, "(e)xporters use more external finance, especially bank, lease, and trade finance." (ibid, p. 479) This relationship between export and leverage makes sense when one considers that in general more resources (production expansion,

time, travel, lengthened sales and payment cycles) are required to export. If a firm has the resources to export, it most likely is an indication that the firm is successful and can handle a higher leverage and the interest and principal payments that come with it.

2.3.3.9 Financial Constraint and Finance

For the relationship between financial constraint and leverage, intuition would suggest that the more financially constrained a firm is the greater its leverage. Financial constraint in this situation is measured by being turned down for a loan request (see Freel (2007) and Angelini and Generale (2008)). The assumption here is that a firm that has been turned down for a loan is already at or above a level of debt which the lending institutions consider safe. Clearly the level of debt which institutions consider safe varies based on the type of business the firm is undertaking (e.g. firms based on innovation support less debt than those with many fixed assets –see discussion above on leverage and innovation). It is assumed that a firm which has been turned down for a loan is financially constrained because it has been unable to obtain funds which it was seeking. From a cost of capital viewpoint, the least expensive capital is retained earnings followed by debt and last equity. If the modified pecking order theory holds, equity is a distant third (Myers, 1984) and it is difficult to obtain especially for SMEs. Since the firm is attempting to obtain further debt, the assumption is that retained earnings have been used and that it is not simply a case of the firm trying to apply the static trade-off theory. If the firm had liquid or semi-liquid assets that it could pledge as collateral (which would be the case for applying static trade-off theory), it is unlikely that it would have been turned down for a loan. Given that retained earnings are not available, the next cheapest (and least effort to obtain) form of capital for a firm is debt so long as it hasn't already reached

its borrowing limit. Therefore a firm that has been turned down for a loan is in all likelihood financially constrained and has probably reached its maximum borrowing capacity making financially constrained a positive predictor of leverage. This intuitive reasoning is borne out by the empirical research. Beck et al. (2008, p. 479) found that "as firms use more external finance, they tend to face greater financing constraints" except when it is equity finance. Angelini and Generale (2008) have also obtained similar results using both loan turndown as a financial constraint in addition to the ratio of financial expenses divided by financial expense plus profits and the ratio of fixed assets to total assets.

2.3.3.10 Government Financial Support and Finance

Surprisingly, very little research was found that investigated the effects of government financial support on leverage. Riding et al. (2007) found that 75% of the loans made under the Canadian Small Business Financing (CSBF) program were to companies that would otherwise not have received a loan. Yet their research didn't investigate if this government support affected the firms' growth, leverage, or innovation. One could extrapolate that since the majority of these firms wouldn't have received money without CSBF, their leverage could possibly be higher in comparison to those firms with similar characteristics that didn't receive CSBF money. Beck et al. (2008) found that firms receiving government support (subsidies from national or local government) had a higher proportion of external finance due to proportionally more development bank and lease financing. It appears that if a firm has received some form of support from the government, other government agencies (development banks) are more

likely to loan it money. When considering the findings of the two sets of researchers, a positive relationship between government financial support and leverage seems plausible.

2.3.3.11 Finance and Country Specific Considerations

Though the context of this research is Canadian SMEs, it is important to point out that country specific differences need to be considered when investigating leverage of firms from different countries. Berger and Udell (2006) provide a thorough review of the factors that need to be considered when comparing SME finance for different countries. They divide the country considerations into three main categories: lending technologies, financial institution structure, and lending infrastructure. Lending technologies are: financial statement lending, credit scoring, asset-based lending, factoring, fixed-asset lending, leasing, relationship lending, and trade credit. Financial institution structure is: large versus small institutions, foreign versus domestic, state versus private, and market competition. Lending infrastructure is: information environment, legal/judicial/bankruptcy environment, social environment, and the tax and regulatory environment. Berger and Udell use asset-based lending as an illustrative example of the differences in lending infrastructures even amongst first world countries. Asset-based lending is lending based on the value of a particular asset (accounts receivable, inventory, equipment, etc.) and not the credit worthiness of the borrower. It requires the most sophisticated lending infrastructure to track the asset value on an ongoing basis, even daily in some cases. Asset-based lending is only available in four countries (United States, Canada, U.K. and Australia). As an example of the importance of asset-based lending in the countries that do have it, in the United Sates it provides one third of the commercial and industrial loans ($300 billion out of $900 billion).

Rajan and Zingales (1995) investigated the capital structure effects which a country's tax and bankruptcy laws had on the leverage of the country's firms when compared to other countries. Specifically, they argue that the bankruptcy laws in the U.K. and Germany favour the creditors more than other countries which explains why the leverage in these two countries are much lower than in the U.S., Canada, Japan, France or Italy.

A follow-on effect of a country's financial infrastructure affecting a company's capital structure is that those companies that require large amounts of external capital grow faster in countries with greater financial development (Rajan & Zingales, 1998). Rajan and Zingales (1998) used pharmaceutical and plastic companies as examples of companies requiring developed financial markets and pottery and leather as examples of those that don't. Controlling for a wide variety of different possible causes, they found that drug and plastic companies grew faster in those countries with developed financial markets while pottery and leather companies grew faster in countries with less developed financial markets.

Beck through a series of papers and a number of different coauthors investigated the factors that differentiated the financing of SMEs between countries (Beck, Demirgüç-Kunt, Laeven, & Levine, 2005; Beck, Demirgüç-Kunt, Laeven, & Maksimovic, 2006; see Beck & Demirgüç-Kunt, 2006; Beck et al., 2008). The presence of property rights was found to be the most important factor in the financing of SMEs. This makes intuitive sense since in order to have collateral for loans as well as reaping the benefits of one's effort, clear ownership of the results needs to be in place. In countries that don't have a developed financial infrastructure, the authors found that older, larger and foreign owned firms did not face the same obstacles in obtaining financing.

2.4 Firm Innovation

The importance of innovation as a positive correlate of growth was described above (see section 2.2.2.2 Innovation and Growth). Repeating from above, if a firm wants to survive, it must differentiate itself from the businesses it is competing with. In order to do this it must offer something that sets it apart from the rest. This is achieved by having an innovative product or process. Note that a service is considered a type of product. Even in the situation when a firm is competing based on price, it must have innovative processes in order that it can produce the product more efficiently than its competitors. This is the intuitive argument for why firms innovate. The next subsection presents the theories of firm innovation that were found in the academic literature. Following this, a brief review of the risks and benefits of innovation to the firm is presented. The third subsection discusses the literature that has considered the different ways of measuring innovation (input, outputs and orientation) and their respective efficacy. The final subsection of this innovation literature review presents the factors which have been shown to affect a firm's level of innovation.

2.4.1 Theory of Firm Innovation

A review of the literature determined five theories for why firms do or do not innovate. These are: as a strategy; in response to adversity; the firm has available slack (either financial or human resource); as a natural outcome of the product life cycle (PLC); and reduced innovation due to fear of appropriation. Each of these theories will be considered in turn.

2.4.1.1 Innovation as Strategy Theory

The theory that companies pursue innovation as a strategy has as its premise that a company differentiates itself from its competitors on the basis of its innovative abilities. Companies pursuing this strategy spend proportionally more on innovating activities than their competitors in the same industry (O'Brien, 2003). By focusing on innovation (investment in R&D), these companies hope to create innovative products, processes, and/or services that will allow them to achieve higher profits and growth than the firms that they compete with. O'Brien's (2003) research supports this theory. He points out that even though "annual R&D expenditures averaged less than 2 percent of sales" for the publicly traded firms in his sample, it remains "a significant predictor of leverage even after the firm's tangible assets ratio has been controlled for" (ibid, p 419). In general, the more a firm innovates the fewer tangible assets it has. For an innovating firm, its innovations and its ability to create innovations are its assets. While tangible assets can be used as collateral for debt, innovations before they are productized are intangible such that their monetary value is difficult to realize. Following this logic, one would think that tangible assets alone would be a significant predictor of leverage. As O'Brien points out, R&D must be a proxy for more than just a firm's intangible assets by its significance in predicting reduced leverage. Furthermore, the effect of innovation on leverage is reduced when it is less specific (more general applicability) and less opaque (understood by more people) (Vicente-Lorente, 2001). In effect, the innovation becomes more tangible. Numerous researchers report this negative relationship between innovation and leverage (Baldwin et al., 2002; Gellatly et al., 2003; Hovakimian et al., 2001; Myers, 1984; Titman & Wessels, 1988).

Given that a firm which invests more in R&D has reduced leverage when compared to another firm, ceteris paribus, what is causing this? O'Brien (2003) suggests that it is due to an explicit strategy by these firms to have available financial slack. For R&D to be effective, it requires ongoing constant investment (Coad & Rao, 2010; Dierickx & Cool, 1989; Hall, 2002; Wolff, 2007). These researchers point out that research is not something that can be started and stopped without disproportional delays occurring. Also it takes time to find, hire, and train employees, further increasing the lag between starting or increasing research and outputs occurring. Consistent with this lag, research has determined that R&D acts as if it has a high cost of adjustment which indicates a reluctance of firms to reduce R&D spending when sales decrease (Coad & Rao, 2010; Hall, 2002) and during economic downturns, investment in innovation remains more or less constant (Huergo & Jaumandreu, 2004). Therefore companies pursuing innovation need to retain financial resources (in the form of financial slack) in order to prevent a reduction in research due to financial shortfall. Financial shortfall can be due to either a recession or an unsuccessful set of innovation attempts. To avoid potential research debilitating financial shortfalls, it has been suggested that innovating firms use hedging strategies to manage financial risk (Froot, Scharfstein, & Stein, 1993).

Another possible explanation for reduced leverage due to R&D could be a result of the inherent risk involved in innovation. A firm pursuing innovation compared to a similar firm that isn't, has a higher risk of insolvency because of the real possibility that the innovation will not succeed. Lenders would account for this risk by increasing the cost of capital thereby reducing the value of the firm's assets which would in turn reduce the amount it could borrow. This is supported by Hall (2002) when he found that

liquidation costs and R&D expenditure were positively related and by Freel (2007) when he found that innovating SMEs received less credit approval. In addition, Hall (2002) found that debt funded firms that pursued R&D grew slower than similar equity funded firms. The implication being that the debt funded firms were unable to take on the equivalent number of risky projects that could have resulted in higher growth.

No matter if an innovating firm's leverage is reduced due to increased risk, a requirement for increased financial slack or more likely a combination of both these reasons, a firm pursuing a strategy of innovation is funded proportionally more by equity (either share capital or retained earnings) than by debt when compared to a firm that innovates less.

2.4.1.2 Innovation as a Response to Adversity Theory

An early theory for why firms innovated was that firms innovate in order to survive an adverse situation (O'Brien, 2003). The idea is that necessity is what drives innovation. Hence the expression "necessity is the mother of invention". One example of adversity can be when a firm has reduced revenue due to a competitor undercutting its prices because the competitor has more efficient production processes. Another adverse situation can occur when the firm encounters a problem in its daily operation that needs to be solved before production can continue. According to the adversity theory of innovation, innovation is only undertaken when an adverse situation is encountered and not before. The theory doesn't take into account innovations such as to increase profits by increasing efficiency or to expand business opportunities by creating new products. According to O'Brien (2003, p. 419), there has been a "lack of empirical support for the theory".

2.4.1.3 Innovation due to Available Slack Theory

Another theory cited by O'Brien (2003) is that innovation is due to available slack in the firm. The premise of the theory is that a firm will innovate if it has the available time and/or financial slack to fund innovating activities. As opposed to the previous theory which had the firm only innovating if the firm had an issue which it had to solve, this theory has the firm innovating only if it has nothing else to do with its time and/or money, like reducing debt or paying out dividends. This is somewhat like innovation as an afterthought rather than something purposeful. On the surface it fits the stylized fact that innovation is a negative predictor of leverage, but implicit in the argument is that the firm is using the financial slack to fund innovation. If this was the case, the firm wouldn't have the financial slack. The theory also doesn't predict the firm will invest consistently in innovating activities which is necessary to be successful (Coad & Rao, 2010; Hall, 2002). The firm will only invest in those years where it has the extra money. No doubt some firms might follow this ad hoc method of investing in innovation but based on the findings from the empirical literature it is unlikely to be a successful strategy.

2.4.1.4 Innovation as a Natural Outcome of the PLC Theory

Klepper (1996) presents an overview of innovation as a result of product life cycle (PLC). PLC is the stages an industry for a particular product goes through from birth to maturity. It looks at the entry, exit, and growth of firms from the time a new product is first introduced to its maturity or end of life. Commensurate with a product's life cycle is the frequency and types of innovation which occur within the industry. It should be noted that the PLC theory of innovation is only applicable to technological progressive industries. Past and present examples of these industries are telecommunications, light

bulbs, computers, televisions, integrated circuits, software, automobiles, and aircraft. PLC theory taps into the two previously described growth theories of stages of growth and population ecology (Utterback & Suárez, 1993). The relationship to stages of growth theory is readily apparent since both have the concept of a linear progression from birth to maturity and decline (or commoditization in the case of some products e.g. light bulbs). The population ecology connection stems from PLC theory's explanation of innovation rates that are dependent on the initial size and volume of market entrants (i.e. the initial market structure) (ibid).

PLC explains six stylized facts of industry evolution, three of which are related to innovation. The six stylized facts are: the number of entrants for a new industry after peaking declines over time; the total number of firms after peaking also declines over time though total production continues to increase; market share amongst the leaders stabilizes over time; product variety and major innovations also peak and decline over time; process innovation takes over from product innovation over time; and new entrants dominate in the number of innovations created (Klepper, 1996).

Klepper (1996, p. 563) proposes that firms "have different capabilities that lead them to pursue different types of product innovations" and early entrants to a field are motivated to perform process innovation due to the advantage they gain by the cost advantages they achieve which "eventually causes a cessation in entry and a shakeout in the number of producers". The implicit assumption here is that the lead product and process innovators will survive the shakeout process. Klepper further states that the reduction in the number of competitors results in fewer product innovations as process innovations (cost reduction) start to dominate. Klepper (1996, p. 581) allows for

randomness in the model such that "later entrants may leapfrog over the industry leaders and the firms that eventually dominate the industry may not come from the earliest cohort of entrants." PLC explains why as products mature, large firms tend to dominate the innovation process since they have the scale of production to benefit from process innovations.

PLC innovation theory differs from the previously described innovation theories (strategy, response to adversity, available slack) in that it looks at innovation from a product industry as a whole rather than from an individual firm's perspective. It is my belief that the theories need not be mutually exclusive. Intuitively it makes sense that the potential for and type of innovation depends on which life cycle stage a product is at and within this context a company which is pursuing innovation as a strategy is devoting more resources to innovation than its peers.

2.4.1.5 Innovation Reduction due to Fear of Appropriation Theory

Hall (2002) lists benefit appropriation by other firms as an economic theory for why firms will be reluctant to innovate. Hall (2002, p. 35) states: "(t)o the extent that knowledge cannot be kept secret, the returns to the investment in it cannot be appropriated by the firm undertaking the investment, and therefore such firms will be reluctant to invest, leading to the under-provision of R&D investment in the economy." Not all innovations can be adequately protected by patents. From personal experience of working with venture capitalists (VCs), one of the first questions that they ask about a potential investment is how difficult the product idea will be to duplicate (also known as the barrier to entry). Even though the idea may be unique and profitable if pursued, a VC doesn't want to be in a market that will quickly have many competitors. Hall (2002, p.

36) cites evidence that even though the cost of imitating an invention is "as much as 50-75 per cent of the cost of the original invention" it still does "not eliminate the under-investment problem." Furthermore Hall states that given the positive benefits which innovation creates for the economy and to ameliorate these innovation disincentives, governments create various R&D incentives such as tax breaks (e.g. SRED in Canada) and research funding that can be applied for (e.g. IRAP in Canada).

2.4.2 The Risks and Benefits of Innovation to the Firm

Though successful innovation has its obvious benefits with regards to increased firm growth, it also has other benefits as well as some significant risks. Researchers have investigated both the benefits and risks to firms undertaking innovation. Each will be discussed in turn.

Two additional firm specific benefits of successful innovation have been cited by the literature: increased external absorptive capacity which leads to greater flexibility and adaptability (Freel, 2000); and increased productivity (Van Beveren & Vandenbussche, 2010).

The obvious risk of attempting to innovate is being unsuccessful. "Innovation is a task fraught with high failure rates" (Rosenbusch et al., 2011, p. 442). A firm invests its financial resources in R&D with the plan to achieve an innovative product or process that will generate a return on its investment. If no innovation is obtained, the invested funds are lost. This is less of a risk for large firms which typically have multiple R&D projects that spread out the risk. On the other hand, small firms generally have limited resources to absorb a failed innovation project which can lead to their demise. Firms new to

innovation face the additional risks of lack of experience as well as a lack of organizational innovative capabilities which both increase failure rates (ibid).

2.4.3 Measuring Innovation

How does one effectively measure innovation? This is a question that has been investigated by numerous researchers. An innovation measure can be of two basic types: either input or output. As the names imply, an innovation input measure is one that uses the inputs into creating innovation such as dollars spent while an innovation output measure uses outputs such as innovative products or processes. In the academic literature a variety of innovation input measures have been used. Some examples are the amount of money invested in R&D, the number of employees involved in R&D, a dummy variable if the firm invests in R&D, innovation orientation, or the number employees in the firm with engineering or scientific backgrounds. Continuous measures such as R&D spending and number of employees can be either scaled (i.e. divided by total sales in the case of R&D or divided by total employees for number of technical employees) or used without being scaled. Innovation output measures that have been used are the actual number of innovations (process or product) that the company creates, a dummy variable for if the company has created an innovative product or process, the percentage of new products (products introduced in the past three to five years) in the total product mix, and the percentage of sales derived from new products.

Patents have also been used as a measure of innovation output but their utility has been questioned for several different reasons. One issue with patents is that even though they are an output of R&D, they behave more like an input since they increase "proportionately with firm size" (Acs & Audretsch, 1991, p. 41). Another issue with

patents is that the likelihood to patent varies considerably industry to industry and the probability that patents "result in innovations also varies across both industries and firm size" (ibid, p. 41). Research from the SME manufacturing sector by Baldwin, Hanel and Sabourin (2002) also questions the usefulness of patents as a measure of innovation. In their research they found that having patents was a weak negative predictor for producing an innovative product or process. For these reasons, patents are not recommended as a measure of innovation.

Given that patents are not a recommended measure of innovation, what has the extant academic literature found with regards to the other input and output measures that were listed above? What are the relationships between the various input and output measures? Does it matter which one is used? Acs and Audretsch (1988) in their landmark paper investigating innovation in large and small firms also compared the correlations between various input and output measures of innovation. A portion of their correlation table is reproduced in Table 1 below. Innovations were the number of innovations and company R&D expenditures was the absolute value (i.e. not scaled). Notice that the correlations between patents and either innovations or R&D expenditures is less than the correlation between innovations and R&D expenditures which adds further evidence to the weakness of patents as a measure of innovation. Also note that the correlations between innovations and R&D expenditures (input and output measures) are all above 0.67. The authors go on to report that the correlation between R&D investment and innovation drops off considerably for small firms (less than 500 employees) when considering either high-innovative industries (at least 15 innovations) or low-innovative industries (less than 7 innovations, correlation less than 0.070). So when using R&D as a measure of

innovation, it is necessary to be cognisant of the size of the firms under investigation and the industry level of innovation.

	Total Innovations	Large-Firm Innovations	Small-Firm Innovations	Company R&D Expenditures
Large-Firm Innovation	0.920	-	-	-
Small-Firm Innovation	0.922	0.698	-	-
Company R&D Expenditure	0.746	0.737	0.672	-
Patents	0.467	0.482	0.382	0.440

Table 1: Correlation Matrix of Input and Output Measures of Innovative Activity[2]

For a different perspective, a partial table showing the correlations between dummy variables is shown in Table 2 below. This table was reproduced from a paper by Van Beveren and Vandenbussche (2010). It was based on 189 Belgium firms with the R&D and innovation data coming from the year 2000. Acs and Audretsch's (1988) R&D data was from 1977, the innovation data was from 1982, and involved a much larger number of firms (over 8000 innovations in total). Notice that the correlations were higher when using actual number of innovations and R&D investment than dummy variables. Although the data sets were from different countries, time periods and one was much larger than the other, the higher correlations for the actual values make sense intuitively. Actual values contain more information which should result in more representative correlations.

	Internal R&D	Product innovation dummy
Product innovation dummy	0.5176	-
Process innovation dummy	0.4805	0.4428

Table 2: Correlations of Innovation dummy measures[3]

[2] From Acs and Audretsch (1988)
[3] From Van Beveren & Vandenbussche (2010)

Another consideration when choosing an innovation measure requires knowing how it is going to be used within the theoretical model. As described previously, there is a delay between when a firm invests in R&D and this R&D investment resulting in sales revenue. Acs and Audretsch (1988) report that the innovations for their study (new products or processes introduced in 1982) were the result of inventions made in 1978. In order to create the invention in 1978, they used the assumption this was a result of R&D investment made in 1977. So they used a 5-year lag between R&D investment and revenue resulting from that investment and achieved moderate effect sizes in their regression. In a study of the effects of growth rates in employment, sales, profits, and R&D on each other, Coad and Rao (2010) found that the effect R&D growth has on sales becomes more significant when the lag is increased from one to two years (first lag becomes insignificant), but in both cases the effect size is quite small which appears to support the requirement for a longer lag. They point out that "this is no doubt due to the uneven returns from R&D and also the long time lag required for a commercially valuable discovery to finally materialize in terms of growth of sales" (ibid, p. 133).

An issue specific to measuring SME innovation is that of underreporting. This applies to the situation when using an SME's R&D expenditure as a measure of innovation. Unlike large firms which have dedicated departments for R&D, employees working for an SME invariably perform multiple roles such that the portion of their salary that they dedicate to innovative activities is unlikely to be included as an R&D expenditure (Hansen, 1992). Hansen (1992) cites research that had found numerous innovating SMEs using individual firm survey techniques that had not been captured by R&D information filed with the government.

In concluding this section on innovation measurement, a result of an innovation and performance relationship meta-analysis is highlighted. Of all the various measures of innovation, which has the largest effect on firm performance? Rosenbusch et al. (2011) performed a meta-analysis of 42 innovation and firm performance papers spanning from 1990 to 2009. They found that innovation orientation had the greatest effect followed by output measures followed by input measures. It is interesting that innovation orientation, an organization culture measure, is the strongest predictor of performance. This finding might be a result of the inherent difficulty in accurately measuring either inputs or outputs. Measuring the culture as it turns out is the most effective even though it isn't an absolute measure. Though innovation orientation appears to be the most effective for measuring firm performance, it doesn't necessarily follow that it is the best measure for other concepts such as exporting. Investigating the effectiveness of innovation orientation as a predictor of other concepts would be a future research opportunity.

2.4.4 Factors Affecting Firm Innovation

Besides the types of innovation measures that are used, it is also necessary to control for a number of other factors which are known to affect the rate of innovation. These are the firm's growth rate, leverage, intention to grow, cash flow/profitability, size, age, export behaviour, financial constraint, government financial support, and the type of industry the firm is in. Each of these factors will be discussed in turn in the following sub-sections.

2.4.4.1 Growth and Innovation

In the academic literature, the most common assertion is that innovation causes growth but some researchers question this causal connection since the research is often

cross-sectional (Dobbs & Hamilton, 2007). Without lags between either of the two concepts they question whether "innovators were more likely to grow, or if growing firms were more likely to innovate" (ibid, p. 314). With this in mind, several papers were found that investigated the influence of growth on innovation: one using a cross-sectional study and three other ones which used lags. In all cases, the findings were that growth was a positive influence on innovation. The cross-sectional study is presented first followed by the three studies that used lagged growth measures in their innovation regressions.

In their study of the financing of innovation in new small firms, Baldwin, Gellatly and Gaudreault (2002) performed a cross-sectional probit regression with innovating (binary output measure) as the dependent variable. The SMEs surveyed for the research were born between 1983 and 1986 and were still in operation in 1996. They found that the probability of innovating was greater for faster-growing firms (those above the weighted sample median) as well as for firms that rated R&D capability very important or crucial (four or five on a five point Likert scale) as compared to slower growing firms (growth rate below the median) and firms which didn't rate R&D capability as important.

The three studies that used lagged values for growth in their innovation regressions covered three different time periods, two different countries and their samples varied among SMEs and private and publicly traded companies. Furthermore their measures of innovation and time lags were different. Each will be discussed in turn followed by a discussion which puts their findings in a broader context.

Coad and Rao (2010) used a vector autoregression (VAR) model for publicly traded US firms from 1973 to 2004. They used both one- and two-year lags for logged sales growth as a predictor of logged R&D growth (innovation input measure). They found

sales growth to be a positive predictor of R&D growth. Finding that R&D grows with sales is consistent with the generalization that companies invest in R&D as a percentage of sales.

Audretsch (1995a) used OLS to estimate a regression of US firms (public and private) with the number of innovations divided by employees in 1982 as the dependent variable and the growth rate from 1974-1975 as one of the predictors. Audretsch didn't find a significant relationship for either high-tech or low-tech industries as a whole but did find that the two low-tech industries of food and beverage and oil exhibited a significant positive relationship. Expecting a one year growth rate to significantly change the innovation rate for a firm seven years later without accounting for firm growth over a longer time period seems unlikely. The fact he found it for two specific industries could have just been spurious. As an interesting side note, another predictor in his regression was R&D/sales in 1975 and this was found to be a significant positive predictor of innovation rate for low-tech but not for high-tech firms. This finding does have an intuitive explanation. For low tech companies, whom don't spend much on R&D, increasing their R&D expenditure would in all likelihood have a noticeable effect. In addition, it is probably a signal that they have some new process or product ideas that they think are worth investigating. For high-tech firms as a group, they already spend a high proportion of sales on R&D and one firm increasing their spending is unlikely to have the same effect size due to the already competitive innovative environment and the law of diminishing returns.

Bhattachary and Bloch (2004) used a TOBIT regression with innovation as a dependent dummy variable from 1997/1998 and the growth rate from 1994/1995. Like

Audretsch (1995a), they found that growth rate didn't have an effect on future innovation. Like Audretsch (1995a), they also had R&D intensity as an additional predictor and opposite to Audretsch (1995a), they found R&D intensity to be significant positive predictor for the full sample and high-tech firms but not for low-tech firms. This difference could be attributed to their use of an innovation dummy rather than an innovation rate. Each measure could possibly be more effective depending on the particular sample's likelihood of innovating.

In summary, when looking at the effect which growth rate has on innovation, the findings are mixed. The findings appear to be dependent on the measures and the methodology used. Cross-sectional analysis using an innovation output measure found a positive relationship as did using a 2-year lag with an innovation input measure. Two other lag studies (3 and 7 year) using two different output measures didn't find a relationship. Maybe in order to observe a growth effect on innovation requires a shorter lag between the two or requires growth to be measured over a longer time period or maybe there isn't a relationship.

2.4.4.2 Finance and Innovation

As described above, innovation has been shown to be a negative predictor of leverage (leverage is a proxy for firm finance) since innovation is an intangible resource that has limited residual value if unsuccessful. Innovation's negative influence is compounded by its inherent risk. In addition to innovation being a negative predictor of leverage, researchers have hypothesized the existence of a simultaneous relationship in the opposite direction (leverage to innovation) that together form a two-way relationship (O'Brien, 2003). Baldwin et al. (2002) found one (negative in both directions) when

investigating innovation and finance in new small firms. These researchers make the case that a company can't change its innovation strategy without changing its financing. The two decisions have to be made in concert.

2.4.4.3 Intention to Grow and Innovation

If innovation is a positive predictor of growth (see section 2.2.2.2 Innovation and Growth on page 21) and intention to grow is also a positive predictor of growth (see section 2.2.2.3 Intention to Grow and Growth on page 25), one would think that intention to grow would be a positive predictor of innovation since innovating would be a method used to achieve the desired growth. This is the intuitive argument in support of intention to grow as a positive predictor of innovation.

In a search of the literature, only one paper was found that included both innovation and intention to grow in the same study (Stam & Wennberg, 2009). Unfortunately this study used these two measures as predictors for employment growth rather than one for the other. Nevertheless, its findings are insightful. The study's sample was Dutch firms that were created in 1994 and were surveyed every two years until 2000. The researchers' primary innovation measure was a dummy variable set to one if a firm performed research and development activities (innovation input measure). Their growth measure was the firm's growth rate over the six year study period. Growth ambition was a dummy variable representing if the firm wanted to expand the number of employees over the next two to three years. For the full sample they found that growth ambition was a significant positive predictor of growth while their R&D activity dummy variable was not. When they only considered the top 10% growth firms, R&D activity became significantly positive but growth ambition was insignificant and negative. It appears that the firms that

had the highest employment growth did not start their businesses intending to grow employment. Would this result for growth ambition have been different if the researchers had considered sales growth instead of employment growth? Are the fastest employment growing firms actually firms that want sales growth and employment growth is an unintended by-product? When the researchers only consider high-tech firms, the results are the same as for the high growth decile such that R&D activities is a significant positive predictor and growth ambition is not significant. For the low-tech cohort, only growth ambition was significant (positive).

Extrapolating the findings from this one paper to predict the innovation/growth ambition interaction, it appears that for growth ambition to be a significant predictor of innovation it might have to be measured as sales growth rather than employment growth and the relationship might only exist for high-tech firms and the highest decile growth firms.

2.4.4.4 Cash flow and Innovation

Several researchers have investigated the relationship between cash flow/profitability and innovation and all have found that cash flow is a positive predictor of innovation (Audretsch, 1995a; Bhattacharya & Bloch, 2004; Brown, Fazzari, & Petersen, 2009; Hall, 2002). Hall (2002, p. 41) makes the point "that positive cash flow may be more important for R&D than for ordinary investment." This stems from R&D requiring risk capital which means shareholder equity rather than debt. It is much easier for a firm to use retained earnings if they are available than going out and selling share equity.

Though researchers have found that cash flow is a positive predictor of innovation, there have been some contradictory findings on which industries exhibit this effect.

Bhattacharya and Bloch (2004) using two-year lags between profitability (1995) and innovations (1997) for Australian firms found that profitability was a positive predictor of innovation for low tech firms but not for high tech firms. Audretsch (1995a), using US firm innovations from 1982 and profitability from 1975 (7 year lag) found the opposite, with high-tech profitability being a positive predictor and low-tech not. Audretsch (1995a) used innovation rate (continuous variable) and OLS while Bhattacharya and Bloch (2004) used a dummy variable for innovation and probit analysis. While Bhattacharya and Bloch (2004) listed what categories their high-tech firms came from, Audretsch (1995a) only listed a few. One definite inconsistency was that Audretsch (1995a) considered oil low-tech while Bhattacharya and Bloch (2004) considered oil high-tech. Given the different time periods, countries, firm classifications, methodologies and variable definitions, it is difficult to reconcile the differences between the two studies other than to say profitability appears to have a positive effect on innovation in general but its effect on specific industries grouped on technological sophistication (low- or high-tech) is unclear.

2.4.4.5 Size and Innovation

For the relationship between size and innovation, Schumpeter (1954) thought that large firms with their access to more resources would be able to innovate more effectively than smaller firms and would in the end control innovation. This is not how it has turned out. Even though large firms may be able to invest more (i.e. apply more inputs in the terms of absolute dollars into R&D) than small firms, Kirchhoff (1994) and Kenney (1986) have found that it is the small firms that are more effective at productizing the innovations. For the US manufacturing industry it was found that small

firms (fewer than 500 employees) were 43% more innovative (innovations/employee) that large firms (Acs & Audretsch, 1988). If considering only highly innovative manufacturing industries, "the ratio of the innovations-per-employee is 6.64 times greater for small firms than for larger firms" (ibid, p. 681).

When reviewing the academic literature that has investigated the relationship between size and innovation, it is necessary to distinguish between the studies that have used innovation input measures (e.g. R&D investment) versus innovation output measures (e.g. actual innovations) so that the results being compared are compatible. Researchers have investigated the relationship between size and both types of innovation measures.

From an innovation output viewpoint, Huergo and Jaumandreu (2004) in their study of Spanish manufacturing firms with more than 10 employees found that the probability of introducing an innovation (process or product) increased with the size of the firm. Since the study didn't track the number of innovations per firm, the result is somewhat misleading. One would expect larger firms to produce more innovations in absolute terms based purely on the fact that they employ more people! Using a similar methodology Bhattacharya and Bloch (2004) found a similar result. A more comparative perspective is provided by Acs and Audretsch (1991). Their data set was based on a *Business Week* sample of over 700 corporations that excluded small enterprises but did include a number of firms with fewer than 500 employees. They were analysing the efficiency in converting innovation inputs into outputs. Innovation outputs for their research were the number of documented profitable innovations a firm produced. Though they did find that larger firms produced more innovations, they also found that the number of innovations produced by firms were a decreasing quadratic function of size. In other words, as firms

increased in size they produced more innovations but the rate at which they were creating them was slowing. The same result was obtained when either firm size (employees or sales) or total R&D investment was used as the predictor variable. There is a decrease in innovation creation efficiency as a firm gets larger and/or the R&D investment is increased. This same decrease in innovation output as a firm got older was obtained by Hansen (1992). Using either the number of new products released in the previous five years scaled by firm sales or the percentage of sales revenue resulting from these new products, he found that both decreased as the firm aged.

Several papers were found that had investigated the effect which size has on innovation input. Audretsch (1995a, p. 580) cites research which found "that beyond a minimum size larger firms devote a smaller percentage of their sales to R&D than do smaller firms." This is not to be confused with the stylized fact that for those firms which invest in R&D increase their spending such that it is a fixed percentage of their total sales (Acs & Audretsch, 1991; Coad & Rao, 2010). So even though firms spend a fixed percentage of sales on R&D, this fixed percentage is lower for firms beyond a minimum size. Coad and Rao (2010) in their panel vector autoregression study of publicly traded US manufacturing firms found that larger firms invest proportionally less in R&D than smaller firms. A similar result was found in a study of growing SMEs with less than 500 employees by Baldwin, Rafiquzzaman and Chandler (1994). Firms with sales of less than one million dollars spent on average 11.9% of sales on R&D while the average for all firms was 3.1%. These findings have intuitive appeal since new firms may invest a high proportion (based on sales or assets) in innovation in order to differentiate themselves in the market when they first start and as their sales increase this investment may fall

proportionally if not in absolute terms. This is the same intuitive argument made above with regards to the size and growth relationship.

So when considering both input and output measures of innovation, innovation decreases as firms grow.

2.4.4.6 Age and Innovation

With regards to age as a predictor of innovation, several papers present evidence that this is an inverse relationship. Klepper (1996, p. 565) states as a stylized fact citing several studies that in an industry that is growing in the total number of firms, "the most recent entrants account for a disproportionate share of product innovations". This implies that innovation decreases with the age of the firm. Consistent with this, Hansen (1992) in a study of public and private American businesses found that the proportion of sales derived from new products (products introduced in the previous five years) decreased with the age of the firms. Huergo and Jaumamdreu (2004) using a semiparametric estimation technique found that the probability of creating a process or product innovation was a non-linear function of age for Spanish manufacturing firms. For their data, using a standard linear estimation did not result in a significant finding. The non-linear function had innovation decreasing as a function of age until a firm was approximately 20 years old where it would then start to increase back to initial levels. Their results seem to indicate that a firm can last for upwards of 20 years on the basis of its initial innovations but that to survive past this point it needs to start innovating again. Overall these findings are in line with the discussion above regarding the predicted relationship between size and innovation. The argument was made above that the proportion of money invested in innovation was likely to decrease as the firm grows. If

innovation does decrease as a firm gets larger and there is a correlation between size and age, there is most likely a negative relationship between age and innovation as well.

2.4.4.7 Export and Innovation

Successful exporting is also an indicator of a firm that innovates. In order to export to the markets of the world, firms must compete against a broader range of competitors. In order to be a successful exporter the firm has to be innovative in its product offering otherwise it would be unable to compete (McMahon, 2000; Van Beveren & Vandenbussche, 2010). Accordingly, researchers have found a positive relationship between exporting and innovation (Baldwin et al., 2002; Bhattacharya & Bloch, 2004; McMahon, 2000; Van Beveren & Vandenbussche, 2010).

Van Beveren and Vandenbussche (2010) investigated the causal relationship between export and innovation in order to determine if innovation caused exporting. Their study looked at Belgium firms' innovations (process and product) from 2000 to see if they would lead to the start of exporting in 2004. In their probit analysis when they didn't treat innovation as endogenous to exporting, they found that a firm creating both a product and process innovation (not product or process alone) in 2000 was significant in predicting the start of exporting in 2004. Interestingly, when they treated innovation as endogenous to exporting and re-estimated the equation using 2SLS, the significance of either form of innovation in predicting exporting disappeared. This finding lead the authors to conclude that innovation in itself doesn't lead to exporting but rather "only firms with a sufficiently high probability to start exporting will engage in product and process innovation prior to their entry into the export market, pointing to the importance of *self-selection into innovation activities*." (ibid, p. 18)

An indication of a possible endogenous relationship between export and innovation was also found by Baldwin et al. (2002). In their analysis of firm R&D and capital structure, they found that exporting as a significant predictor of R&D spending disappeared when they treated R&D and capital structure as mutually endogenous. There were a couple of important differences between the two studies that should be noted. The Baldwin et al. (2002) study was cross-sectional (all variables were measured contemporaneously) and export was used as an instrumental variable (IV) for R&D when capital structure was the dependent variable. Nevertheless, the results of both Baldwin et al. (2002) and Van Beveren and Vandenbussch (2010) seem to point to some sort of endogenous interaction occurring between export and innovation.

2.4.4.8 Financial Constraint and Innovation

In considering the relationship between financial constraint and innovation, one would think that financial constraint is a positive predictor of innovation. As mentioned previously, innovation is generally funded by equity and not credit which reduces this source of financing for firms that innovate. So it is hypothesized that innovation and financial constraint increase together.

Freel (2007) investigated the relationship between a variety of innovation measures (both input and output) and financial constraint. Financial constraint was defined as the percentage of a loan request that was approved, with 0% representing that the loan was turned down and 100% for when the full requested amount was approved. Input innovation measures that were used were the proportion of technical staff and R&D investment divided by sales. The innovation output measures were: a dummy variable each for a novel or incremental product innovation; a dummy variable each for a novel or

incremental process innovation; and one each for the proportion of sales and profits resulting from new products or processes introduced in the previous three years. Using a best fit model, Freel found that some innovation input and output measures were significant negative predictors of the percentage of loan requests that were approved. The significant innovation measures were: for input - R&D investment divided by sales greater than 10%; and for output - novel product innovation and new products/processes constituting greater than 20% of sales or profits. The one exception to this negative relationship between financial constraint and innovation was a significant positive relationship when new processes/products make up between one and five percent of sales.

Though Freel investigated the relationship of innovation on financial constraint, the same relationship is likely to exist when the directional relationship is reversed. Therefore, financial constraint is predicted to be a positive predictor of innovation for those firms which invest heavily in R&D (greater than 10% of sales) or for which new products/processes make up over 20% of sales. In all likelihood, these two groups are probably one and the same though Freel didn't report on this.

2.4.4.9 Government Financial Support and Innovation

No papers were found that had explored the relationship between government financial support and innovation. One paper was found that had used a sample of companies that had received IRAP funding (Tanev, 2004). This paper investigated how the type of company and the intelligence information that it used to make decisions about innovation affected the company's innovation performance. This is different than determining the effects which government financial support has on innovation. This lack

of research into the relationship between government financial support and innovation is surprising considering the effort which governments go to in order to support innovation. Within the Canadian context, two innovation financial support programs are IRAP that exists to fund innovation and SRED which offers firms tax credits for money spent on research. IRAP is a matched funding program specifically targeted at firms with 500 or less full time employees (Government of Canada, 2011). The SRED tax credit as the name implies is a tax credit where the firm has to track and document its spending on research and development in order to receive the tax credit. While a program like IRAP specifically targets SMEs, SRED is a tax credit that applies to all firms and requires the firm to carefully track their research time and expenditures. This has been shown to underestimate the true amount of R&D carried out by SMEs (Hansen, 1992) indicating that SMEs are unlikely to make full use of programs like this.

Even, without knowing the complete suite of Canadian government financial support programs that are in place besides IRAP and SRED, it would still be informative to see if government financial support does increase innovation. One would hope that it does since innovation has been shown to increase growth which is one of the government's objectives.

2.4.4.10 Industry Type and Innovation

The level of innovation is not static across industries. Research has found that the amount of innovation varies from industry to industry due to a number of industry specific factors (Acs & Audretsch, 1988; Huergo & Jaumandreu, 2004; O'Brien, 2003; Wolff, 2007). Acs and Audretsch (1988) found that industry concentration and unions (percentage of employees belonging to a union) are a negative influence on innovation.

Industry concentration is the percentage of total sales contributed by the four largest firms. Therefore the amount of innovation an industry creates decreases as the market share of the four largest firms increase. It is unclear if this is due to either large firms stifling creativity or high industry concentrations occurring in mature industries where there is less opportunity to innovate. Besides the negative influences, the authors found that large-firm employment share (employment accounted for by firms with more than 500 employees), skilled labour (percentage of total employment), and industry size (value-of-shipment for the industry) were all positive predictors of innovation.

Huergo and Jaumandreu (2004) found that the probability of a process and product innovation varies from industry to industry. For example, their results show that the transport equipment industry has an approximate 30% probability of a product innovation while for the paper and printing industry it is only 16%. They found a similar difference for the probability of process innovation with transport equipment having a 52% probability and paper and printing approximately 38%. Furthermore the graphs of the probability of either type of innovation based on age of firm for each industry are noticeably different as well.

In a study of innovation, growth and survival, Audretsch (1995b) reports additional industry to industry differences based on innovation. He found new entrants have lower odds of surviving in highly innovative industries, yet if they do manage to survive, they grow faster and they have a greater likelihood of surviving. From the same study Audretsch reports that in some industries small firms have the innovative advantage while in others it is the large firms. Furthermore, in the industries where the small firms have the innovative advantage, the entry rate for small firms is higher.

Further evidence of industry differences with regards to innovation is cited by Wolff (2007, p. 7) where he writes that when investigating the relationship between R&D and growth "one would not expect to find any relationship for many sectors where R&D is far from being the major investment and something other than new products is usually driving sales growth (such as capex or marketing spend)."

In order to control for the differences in innovation between industries, researchers have commonly used industry dummy variables in their regressions (e.g. Huergo & Jaumandreu (2004), Van Beveren & Vandenbussche (2010)). A novel approach to control for the varying effect which innovation has based on industry was used by O'Brien (2003). O'Brien percentile ranks each firm's (or each business segment if different industries) R&D intensity (R&D spending divided by sales) by the firm's 3-digit SIC (Standard Industrial Classification) code. Performing a percentile rank of relative R&D spending within an industry, enables a comparative analysis of the effects which innovation has for all industries. The underlying assumption for this to be effective is the effects of innovation intensity are comparable when scaled relative to each particular industry. O'Brien's research found this to be the case.

2.5 Research Gaps

The preceding literature review was divided into three distinct sections: growth, finance, and innovation. This division is not an artefact of this paper but is found throughout the academic literature. Researchers investigating each of these areas focus on their particular theoretical construct of interest (growth, finance, or innovation) using it as the dependent variable in any statistical analysis that they perform. On occasion researchers investigating one of these concepts may use one of the other two concepts as

a predictor, but rarely is the directional relationship between the two concepts considered. No literature was found that considered the directional relationship between all three. This gap in the literature applies not only to SMEs but to publicly traded firms as well, though the focus of this thesis remains SMEs. So the primary gap in the literature is investigating the simultaneous directional relationship between growth, finance, and innovation for SMEs. Given that there has been no published academic literature investigating the directional relationship between these three concepts, any research based on this directional relationship would be novel and therefore fill a gap in the literature. For this thesis it was decided to focus on how the directional relationship between these three concepts changes between different groups of SMEs. The groups are differentiated base on their growth rate, export orientation, innovation, use of government financing, expressed financial constraint (loan turn down), and size.

3.0 Research Premise

3.1 Introduction

This study investigated the interactions of growth, finance, and innovation for Canadian SMEs. As mentioned earlier, up until now there has been no published research which has investigated the relationship between growth, finance, and innovation treating them as mutually dependent endogenous variables. This apparent gap in the literature could be due to several reasons. One might be a product of the way research fields are organized. Research has a tendency to be siloed such that a researcher stays within his or her domain, be it firm finance, firm growth or innovation. A researcher typically has the concept from their domain as the dependent variable and the concepts from the other domains as the independents. The researcher is trying to explain the behaviour in their

domain from their contextual viewpoint. The researcher is likely not considering all three domains simultaneously. This three domain simultaneous consideration adds a layer of complexity and requires multi-domain knowledge that a researcher may not have. Another possible reason for this gap in the research is that to investigate the endogenous interrelationship between three concepts simultaneously requires statistical methods other than standard regression using ordinary least square (OLS). Researchers might not know or be aware of statistical methods that are capable of solving problems of this type. Lastly, the lack of an SME data set that has sufficient observations and suitable measures has no doubt hindered the research in this area. In all likelihood, the gap is probably due to combination of all three reasons.

In the preceding literature review, it was shown that a number of academic papers have investigated the relationship between growth and innovation, growth and finance, and finance and innovation. In considering this literature in its totality, it leaves the reader with the impression that there is a more complex relationship among these variables that has not been investigated. This section takes the literature from each of these three separate areas and uses it to develop a conceptual model that incorporates the three fundamental variables (growth, finance, innovation) into a model where each variable is both dependent and endogenous to the other. This model is then used to develop the research objectives and testable hypotheses for this thesis.

The remainder of this chapter is divided into three sections. The next section presents the conceptual model that has been developed as a result of the literature survey. This is followed by the research objectives and then the final section which presents the research hypotheses.

3.2 Conceptual Model for Growth, Finance, and Innovation

Growth, finance and innovation are three different theoretical concepts, each with its own underlying theory as detailed in the literature review. Within this literature, some authors have recognized the possibility of reciprocal relationships between some of these variables. O'Brien (2003, p. 429) states "it is highly likely that there is a dynamic relationship between strategy and capital structure, such that each affects the other." O'Brien in his paper was investigating innovation as a strategy.

Baldwin et al. (2002) recognized the possibility of a two-way relationship between finance and innovation and used two-staged least squares (2SLS) to estimate the relationship. The proposition of reciprocal relationships has been found in other areas of finance as well. Kochhar and Hitt (1998, p. 601) "found a reciprocal relationship between a firm's financial strategy and its corporate diversification strategy." Therefore, reciprocal relationships involving finance are not new. The idea of reciprocal relationships between growth, finance, and innovation was applied in the development of the conceptual model proposed for this research. The model is shown in Figure 1 on page 98. Following the figure, Table 3 provides a linkage between the studies cited in the literature review of chapter 2 and the predicted sign of the links between variables. In the table, finance has been replaced by its proxy leverage in order give context to the prediction.

The RBV theory of firm growth is reflected by the correlates of growth that are shown in the model. Financing (cash flow, equity or borrowing) enables a firm to fund its growth. Innovation allows a firm to create unique product offerings. A firm's competencies, as shown in the model, are also resources. Myers' (1977) growth theory is represented in the model by having growth with an inverse relationship with finance when controlling for factors such as tangible assets, earnings volatility, cash flow etc. Innovation as a firm's strategy (O'Brien, 2003) is represented in the model by a negative bidirectional connection between innovation and finance.

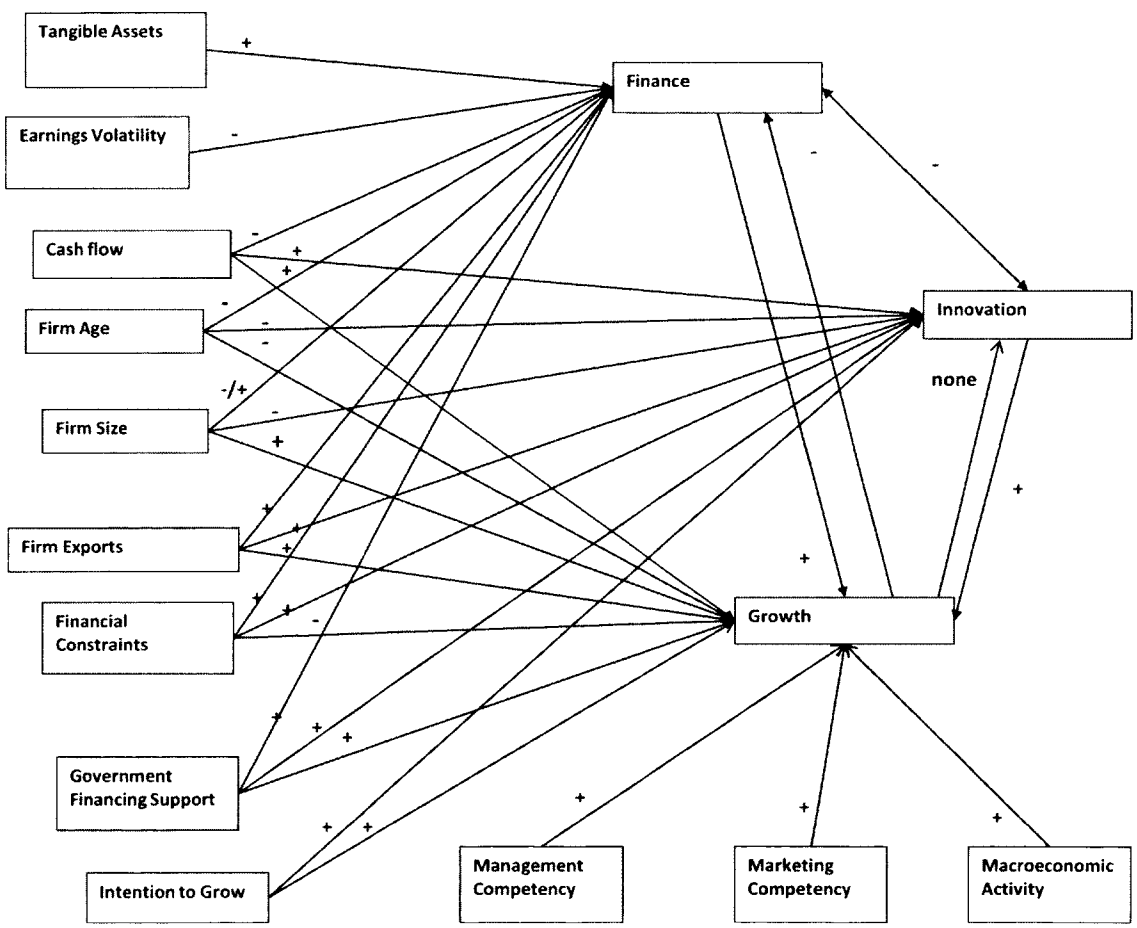


Figure 1: Conceptual Model of Growth, Finance, and Innovation

Dependent Variable	Independent Variable	Literature supporting relationship
Leverage	Growth rate	Public companies – negative -(Lemmon et al., 2008;Rajan&Zingales, 1995) SMEs – indeterminate – (Baldwin et al., 2003; Brav, 2009)
Growth rate	Leverage	SMEs – positive not significant – (Becchetti & Trovato, 2002) Public companies - no evidence
Leverage	Innovation	SMEs and public companies – negative – (Baldwin et al., 2002; Hovakimian et al., 2001; etc)
Innovation	Leverage	SMEs and public companies – negative – (O'Brien, 2003; Baldwin et al., 2002)
Growth	Innovation	SMEs– positive– (Rosenbusch et al., 2011; Johnson et al., 1997)
Innovation	Growth	SMEs– none – (Audretsch, 1995a; Bhattachary & Bloch, 2004)
Leverage	Tangible assets	SMEs and public companies – positive – (Brav, 2009; Lemmon et al., 2008)
	Earnings volatility	Public companies theory and empirically – negative - (Bradley et al., 1984; Titman & Wessels, 1988) SMEs theory only – negative – (E. Walker & Petty, 1978)
	Cash flow	SMEs and public companies – negative – (Brav, 2009; Faulkender & Petersen, 2006)
	Firm age	SMEs and public companies – negative – (Brav, 2009; Faulkender & Petersen)
	Firm size	Size as # of employee – positive for firm with more than 50 employees (Brav, 2009) and not significant when including all firm sizes (Baldwin et al., 2002)
	Firm exports	SMEs – positive – (Beck et al., 2008)
	Financial constraints	SMEs – positive (Angelini & Generale, 2008; Beck et al., 2008)
	Government support	SMEs – positive – (Beck et al., 2008)
Growth	Cash flow	SMEs and public firms – positive – (Angelini & Generale, 2008; Myers, 2001)
	Firm age	SMEs – negative – (Freel & Robson, 2004; Angelini & Generale, 2008)
	Firm size	SMEs – positive – (Haltiwanger et al., 2010; Dixon & Rolin, forthcoming)
	Firm exports	SMEs – positive – (Becchetti & Trovato, 2002;McMahon, 2000)

Dependent Variable	Independent Variable	Literature supporting relationship
	Financial Constraints	SMEs – negative – (Angelini & Generale, 2008; Becchetti & Trovato, 2002)
	Government Support	SMEs – positive – (Becchetti & Trovato, 2002)
	Intention to grow	SMEs – positive – (Oser & Riding, 2002; Delmar & Wiklund, 2008)
	Management Comp.	SMEs – positive – (Lohmann,1998; Orser & Riding, 2003)
	Marketing Comp.	SMEs – positive – (Johnson et al., 1997; Baldwin et al., 1997)
	Macroeconomic	SMEs – positive – (Baldwin et al., 2000; Lohmann, 1998)
Innovation	Cash flow	SMEs and public firms – positive (Audretsch, 1995a; Hall 2002)
	Firm age	SMEs and public firms – negative – (Hansen, 1992; Klepper, 1996)
	Firm size	SMEs – negative – (Kenney, 1986; Acs & Audretsch, 1988)
	Firm exports	SMEs – positive – (Baldwin et al., 2002; Bhattacharya & Bloch, 2004)
	Financial Constraints	SMEs – positive – (Freel, 2007)
	Government Support	SMEs – positive – no empirical evidence
	Intention to grow	SMEs – positive – no empirical evidence found

Table 3: Predicted Signs of links between variables and supporting literature citations

Note how each of the three main concepts of growth, finance, and innovation have a bidirectional connection in the model. This interconnection captures the belief that these concepts are dependent on each other. Assuming the model is an accurate representation of SME behaviour, it means that when an SME is considering a financing decision, it cannot be taken in isolation. The SME must also take into account its growth and innovation plans as well. Analysing the conceptual model using the full sample implies that the model is linear for all SMEs. This means that the relationships amongst the dependent and independent variables would not be expected to change if various subgroups of SMEs were analysed. This assumes homogeneity for SMEs that is not

realistic. SMEs are a heterogeneous lot and it is expected that dividing the sample into different subgroups will result in different relationships being revealed among the variables. With this in mind, the remainder of this section discusses how the relationships among the three dependent variables vary when comparing different groups of SMEs.

The intent of using the conceptual model to compare different SME groups is to understand the dynamics of the model. Depending on the differences between each group, how are the relationships among growth, finance, and innovation expected to vary? Given that previous SME research only considered at most the interrelationship between two of these concepts, this is a novel approach. By considering different outcomes predicted by the conceptual model based on group comparisons, it is hoped that a richer and more informative picture of SME growth, finance, and innovation behaviour will result. Given the novelty of this approach, the outcomes derived below are a result of extrapolating from the extant theory of the concepts in the conceptual model. The outcomes are based on how the two groups are predicted to be significantly different from each other with respect to their fit of the conceptual model. Given the speculative nature of these predicted outcomes, they are limited to the bidirectional relationships between growth, finance, and innovation.

Six different group comparisons are performed. They are: high, medium and low growth firms; firms that export with those that do not; innovators to non-innovators; firms that use government financing to those that do not; firms that are financially constrained to those that are not; and large, medium and small firms. When considering the interaction between growth, finance, and innovation for each of these six different group comparisons, it is first necessary to have an understanding of the underlying ideas

that pertain to both SME behaviour as well as the interactions between growth, finance, and innovation. These underlying ideas which are a distillation of the preceding literature review will then be used to explain and support the predicted outcomes for each group comparison. The underlying ideas will be presented first followed by a discussion and the predicted outcomes for each of the group comparisons.

For each of the group comparisons, the sample was divided into groups based on the comparison factor. Four of the comparisons had two groups and two of the comparisons had three groups. When considering all six group comparisons simultaneously, this results in 143 (2x2x2x2x3x3-1) distinct groups. Though comparing group interactions like this is one possible approach, it is not considered by this research.

3.2.1 Underlying Ideas for SME Growth, Finance, and Innovation

This section presents six underlying ideas about SME behaviour and the interactions of growth, finance, and innovation. These ideas are then used to explain the reasoning behind the predicted outcomes for each of the six group comparisons which follow.

3.2.1.1 Non-Standard Business Practices

When investigating SMEs it is important to understand that small businesses are not like publicly traded companies with large management teams that have a wide range of business skills and decentralized responsibilities. The typical small company is owner operated with all businesses decisions being made by the owner/operator. Furthermore, SME owners generally lack the knowledge, interest, time, and/or resources to perform long range business planning. They react to their environment. They are too busy running the business and fighting fires to have time to spend on long range business plans, financial plans and contingency planning.

Consistent with small business owners being focused on running the day to day business, they don't spend much time on financial considerations. Stories of keeping all expense receipts in a shoe box and handing it all to an accountant at fiscal year end are not tall tales. Further compounding the problem is that often the business' and the owner's finances are intertwined. The business owner can have family members on the payroll to reduce personal taxes by spreading the income to multiple people. Personal loans either to the business or from the business frequently occur. The owner can also use one business to finance another which she or he owns.

From an organizational perspective, SMEs generally are controlled by one owner which makes all the decisions. The owner is the business. Even if there are technically multiple owners in the case of a family run business, effective control usually remains with the person that started the business. With this "owner is the business" model, business survivability is a real concern when the primary owner decides to retire or suddenly dies. Further problems occur when succession issues lead to debilitating disputes between families and/or business partners.

3.2.1.2 SME Informational Opaqueness

SMEs are notorious for being informational opaque. Opaque in this context means that people outside the SME generally have little to no understanding about the firm's operations, business model, capital structure, or prospects. SMEs are not publicly traded companies that have to publish their business information with their country's security commission. All information has to be obtained from the company itself. Furthermore, if someone wanted this information from the firm, it is unlikely that the firm would actually have it. See the previous subsection discussion on non-standard business practices. The

absence of standard business documents found in large firms makes it that much more difficult for outside parties to understand the operations of the SME.

As discussed above, SMEs typically have centralized control and decision making that resides with the owner/operator. The reason many small business owners created their business in the first place was to be able to control their own destiny. They like to be in control. With this in mind, even if the business owner has detailed financial statements and business plans, the idea of providing all the information, which outside parties require to invest, can be viewed as impinging on their fiefdom. This touches on the issue of control which is covered in a separate subsection below.

Another area that contributes to an SME's opaqueness is the markets which it sells to are typically niche markets that are often understood only by the owner. Outside investors and banks are unlikely to have a ready understanding of the business based on previous experience. It then requires more time for the outside person to make an informed decision. The SME owner has to provide further information (which they probably don't have) and take additional time (which they are short of) to educate this outside person.

Little if no outside information, centralized control, non-standard business practices, and niche markets all contribute to an SME's information opaqueness. Of course these are generalizations and there are SMEs which follow generally accepted business operational practices and work in well understood businesses but these are the exception rather than the rule. Even in the case where the owner does have all the required business information, the outside parties don't have access to it unless the owner gives it to them. SMEs don't have investment analysts following them and writing reports like publicly

traded companies do. So anyone investigating an SME has to wade through whatever limited information the owner gives them in order to make their decisions.

3.2.1.3 Seven Underlying Ideas Related to Innovation

When investigating innovation, it is helpful to be aware of eight underlying ideas which affect firm behaviour. These seven underlying ideas are a distillation of the innovation literature review section. These seven ideas help in explaining SME behaviour with regards to interactions with growth, finance, and innovation. The seven ideas are: innovation leads to growth; there is a lag between investing in R&D and obtaining revenue from it; there is lag between deciding to invest in R&D and having a functional team in place; successful R&D requires a constant investment (non-decreasing); firms that innovate spend a fixed percentage of sales on R&D; innovation is risky with no guarantee of success; and innovation is funded by equity, not debt. Each of these ideas will be discussed in turn.

The first idea is that innovation leads to growth. As discussed previously in this thesis, for a business to survive and grow, it has to be doing something different than its competitors. This difference is a result of being innovative in its product, service, process, and/or marketing. Many firms have failed because the product or service they offered was not sufficiently different from that of their competitors. Given that innovation leads to growth, this is the reason why many firms pursue innovative activities.

The second underlying idea is more of a truism than an idea. It is the lag between a firm's investment in R&D and when the innovation occurs. There is a subsequent lag between when the innovation occurs and it is productized such that the firm starts

receiving a revenue stream from it. This lag between R&D investment and revenue is approximately five years depending on the innovation. The lag can vary depending on the type of innovation. A simple process innovation can be implemented immediately while a complex one (e.g. float glass production in the 1950s) can take many years. Therefore, when investing in innovation, one has to be aware that financial results may not be instantaneous.

The third underlying idea is related to the second since they are both lags. Just like there is a lag between R&D investment and revenue, there is also a lag between the time when the firm decides to hire R&D staff and innovation truly begins. A firm doesn't wake up some day to magically find itself an expert in a field. It takes time to find and hire the people with the appropriate skills. In addition, since the firm is attempting an innovation (i.e. hasn't been done before) in a particular field, the people retained to perform the task will in all likelihood have to develop their skills further in order to achieve the innovation. This lag in developing expertise (brain trust) gives incumbents in a field an advantage over new entrants (not counting technology disruptions like the advent of mini-mills etc.).

The fourth underlying idea is that to be successful at innovation, it requires constant investment over an extended period of time. Given the lag between hiring researchers and subsequently developing expertise in a particular domain, combined with the time it takes to realize revenue from the process, innovation is not something a firm can invest in for one or two years and then stop. Additionally a firm can't downsize the research team one year and grow it again the next with the hope of delaying the research program by less than a year. R&D is not something that can be instantly turned on and off. If it takes

approximately five years to realize revenue from an R&D investment, a firm should plan on spending a constant amount on R&D over that time in order to make a return on their investment. A corollary of this idea is that firms are reluctant to reduce R&D spending during periods of poor revenue, since they will reduce their future innovative output and by extension their future revenue. Furthermore, it will take time to rebuild the lost R&D capabilities which will set the company back further than the short term revenue drop they are trying to manage in the first place.

The fifth underlying idea also relates to the amount firms spend on R&D. The fourth underlying idea stated that firms spend a constant amount on R&D and that this amount has a tendency to remain unchanged even as revenues decrease. But what happens when revenues increase? Generally, a firm's R&D dollar investment is based on a percentage of sales. As sales increases, the amount invested in R&D increases in direct proportion. This makes intuitive sense when considering that a company would like to grow at a constant rate. It would be unreasonable to expect that the firm would grow at the same proportional rate by investing a constant dollar amount in R&D. As the firm gets bigger, it would need to increase its R&D investment in proportion to its growth in sales short of an efficiency gain in its conversion of R&D investment to innovative outputs. R&D investment is based on a percentage of sales rather than profits or employees since R&D is more or less viewed as a cost of sales.

The sixth underlying idea acknowledges that innovation by its very nature is a risky endeavour. In performing R&D there is no guarantee that an innovation will result let alone one that will generate revenue for the firm. R&D/Innovation is not always successful. A firm by undertaking an R&D program is in effect playing the odds. Spend

enough time and money and hope that a revenue generating product will result that will cover the costs of the R&D investment and make a profit. The more R&D projects that the firm has ongoing the better the odds of having at least one that is successful. Small firms have a much higher risk in pursuing innovative activities since they don't have the resources to fund more than one or two projects. Small firms also have less financial resource to back them up if the R&D activities are unsuccessful. This explains why venture capitalists invest in multiple small innovative firms realizing that only a small percentage of them will be successful.

The seventh and final underlying idea involving innovation is the inherent risk of R&D investment. This risk explains why it is funded by equity rather than debt. As mentioned previously in this thesis, innovative activities are funded by equity (either external or internal) since the odds of success are low and there is little to no residual value if it is unsuccessful. To fund innovation with debt would expose the debt holders to all of the risk without the potential upside benefit of the firm's value increasing multi-fold if the innovation was successful.

3.2.1.4 Do I Want to Grow?

Growth is not an outcome that all SMEs aspire to. For many SME owners, the reason for creating their own business was a lifestyle choice. These owners start a business to gain control of their work environment and to achieve a work-life balance where growth is perceived to have a negative effect. So when investigating SME growth it is necessary to keep this in mind. A firm that isn't growing might be successful from the owner's perspective even though a researcher studying growth may classify it as "unsuccessful". Nevertheless, a firm that is experiencing negative growth is more than likely unsuccessful

in all situations other than the rare instances where the owner is shrinking the business for some reason (it was too large, winding the business down before retirement etc).

3.2.1.5 Cash Flow: The Primary Source of Finance

A firm's cash flow is its dominant source of finance. A firm that wants to grow needs to invest in marketing, equipment, plants, and/or R&D. Where does the firm obtain the financing required to make these investments? Unlike publicly traded firms it can't float additional shares on the stock exchange or issue bonds. SMEs have only three options: outside investors, loans, and/or retained earnings via cash flow. Once a firm has maximized its leverage and exhausted its potential equity investors (generally family and friends), it then only has its own cash flow to fund its investments. As it turns out, cash flow as retained earnings is the real limit to a firm's growth. A firm's growth rate is more or less tied to the rate at which it accumulates retained earnings.

3.2.1.6 Debt versus Equity versus Control

Another feature that limits the growth of many SMEs is the reluctance of business owners to issue equity in their business. As alluded to in the above subsection on informational opaqueness, one of the primary reasons SME operators set up their business in the first place is to gain control over their destiny so to speak. This concept of being in control is something which drives them and is an important consideration in any business decision that they make. If they were to issue any sizable portion of share equity, they would in effect be relinquishing control of their business which for most SME owners would be an anathema. For this reason, SME owners prefer debt over equity which limits the external finance that is available to them. Furthermore, since innovation

is funded by equity, this reluctance to take on equity limits their innovation opportunities which in turn limits their growth to what can be funded by retained earnings.

3.2.2 Comparing firms with different rates of growth

For this comparison, consider dividing the SME population into three groups based on their growth rates: high, medium and low. High growth would be the top quartile with an average growth rate of upwards of 20%. Medium growth would be the middle two quartiles having an average growth rate that is positive, say around 5%. Low growth would be the bottom quartile which would have a growth rate approaching zero or even negative. Using growth as a group comparison variable while it is one of the three endogenous variables in the conceptual model can possibly affect the model results due to a possible reduction of variance. Given the large sample size combined with the stochastic nature of small firm growth should ensure that the growth rate variance for each group is unlikely to differ significantly from that of the overall group. Nevertheless, the variance of growth for the full sample as well for each of the groups will be reported.

When comparing groups of firms with different growth rates, how would the relationship between growth, finance, and innovation differ? As mentioned in the subsection on stylized facts, not all SMEs want to grow. With this in mind, a comparison based on relative growth rates in one sense is an analysis of the differences between SMEs that want to grow versus those that do not want to or are unsuccessful in growing. For those that want to grow and are growing successfully, what are the factors that set them apart from the other groups? They must be doing something that differentiates them from their competitors. Even in the situation where an industry is growing for all participants, there will be those that will grow faster than others. What differentiates

these SMEs from the slower growing ones? How would these differences be reflected in the relationships between the concepts in the conceptual model? This section attempts to answer these questions. First the relationship between innovation and growth is presented, followed by the growth-finance relationship, and lastly the innovation-finance relationship.

3.2.2.1 Innovation-Growth Relationship (Growth rate group comparison)

The effect which innovation has on growth in the different SME groups will be examined first. Given the idea that innovation leads to growth, how does this relationship vary between high, medium, and low growth firms? One would think that the faster growing companies would be more successful at converting innovative inputs (R&D expenditures) into outputs (i.e. unique innovations that result in higher sales) all else equal. With this in mind, it would be expected that the high growth rate group would have innovation exhibiting a stronger influence on growth in the conceptual model since these firms would be better at converting R&D input into outputs. Mid-growth SMEs would exhibit a weaker influence due to their lower growth rate and low/negative-growth SMEs would likely have no connection from innovation to growth since they may not do any innovation or they are unsuccessful in creating revenue generating outputs from their innovating activities.

When considering the effect that growth has on innovation, it is important to understand the question that is being asked. Specifically, does an increase in growth rate lead to an increase, decrease or have no effect on a firm's ratio of R&D to sales spending? Two of the innovation underlying ideas come into play. Specifically, innovation has to be done continuously over a long period of time and firms increase

their R&D budget in proportion to their sales in order to continue to grow at the same rate. It is assumed that the lag between R&D and growth doesn't come into play if R&D is performed consistently over a long period of time. Therefore assuming firms have been doing innovation on an ongoing basis and that they have been increasing R&D in proportion to sales growth, one would expect innovation to increase in proportion to growth, ceteris paribus. In other words with all else equal, those companies experiencing higher growth rates would in general be innovating more, but their R&D spending to sales ratio would not change leading to no relationship when innovation is regressed on growth. Negative growth firms would have a negative relationship from innovation to growth due to the underlying idea that firms try not to reduce R&D when sales decrease.

In applying the above logic to the different groups of SMEs based on growth rates, one would expect high- and mid-growth SMEs to have growth having no influence on innovation due to the underlying idea that firms in general spend a constant percentage of sales on R&D. With respect to the low/negative growth SMEs, as described above, one would expect a negative relationship when innovation is regressed on growth since firms try to maintain R&D spending when sales decline.

3.2.2.2 Growth-Finance Relationship (Growth rate group comparison)

Two underlying ideas affect the growth-finance relationship for SMEs. The first is a firm's cash flow is its primary source for financing its investments. The second is that SMEs will use debt but are unlikely to accept equity due to control issues. With these two underlying ideas in mind, a firm which is able to obtain additional money via debt would have a growth advantage over a similar firm that didn't receive the additional money. A similar result is obtained using corporate finance theory. Assume two firms of equal

value have the same number of positive net present value (NPV) projects available to them but neither has the internal financing available to act on them. If only one of the firms is able to obtain debt to fund the project, this firm will be increasing the dollar value of its total investment which should in theory increase its overall growth rate. So in the general case, an increase in leverage should increase growth rate assuming the undertaken projects are on average NPV positive. In comparing the effect of increased leverage on growth for high and moderate growth firms, one would assume that leverage would have a greater effect for high growth firms since they are more effective at converting inputs (in this case additional money via debt) into outputs (increased revenue). For low/negative growth firms, the effect of increased debt is likely to result in decreased growth. Assume that the majority of firms experiencing low/negative growth are under financial stress and in all likelihood are in a negative cash flow situation as well. In this situation, the increased leverage could be a passive effect of reducing retained earnings and/or the firm borrowing money to cover expenses. Whichever the case, the de facto increase in leverage is reducing the firm's options to finance investment in new NPV projects thereby reducing their growth potential for growth even further. With this in mind, it is predicted that increased leverage is a negative growth predictor for low/negative growth firms.

As a predictor of leverage, the argument can be made that growth rate can be either positive or negative. From a positive viewpoint, a high growth rate can be a signal to lenders that the firm is performing well and is therefore less likely to default on its obligations. This will in turn allow the firm to borrow more money increasing its leverage. This assumes that the firm needs additional money above and beyond the cash

flow generated by its high growth rate. Given the underlying idea that firms are generally financed by their cash flow leads one to the opposite argument in support of growth rate as a negative predictor of leverage. A firm, which is growing with positive cash flow that doesn't borrow new money, will passively be reducing its leverage each year as it accumulates more retained earnings. Using the additional underlying idea that SMEs follow nonstandard business practices, it is highly unlikely that SMEs rebalance their leverage each year in order to maintain a target leverage ratio. Therefore, it is proposed that growth is a negative predictor of firm finance as represented by firm leverage. This relationship will be the same for all growth rates since the passive rate at which leverage is reduced (or increased in the case of negative growth) is in direct proportion to the rate of growth (accumulation or reduction of retained earnings).

3.2.2.3 Innovation-Finance Relationship (Growth rate group comparison)

The primary underlying idea influencing innovation's effect on firm finance is that innovation is a negative predictor of leverage. But the question here is, do high growth companies exhibit a smaller negative effect of innovation on leverage due to their success (a halo effect) or does the rate of innovation affect their leverage the same as middle and low/negative growth rate SMEs, all else equal? The key point here is the words "all else equal". Since the leverage differences due to growth have been controlled for, are there any remaining effects due to innovation alone? As a group, low/negative growth SMEs are probably more leveraged due to their poor performance than their medium and high growth counterparts independent of if they are innovating or not. This assumes the medium and high growth groups are growing with positive cash flow. Given that innovating firms have reduced leverage, this fact would be more pronounced in a group

of firms that collectively were at the limits of their leverage (i.e. the low/negative growth group). With this in mind one would expect the low/negative growth group to exhibit a stronger negative influence of innovation on leverage than either the medium or high growth groups. It is unclear if innovation will exhibit a weaker or stronger influence on the high growth group than the medium growth group. The possible halo effect might increase leverage while the cash flow generated by the high growth might reduce leverage.

When looking at the effect which leverage has on innovation, the same underlying idea with regards to the negative relationship between innovation and leverage needs to be considered. Lenders are not going to lend money to a firm to perform innovation. So the more leveraged a firm is, the less innovation it is likely to perform all else equal. A possible scenario in the firm population that could weaken this negative effect that leverage has on innovation would be if a firm had unused debt capacity (e.g. mortgage free building, debt free equipment, etc.) and increases its leverage in order to fund innovation. This scenario is unlikely to occur for high growth firms since they are generating enough retained earnings to fund innovation. This possible weakening of the negative effect of leverage on innovation is equally unlikely for low/negative growth firms since they have most likely reached their maximum leverage ratio due to their poor performance. That leaves only the moderate growth firms that could possibly exhibit reduced negative or possibly a positive effect of leverage on innovation. Assuming that moderate growth firms are generally conservative in nature and do not use their maximum possible leverage, then those firms that decide to innovate could possibly use this untapped leverage to fund innovation. With this in mind, high and low/negative

growth firms are expected to exhibit the equivalent negative effect of leverage on innovation while for moderate growth firms this effect will be weaker or even positive.

3.2.3 Comparing exporting and non-exporting firms

For this comparison, the sample is divided into two groups based on whether they export or not. Further to the underlying ideas already discussed above, an additional one needs to be added when considering exporters. It is important to realize that the competition for an exporter is much greater than for a firm that chooses to sell only in its domestic market. By choosing to export, the firm is now competing with firms from all over the world including firms which are local to the market that it is exporting to. In order to be successful, an exporting firm has to have an offering that is valuable to the buyer after taking into account whatever additional costs are added through exporting. Therefore a firm that is successfully exporting (other than natural resources) from a high labour cost country like Canada has done something innovative in order to compete internationally. With this underlying idea in mind, the predicted differences in the interrelationships between growth, finance, and innovation for the two groups will be presented.

3.2.3.1 Innovation-Growth Relationship (Exporters vs. non-exporters)

It is hypothesized that the model for exporters will show a stronger positive relationship of growth on innovation. Two underlying ideas contribute to the formation of this hypothesis. The first is the just described underlying idea that a successful exporter must have a superior innovation that has allowed it to compete successfully against its worldwide competitors. The second underlying idea is that successful innovation contributes to growth. Using successful exporting as a more rigorous test of the value of

the innovation, one would expect those innovators having passed this more stringent test are better innovators. Furthermore, by successfully accessing the export market, their opportunities for growth are much greater than those firms limited to just the domestic market. This then leads to the hypothesis that exporters have innovation as a stronger predictor of growth.

No relationship is predicted for innovation on growth.

3.2.3.2 Growth-Finance Relationship (Exporters vs. non-exporters)

The decision to export for a firm is assumed to be a conscious decision in most cases. More effort is required to sell to an export market than to a domestic one. For this reason, it is assumed that those SMEs which export have made the conscious decision to grow their firm. This combined with the increased selling opportunities that exporting provides, exporters are expected to have higher growth rates than non-exporters. This is consistent with the empirical research. In addition, previous research has determined that exporters have higher leverage. This is consistent with the underlying idea that SMEs prefer debt to equity due control issues such that they fund their export activities with debt.

If exporters have high growth rates and higher leverage than their non-exporter peers, what does this mean for growth as a predictor of leverage? In the total population it was predicted to be negative. Will it be stronger, weaker, not significant or positive for exporters? Starting from the point that exporters have more leverage to begin with and that firms will want to reduce their leverage to reduce risk, it is hypothesized that growth will be a stronger negative predictor of leverage for exporters. This hypothesis is based on the assumption that exporters having greater leverage will then have greater incentive

to reduce their leverage and will use more of their increased cash flow from their growth to reduce their leverage to average values.

From the literature review, leverage is predicted to be a positive predictor of growth in the general population. Combining this prediction with the knowledge that exporters have increased leverage and growth opportunities leads to the hypothesis that leverage will be a stronger predictor of growth for exporters. This hypothesis is based on the assumption that an exporter has proportionally more growth opportunities than a non-exporter due to the available world market. Therefore, each dollar borrowed to fund an exporter's growth increases its market potential more than for a non-exporter that only has the domestic market to sell to.

3.2.3.3 Innovation-Finance Relationship (Exporters vs. non-exporters)

Even though exporters have been found to have greater leverage and to be greater innovators, the leverage and innovation relationship is still hypothesized to be invariant to whether a firm exports or not. The risks of funding innovation are the same whether a firm is exporting or not. Therefore it is predicted that the innovation/leverage relationship will be equally negative for the both exporters and non-exporters.

3.2.4 Comparing innovating and non-innovating firms

For this section, the sample is divided into two groups based on whether the firm innovates or not. When comparing groups based on whether they innovate or not, it is only possible to consider the relationship between leverage and growth. Innovation can't be in the relationship since it is the criteria used to create the groups.

3.2.4.1 Growth-Finance Relationship (Innovators vs. non-innovators)

As discussed above, innovators should export more, have less leverage and grow faster than their non-innovating peers. Even though one would expect the means of growth and leverage to be different for innovators and non-innovators, would this change the relationship between these two concepts for the two groups? For this to occur, the slope of the leverage to growth rate line would have to be different for innovators and non-innovators. Given that innovators have higher growth rates and less leverage than their non-innovating peers, intuitively one would think that each dollar increase in leverage would enable the innovating firm to fund further growth activities that are predicted to induce a higher growth rate than that of a dollar spent in the non-innovating firm. With this in mind, the hypothesis is that leverage will have a stronger positive effect on growth for the innovating group versus the non-innovating group.

For growth as a predictor of leverage, which is predicted to be negative in the general population, the hypothesis is that growth will be a weaker negative predictor of leverage for the innovating group. The reasoning behind this hypothesis is that innovators already have less leverage than average such that the incentive to reduce leverage isn't as great as for the non-innovators. The assumption here is that an innovating firm's reduced leverage in comparison to a non-innovating firm's leverage is imposed by the risk adverse lenders rather than self-imposed. Furthermore, using the stylized fact that SMEs prefer debt to equity combined with the knowledge that innovators have less debt to start with supports the belief that innovators have less incentive to pay down debt and might even reduce the passive reduction in leverage through the accumulation of retained earnings by borrowing further monies when their growth supports it.

3.2.5 Comparing firms that use and don't use government financing

For this comparison the group of firms is divided into two groups based on whether they use some form of government financing or not. The hope in governments providing financing to SMEs is that it will increase their growth prospects by reducing the financial constraints that they might be facing. In addition, government financing and tax credits often targets innovation (see previously mentioned IRAP and SRED) because of its linkage to growth. From a resource perspective, it is hypothesized that those firms that have received government financing have a higher growth rate, innovate more, have greater leverage, and are less financially constrained than those firms that haven't received government financing. The question is how these mean differences might tie into the interrelationship between growth, finance, and innovation in the conceptual model.

3.2.5.1 Innovation-Growth Relationship (Government finance and not)

In the general population, innovation is hypothesized to be a positive predictor for growth. Receiving government financing in and of itself is not expected to change the effect which innovation has on growth. Nevertheless, if the government is assumed to vet the firms and projects which it finances (e.g. like IRAP does), then receiving government finance might act as an indicator for those firms that have greater odds of innovative success as indicated by a higher growth rate. This assumes that the government has better than 50-50 odds of recognizing innovative firms/projects that will result in successful growth. Working under this assumption, it is hypothesized that the group receiving government finance will have innovation as a greater positive coefficient estimate for growth.

No relationship is predicted for innovation on growth.

3.2.5.2 Growth-Finance Relationship (Government finance and not)

An SME that receives government financing has in effect received more cash flow than an equivalent SME that hasn't. Using the underlying idea that growth for SMEs is driven by cash flow, the SME that has received this additional money should have greater growth than the equivalent firm which hasn't received government finance. Now depending on the type of government finance (grant or loan), this money may or may not appear as increased leverage. In the case where the government finance is a grant, the firm that receives it will have a greater growth rate with less leverage, all else equal. In the case where it is a loan, using the assumption that the government's ability to select successful growth prospects is better than 50-50, the group that receives the loans should grow at faster rate than those that don't. Therefore, for SMEs that receive government finance as a grant or a loan, their leverage is hypothesized to have a greater positive effect on growth.

In the general population, growth is hypothesized to have a negative effect on leverage. Are government funded SMEs less, more or equally likely to reduce leverage as they grow? For the case of innovators, the argument was made that they would be less likely since they have less leverage to start with. For high, medium and low growth rate groups, the effect of growth was hypothesized to not be different since the passive difference in accumulation (reduction) in retained earnings for positive (negative) growth rate would be linear. For exporters, growth was hypothesized to be a greater negative predictor since exporters had more leverage to start with. So in the case of SMEs that have received government financing, though they may have had an advantage in

obtaining more funding (grant or loan), it doesn't follow that this additional money would cause the SME to reduce leverage at a faster or slower rate than the general population. If firms receiving government finance are predominantly innovators, then the argument could be made that government finance is in effect a means of sorting firms into innovator and non-innovator groups. If this was the case, then the growth rate for firms receiving government finance would be a less negative predictor of leverage for the same reason as discussed in the innovator group comparison above. Since there is no evidence to support government finance as a means of sorting firms based on level of innovation, the negative predictive effect of growth rate on leverage is hypothesized to be the same for both groups of firms.

3.2.5.3 Innovation-Finance Relationship (Government finance and not)

For the finance-innovation interrelationship, will government finance change the relationship between the two concepts given that their means are probably different? There is little doubt that that the interrelationship will be negative between innovation and leverage for the government financed group just as it is for the general group. The only question is if it is weaker or stronger than those that don't receive government finance. The underlying idea to keep in mind when analysing this scenario is that innovation is funded by equity and the government is giving a grant (increased cash flow) or loan (increased leverage). The government finance is changing the dynamic. Assuming that a firm that has received government financing would not have obtained additional financing from another source, would mean that this firm would then have increased leverage compared to an equivalent firm that hadn't received government financing. Based on this assumption it is hypothesized that innovation is a weaker negative predictor

of leverage for the group that received government financing. As for leverage as a predictor of innovation, its negative influence won't be as strong for the same reason. The firm that has received the government finance is able to perform a greater amount of innovation with the same amount of leverage when compared to an equivalent firm that didn't receive government finance.

3.2.6 Comparing SMEs that are financially constrained to those that are not

For this comparison the sample is divided into two groups based on whether the firm has been turned down for a finance request which proxies for financial constraint. In general, one would expect firms that are financially constrained to have higher leverage, lower growth and lower cash flow than their unconstrained peers.

3.2.6.1 Innovation-Growth Relationship (Financially constrained and not)

All else equal, a financially constrained firm is likely to innovate more than a non-financially constrained firm, since innovating firms have lower leverage due to the unwillingness of lenders to fund innovation. Having a lower leverage limit means that innovators are more likely to reach this limit and be refused financing sooner than a non-innovating firm. Assuming the firm required the financing to carry out some aspect of its business plan, it is now unable to which could indicate reduced growth prospects. Furthermore, one would think that having been turned down for financing is a sign of either poor financial planning and/or poor growth prospects. Either of these two situations probably indicates that the innovation/growth relationship for these financially constrained firms is weaker or possibly even negative in comparison to those firms which have not been turned down for a loan.

No relationship is predicted for innovation on growth.

3.2.6.2 Growth-Finance Relationship (Financially constrained and not)

It is assumed that financially constrained firms have lower growth since their growth isn't meeting their financing needs and in not receiving the funding they requested, it would limit their ability to carry through with their business plans. One could argue the financially constrained firm is experiencing exceptional growth and requires the funding to deal with this growth (e.g. increased working capital), but this is more likely to be the exception rather than the norm. So based on the assumption that financially constrained firms have lower growth and higher-leverage, one would expect that growth would have a more profound effect on reducing leverage for these firms than a firm that hasn't been refused financing. A financially constrained firm would be more likely to apply funds obtained through growth to reducing leverage than a firm that is not financially constrained.

In the reverse direction, it is not clear if leverage would exert a greater or lesser positive effect on growth for the financially constrained firm. If on one hand the predominant firm in the constrained group has been refused financing due to its poor growth prospects, then increased leverage would likely be a negative influence on growth. If on the other hand the predominant firm in the constrained group is constrained because it is experiencing higher than average growth, then the additional leverage would affect greater growth. The assumption used for leverage on growth was that constrained firms likely had poor growth prospects. With this in mind it is assumed that increased leverage for the financially constrained group would be a negative predictor of growth while it is a positive predictor of growth for the non-constrained group.

3.2.6.3 Innovation-Finance Relationship (Financially constrained and not)

The assumptions used in the previous two sub-sections apply to the innovation/finance relationship as well. The first assumption is that a firm that has been refused financing has greater leverage than its peers. The second assumption (really an underlying idea) is that innovators are lent less money resulting in reduced leverage. Given innovators support less leverage, they are therefore more likely to be turned down for a loan request all else equal. Applying these two assumptions leads to the financially constrained group including proportionally more highly leveraged innovators than the non-financially constrained group. Following from this, one would expect that the financially constrained group would exhibit a weaker negative bidirectional relationship between leverage and innovation since their leverage is higher than that of nominal innovator.

3.2.7 Comparing very small and larger SMEs

In general researchers do not analyse very small firms often using a minimum cut-off of 10, 20 or 50 employees as the minimum size to be included in a study due to either lack of data or stating that very small firms have very different behaviours (Angelini & Generale, 2008; Becchetti & Trovato, 2002; Brav, 2009; Delmar & Wiklund, 2008). In contrast, this study included all firms so long as they had more than zero employees. By not including very small firms, important characteristics could be overlooked. A possible example from the literature review is when sales growth was a positive predictor of leverage for SMEs with greater than 50 employees in one study and a negative predictor when SMEs of all sizes (predominantly less than 10 employees) were considered in another study. By dividing the SMEs into three different groups based on their number of

employees and comparing the differences among their respective fit of the conceptual model, the actual differences, if any, related to size would be revealed. From the literature review above it was found that both relative growth rate and innovation decreased with size. With regards to leverage, the effect of size varied depending on the measure used, and if firms without debt were included. For size based on log assets or employees and including firms with and without debt, size was a positive predictor of debt. For SMEs only and using employees as a size measure, size was a non-significant negative predictor of leverage.

For this analysis, the plan is to divide the sample into three group groups based on the number of employees in the firm. The first group will be for very small companies with less than 10 employees. This size was selected because two studies that had considered the size-growth relationship for SMEs included only firms with greater than 10 employees (Angelini & Generale, 2008; Becchetti & Trovato, 2002). The second group had firms with 10 to 19 employees and the third group had firms with 20 to 500 employees. Using 20 employees as a dividing point was based on the cut-off used in other growth studies (Delmar & Wiklund, 2008; Wiklund & Shepherd, 2003).

3.2.7.1 Innovation-Growth Relationship (Size-based group comparison)

In the general population both growth and innovation rates are predicted to decrease as the size of the firm increases. The underlying ideas state that innovation is risky and even riskier for very small firms since they can't fund multiple innovative projects simultaneously in order to spread out the risk. Furthermore, given innovation is generally funded by equity and the underlying ideas that very small firms are funded mostly by debt and cash flow combined with the small firm's information opaqueness and the

owner's reluctance to take on equity due to control issues, all add up to a low probability that very small firms that stay small will spend much on R&D. This applies to innovation as measured by spending on R&D not to introduced innovations (process, product or marketing). This leads to the hypothesis that it is the midsize transitioning to larger firms which drive the decrease in innovation as the size of firms increase since the small firms are unlikely to spend proportionally as much on R&D. With this in mind, it is hypothesized that there will be a weaker positive relationship between innovation and growth for the two smallest firm groups due to innovation being measured by R&D spending. The positive relationship between innovation and growth is predicted to be greater for the largest firm group (20 employees and greater).

No relationship is predicted for innovation on growth.

3.2.7.2 Growth-Finance Relationship (Size-based group comparison)

Considering first the influence which growth has on firm finance (as represented by leverage), based on the research discussed in the literature review it is expected that growth is a negative predictor for smaller firms and becomes positive for larger firms (based on number of employees). With this in mind, it is predicted that the two groups containing the smallest firms (0< <10 and 10-19 employees) will have growth as a negative predictor of leverage with the influence being weaker for the larger of these two groups. For the third group containing the largest firms (20-500 employees), it is hypothesized that growth will be a positive predictor of leverage. In the context of the underlying ideas, these hypotheses make sense. New firms overwhelmingly start out very small, are information opaque, and have limited access to equity which together causes them to have higher leverage than older and larger firms. As firms grow they pay down

debt, reducing their leverage and increasing their odds of survival. Once the firms approach medium size (somewhere between 20 and 50 employees), they presumably have a successful track record, less risk of bankruptcy, and are less information opaque such that they are willing and able to take on more debt.

With regards to leverage as a predictor of growth, as discussed previously, it is hypothesized to be a positive predictor of growth in the general population. This relationship is predicted to continue for each of the different size groups. But will the strength of this relationship vary based on the size of the firms under consideration? Leverage is hypothesized to have a stronger influence on growth for smaller firms since they have both higher leverage and growth. The logic here is that leverage provides finance to grow and those small firms able to obtain more leverage possibly have a greater relative growth advantage than a larger firm obtaining additional leverage. Therefore the positive predictive effect which leverage has on growth is hypothesized to weaken as the size of the firms increase.

3.2.7.3 Innovation-Finance Relationship (Size-based group comparison)

As previously discussed, in the general population the bidirectional relationship between innovation and leverage is predicted to be negative. It was also hypothesized that innovation decreases with size, though this effect is most likely due to firms with 10 or more employees as a result of innovation being measured by R&D spending (see subsection 3.2.7.1 above). Lastly, the literature review presented the results of SME research using employees as a proxy for firm size which found size to be a non-significant negative predictor of leverage. So an SME's leverage appears to decrease as firm size increases. Furthermore, when innovation is measured by R&D spending scaled

by sales, it is expected to increase until the firm reaches approximately a medium size when it then is expected to decrease as the firm continues to grow.

Given these prior predictions, leverage is predicted to be a greater negative predictor of innovation for the largest firm group (20 or more employees) than the two smallest firm groups. This difference is a result of innovation as measured by R&D spending being weaker for very small SMEs than for larger SMEs. The strength of leverage as a predictor for the two smallest firm groups might be greater for the group containing the larger firms (10-19) but it is unlikely to be significantly different since the firm size range is quite narrow.

As for innovation as a predictor of leverage, it is predicted to be negative for all three groups. Once again this negative relationship is predicted to be weaker for the two smallest firm groups using the same logic that the two smallest firm groups will have a weaker innovation/leverage relationship due to innovation being measured as R&D spending.

3.3 Research Objectives

In the previous subsection a novel conceptual model was presented that had growth, finance, and innovation as mutually dependent, endogenous variables. Besides these three endogenous variables, a set of 12 independent predictor variables (tangible assets, earnings volatility, cash flow, age, size, firm exports, financially constrained, government financing support, intention to grow, management competency, marketing competency, macroeconomic activity) were also included in the model. Accompanying the model was a discussion on how the relationships between the three endogenous variables are expected to vary depending on the type of SMEs that are considered. Developing this

model, testing it against a representative set of SMEs as well as groups of SMEs that differ on one of six criteria (growth rate, size, export orientation, innovating or not, receipt of government finance, and financially constrained) were the three primary objectives of this research. These research objectives are summarized in Table 4 below.

Objective	**Description**
Develop a conceptual model for growth, finance and innovation	Based on a review of the academic literature of the theory and empirical findings of firm growth, finance and innovation, develop a conceptual model that incorporates all three concepts
Test the proposed conceptual model for growth, finance, and innovation.	Using Statistics Canada's SFSME dataset, test the conceptual model to determine to what extent it represents SMEs in Canada.
Determine how SMEs differ in their growth, finance, and innovation relationship when divided into groups and compared based on their group differences.	Six separate group comparisons are proposed. For each comparison, the SME dataset will be divided into two or three groups using the factor under consideration. The resulting groups will be analysed and compared using the conceptual model to see how the growth, finance and innovation interrelationship differ. Groups will be based on the following factors: growth rates, size, export orientation, innovating or not, receipt of government financing, and financially constrained.

Table 4: Summary of Research Objectives

After creating the model, the next research objective was to determine to what extent the proposed conceptual model is an accurate representation of SMEs. This was tested using SMEs in Canada as represented by the Statistics Canada 2007 Survey of Financing of Small-and Medium-Enterprises (SFSME) dataset which is described 4.2 on page 134. This dataset which consists of specific questions asked of the SMEs and five years of tax information provided a unique opportunity to test the conceptual model. Note that the

data is weighted to account for size, age, geographic location, industry type, use of the Canadian Small Business Financing Act (CSBFA) in the Canadian SME population. The third objective was to determine how SMEs differ in their growth, finance, and innovation relationship when divided into groups and compared based on different criteria. Six separate group comparisons were performed. For each comparison, the SME dataset was divided into two or three groups using the factor under consideration. The resulting groups were then analysed and compared using the conceptual model to see how the growth, finance and innovation interrelationship differ. Groups were based on the following factors: growth rates, export orientation, innovator/non-innovator, receipt of government financing, financially constrained or not, and size.

3.4 Hypotheses

Two of the research objectives listed above involved tests that were performed using the proposed conceptual model. Each of these research objectives had its own set of hypotheses which are presented in the tables below. The hypotheses from the conceptual model for the bidirectional relationships are presented in Table 5 and the hypotheses for the group comparisons using the conceptual model are shown in Table 6 through Table 11. In order to make the hypotheses more tangible and give meaning to the directional effects, the concept of firm finance is replaced by its proxy leverage.

Area being tested	**Hypothesis**
Investigates leverage-growth relationship	H1. Leverage on growth is negative
	H2. Growth on leverage is positive.
Investigates leverage-innovation relationship	H3. Leverage on innovation is negative
	H4. Innovation on leverage is negative
Investigate growth-innovation relationship	H5. Growth on innovation is positive.
	H6. Innovation on growth no relationship

Table 5: Summary of bidirectional relationship hypotheses

Area being tested	Hypothesis
Investigates innovation-growth relationship	H7. Growth <= Innovation (greater positive for high-growth than mid-growth and no relationship for low-growth)
	H8. Innovation <= Growth (no relationship for mid-growth and high-growth and negative relationship for low-growth)
Investigates leverage-growth relationship	H9. Leverage <= Growth (equally negative for all three groups)
	H10. Growth <= Leverage (greater positive for high-growth than mid-growth group, negative for low-growth group)
Investigate leverage-innovation relationship	H11. Leverage <= Innovation (all negative but stronger negative for low growth group)
	H12. Innovation <= Leverage (equal negative for all three groups)

Table 6: Summary of Growth based Group Comparison Hypotheses

Area being tested	Hypothesis
Investigates innovation-growth relationship	H13. Growth <= Innovation(greater positive for exporters)
	H14. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H15. Leverage <= Growth (relationship will be more negative for exporters)
	H16. Growth <= Leverage (relationship will more positive for exporters)
Investigate leverage-innovation relationship	H17. Leverage <= Innovation (relationship will be the same for exporters and non-exporters –negative)
	H18. Innovation <= Leverage (relationship will be the same for exporters and non-exporters –negative)

Table 7: Summary of Exporter/Non-exporter based Group Comparison Hypotheses

Area being tested	Hypothesis
Investigates leverage-growth relationship	H19. Leverage <= Growth (greater negative for non-innovators than innovators)
	H20. Growth <= Leverage (greater positive for innovators than non-innovators)

Table 8: Summary of Innovator/Non-innovator based Group Comparison Hypotheses

Area being tested	Hypothesis
Investigates innovation-growth relationship	H21. Growth <= Innovation (greater positive in for firms that receive government finance)
	H22. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H23. Leverage <= Growth (the same for both groups of firms - negative)
	H24. Growth <= Leverage (greater positive for firms receive government finance)
Investigate leverage-innovation relationship	H25. Leverage <= Innovation (less negative for firms receiving government financing)
	H26. Innovation <= Leverage (less negative for firms receiving government financing)

Table 9: Summary of Hypotheses from Comparing Firms that use and don't use Government Financing

Area being tested	Hypothesis
Investigates innovation-growth relationship	H27. Growth <= Innovation (less positive for financially constrained firms)
	H28. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H29. Growth <= Leverage (negative for financially constrained firms and positive for non-financially constrained firms)
	H30. Leverage <= Growth (greater negative for financially constrained group)
Investigates leverage-innovation relationship	H31. Leverage <= Innovation (less negative in for financially constrained group)
	H32. Innovation <= Leverage (less negative in for financially constrained group)

Table 10: Summary of Financially Constrained and not Constrained Group Comparison Hypotheses

Area being tested	Hypothesis
Investigates leverage-growth relationship	H33. Leverage <= Growth (negative for the smallest two size groups with the larger of the two groups having a smaller effect; positive for the largest firm grouping)
	H34. Growth <= Leverage (positive effect weakening as the firm size grouping increases)
Investigates innovation-growth relationship	H35. Growth <= Innovation (positive but larger effect for largest firm size grouping)
	H36. Innovation <= Growth (no relationship)
Investigate leverage-innovation relationship	H37. Leverage <= Innovation (negative but larger effect for largest firm size grouping)
	H38. Innovation <= Leverage (negative but larger effect for largest firm size grouping)

Table 11: Summary of Size based Group Comparison Hypotheses

4.0 Research Methodology

4.1 Introduction

The purpose of this chapter is to provide information on how the conceptual model and group comparisons were tested. The following subsection describes the dataset that was used to test the model. This subsection is followed by a discussion of the key concepts of the conceptual model and the proxies that were used to model them. The last subsection presents the proposed statistical techniques that were used to perform the tests along with the descriptive statistics.

4.2 Dataset

This study was a secondary analysis of a Statistics Canada dataset titled "2007 Survey of Financing of Small-and Medium-Enterprises (SFSME)". This dataset combined data from a survey of approximately 15,000 private incorporated and unincorporated SMEs

(defined as less than 500 employees) with each firms' tax data filed with the Canada Revenue Agency (CRA) as well as their payroll deduction data (used for number of employees). Furthermore, the dataset was properly weighted to represent the Canadian SME sector based on size, age, industry, geographic region, and use of the Canadian Small Business Financing Act (CSBFA). Size had five groupings based on number of employees: 0, 1-4, 5-19. 20-99, and 100-499. Age had two groups: less than one year old and greater than one year old. Industry had seven groups: accommodations and food, agriculture and primary, manufacturing, wholesalers/retailers, professional, knowledge based, and all others. Geographic region was divided into six groups: Atlantic, Quebec, Ontario, Prairies, British Columbia, and territories. These four categories alone would generate 420 different strata. Due to the small number of firms that use the CSBFA (only 3,673 out of almost 2 million businesses), region was not included in the strata for CSBFA. Firms in a stratum with five or less were all surveyed to ensure statistically meaningful representation. To ensure representative estimations, each firm that was surveyed was assigned a weight proportional to how many of its stratum type were included in the survey and how many were in the Canadian population.

The sampling frame used by the SFSME was businesses that were in the Business Register (BR) file that is constructed using tax data from the Canada Revenue Agency (CRA). The BR contains all businesses in Canada including both incorporated and unincorporated. Given that this is a survey of SMEs the following businesses were excluded: more than 500 employees, more than $50 million in gross revenue, non-profits; joint ventures; governments of all levels; and various other businesses where SME finance isn't relevant (e.g. utilities, finance, insurance etc. - see Table 49 in

Appendix A for a complete list). A total of 1,999,000 firms were in the final sampling frame. A total of 35,055 enterprises were selected to be sampled with 15,808 completing the interview. This resulted in a collection phase response rate of 45%. For the purpose of estimation, the overall response rate is 59% because a number of the firms that were selected to be sampled were considered to be out of scope for estimation. This response rate was in line with Statistics Canada's expectation of a 45% non-response rate. Sample size was guided by response rates to previous versions of the survey which were carried out in 2000, 2001 and 2004 and with the goal of achieving a 5% coefficient of variance for all domains.

Interviews were conducted between September 2007 and March 2008. Statistics Canada performed nearest neighbour imputation for partial non-response. The time period referenced in the survey questions was relative to the time when the firm was surveyed. Tax data for each firm was taken from their filings for 2002 through 2007.

The more than 15,000 firms that completed the survey consisted of both incorporated and unincorporated businesses. In Canada, only incorporated businesses need to file balance sheet information. As will be discussed in the next section, some of the proxies used in the conceptual model require balance sheet information and for this reason the analysis was restricted to incorporated firms.

Together, this weighted, stratified survey data combined with the matching firm tax data provides a comprehensive, representative, balanced, and statistically accurate perspective of Canadian SMEs. A comprehensive dataset of this size and scope for Canadian SMEs exists nowhere else and provided a unique opportunity to investigate the interaction of SME growth, finance, and innovation.

4.3 Conceptual Model Concepts and their Proxies

The conceptual model shown in Figure 1 on page 98 has a total of 15 concepts (growth, finance, innovation, tangible assets, earnings volatility, cash flow, firm age, firm size, firm exports, financial constraint, government finance, intention to grow, management competency, marketing competency, macroeconomic activity). Of these 15 concepts, the SFSME dataset and firm tax data only provided proxies for 11. As was mentioned previously, this research was a secondary analysis of the existing SFSME dataset. Given this, there were questions that were not asked, questions that could have been used if they had been asked differently and questions that were asked only of a subset of the respondents. For these reasons, no proxies were available for previous intention to grow, management competency, marketing competency, and macroeconomic activity. The survey did have a question about future growth intentions but the linked-in tax data was for the years prior to when the question was asked. Furthermore, the growth intention question was only asked of a subset of the respondents which was too small to obtain significant results. The survey didn't have any questions on management competency. Lastly, the survey question on R&D expenditure was not sufficiently precise to be useful. It asked only the total percentage of investment expenditure that was devevoted to R&D without asking what the total investment expenditure was. For this reason, R&D spending from tax data was used instead.

In addition to the four concepts for which the dataset did not have proxies for, other potential missing variables not included in the model were the ownership structure of the firm, whether the firm had venture capital and specific industry characteristics. Each of these three constructs would have added further insight to the dynamics of SME growth,

finance and innovation. Their absence from the analysis means that the explanatory power of the regressions will be lower and that the resultant regression coefficients could be either smaller or larger. Ownership structure and venture capital funding were not included in the survey and there were not enough firms included in specific industries to obtain significant results. Nevertheless, even with these limitations, the survey combined with the linked-in tax data for the preceding five years provided an invaluable resource which was unique because of its longitudinal nature and comprehensive representation of Canadian SMEs. It may not have been perfect, but the dataset was better than anything else that was available in Canada. With this in mind, the model with the 11 remaining concepts provided valuable insights into the interrelationship between growth, finance and innovation since the literature identified primary correlates of leverage and innovation were included as well as three of the four primary correlates for growth (innovation, age, and cash flow). Each concept, its proxy and its data source is provided in Table 12 below. In the table, CRA stands for Canadian Revenue Agency (tax data) and GIFI stands for General Index of Financial Information which provides the codes for the line items in the balance sheet and income statements. Following the table, each of the 11 available concepts and selection of proxies are discussed in further detail.

Concept	**Proxy**	**Data Source**
Growth	ln([sales 2007 – sales 2002] /sales 2002 + 1) ln([employment 2007 – employment 2002] /employment 2002 + 1)	GIFI 8000(trade sales of goods and services) Payroll deduction average yearly employment
Finance	Leverage = ln([total liabilities 2007 / total assets 2007 + total liabilities 2003 / total assets 2003]/2)	GIFI 3499/GIFI 2599

Concept	Proxy	Data Source
Innovation	Sum of R&D spending/total sales for each year (2003-2007) divided by 5 then decile-ranked by 3-digit NAIC	GIFI 9282/ GIFI 8000
Tangible Assets	(Total tangible assets – total tangible asset amortization) / total assets for 2007 added to the value for 2003 then divide by 2	(GIFI 2008 – GIFI 2009) / GIFI 2599
Earnings Volatility	Standard deviation of operating income / total assets over 2002-2007 period	(GIFI 9369 + GIFI 8710) / GIFI 2599 (Net non-farm income before taxes + interest and bank charges)
Cash Flow	Sum of (Net income + tangible and intangible amortization) / total assets for 2003-2007 divided by 5	GIFI 3680 + GIFI 8670 + GIFI 8570) / GIFI 2599
Age	ln (years in business in 2007)	Survey question on when the firm started selling goods and services
Size	ln ([# of employees 2007 + # of employees 2002]/2)	Payroll deduction average yearly employment
Exporting	Dummy whether the firm exports or not	Survey question if the firm exported or not
Financial Constraint	Dummy whether the firm had a financing request rejected or not	Any negative response to a series of survey questions asking if the firm has had type of finance request rejected
Government Financing	Dummy whether firm has received government finance	Any positive response to survey questions asking if the firm has received a government grant, subsidy, no-interest loan or non-repayable contribution
Growth Volatility (Instrumental variable for growth rate)	Standard deviation of the yearly sales growth rate over five years	Standard deviation (sales growth rate 2002-2003, 2003-2004, 2004-2005, 2005-2006, 2006-2007)

Table 12: Concepts, their proxies and data sources

4.3.1 Growth

Growth as a concept has four common measures (sales, employment, profit, equity/assets) with sales growth being the most prevalent (Shepherd & Wiklund, 2009). Sales growth has the advantage that it captures growth in companies that expand through outsourcing rather than hiring additional employees (ibid). For this reason, sales growth was selected as the primary measure of growth and employment growth was used for comparative purposes.

Another decision was whether to calculate growth in absolute terms or relative terms. An absolute measure favours large companies where a small percentage increase (decrease) is a large absolute increase (decrease). A relative measure favours small companies where a small absolute increase (growing from $20,000 to $40,000 in sales) is a large relative increase (100%). According to Shepherd and Wiklund (2009), the papers analysed for their survey were equally split between relative and absolute measures. In contrast to their findings, virtually all growth calculations in the citations used in this thesis were relative growth. With this in mind, a relative measure was used for this research.

Large relative or absolute increases/decreases can be smoothed by using a natural logarithm transformation. Numerous researchers have taken this route (Angelini & Generale, 2008; Carpenter & Petersen, 2002; Rajan & Zingales, 1995). Given that the focus of this research is SMEs which are predominantly very small, the likelihood of having large relative growth increases and decreases was quite high. With this in mind, the relative sales growth measure was transformed using a natural logarithm.

The final consideration for measuring growth was selecting the duration. In an attempt to smooth out the randomness of firm growth from year-to-year (Dobbs & Hamilton, 2007; Geroski, 2005), a relatively long time duration of five years was selected. The hope was that by measuring growth over a longer duration those firms with higher growth would have done purposeful actions to achieve this growth that would be reflected in the analysis.

The data source for sales growth came from tax data GIFI 8000 which is a firm's total trade sales of goods and services. Total employees came from the payroll deduction data filed with CRA, specifically the average yearly employment.

4.3.2 Finance

How a firm finances itself is manifest through its capital structure. As described earlier, a firm's capital structure is the proportion of debt and shareholder equity that a firm has. Shareholder equity is made up of both paid-in capital and retained earnings. Since the shareholders own both the retained earnings and paid-in capital, for the purposes of capital structure they can be treated as one and the same. With this in mind, capital structure was modeled as the ratio of debt or liabilities to total firm value which is also known as leverage (Brav, 2009; Hovakimian et al., 2001; Rajan & Zingales, 1995; Titman & Wessels, 1988).

In the literature there are two primary proxies for a firm's leverage. One is market value and the other is book value. Market value leverage has the book value of debt in the numerator and the book value of debt plus the market value of equity in the denominator. Book value leverage uses the book value of equity in place of the market value. Needless-to-say, market value leverage is not an option when considering SMEs since

they are not publicly traded companies. It is interesting to note that O'Brien (2003) in his investigation of innovation as a strategy found no quantifiable difference in his results using book or market value for leverage. In his regression, leverage was the dependent variable and innovation was the independent variable.

The last decision to be made is to choose the appropriate balance sheet line item to use for debt. In the research on publicly traded companies, some researchers use only long-term debt (Bradley et al., 1984), some use long-term debt and short-term debt (Brav, 2009; Faulkender & Petersen, 2006) while yet others use total liabilities (Rajan & Zingales, 1995). Hughes (1994) makes the point that small firms use current liabilities as a key component of their financing since other debt options are often not available to them. With this in mind, capital structure was proxied by the book leverage using total liabilities in the numerator and total assets in the denominator. Both these values came from the balance sheet information that Canadian incorporated businesses are required to file with the CRA (GIFI 3499 for total liabilities and GIFI 2599 for total assets). Since growth was measured over a five-year period, leverage was measured as the average between the firms leverage in the first year (2003) and last year (2007).

4.3.3 Innovation

An in-depth discussion on measuring innovation was already presented in section 2.4.3 on page 75. Even though output measures (such as the number of innovative processes and products not patents) and a firm's innovation orientation are better measures of innovation, they were not available in SFSME. With access to each firm's tax data, a firm's R&D spending (input measure) was available since it is a claimable expense. Therefore R&D spending scaled as a percentage of sales was used as the proxy

for innovation. Following O'Brien (2003), the R&D scaled value was decile-ranked by 3-digit NAIC in order to effect comparisons across industries that have different rates of R&D spending. The GIFI code for R&D spending is 9282 and total sales is the same as used for firm growth GIFI 8000. The R&D spending to total sales was averaged over the 2003 to 2007 time period before it was decile-ranked.

4.3.4 Tangible Assets

Tangible assets are a firm's assets that are considered to have value lasting more than a year and can be depreciated over a number of years, the length of which depends on the asset. Machinery and buildings are examples of tangible assets. In the literature, asset tangibility is proxied by the book value of fixed assets divided by the book value of total assets (Hovakimian et al., 2001; O'Brien, 2003; Rajan & Zingales, 1995). Contained in the balance sheet information filed with the CRA are line items for a firm's total tangible assets and total assets. Following the literature, the level of a firm's tangible assets was proxied by dividing the former by the latter. The balance sheet information tracks the initial book value of the tangible assets (GIFI 2008) as well as the total accumulated amortization (GIFI 2009). In order to get the current book value, the latter was subtracted from the former. Total assets is GIFI 2599. The value used in the regression was the average between the starting year (2003) and final year (2007).

4.3.5 Earnings Volatility

Earnings volatility is how much a firm's net income varies from year to year. Three examples of earnings volatility measures used in previous research are: "the standard deviation of the percentage change in operating income" (Titman & Wessels, 1988, p. 6); "the standard deviation of historical operating income, requiring at least 3 years of data"

(Lemmon et al., 2008, p. 1606); and "the standard deviation of the first difference in the annual earnings before interest, depreciation and taxes" divided by total assets (Bradley et al., 1984, p. 872). Following from these previous researchers, earnings volatility was measured as the standard deviation of operating income divided by total assets over the period 2003 to 2007. This information came from the firm's tax data. A firm's net income before taxes is GIFI 9369 and its interest and bank charges (GIFI 8710) was added to it to get the operating income. Total assets is GIFI 2599.

4.3.6 Cash Flow

Cash flow is the amount of actual cash that a firm earns before paying taxes. The definition of the measures for cash flow and profitability (also known as Return on Assets (ROA)) are quite similar and are probably highly correlated. ROA in the literature is most often defined as EBITDA (earnings before interest, taxes, depreciation, and amortization) divided by the book value of assets (Lemmon et al., 2008; O'Brien, 2003; Rajan & Zingales, 1995). Sometimes ROA is defined as EBIT/total assets which is slightly different than the previous definition in that it removes depreciation and amortization (Brav, 2009; Titman & Wessels, 1988). Cash flow in contrast to ROA is a measure of how much actual free cash the company is generating. In this case, interest and taxes must be paid and only depreciation and amortization are non-cash accounting entries in the income statement. So cash flow is defined as net income plus depreciation and amortization divided by total assets. This was the definition used by Carpenter and Petersen (2002) in their paper which showed cash flow to be the primary driver of growth for small publicly traded firms. Since the predictor proposed for this research is based on the concept of cash flow being a primary driver of growth like that of Carpenter and

Petersen (2002), their proxy was used. Once again, this data will come from the firm's tax data. Net income is GIFI 3680 and yearly amortization of tangible assets is GIFI 8670 and intangible assets it is GIFI 8570. As always total assets is GIFI 2599. The cash flow measure was averaged over the 5-year period 2003 to 2007.

4.3.7 Firm Age

Firm age was obtained by one of the questions in SFSME interview. Specifically, each firm was asked: "During what year did the business first start selling goods and services?" The response was then subtracted from 2007 to obtain the firm's age. Since the distribution of firm ages was positive skewed, firm age was transformed using a natural logarithm (Angelini & Generale, 2008; Beck et al., 2006; Brav, 2009).

4.3.8 Firm Size

In the literature, firm size can be measured by number of employees (Angelini & Generale, 2008; Becchetti & Trovato, 2002; Brander, Hendricks, Amit, & Whistler, 1998), total assets (Brav, 2009; Hovakimian et al., 2001; Lemmon et al., 2008) or sales (Beck et al., 2006; Rajan & Zingales, 1995; Titman & Wessels, 1988). Virtually in all cases whichever measure is used for firm size, the value is transformed by its natural logarithm due to its positive skewed distribution. Generally in growth studies, number of employees is used and in leverage studies it is either sales or total assets. For this research, growth was considered to be the first of the three primary concepts (growth, finance, innovation) and following from this number of employees was chosen as the measure of size. To account for the positive skewed distribution of firm size, it was transformed using a natural logarithm. In order to avoid the regression to the mean issue associated with using size from the initial year of the growth measure (Haltiwanger et al.,

2010), size was measured as the average between the starting year (2003) and final year (2007). The number of employees was obtained from payroll deduction files associated with the firm's tax information. This is known as the average yearly employment.

4.3.9 Firm Exporting

Firm exporting is whether a firm is involved in exporting. It can be measured as a dummy variable or as a percentage of sales that is derived from exports. By far the most common measure used in the literature for firm exporting is a simple dummy variable that represents whether the firm exports or not (Baldwin et al., 2002; Becchetti & Trovato, 2002; Beck et al., 2008; McMahon, 2000; Smallbone & North, 1995; Van Beveren & Vandenbussche, 2010). Firm exporting as the percentage of total sales derived from exporting was found in only two papers (Bhattacharya & Bloch, 2004; McMahon, 2000). The SFSME data provided only the option for whether a firm exports or not. Given that all the cited papers which used an export dummy as a predictor had significant findings and it was the only option available, it was used in this study.

4.3.10 Financial Constraints

A firm faces financial constraint when it would like additional money (from earnings or any other source) and is unable to obtain it. There are several different proxies for financial constraint used in the literature. The most common one was a survey question asking if the firm was turned down for a loan which was found in three papers (Angelini & Generale, 2008; Becchetti & Trovato, 2002; Freel, 2007). Two papers were found that used a multi-point scale asking the level of financial constraint that the firm perceived (Beck et al., 2008; Binks & Ennew, 1996). In addition to using a dummy variable based on whether a firm had been turned down for a loan, the paper by Angelini and Generale

(2008, p. 433) also used "two alternative, non-survey-based proxies for financially constrained firms" which obtained substantively the same results. The first measure which they used was the ratio of financial expenses divided by financial expense plus profits and set the firms in the upper quartile as financially constrained. The other measure they used was a ratio of fixed assets to total assets and this time setting the bottom quartile as financially constrained. Angelini and Generale were studying employment growth such that the dependent variable in their regressions was the percentage change in employees. Given the apparent robustness of a loan turndown dummy for indicating financial constraint and the fact SFSME has this information, it was used as the proxy for financial constraint.

The SFSME is a finance centric survey and it asked questions about a wide range of finance types and finance suppliers that a firm could use. Examples of finance types are loans, leases, equity, supplier credit and government financing. In each case, the survey asked whether the firm's request was authorized, partially authorized, and/or turned down in the past three years. The financial constraint dummy was set to one if a firm received only a partial amount or was turned down.

4.3.11 Government Financing Support

Government financing support is when a firm has received some form of monetary benefit from the government. This can be in many different forms such as loan guarantees, grant, subsidy, reduced interest loans, etc. Beck et al. (2008) used a dummy variable to represent if a firm has received subsidies from government in their source of finance regression. Following this, this research used a dummy variable set to one to represent government financing support if a firm had received a grant, subsidy, no-

interest loan or non-repayable contribution from government in the last three years. This information was obtained from the response to a question in the SFSME that asked specifically about these four types of government financing support.

4.4 Data Analysis

Due to the measures that were selected to represent the concepts in the conceptual model, the type of firms included in the analysis was affected. First, as mentioned previously, only incorporated firms were included since unincorporated firms in Canada don't file balance sheet information. Second, very young firms were excluded, since a firm must have five years of growth data (2002-20007) to be included. Third, firms must have greater than 0 employees to be included in the study. Employment numbers were obtained through CRA's payroll deduction database which only exists for a firm if there was at least a fraction of a person on the payroll. This is a reasonable restriction. Considering that growth is one of the primary concepts for this research, a firm that doesn't have anyone on its payroll after five years is likely not applicable.[4]

In addition to the NAICs originally excluded from the sample frame, all businesses starting with the first two digits "11" (agriculture, forestry, fishing and hunting) were also removed due to their unique business structures.

Since the SFSME survey was performed at a single point in time, it limited the analysis to cross-sectional. In the literature, growth, finance, and innovation regressions are typically performed using ordinary least square (OLS), but since the conceptual model has hypothesized endogenous relationships between growth, finance, and

[4] Similar research is typically limited to firms with at least 10 employees (e.g. Angelini & Generale, 2008; Becchetti & Trovato, 2002; Delmar & Wiklund, 2008).

innovation, using OLS may not be suitable. When an independent variable's error term is correlated with the error term of the dependent variable, OLS results in inconsistent estimators (Wooldridge, 2002). In order to confirm if the hypothesized endogenous variables were actually endogenous a Hausman test was performed (Wooldridge, 2002). If the independent variable was endogenous, two-staged least squares (2SLS) was used to test the model. All statistical tests were carried out with robust standard errors in order to account for heteroskedasticity.

Another method considered for analysing the model was to use statistical techniques that handle simultaneous equations. Simultaneous equation modeling is applicable in situations where there are a series of equations where each equation can be considered autonomous (considered in isolation) but due to measurement errors and/or omitted variables OLS is not applicable (Wooldridge, 2002). In these situations 3SLS (3-staged least squares) or the structural equation modeling (SEM) technique of path analysis can be used. In order to use either of these two techniques, the model needs to be identified. As specified, the model isn't identified unless several exogenous/endogenous links (links between predictor variables and growth, finance, innovation) are removed. Though the presented conceptual model hypothesizes the possible existence of numerous exogenous/endogenous relationships, as will be discussed in the next chapter, the regression analysis revealed that a number of the links were not significant which allowed for the links to be trimmed making the model identified such that it could be analysed using simultaneous equation modeling technique.

The trimmed and subsequent identified model was analysed using SEM path analysis. Path analysis, by explicitly modeling the variable endogeneity, results in consistent

estimators. Path analysis, rather than latent variable SEM was used due to a lack of multiple indicators for each of the concepts in the model. SEM path analysis has advantages over 2SLS in that it estimates the full model simultaneously using maximum likelihood estimation as well as handling covariance between predictors and between endogenous variables (Kline, 2005). SEM is preferred to 3SLS since the Mplus SEM statistical package supports survey weights and robust to heteroskedasticity standard errors. The Stata statistical package implementation of 3SLS doesn't support survey weights and the SAS statistical package implementation of 3SLS doesn't support robust standard errors. Another advantage of SEM was that group comparisons could be performed using multi-sample path analysis which provides the ability to compare two groups simultaneous and determine if the values of the model parameters significantly differ across the two groups.

All data are subject to outliers that in themselves can be valid or may be a result of a data entry problem. As discussed previously, very small, private firm income statements and balance sheets may not reflect the actual business and don't undergo the same scrutiny as that of public firms or even that of larger SMEs. Compounding this problem is whatever balance sheet information filed with the CRA is entered "as is". This potentially complicates data analysis due to the possible presence of a larger number of outliers. In order to manage outliers, researchers trim their accounting variables by 0.5% or 1.0% at the tails (e.g. see Brav, 2009). Another technique for removing outliers is the use of robust estimators (see Macdonald, 2007). Robust estimators are iterative algorithms that predict which data points are outliers and/or leverage points for a specified regression. Outliers are aberrant dependent variable observations while leverage points are aberrant

independent variable observations. One type of robust estimator is the S-estimator of Rousseeuw and Yohai (1984) which is able to predict both outliers and leverage points.

In order to determine which filtering technique would be most appropriate for this research, each technique was used on the dataset followed by some trial regressions. The two endogenous variables of growth and finance were both filtered. Since there were two measures for growth, employment and sales growth, each was filtered. Innovation was decile-ranked and did not need to be filtered. Before filtering, there were 3459 observations. Filtering at the 1% tails resulted in 228 (6.6%) observations being removed. Outlier filtering using the robust S-estimator (cut off was three standard deviations) resulted in 411 (11.9%) observations being removed. Filtering at three standard deviations with the S-estimator should have resulted in approximately 1.8% (0.3% x 6) observations being filtered assuming a normal distribution. The dataset that was trimmed 1% at the tails had very poor R-squared values, resulted in weak instrumental variable explanatory power, and had unstable SEM performance. For these reasons, the analysis was performed using the S-estimator trimmed data.

Table 13 presents the means for the variables including the untransformed values for leverage, growth rate, size (number of employees) and age (in years). Several points are worth noting. Sales growth over the five-year period was twice that of employment growth: 38.4% versus 16.3%. Clearly firms do not grow their number of employees in proportion to their sales. Average leverage was 82%. This was a result of some firms having negative retained earnings such that in the extreme case leverage was over 500%. The average age and firm size was 22 years old and 11 employees respectively. Half the firms had five or less employees. Average age was affected by the requirement that firms

had to be greater than five years old to be included in the analysis; 36% of the firms were removed due to age. This excluded group had an average age of 2.6 years and an average of 7.4 employees. This is consistent with typical firm size distributions (Angelini & Generale, 2008) and the fact that 50% of new entrants don't live to see their third birthday and only 20% reach their 10th birthday (Baldwin et al., 2000). Since export, financial constraint, and government were dummy variables, their means represent the percentage of the population that have this characteristic. Therefore 13.9% export, 3.6% were financially constrained, and 2.8% received some form of government finance. Lastly 5.7% of the firms had R&D spending.

Table 14 on the following page presents the correlations (lower diagonal), variances (diagonal) and covariances (upper diagonal) for the variables. There is one additional

Variable	**Means**	**Standard Deviation**
Leverage	-0.478	0.712
Untransformed leverage	81.7%	7.94
Sales Growth	0.200	0.493
Untransformed sales growth	38.4%	6.93
Employment growth	0.020	0.511
Untransformed employment growth	16.3%	5.93
Innovation	0.528	2.08
% firms that have R&D spending	5.7%	-
Tangible	0.296	0.254
Earnings Volatility	0.167	0.247
Cash Flow	0.117	0.177
Age	2.91	0.600
Untransformed age	22.1 years	134
Size	1.73	1.15
Untransformed size	11.4 employees	180
Exporter	0.139	0.346
Financial Constraint	0.036	0.186
Government finance	0.028	0.164

Table 13: Variable means

	Leverage	Growth (sales)	Growth (emp.)	Innov.	Tangible Assets	Earnings Volatility	Cash Flow	Age	Size	Export	Constraint	Gov.
Leverage	0.508	-0.004	-0.014	-0.060	0.031	0.063	-0.037	-0.071	-0.081	0.015	0.005	-0.002
Growth (sales)	-0.010	0.243	0.125	-0.022	0.007	-0.002	0.019	-0.037	0.055	0.001	-0.005	0.005
Growth (emp.)	-0.039**	0.497***	0.261	-0.021	0.005	-0.002	0.012	-0.030	0.040	-0.000	-0.003	0.006
Innovation	-0.041**	-0.021	-0.020	4.309	0.011	-0.017	-0.009	-0.044	0.231	0.076	0.028	0.051
Tangible	0.169***	0.052***	0.036**	0.021	0.065	0.002	0.003	-0.004	-0.004	-0.009	0.005	0.002
Earnings Volatility	0.359***	-0.014	-0.016	-0.033*	0.035*	0.061	-0.006	-0.021	-0.061	0.002	0.001	-0.003
Cash Flow	-0.289***	0.217***	0.135***	-0.024	0.062***	-0.130***	0.031	-0.006	-0.010	-0.007	-0.000	-0.001
Age	-0.167***	-0.124***	-0.097***	-0.035*	-0.029	-0.139***	-0.054***	0.360	0.166	-0.000	-0.001	0.005
Size	-0.098***	0.098***	0.068***	0.097***	-0.015	-0.215***	-0.051***	0.240***	1.322	0.051	0.006	0.034
Export	0.063***	0.007	-0.002	0.106***	-0.098***	0.023	-0.107***	-0.001	0.128***	0.120	0.000	0.007
Constraint	0.034**	-0.054***	-0.033*	0.073***	0.097***	0.024	-0.006	-0.007	0.028	0.004	0.034	-0.000
Government	-0.017	0.057***	0.070***	0.151***	0.054***	-0.063***	-0.021	0.049***	0.181***	0.127***	-0.012	0.026

Table 14: Variable Covariances, Correlations and Variances[5]

[5] Variable definitions are in Table 12. Correlations are in the lower diagonal. Covariances are in the upper diagonal. Variances are on the diagonal. * is significant at p <.10, ** is p <.05, and *** is p < .01. There were 3048 observations.

variable included in the table that is "growth volatility". Growth volatility was used as an instrumental variable for growth and is the standard deviation of the yearly sales growth rate over the years 2002 to 2007.

5.0 Findings

Before proceeding with the analysis, endogeneity tests were performed in order to determine if 2SLS should be used rather than OLS. As it turns out, none of the dependent variables (growth, leverage, innovation) were endogenous, so OLS could be used. Furthermore, the OLS regression revealed that some of the independent variables had insignificant coefficients such that they could be dropped enabling identification for the SEM analysis. The findings chapter is organized as follows. The results of the endogeneity tests are presented first followed by the results of the OLS regression. The results of the SEM path analysis is then presented and compared to the OLS results. Following this the results of the six different group comparisons using SEM path analysis are presented.

5.1 Endogeneity Tests

The primary hypothesis of the conceptual model presented in Figure 1 is that growth, finance and innovation are endogenous to each other. As previously described, if they are in fact endogenous, using OLS to estimate the model will result in incorrect estimates and 2SLS needs to be used instead. The regression equations for the three dependent variables are listed below.

(1) Growth
$$= \beta_0 + \beta_1 Leverage + \beta_2 Innovation + \beta_3 Cash\ Flow + \beta_4 Age + \beta_5 Size + \beta_6 Export + \beta_7 Financial\ Constraint + \beta_8 Government\ Support$$

(2) Leverage
$= \beta_0 + \beta_1 Growth + \beta_2 Innovation + \beta_3 Cash\ Flow + \beta_4 Age + \beta_5 Size + \beta_6 Export + \beta_7 Financial\ Constraint + \beta_8 Government\ Support + \beta_9 Tangible\ Assets + \beta_{10} Earnings\ Volatility$

(3) Innovation
$= \beta_0 + \beta_1 Growth + \beta_2 Leverage + \beta_3 Cash\ Flow + \beta_4 Age + \beta_5 Size + \beta_6 Export + \beta_7 Financial\ Constraint + \beta_8 Government\ Support.$

In order to perform the endogeneity tests, instrumental variables were required for each of the predicted endogenous variables. Furthermore, if more than one instrumental variable is selected for an endogenous variable, overidentification tests need to be performed to confirm that the instrumental variables themselves are not endogenous. In the case of a single instrumental variable it is not possible to perform a test to determine if it is endogenous, so it is necessary to rely on reasoning.

The selected instrumental variable for sales growth and employment growth was sales growth volatility and employment growth volatility respectively. These volatility measures were measured as the standard deviation over five years (2002-2007) of each firm's annual sales growth rate and employment growth rate. Sales growth volatility is significantly correlated with sales growth (0.163, $p < 0.0001$) and employment growth volatility is significantly correlated with employment growth (0.081, $p < 0.0001$). Another consideration in selecting an instrumental variable is whether the instrumental variable itself is endogenous. One possibility is that as a volatility measure, sales growth volatility could be correlated with leverage since it is in theory affected by fluctuating income. But since earnings volatility was included as an independent variable, this volatility is taken into account. Since there is only one instrumental variable for growth, an overidentification test is not possible. A further consideration in selecting an

instrumental variable is that it must have a nonzero coefficient when the endogenous variable is regressed on it and the other exogenous variables. For sales growth rate volatility, the coefficient estimate was significantly different than zero (0.197, $p<0.000$) and for employment growth rate volatility the coefficient estimate was also significantly different than zero (0.062, $p<0.064$). A final consideration in selecting an instrumental variable is computing the F statistic from the first-stage regression which is 12.75 for sales growth rate and 5.16 for employment growth rate.

For leverage, possible instrumental variables were tangible assets and earnings volatility since they were not correlates of either growth or innovation in the proposed model. Both earnings volatility and tangible assets were significantly correlated with leverage (see Table 14) and their regression coefficient estimates were significantly different from zero in the first stage regression (0.849, $p < 0.000$ and 0.491, $p <0.000$ respectively). Given that leverage has two instrumental variables, an overidentification test to determine if the instrumental variables themselves are endogenous can be performed. The result of a heteroskedasticity-robust overidentification test had a significance of $p = .42$ indicating that the instrumental variables were not endogenous. The F statistic from the first stage regression was 22 independent of whether growth was measured using sales or employment.

The selected instrumental variable for innovation was a dummy variable representing whether or not a firm had invested in R&D. This dummy variable was created using the firm's response to the survey question which asked "What percentage of total investment expenditure was devoted to research and development?" If the firm responded with a value greater than zero, the dummy was set to one; otherwise it was set to zero. This

R&D investment dummy variable had a significant coefficient in the innovation regression (0.811, $p < 0.001$) and it was significantly correlated with the innovation measure (0.191, $p < 0.0001$). The F statistic from the first stage regression for sales growth and employment growth was 5.55 and 5.48 respectively.

With the instrumental variables selected for each of the hypothesized endogenous variables, endogeneity tests were performed. To save space, only the conclusions of the tests are presented. Furthermore, since the tests were qualitatively the same for both sales growth rate and employment growth rate, only the sales growth rate results are discussed here. The overall result is that none of the three dependent variables were endogenous in any of the three models. The tests indicated that neither growth rate nor innovation are endogenous to leverage ($F = 1.20$, $p<0.70$). Neither leverage nor innovation were endogenous to growth ($F = 0.53$, $p<0.41$). Lastly, neither leverage nor growth rate were endogenous to innovation ($F = 0.18$, $p<0.16$). Though innovation was not found to be endogenous to either growth or leverage, this may be a result of the weak measure for innovation which was used in this research. This will be discussed in further detail later.

Given that none of the dependent variables (growth, leverage, innovation) were found to be endogenous, it is not necessary to use 2SLS. The next section presents the results of the OLS estimation.

5.2 OLS Results

The purpose of this section is to present the results from testing the conceptual model shown in Figure 1 on page 98 using the dataset as a whole before dividing it into groups and performing the six different group comparisons. The hypotheses for this test are repeated in Table 15 below. It was hypothesized that leverage and growth as well as

leverage and innovation would exhibit bidirectional significant relationships and that innovation on growth would have a significant relationship. The results from the OLS estimation are shown in Table 16.

Comparing the results to the hypotheses in Table 15 and the predictions shown in Figure 1 reveals several differences. From a hypotheses perspective, none of the dependent variables exhibit a significant relationship with each other. Other than growth on innovation which was predicted not to have a relationship, the lack of significant relationships among the remaining dependent variables was contrary to the hypotheses.[6] As will be shown later, when dividing the sample into groups, the dependent variables on occasion do exhibit significant relationships with each other. The sample as a whole is likely too heterogeneous to exhibit relationships among the dependent variables.

With regards to innovation as a regressor of either leverage or growth, the lack of significance could also be a result of the measure used for innovation.[7] As other researchers have pointed out, using R&D expenditure for SMEs only captures a fraction

Area being tested	**Hypothesis**
Investigates leverage-growth relationship	H1. Leverage on growth is negative
	H2. Growth on leverage is positive.
Investigates leverage-innovation relationship	H3. Leverage on innovation is negative
	H4. Innovation on leverage is negative
Investigate growth-innovation relationship	H5. Growth on innovation is positive.
	H6. Innovation on growth no relationship

Table 15: Summary of bidirectional relationship hypotheses

[6] As an experiment, following from Delmar and Wiklund (2008), previous growth experience as a predictor of future growth (a proxy for future growth intention) was used. Growth rates for 2002-2003 and 2002-2004 were used as predictors for the growth rate for 2003-2007 and 2004-2007 respectively. No significant results were found in either case.

[7] A number of alternative innovation measures were tried such as: a dummy variable for whether a firm had R&D spending or not; not decile ranking the R&D expenditure; using the % of investment devoted to R&D from the survey and a dummy for whether or not a firm devoted investment monies to R&D. The R&D expenditure decile ranked by 3-digit SIC code performed best. One other experiment was rerunning the regression using only knowledge based firms, but there were not a sufficient number of firms to give statistical significant results.

	Sales Growth Rate			Employment Growth Rate		
Variable	Growth	Leverage	Innovation	Growth	Leverage	Innovation
Growth	-	0.043 (0.043)	-0.160 (0.119)	-	-0.025 (0.047)	-0.153 (0.127)
Leverage	0.033 (0.023)	-	-0.167 (0.133)	-0.008 (0.029)	-	-0.173 (0.133)
Innovation	-0.008 (0.006)	-0.017 (0.013)	-	-0.009 (0.007)	-0.017 (0.013)	-
Tangible Assets	-	0.491*** (0.085)	-	-	0.496*** (0.085)	-
Earnings Volatility	-	0.841*** (0.101)	-	-	0.844*** (0.100)	-
Cash Flow	0.644*** (0.093)	-1.093*** (0.131)	-0.240 (0.283)	0.374*** (0.092)	-1.057*** (0.130)	-0.286 (0.266)
Age	-0.117*** (0.027)	-0.153*** (0.036)	-0.258* (0.134)	-0.102*** (0.030)	-0.160*** (0.036)	-0.255* (0.138)
Size	0.062*** (0.013)	-0.013 (0.018)	0.137** (0.063)	0.042*** (0.014)	-0.009 (0.018)	0.133** (0.065)
Export	0.012 (0.041)	0.107 (0.070)	0.484*** (0.156)	-0.006 (0.044)	0.108 (0.069)	0.481*** (0.157)
Financial Constraint	-0.148 (0.102)	0.051 (0.066)	0.796 (0.530)	-0.087 (0.067)	0.042 (0.068)	0.806 (0.525)
Government support	0.143** (0.059)	-0.019 (0.090)	1.673*** (0.551)	0.208*** (0.070)	-0.008 (0.091)	1.682*** (0.549)
Constant	0.379*** (0.083)	-0.185 (0.116)	0.882** (0.393)	0.200** (0.089)	-0.166 (0.114)	0.852** (0.394)
R-squared	0.088	0.242	0.047	0.043	0.241	0.047
Number of observations	3048	3048	3048	3048	3048	3048

Table 16: OLS Regression Results for Sales and Employment Growth Rates[8]

[8] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01

of the innovative activities (Hansen, 1992). This issue is likely exacerbated in Canada since R&D expenditures generate tax credits via SRED and the government regularly audits these claims. SMEs are only likely to make R&D claims when they have all the appropriate documentation further reducing the amount of innovation captured by this measure.

For the independent variables, two of the coefficient estimates were significant and opposite signed to what was predicted: leverage on earnings volatility and innovation on size. Based on theory, earnings volatility was predicted to have a negative coefficient estimate for leverage, yet the coefficient estimate was positive and significant in both the sales growth regression and the employment growth regression. What could have caused this? For publicly traded firms, earnings volatility reduces the amount a firm can borrow since it has to have enough cash to pay the interest on its borrowings. Table 14 shows that earnings volatility had a positive correlation with leverage and a negative correlation with cash flow, age and size. In addition, cash flow is negatively correlated with leverage and it had a significant negative coefficient estimate with respect to leverage (-1.093, $p<0.000$ (sales), -1.057, $p < 0.000$ (employment)). When combining the correlation and regression results, it appears that SMEs start life with higher leverage than older and larger firms and they reduce their leverage whenever they get the chance. It appears that those firms with higher earnings volatility have less overall cash flow (all else equal) due to their fluctuating earnings and are unable to reduce their leverage to the same extent as those firms with lower earnings volatility.

Based on the extant empirical literature, size was hypothesized to have a negative coefficient estimate for innovation, but in this model it was positive (0.137, $p<0.063$

(sales) & 0.133, $p<0.065$ (employment)). Taken at face value this would mean that larger firms (more employees), spend more on R&D as a proportion of sales than their smaller firm peers. To understand this result, it is necessary to understand the R&D spending characteristics of SMEs. Only 5.7% report R&D spending in their tax information. As a percentage of sales, smaller SMEs (defined as less than $1,000,000 in sales) that have R&D spending, spend a higher proportion of sales (1.8%) in comparison to larger SMEs (greater than or equal to $1,000,000 in sales) that have R&D spending and spend an average of 1.5% of sales on R&D. But since 8.9% of larger SMEs have R&D spending versus 3.8% of smaller SMEs, the regression gives the result that larger SMEs "spend more" on R&D than smaller SMEs. The proper interpretation is that larger SMEs have a greater likelihood of spending on R&D. The regression result notwithstanding, if a smaller SME does have R&D spending, it will spend proportionally more than a larger SME.[9]

Two other coefficient estimates had the opposite sign than predicted but they were not significant: innovation on cash flow and leverage on government subsidy. The insignificant negative coefficient estimate for innovation regressed on cash flow is contrary to numerous other researchers' findings and could be due to the weak innovation measure which was used. Leverage on government subsidy had a negative coefficient (though small and insignificant) instead of positive which was hypothesized. This hypothesis was based on a study that used a sample of firms from multiple countries (Beck et al., 2008). Possibly within the Canadian context, government subsidy reduces

[9] The results are quantitatively similar if 20 employees are used as the cut-off between larger and smaller SMEs.

the need for a firm to borrow rather than it being a signal that the firm has lower default risk and can take on proportionally more debt.

There were four noteworthy differences in the regression model results when comparing the use of sales and employment growth rate measures and all involved the growth model. First, the R-squared value for the sales growth model (0.088) was twice the size of the R-squared for the employment growth model (0.043). This difference could be caused by firms being somewhat reluctant to add and remove employees (a form of hysteresis) thereby reducing the explanatory power of the independent variables. The other three differences involved the size of the estimated coefficients. Cash flow and size had a greater effect on sales growth while government subsidy had a greater effect on employment growth. In all three cases, the estimated coefficients were significant and they had the predicted sign. For cash flow, the estimated coefficient was 72% larger for sales growth (0.644) than for employment growth (0.374) and for firm size, the estimated coefficient was almost 50% larger for sales growth (0.062) than for employment growth (0.042). This increased effect of firm size and cash flow on sales growth in comparison to employment growth is likely a result of the same causes that are driving the R-squared differences, namely a reluctance of firms to add or reduce employees as sales change. Using government grants had a significant positive coefficient estimate with respect to growth rate, but its size was almost 50% larger for the employment growth model (0.208) than the sales growth model (0.143). This stronger employment growth effect is consistent with how programs like SRED and IRAP are designed.

For the remaining coefficients estimates, all had the predicted sign except for employment growth rate on export (negative rather than positive but very small and

insignificant), with approximately half of the coefficients significant. These results are discussed briefly below.

As predicted, there was no significant relationship when innovation was regressed on either growth measure which is consistent with R&D exhibiting a high cost of adjustment (Coad & Rao, 2010; Hall, 2002).

Due to mixed results in the literature, no prediction was made for leverage regressed on size. Consistent with this prediction, the coefficient estimates were not significant.

As predicted, age had a significant negative coefficient estimate for growth, leverage and innovation. Also as predicted, tangible assets had a significant coefficient estimate for leverage. Government funding had a significant positive coefficient estimate for a firm's R&D spending relative to its peers which points to the government funding programs such as IRAP and SRED being used to fund R&D.

Exporting had a significant positive coefficient estimate for innovation as predicted but it didn't have a significant impact on growth or leverage. Rerunning the regression on those firms that had either more than $1,000,000 in sales or greater than 20 employees didn't improve the result. The survey data only provided information on whether the firm exported or not, rather than the percentage of revenue that came from export. Perhaps a percentage of revenue measure for export would have resulted in significant findings.

Cash flow had a significant positive coefficient estimate for both sales and employment growth rate consistent with the findings of Carpenter and Petersen's (2002). This result is informative to finance theory in showing that similar to small publicly traded firms, internal finance is an important source of finance. Note that the cash flow coefficient estimate for the sales growth regression is almost double that of the

coefficient estimate in the employment growth regression (0.644 to 0.374). Employment growth occurs at a slower rate than sales growth. Cash flow was also found to have a significant negative coefficient estimate for leverage consistent with the literature for both public and private firms.

Consistent with Haltiwanger et al. (2010), size, measured as the average number of employees over the growth period and controlling for age, had a significant positive coefficient for growth.

The coefficient estimates for leverage on innovation and innovation on leverage were negative as predicted but none were significant. This was probably due to the previously discussed weak measure of innovation that was used for this research.

Though the correlations between financial constraint and the dependent variables were all significant and of the predicted sign, the estimated coefficients were not significant. This could be due to the small number of firms which expressed financial constraint (3.6%).

To summarize, the primary hypotheses predicted that leverage would exhibit significant bidirectional relationships with growth and innovation and that growth on innovation would be significant. For this analysis of the full sample no significant relationships were found between the three dependent variables. Though disappointing, this result is not completely unexpected due to the heterogeneous nature of SMEs as well the weak measure for innovation. SMEs are a diverse and varied lot and in analysing the sample as a whole only those relationships that are truly universal would be revealed. Universal relationships require that all types of SMEs exhibit similar characteristics so that the data with regards to the conceptual model behaves similarly independent of

whether the full group or a subgroup is analysed. As discussed earlier, this is not a realistic assumption such that different subgroups are expected to exhibit different conceptual model characteristics. As will be described shortly, significant relationships between the dependent variables do appear when the sample is divided into specific groups. Even though the relationships between growth, leverage and innovation didn't exhibit any significant links for the full sample, a number of independent variables did, which shows that SMEs act in a manner consistent with some of the extant theories of growth, finance and innovation. This is significant given that the sample is a weighted to represent all SMEs in Canada. Specifically, cash flow and size are positively related with firm growth while age is negatively related. Tangible assets are positively related to leverage while age and cash flow are negatively related. Export is positively related to innovation while age has a negative relationship. One novel and contrary finding was the positive relationship between earnings volatility and leverage which was attributed to the inability of SMEs with higher earnings volatility to pay down their debt.

5.3 Full Model SEM Path Analysis and OLS Comparison

This section repeats the analysis of the previous section but using SEM path analysis rather than OLS. As mentioned earlier, the model as presented in Figure 1 is not identified but based on the results of the previous two sections it is possible to trim several links thereby achieving identification. Specifically, since the endogeneity tests performed above confirmed that growth, leverage and innovation were not endogenous to each other, it is not necessary to link the disturbances of the dependent variables. Also, based on the OLS regressions, size and government support were dropped from the leverage model, export was dropped from the growth model, and cash flow was dropped

from the innovation model. The results of the SEM path analysis using both sales growth and employment growth are in Table 17 below. The OLS results in Table 16 are almost the same as the SEM results with R-squared values, coefficients estimates and standard errors very close in value. There were two changes in the significance of coefficient estimates (employment growth on government support and innovation on size for employment growth), but in both cases the coefficients themselves only changed marginally and the significance change was due to slight decrease in the coefficient estimate value and a slight increase in the standard error causing the significance to cross a threshold.

Given that SEM path modelling and OLS regression had virtually identical results; multi-sample SEM path analysis can be used to perform the six group comparisons.

5.4 Group Comparisons

This section presents the results of the six different group comparisons that were proposed as part of the research objectives. Multi-sample SEM path analysis was used to perform each of the group comparisons. Comparisons followed a two-step procedure. Each model was first analysed freeing the links between the dependent variables (growth, leverage, innovation) that were hypothesized to be significantly different. If this did not result in suitable model fit, modification indices were then used as a guide to free additional links in order to achieve acceptable model fit.

	Sales Growth Rate			Employment Growth Rate		
Variable	Growth	Leverage	Innovation	Growth	Leverage	Innovation
Growth	-	-0.124 (0.109)	-0.317 (0.415)	-	-0.102 (0.099)	-0.244 (0.680)
Leverage	0.096 (0.058)	-	-0.049 (0.140)	0.050 (0.063)	-	-0.024 (0.144)
Innovation	0.009 (0.022)	-0.011 (0.016)	-	0.006 (0.039)	-0.015 (0.016)	-
Tangible Assets	-	0.503*** (0.086)	-	-	0.500*** (0.087)	-
Earnings Volatility	-	0.855*** (0.096)	-	-	0.851*** (0.096)	-
Cash Flow	0.722*** (0.118)	-0.989*** (0.144)	-	0.449*** (0.112)	-1.025*** (0.134)	-
Age	-0.101*** (0.030)	-0.173*** (0.036)	-0.254* (0.154)	-0.087*** (0.031)	-0.170*** (0.035)	-0.234 (0.166)
Size	0.062*** (0.014)	-	0.152** (0.072)	0.042*** (0.016)	-	0.145* (0.074)
Export	-	0.105 (0.069)	0.476*** (0.158)	-	0.104 (0.069)	0.471*** (0.160)
Financial Constraint	-0.170* (0.103)	0.019 (0.076)	0.757 (0.535)	-0.107 (0.073)	0.031 (0.071)	0.779 (0.526)
Government support	0.114* (0.068)	-	1.695*** (0.548)	0.180* (0.094)	-	1.703*** (0.554)
Constant	0.346*** (0.087)	-0.136 (0.123)	0.906** (0.458)	0.168* (0.093)	-0.159 (0.116)	0.813* (0.443)
R-squared	0.076	0.229	0.045	0.034	0.238	0.044
Number of observations	3048	3048	3048	3048	3048	3048

Table 17: SEM Path Analysis Results for Sales and Employment Growth Rates for full sample[10]

	Model Chi-Square	RMSEA	CFI	SRMR
Sales growth	2.063, p=0.9790	0.000	1.000	0.004
Employment growth	2.243, p=0.9726	0.000	1.000	0.004

Table 18: Model fit indexes for full sample

[10] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01

5.4.1 Growth-rate Group Comparison

For the growth-rate group comparison, the sample was divided into three groups based on growth-rate. Those firms in the lowest growth quartile were one group. The firms in the middle two growth quartiles were the second group and the firms in the highest growth quartile were the third group. Group comparisons were performed on both sales growth and employment growth rates. The hypotheses for this comparison are repeated in Table 19 below. In general the hypotheses predict that there will be significant bidirectional relationships between the dependent variables (growth, leverage, innovation) but the coefficient estimates would differ between the groups in certain cases due their different growth records. The results of the group mean tests and the SEM analyses are in Table 20 through Table 25.

Area being tested	**Hypothesis**
Investigates innovation-growth relationship	H7. Growth <= Innovation (greater positive for high-growth than mid-growth and no relationship for low-growth)
	H8. Innovation <= Growth (no relationship for mid-growth and high-growth and negative relationship for low-growth)
Investigates leverage-growth relationship	H9. Leverage <= Growth (equally negative for all three groups)
	H10. Growth <= Leverage (greater positive for high-growth than mid-growth group, negative for low-growth group)
Investigate leverage-innovation relationship	H11. Leverage <= Innovation (all negative but stronger negative for low growth group)
	H12. Innovation <= Leverage (equal negative for all three groups)

Table 19: Summary of Growth based Group Comparison Hypotheses

Comparing the means between the three groups reveals their distinct characteristics. First, as expected, the growth rate means for the groups are significantly and meaningfully different. The lowest growth quartile had negative growth over the 5-year

period (-26% for sales growth and -38% for employment growth). At the other end, the top quartile for sales growth was 170% and 125% for employment growth. Clearly the three groups are experiencing different circumstances. Consistent with the means for the

	Group 1 0-25%	**Group 2 25-75%**	**Group 3 75-100%**	**Group Comparison p-values**		
				1&2	**1&3**	**2&3**
Sales growth	-0.336	0.269	0.947	0.000	0.000	0.000
Untransformed sales growth	-0.257	0.327	1.700			
Leverage	-0.474	-0.478	-0.484	0.954	0.889	0.912
Innovation	0.685	0.461	0.454	0.203	0.216	0.958
Tangible Assets	0.264	0.314	0.296	0.013	0.177	0.422
Earnings Volatility	0.169	0.161	0.180	0.679	0.554	0.280
Cash Flow	0.066	0.131	0.163	0.000	0.000	0.014
Age	2.978	2.939	2.711	0.406	0.000	0.000
Untransformed Age	23.62	22.63	18.05			
Size	1.524	1.823	1.789	0.000	0.005	0.689
Untransformed Size	9.318	12.44	11.68			
Export	0.160	0.111	0.186	0.044	0.432	0.009
Financial Constraint	0.047	0.035	0.020	0.529	0.135	0.259
Government Support	0.019	0.028	0.044	0.282	0.032	0.181

Table 20: Means Comparison for Sale Growth-rate Groups

	Group 1 0-25%	**Group 2 25-75%**	**Group 3 75-100%**	**Group Comparison p-values**		
				1&2	**1&3**	**2&3**
Employment growth	-0.527	0.099	0.758	0.000	0.000	0.000
Untransformed emp. growth	-0.377	0.115	1.245			
Leverage	-0.420	-0.542	-0.399	0.052	0.775	0.016
Innovation	0.584	0.476	0.576	0.492	0.969	0.589
Tangible Assets	0.296	0.285	0.325	0.608	0.276	0.091
Earnings Volatility	0.170	0.150	0.207	0.230	0.077	0.006
Cash Flow	0.091	0.123	0.144	0.008	0.001	0.153
Age	2.939	2.947	2.765	0.868	0.003	0.001
Untransformed Age	22.56	22.88	18.37			
Size	1.646	1.805	1.644	0.031	0.985	0.079
Untransformed Size	10.43	12.04	11.06			
Export	0.152	0.123	0.160	0.238	0.793	0.157
Financial Constraint	0.048	0.034	0.021	0.467	0.123	0.279
Government Support	0.015	0.027	0.052	0.097	0.014	0.105

Table 21: Means Comparison for Employment Growth-rate Groups

	Sales Growth Rate											
Variable	Sales Growth				Leverage				Innovation			
	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3
Sales Growth	-	-	-	-	0.204 (0.139)	a	a	a	-0.112 (0.344)	a	a	a
Leverage	-0.012 (0.020)	a	a	a	-	-	-	-	0.111 (0.126)	a	a	a
Innovation	0.004 (0.004)	a	a	a	-0.028* (0.015)	a	a	a	-	-	-	-
Tangible Assets	-	-	-	-	0.490*** (0.081)	a	a	a	-	-	-	-
Earnings Volatility	-	-0.105* (0.055)	-.005 (0.033)	0.170** (0.083)	0.826*** (0.095)	a	a	a	-	-	-	-
Cash Flow	0.098** (0.041)	a	a	a	-1.106*** (0.129)	a	a	a	-	-	-	-
Age	-0.011 (0.013)	a	a	a	-0.187*** (0.037)	a	a	-0.019 (0.051)	-0.203* (0.108)	a	a	a
Size	0.004 (0.006)	a	a	a	-	-	-	-	0.157*** (0.057)	a	a	a
Export	-	-	-	-	0.067 (0.059)	a	a	a	0.451*** (0.162)	a	a	a
Financial Constraint	-	-	-	-	0.083 (0.064)	a	a	a	-	-	1.373 (0.922)	-
Government support	0.020 (0.035)	a	a	a	-	-	-	-	1.708*** (0.592)	a	a	a
Constant	-	-0.307*** (0.043)	0.274*** (0.039)	0.915*** (0.043)	-	-0.039 (0.138)	-0.122 (0.125)	-0.739*** (0.221)	-	0.961** (0.397)	0.708* (0.381)	0.724 (0.461)
R-squared	-	0.018	0.014	0.017	-	0.246	0.229	0.224	-	0.020	0.058	0.058
Number of observations	-	762	1524	762	-	762	1524	762	-	762	1524	762

Table 22: SEM Path Analysis Results for Sales Growth Rate Group Comparison[11]

Model Chi-Square	Chi-Square Group1	Chi-Square Group2	Chi-Square Group3	RMSEA	CFI	SRMR
36.908, p=0.9981	13.100	11.967	11.841	0.000	1.000	0.019

Table 23: Sales Growth Rate group comparison model fit indexes

[11] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 a => is the common value to the left. Group 1 is lowest growth quartile. Group 2 is the middle two growth quartiles. Group 3 is the upper growth quartile.

	Employment Growth Rate											
Variable	Employment Growth				Leverage				Innovation			
	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3
Employment Growth	-	-	-	-	0.220 (0.157)	a	a	a	-0.668 (0.690)	-0.218 (0.428)	a	a
Leverage	-	-0.094** (0.041)	-0.008 (0.014)	-0.025 (0.042)	-	-	-	-	0.101 (0.141)	a	a	a
Innovation	-0.001 (0.004)	a	a	a	-0.003 (0.015)	-0.075*** (0.024)	a	a	-	-	-	-
Tangible Assets	-	-	-	-	0.401*** (0.095)	a	a	0.731*** (0.196)	-	-	-	-
Earnings Volatility	-	-	-	-	0.695*** (0.087)	1.392*** (0.252)	a	a	-	-	-	-
Cash Flow	0.082* (0.044)	a	a	a	-1.090*** (0.124)	a	a	a	-	-	-	-
Age	-0.023** (0.010)	a	a	-0.092*** (0.035)	-0.185*** (0.038)	a	a	-0.031 (0.063)	-0.212* (0.127)	a	a	a
Size	0.012** (0.005)	0.071*** (0.017)	a	a	-	-	-	-	0.138** (0.065)	a	a	a
Export	-	-	-	-	0.087 (0.057)	a	a	a	0.072 (0.206)	a	0.898*** (0.258)	a
Financial Constraint	-	-	-	-	0.076 (0.068)	a	a	a	-	-	-	-
Government support	-0.016 (0.022)	a	a	a	-	-	-	-	1.631*** (0.559)	a	a	a
Constant	-	-0.621*** (0.050)	0.132*** (0.032)	0.974*** (0.102)	-	0.011 (0.147)	-0.114 (0.125)	-0.718*** (0.268)	-	0.872** (0.417)	0.818** (0.405)	1.386 (0.919)
R-squared	-	0.067	0.024	0.029	-	0.285	0.210	0.295	-	0.004	0.061	0.048
Number of observations	-	762	1524	762	-	762	1524	762	-	762	1524	762

Table 24: SEM Path Analysis Results for Employment Growth Rate Group Comparison[12]

Model Chi-Square	Chi-Square Group1	Chi-Square Group2	Chi-Square Group3	RMSEA	CFI	SRMR
58.158, p=0.5433	21.795	16.282	20.081	0.000	1.000	0.023

Table 25: Employment Growth Rate group comparison model fit indexes

[12] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 a => is the common value to the left. Group 1 is lowest growth quartile. Group 2 is the middle two growth quartiles. Group 3 is the upper growth quartile.

whole sample, sales grows proportionally faster than employment. Faster growing firms make more use of government support. Given that the data is cross-sectional, it is not possible to determine causality: Does government support facilitate growth or are growing firms better at utilizing government support? Consistent with Carpenter and Petersen's (2002) findings, cash flow is tied to growth. The slower growing firms (sales and employment) have proportionally less cash flow. Consistent with the findings of Haltiwanger et al (2010), the fastest growing quartile is significantly younger than the lower three quartiles. Lastly, firm size in the bottom sales growth quartile is significantly smaller than the other quartiles. This size difference is not seen when the sample is divided by employment growth rate. It appears that smaller firms are just as likely to experience employment declines as high employment growth.

When the sample was analysed as a whole, no significant relationships between the dependent variables were obtained. This result was attributed to the heterogeneity of the sample. Now looking at the SEM multi-sample growth analysis, some relationships between the dependent variables begin to appear, though there are some subtle differences between sales and employment growth groups. Overall, the R-squared values for the multi-sample analysis were similar to the whole-sample except that the R-squared value for the growth analysis of the different sales growth rate groups was much poorer (age and size are no longer significant implying the reduced sample size of the growth groups provides less information than considering the sample as a whole) and the innovation analysis had better R-squared values for the upper two growth groups (greater heterogeneity and poorer R-squared in the lowest (negative) growth group).

When divided into groups based on sales growth rates, the coefficient estimate for innovation becomes weak and negative for leverage in all groups (-0.028, $p < 0.062$). This result almost matches the hypothesis except that the lowest growth group was predicted to have a larger negative relationship. When considering the employment growth groups, it was only the lowest growth group that had a significant negative coefficient estimate for innovation (-0.075, $p < 0.002$). It appears that from a sales growth perspective, innovation affects leverage equally for all firms (negative through high positive growth) but from an employment growth viewpoint, it is only those firms that are experiencing negative growth whose leverage is negatively affected by innovation. The only other significant dependent variable relationship was leverage with a negative coefficient estimate for the lowest (negative) employment growth group growth rate (-0.094, $p < 0.022$). This is consistent with a firm under stress that is sinking under a heavy debt load and has to lay off staff.

For the sales growth rate comparison, earnings volatility had a significant coefficient estimate for growth rate. This was not predicted from the literature review. Note that earnings volatility had a significant negative estimated coefficient for the negative growth group (-0.105, $p < 0.056$) and a significant positive estimated coefficient for the highest growth group (0.170. $p < 0.041$). When comparing the mean earnings before interest and tax (EBIT) divided by total assets for each of the three groups of firms over the five year period, it comes as no surprise that the lowest growth group had the lowest average EBIT ratio (0.026 versus 0.094 versus 0.134). Given how close the EBIT ratio is to zero for the lowest growth group, this low growth group's fluctuating earnings mean that they often lose money in comparison to the high growth firms which almost always make money

but the relative amount varies. It appears that for the lowest growth group, earnings fluctuation is downwards while for the highest group it is upwards.

From an employment growth perspective, it is interesting to note that age had a much larger, significant negative coefficient estimate for growth for the highest growth rate group versus the lower two groups (-0.092, $p < 0.009$ versus -0.023, $p < 0.021$). Consistent with Haltiwanger et al (2010), older firms are less likely to have high employment growth than younger firms. Similarly, for those firms experiencing negative employment growth, size had a larger coefficient estimate for growth than for the other two groups which have positive growth (0.071, $p < 0.000$ versus 0.012, $p < 0.016$). Larger firms don't shrink as much as smaller firms. Lastly, export had a significant positive coefficient estimate for innovation but only for the middle employment growth group. This can be interpreted as export driven innovation not playing a strategic role for either high growth firms or negative growth firms but rather for those firms with steady average growth.

To summarize, the primary hypotheses predicted significant relationships between the three dependent variables but with the relationships differing based on the growth group. Unlike the full sample analysis where no significant relationships between growth, leverage and innovation were realized, dividing the group based on growth rates resulted in two significant relationships. Growth on leverage had a significant negative coefficient estimate for the lowest employment growth group as predicted and innovation had a negative coefficient estimate for the lowest employment growth group and for all sales growth groups. Once again, in considering these results, it is necessary to keep in mind that the sample that was analysed was a weighted, representative sample of Canadian

incorporated SMEs. Given the variability of SMEs in general, the significant results that were obtained, provide insight into overarching general characteristics. Though leverage is not a significant positive regressor for the two higher growth-rate groups as predicted, it being a significant negative regressor for the lowest employment growth rate group is informative to SME finance theory. Specifically, for SMEs in the lowest employment growth quartile, increasing leverage is an indicator of duress leading to even greater employment reduction which points to a possible death spiral. Consistent with theory, innovation was a significant negative regressor of leverage for the sales growth groups. For this theoretically predicted result to occur, it was necessary for the SMEs to be divided into groups, which illustrates the importance of subdividing the SME population in order to reduce heterogeneity that then allows common characteristics to be revealed.

5.4.2 Exporter versus Non-exporter Comparison

The sample was divided into two groups based on whether the firm exported or not. Non-exporters are in the first group and exporters are in the second group. Twenty-three percent of the firms were exporters. The hypotheses for this comparison are repeated in Table 27 below. The hypotheses predict that there will be significant bidirectional relationships between the dependent variables (growth, leverage, innovation) with exporters having larger coefficient estimates for growth on innovation and in both directions for the leverage and growth relationship.

The results of the group mean tests and the SEM analyses are in Table 27 through Table 29 below. The mean tests reveal some distinct differences between the non-exporters and exporters. Exporters make more use of government support which is probably due to the Canadian government's program for assisting the finance of exports

(Export Development Corporation). Canadian exporters invest a greater proportion of sales in innovation which is consistent with both the theory and the results from other empirical studies (McMahon, 2000; Van Beveren & Vandenbussche, 2010). Exporters are significantly larger with an average of 18 employees compared to an average of 10

Area being tested	**Hypothesis**
Investigates innovation-growth relationship	H13. Growth <= Innovation(greater positive for exporters)
	H14. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H15. Leverage <= Growth (relationship will be more negative for exporters)
	H16. Growth <= Leverage (relationship will more positive for exporters)
Investigate leverage-innovation relationship	H17. Leverage <= Innovation (relationship will be the same for exporters and non-exporters –negative)
	H18. Innovation <= Leverage (relationship will be the same for exporters and non-exporters –negative)

Table 26: Summary of Exporter/Non-exporter based Group Comparison Hypotheses

	Group 1 Non-exporters	**Group 2 Exporters**	**Group Comparison p-values**
Sales growth	0.199	0.209	0.813
Untransformed sales growth	0.377	0.426	
Employment Growth	0.020	0.017	0.941
Untransformed emp. growth	0.162	0.171	
Leverage	-0.496	-0.367	0.061
Innovation	0.440	1.075	0.000
Tangible Assets	0.306	0.234	0.000
Earnings Volatility	0.164	0.181	0.464
Cash Flow	0.124	0.069	0.000
Age	2.911	2.911	0.982
Untransformed Age	22.166	22.046	
Size	1.667	2.093	0.000
Untransformed Size	10.220	18.393	
Financial Constraint	0.036	0.038	0.884
Government Support	0.019	0.079	0.000

Table 27: Means Comparison for non-exporters versus exporters

	Sales Growth Rate						Employment Growth Rate					
Variable	Sales Growth		Leverage		Innovation		Employment Growth		Leverage		Innovation	
	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2
Growth	-		-0.150 (0.122)		-0.195 (0.306)		-		-0.102 (0.113)		-0.031 (0.350)	
Leverage	0.103 (0.066)		-		0.020 (0.153)		0.044 (0.072)		-		0.044 (0.156)	
Innovation	0.002 (0.016)		-0.019 (0.013)		-		-0.007 (0.018)		-0.022* (0.012)		-	
Tangible Assets	-		0.503*** (0.084)		-		-		0.494*** (0.085)		-	
Earnings Volatility	-		0.918*** (0.115)	0.543** (0.118)	-		-		0.914*** (0.116)	0.547*** (0.114)	-	
Cash Flow	0.743*** (0.123)		-0.999*** (0.149)		-		0.463*** (0.116)		-1.050*** (0.137)		-	
Age	-0.100*** (0.030)		-0.179*** (0.036)		-0.230 (0.146)		-0.091*** (0.032)		-0.174*** (0.035)		-0.204 (0.147)	
Size	0.061*** (0.013)		-		0.084 (0.080)	0.460*** (0.092)	0.041*** (0.015)		-		0.075 (0.083)	0.451*** (0.090)
Financial Constraint	-		0.017 (0.078)		-		-		0.031 (0.072)		-	
Government support	0.126** (0.059)		-		1.576*** (0.562)		0.188** (0.078)		-		1.557*** (0.566)	
Constant	0.342*** (0.086)	0.344*** (0.103)	-0.117 (0.128)	0.059 (0.158)	0.990** (0.433)	0.705* (0.411)	0.180* (0.091)	0.172 (0.114)	-0.150 (0.118)	0.022 (0.145)	0.902** (0.407)	0.618 (0.402)
R-squared	0.075	0.068	0.230	0.206	0.019	0.077	0.036	0.043	0.243	0.217	0.017	0.076
Number of observations	2349	699	2349	699	2349	699	2349	699	2349	699	2349	699

Table 28: SEM Path Analysis Results for Non-exporter/Exporter Group Comparison[13]

	Model Chi-Square	Chi-Square Group1	Chi-Square Group2	RMSEA	CFI	SRMR
Sales growth model	22.468, p=0.8003	12.083	10.385	0.000	1.000	0.016
Employment growth model	22.852, p=0.7404	10.135	12.718	0.000	1.000	0.017

Table 29: Non-export/Exporter group comparison model fit indexes

[13] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 Group 1 is non-exporters. Group 2 is exporters.

employees for the non-exporting firms. Interestingly, there was no difference in either sales growth rate or employment growth rate between the two groups which is contrary to what was predicted. This could be due to the proxy that was used for exporting which was a dummy variable rather than a percentage of sales.

In considering the SEM multi-sample path analysis of the non-exporter and exporter groups, there is only one significant relationship between the dependent variables. Innovation has a small coefficient estimate for leverage when using employment growth (-0.022, $p<0.067$). This is a similar result to that which was found when dividing the sample into groups based on growth rates. Once again dividing the sample based on specific criteria reduces heterogeneity allowing some relationships to be revealed. With regards to the hypotheses for differences in the relationships among the dependent variables, two of the six were realized. Growth did not have a significant coefficient estimate for innovation and innovation did have a significant negative coefficient estimate for leverage (for employment growth rate only).

The R-squared values of the exporter and non-exporter models are quite similar to that of the full sample model. The one notable difference is that the R-squared for the innovation model is better for the exporting sample (0.077/0.076 compared to 0.045/0.044) while the non-exporting R-squared is much weaker (0.019/0.017). This result is likely due to a greater percentage of exporters innovating (12.5%) compared to non-exporters (4.7%) increasing the explanatory power of the estimation in the exporter group.

Other model differences between exporters and non-exporters are the size of the coefficient estimate for earnings volatility in the leverage model and that size only had a

significant coefficient estimate for innovation for exporters. For earnings volatility, its coefficient estimate is almost half the size for exporters (0.543/0.547 compared to 0.918/0.914). Looking at the means for earnings volatility, the two groups have similar values but exporters have almost half the cash flow than non-exporters and exporters have greater leverage. It appears that exporters with less cash flow and higher leverage have to be more conservative in their financing such that earnings volatility has less of an effect on leverage. It is interesting that size has only a significant coefficient estimate (positive) for innovation for exporters. When the sample was analysed as a whole, size had a moderate positive coefficient estimate for innovation (0.152/0.145, $p<0.035/p<0.050$ - Table 17) contrary to the prediction that it would be a negative coefficient estimate. It was proposed that this result was due to a higher proportion of larger firms spending on R&D even though the larger firms spent proportionally less on average. In the full sample exporting had a large and significant coefficient estimate for innovation (0.476/0.471, $p<0.003/p<0.003$). By dividing the sample based on exporting provides further clarity to this result. It appears that the full sample result was due to exporters which from an innovation modeling perspective are more homogeneous resulting in a higher R-squared and a stronger relationship between size and innovation.

In summary, the results of comparing the exporting and non-exporting firms substantiate some of the theoretical predictions. As predicted, exporters spend proportionally more on innovating than their non-exporting peers. This supports the theory that in order to compete globally, even SMEs must have greater innovation since they are competing in the larger world market. Also size matters with regards to exporting and innovation as it was found that on average exporters are almost twice as

large as non-exporters (18 versus 10 employees) and that size is only a large significant regressor for innovation (0.460, $p < 0.01$) for exporters. This relationship between size, innovation and exporting is interesting and points to the requirement for further research. What is behind the firm size difference between exporters and non-exporters? Are there any policies that can be implemented to make it easier for smaller firms to export or is there a fundamental size limit? Why do larger exporters spend proportionally more on innovation than smaller exporters?

5.4.3 Innovator versus Non-innovator Comparison

The sample was divided into two groups based on whether the firm spent money on R&D. Non-innovators are in the first group and innovators are in the second group. Ten percent of the firms were innovators. The hypotheses for this comparison are repeated in Table 30 below. The hypotheses predict that there would be significant bidirectional relationships between growth and leverage with growth on leverage being greater positive for innovators and leverage on growth being greater negative for non-innovators.

Area being tested	Hypothesis
Investigates leverage-growth relationship	H19. Leverage <= Growth (greater negative for non-innovators than innovators)
	H20. Growth <= Leverage (greater positive for innovators than non-innovators)

Table 30: Summary of Innovator/Non-innovator based Group Comparison Hypotheses

The results of the group mean tests and the SEM analyses are in Table 31 through Table 33 below. The results of the means tests are consistent with the previous results of this study: innovators are more likely to export, are bigger and make more use of government support.

The SEM path model multi-sample analysis reveals several other differences. It was hypothesized that the coefficient estimate for leverage in the growth model would be larger for innovators due to innovators being able to more efficiently convert the additional leverage into growth. Accordingly, innovators had a significant positive coefficient estimate for leverage (0.140/.215, p<0.055/p<0.051) for both sales and employment growth. Leverage had a small and insignificant coefficient estimate for the non-innovators which is consistent with the overall sample analysis results yet contrary to the hypothesis. It appears that innovators are a more homogeneous group from a growth model perspective considering their small sample size (n=308) and the improved R-squared values for the growth model (0.108 for innovators versus 0.076 for sales growth for the overall sample and 0.106 versus 0.034 for employment growth).

	Group 1 Non-innovators	**Group 2 Innovators**	**Group Comparison p-values**
Sales growth	0.203	0.160	0.411
Untransformed sales growth	0.389	0.316	
Employment Growth	0.023	-0.020	0.583
Untransformed emp. growth	0.166	0.115	
Leverage	-0.467	-0.631	0.162
Tangible Assets	0.294	0.316	0.450
Earnings Volatility	0.169	0.134	0.070
Cash Flow	0.118	0.105	0.298
Age	2.918	2.822	0.223
Untransformed Age	22.248	20.719	
Size	1.701	2.097	0.033
Untransformed Size	10.812	19.246	
Export	0.130	0.276	0.001
Financial Constraint	0.033	0.082	0.148
Government Support	0.022	0.115	0.002

Table 31: Means Comparison for non-innovators versus innovators

	Sales Growth Rate				Employment Growth Rate			
Variable	Sales Growth		Leverage		Employment Growth		Leverage	
	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2
Growth	-		-0.123 (0.110)		-		-0.088 (0.104)	
Leverage	0.090 (0.060)	0.140* (0.073)	-		0.026 (0.066)	0.215* (0.110)	-	
Tangible Assets	-		0.468*** (0.087)	1.217*** (0.353)	-		0.463*** (0.088)	1.200*** (0.358)
Earnings Volatility	-		0.857*** (0.095)		-		0.856*** (0.095)	
Cash Flow	0.436*** (0.115)		-0.997*** (0.142)		0.463*** (0.116)		-1.037*** (0.134)	
Age	-0.092*** (0.031)		-0.169*** (0.035)		-0.091*** (0.032)		-0.165*** (0.034)	
Size	0.042*** (0.015)		-		0.041*** (0.015)		-	
Export	-		0.128* (0.067)		-		0.123* (0.067)	
Financial Constraint	-		0.009 (0.075)		-		0.019 (0.071)	
Government support	0.210*** (0.072)		-		0.188** (0.078)		-	
Constant	0.361*** (0.084)	0.324*** (0.099)	-0.131 (0.120)	-0.567*** (0.211)	0.176** (0.089)	0.218** (0.102)	-0.160 (0.113)	-0.590*** (0.209)
R-squared	0.078	0.108	0.234	0.219	0.038	0.106	0.245	0.208
Number of observations	2740	308	2740	308	2740	308	2740	308

Table 32: SEM Path Analysis Results for Non-innovator/Innovator Group Comparison[14]

	Model Chi-Square	Chi-Square Group1	Chi-Square Group2	RMSEA	CFI	SRMR
Sales growth model	15.819, p=0.9405	6.594	9.225	0.000	1.000	0.013
Employment growth model	11.945, p=0.9915	3.013	8.932	0.000	1.000	0.012

Table 33: Non-innovator/Innovator group comparison model fit indexes

It was hypothesized that the coefficient estimate for growth in the leverage model would be a larger negative value for the innovator group. This was not the case as it was insignificant negative for both groups similar to that of the results for the overall sample.

Besides the hypothesized differences between the dependent variables, there were two other noteworthy results. First, the coefficient estimate for tangible assets (in the leverage model) is over twice the size for the innovator group. This result has intuitive

[14] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 Group 1 is non-innovators. Group 2 is innovators.

appeal implying that tangible assets play a more important role for innovators than non-innovators with innovators utilizing their tangible assets to increase their leverage more than non-innovators. This complements the previous finding that increased leverage increases an innovators growth rate. Second, dividing the sample into two groups based on innovation results in export having a significant coefficient estimate in the leverage model (0.128/0.123, $p<0.056/p<0.066$) which is consistent with the hypothesis that was made for the overall model. The coefficient estimate is the same for both groups. In the full sample the coefficient though positive was smaller and insignificant. Once again it appears that dividing the sample into subgroups results in greater homogeneity within the subgroups which results in significant variable relationships that were not observed in the full sample.

In summary, consistent with the hypothesis, leverage was a larger, significant positive regressor of growth for those firms which were innovators. Therefore, innovating SMEs which are able to obtain greater leverage have higher growth rates. This adds support to both the theory of resourced based view (RBV) of the firm and access to capital (cash flow, equity and/or borrowed funds) enabling growth. Extra funding in the form of additional borrowing (i.e. increased leverage) provides the firm with additional money which it can use to fund a higher growth rate. Consistent with this, innovators rely more on leveraging their tangible assets to obtain these additional funds. Another important finding is that even though innovators made up only 10% of the sample (308 vs 2740 firms), the homogeneity within the innovator group was such that its growth regression had greater explanatory power (as measured by R-squared) than the sample as a whole.

5.4.4 Government Finance Recipient versus Non-recipient Comparison

The sample was divided into two groups based on whether the firm received government financing or not. Firms that had not received government financing are in the first group and those that had are in the second group. Only 5.9% of the firms had received some form of government support. The hypotheses for this comparison are repeated in Table 34 below. The hypotheses predict that there will be significant bidirectional relationships between growth, leverage and innovation such that firms receiving government financing will have innovation as a larger positive regressor of growth, leverage as a larger positive regressor of growth and the leverage/innovation bidirectional relationship will be less negative in both directions.

Area being tested	**Hypothesis**
Investigates innovation-growth relationship	H21. Growth <= Innovation (greater positive in for firms that receive government finance)
	H22. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H23. Leverage <= Growth (the same for both groups of firms - negative)
	H24. Growth <= Leverage (greater positive for firms receive government finance)
Investigate leverage-innovation relationship	H25. Leverage <= Innovation (less negative for firms receiving government financing)
	H26. Innovation <= Leverage (less negative for firms receiving government financing)

Table 34: Summary of Hypotheses from Comparing Firms that use and don't use Government Financing

The results of the group mean tests and the SEM analyses are in Table 35 through Table 37 below. Unlike previous group means tests, the two groups are significantly different on almost every variable except for leverage, tangible assets and financial constraint. Those firms that receive some form of government support have faster sales

and employment growth rates. Does the government support cause growth or is the government good at picking winners or do the successful firms self-select when applying for government programs? As discussed previously it is not possible to disentangle the government support/growth rate relationship with only cross-sectional data. Given the government programs to support both innovation and exporting, it is no surprise that the group that receives government support has higher means for both of these. Also firms receiving government support are both older (26 years versus 22 years) and larger (29 employees versus 11 employees).

In looking at the SEM multi-sample results, there were no differences between the groups for the dependent variable interrelationships even though the hypotheses predicted there would be some except for the case of innovation on growth where no relationship was predicted and none was observed. Unlike the full sample analysis but similar to

	Group 1 No Government support	**Group 2 Government Support**	**Group Comparison p-values**
Sales growth	0.196	0.367	0.004
Untransformed sales growth	0.378	0.603	
Employment Growth	0.014	0.231	0.001
Untransformed emp. growth	0.156	0.401	
Leverage	-0.476	-0.550	0.365
Innovation	0.476	2.385	0.001
Tangible Assets	0.293	0.377	0.109
Earnings Volatility	0.169	0.074	0.000
Cash Flow	0.117	0.095	0.076
Age	2.907	3.087	0.037
Untransformed Age	22.031	26.298	
Size	1.691	2.960	0.000
Untransformed Size	10.848	29.258	
Export	0.132	0.400	0.000
Financial Constraint	0.036	0.023	0.258

Table 35: Means Comparison for no Government Support versus Government Support

	Sales Growth Rate						Employment Growth Rate					
Variable	Sales Growth		Leverage		Innovation		Employment Growth		Leverage		Innovation	
	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2
Growth	-		-0.084 (0.120)		0.022 (0.308)		-		-0.035 (0.114)		0.159 (0.356)	
Leverage	0.078 (0.064)		-		0.140 (0.156)		0.016 (0.073)		-		0.157 (0.161)	
Innovation	-0.010 (0.017)		-0.033** (0.015)		-		-0.019 (0.020)		-0.034** (0.014)		-	
Tangible Assets	-		0.521*** (0.087)	0.038 (0.347)	-		-		0.516*** (0.088)	0.048 (0.344)	-	
Earnings Volatility	-		0.845*** (0.096)		-		-		0.844*** (0.096)		-	
Cash Flow	0.707*** (0.125)		-1.029*** (0.149)		-		0.407*** (0.121)		-1.067*** (0.137)		-	
Age	-0.109*** (0.030)		-0.173*** (0.035)		-0.117 (0.143)	-2.225*** (0.708)	-0.096*** (0.031)		-0.168*** (0.034)		-0.100 (0.146)	-2.218*** (0.714)
Size	0.063*** (0.014)		-		0.137** (0.068)		0.040*** (0.015)		-		0.133* (0.069)	
Export	-		0.087 (0.063)		0.438*** (0.155)		-		0.085 (0.063		0.439*** (0.155)	
Financial Constraint	-		0.035 (0.074)		-		-		0.045 (0.070)		-	
Constant	0.366*** (0.087)	0.518*** (0.115)	-0.129 (0.121)	0.079 (0.179)	0.587 (0.418)	8.740*** (2.468)	0.195** (0.091)	0.424*** (0.132)	-0.153 (0.111)	0.044 (0.163)	0.555 (0.400)	8.712*** (2.486)
R-squared	0.081	0.059	0.235	0.099	0.007	0.115	0.034	0.033	0.241	0.113	0.002	0.117
Number of observations	2869	179	2869	179	2869	179	2869	179	2869	179	2869	179

Table 36: SEM Path Analysis Results for No Government Support/Government Support Group Comparison[15]

	Model Chi-Square	Chi-Square Group1	Chi-Square Group2	RMSEA	CFI	SRMR
Sales growth model	36.757, p=0.82579	14.728	22.028	0.010	0.987	0.019
Employment growth model	32.873, p=0.2404	12.065	20.809	0.011	0.985	0.019

Table 37: No Government Support/Government Support group comparison model fit indexes

[15] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 Group 1 is no government support. Group 2 is government support.

multi-group growth rate analysis, the coefficient estimate for innovation with leverage as the dependent variable was negative, small and significant (-0.033/-0.034, $p<0.028/p<0.015$). This result is in keeping with the full sample prediction for when leverage is regressed on innovation. Investigating the differences in the means for government support in the growth rate multi-sample analysis (Table 20 and Table 21), it can seen that government support increases as the growth rate increases. Dividing the sample by growth rate or by receiving government support is in a sense both sorting on very similar firm characteristics. This is a possible explanation for why the two different group comparisons give similar results with regards to innovation as a regressor of leverage. Further extrapolating, perhaps for this relationship to be observed there has to be a certain degree of homogeneity among the growth rates within the sample of firms.

There were two significant coefficient estimate differences between the two groups of firms. The first difference is that tangible assets only has a significant coefficient estimate for leverage for the no government support group. Looking at the means for tangible assets, those that receive government support actually have more tangible assets than those that don't receive government support though the values are not significantly different (37.7% of total assets versus 29.3%). Leverage values for the two groups are not significantly different either. Also the R-squared value for the leverage model is considerably lower for government support group than the no government support group (0.099/0.113 (sales growth/employment growth) versus 0.235/0.241). Tangible assets only having a significant coefficient estimate for leverage for the no government support group could be due to the small number of observations in the group that receives government financing (n=179) or the mixture of firms is sufficiently different between

the two groups. Looking at the firm mix in the two groups reveals some differences but it is doubtful this is causing the difference (for NAIC 2 firms – construction, mining, oil - government support group has 11.2% versus 18.5% for no government support; 33.5% versus 16.2% for NAIC 3 firms – manufacturing; and 18.4% versus 28.0% NAIC 4 firms – trade and transportation).

The second difference between the two groups is that age has a large and significant negative coefficient estimate for innovation in the government support group (-2.225/-2.218, $p<0.002/p<0.002$) and is much smaller and not significant in the no government support group. So those firms receiving government support that are innovating are considerably younger than the average firm receiving government support. To understand more about the characteristics which government supports induce, it would be necessary to have a breakdown of the different types of supports which each firm received. Perhaps those firms receiving innovation support (e.g. IRAP) are much younger than those firms receiving other forms of support.

In summary, the only significant relationship between the three dependent variables was innovation as a negative regressor of leverage, which was the same for both groups of firms such that it wasn't dependent on whether the firm received government financing or not. This limited finding was consistent with the finding when the sample was divided based on growth rate since those firm which receive government financing have much higher growth rates. Combining this with the mean tests and significant regressor coefficient estimate results, it appears that firms receiving government financing have higher growth rates (both employment and sales), are younger if they innovate, and don't depend of tangible assets for borrowing money. From a policy perspective it would be

informative to undertake further research to determine why it is predominantly younger firms (when controlling for size) that are using government financing for innovation and the causal relationship between receiving government finance and higher growth rates.

5.4.5 Financially Constrained versus Non-financially Constrained Comparison

The sample was divided into two groups based on whether the firm was financially constrained or not. A firm was considered financially constrained if it had a financing request turned down. Firms that were not financially constrained are in the first group and those that are financially constrained are in the second group. Only 3.2% of the firms were financially constrained. The hypotheses for this comparison are repeated in Table 38 below. The hypotheses predict that there will be significant bidirectional relationships between growth, leverage and innovation such that financially constrained firms will have innovation as a less positive regressor of growth, leverage as a negative (versus positive) regressor of growth, growth as a greater negative regressor of leverage and the bidirectional relationship between leverage and innovation would be less negative in both directions.

The results of the group mean tests and the SEM analyses are in Table 39 through Table 41 below. Comparing the means of the two groups reveals few differences. As would be expected the financially constrained group has greater leverage but the difference is not significant ($p < 0.117$). The only statistically significant mean difference is that the financially constrained group has more tangible assets (42% versus 29%) as a proportion of total assets. A possible explanation for this could be that financially constrained firms have less total assets thereby increasing the percentage of tangible

Area being tested	Hypothesis
Investigates innovation-growth relationship	H27. Growth <= Innovation (less positive for financially constrained firms)
	H28. Innovation <= Growth (no relationship)
Investigates leverage-growth relationship	H29. Growth <= Leverage (negative for financially constrained firms and positive for non-financially constrained firms)
	H30. Leverage <= Growth (greater negative for financially constrained group)
Investigates leverage-innovation relationship	H31. Leverage <= Innovation (less negative in for financially constrained group)
	H32. Innovation <= Leverage (less negative in for financially constrained group)

Table 38: Summary of Financially Constrained and not Constrained Group Comparison Hypotheses

	Group 1 Not Financially Constrained	Group 2 Financially Constrained	Group Comparison p-values
Sales growth	0.206	0.063	0.171
Untransformed sales growth	0.392	0.181	
Employment Growth	0.023	-0.067	0.189
Untransformed emp. growth	0.168	0.029	
Leverage	-0.483	-0.351	0.117
Innovation	0.499	1.313	0.135
Tangible Assets	0.291	0.423	0.014
Earnings Volatility	0.166	0.198	0.375
Cash Flow	0.117	0.112	0.847
Age	2.913	2.889	0.828
Untransformed Age	22.175	21.464	
Size	1.720	1.894	0.307
Untransformed Size	11.374	10.864	
Export	0.139	0.146	0.885
Government Support	0.028	0.017	0.231

Table 39: Means Comparison for not Financially Constrained versus Financially Constrained

	Sales Growth Rate						Employment Growth Rate					
Variable	Sales Growth		Leverage		Innovation		Employment Growth		Leverage		Innovation	
	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2	Group1	Group2
Growth	-		-0.137 (0.098)		-0.386 (0.290)		-		-0.109 (0.091)		-0.166 (0.356)	
Leverage	0.101* (0.053)	0.243 (0.173)	-		-0.109 (0.123)	3.810** (1.717)	0.053 (0.059)		-		-0.071 (0.118)	3.797** (1.683)
Innovation	0.013 (0.015)		-0.005 (0.016)	-0.076*** (0.023)	-		0.002 (0.018)		-0.012 (0.015)	-0.077*** (0.023)	-	
Tangible Assets	-		0.516*** (0.084)		-		-		0.513*** (0.085)		-	
Earnings Volatility	-		0.844*** (0.094)		-		-		0.842*** (0.093)		-	
Cash Flow	0.739*** (0.117)		-0.994*** (0.136)		-		0.451*** (0.110)		-1.032*** (0.130)		-	
Age	-0.097*** (0.030)		-0.167*** (0.036)	-0.494*** (0.134)	-0.213 (0.135)		-0.088*** (0.031)		-0.164*** (0.035)	-0.464*** (0.123)	-0.176 (0.132)	
Size	0.063*** (0.014)		-		0.131* (0.068)	1.580*** (0.611)	0.043*** (0.015)		-		0.117* (0.069)	1.564*** (0.598)
Export	-		0.111* (0.067)		0.464*** (0.156)		-		0.110* (0.066)		0.463*** (0.156)	
Government Support	0.108* (0.062)		-		1.676*** (0.556)		0.187** (0.075)		-		1.660*** (0.559)	
Constant	0.334*** (0.086)	0.210* (0.126)	-0.154 (0.123)	0.894** (0.402)	0.811 (0.412)	0.201 (0.888)	0.172* (0.091)	0.068 (0.115)	-0.179 (0.117)	0.800** (0.371)	0.669* (0.382)	0.084 (0.888)
R-squared	0.070	0.091	0.220	0.374	0.037	0.027	0.033	0.052	0.231	0.395	0.038	0.021
Number of observations	2949	99	2949	99	2949	99	2949	99	2949	99	2949	99

Table 40: SEM Path Analysis Results for Not Financially Constrained/Financially Constrained Group Comparison[16]

	Model Chi-Square	Chi-Square Group1	Chi-Square Group2	RMSEA	CFI	SRMR
Sales growth model	29.212, p=0.3015	2.797	26.416	0.009	0.994	0.014
Employment growth model	18.848, p=0.8755	2.770	16.077	0.000	1.000	0.011

Table 41: Not Financially Constrained/Financially Constrained group comparison model fit indexes

[16] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 Group 1 is not financially constrained. Group 2 is financially constrained.

assets. In fact, financially constrained firms have more total assets than unconstrained firms but the difference is not significant ($1.2 million compared to $1.0 million, $p < 0.370$).

Comparing the SEM multi-sample results for the two groups reveals several differences. With regards to the predictions for the interactions between the three dependent variables, the results were mixed. For the growth-innovation relationship, consistent with the other group comparisons and the predicted hypothesis, growth did not have a significant coefficient estimate for innovation. Contrary to the hypothesis that innovation would have a weaker positive coefficient estimate for growth for financially constrained firms, it was not significant for either group which is consistent with the full sample analysis and other group comparisons.

For the growth-leverage relationship, the results were mixed. For sales growth rate, as predicted, leverage had a significant positive coefficient estimate (0.101, $p < 0.057$) for growth in the not financially constrained group and an insignificant coefficient for the constrained group. It was predicted to be negative for the constrained group. For employment growth rate, the leverage coefficient estimate was the same and insignificant for both groups. Given that there were no significant relationships between the dependent variables for the full sample SEM analysis, the only difference for this case is the positive coefficient estimate for leverage in the sales growth model. It appears that unconstrained firms increase leverage when they are experiencing sales growth. Financially constrained firms appear to be using leverage for a variety of things and not necessarily to fund growth. Also, it is consistent that leverage has a significant coefficient estimate for sales growth and not employment growth. Firms borrow to fund sales growth but not

employment growth which requires stable and consistent revenue. Contrary to the hypothesis but consistent with the findings from the full sample, growth was not a significant predictor of leverage for either group.

For the leverage-innovation relationship, it was predicted to be less negative in both directions for the financially constrained group. Given that there were no significant relationships for the full sample, it was not surprising that the unconstrained group didn't have any either. It is a different story for the financially constrained group. Since the results were almost the same for the sales growth rate and employment growth rate analysis, only the sales growth rate analysis is discussed. The financially constrained firms had a small but significant negative coefficient estimate for innovation in the leverage model (-0.076, $p < 0.001$) and a large, positive, significant coefficient estimate for leverage in the innovation model (3.810, $p < 0.026$). When considering the leverage-innovation relationship, the financially constrained group is considerably more homogenous than the unconstrained group. Given that the constrained group has only 99 observations, it exhibits significant relationships between innovation and leverage when the unconstrained group with 2949 observations does not. The negative coefficient estimate for innovation in the leverage model was predicted by the hypothesis but the large positive coefficient estimate for leverage in the innovation model was not, though it was hypothesized to be less negative. For financially constrained firms, as leverage increases the likelihood of a firm being in a higher decile for percentage of R&D to sales spending when grouped by 3-digit NAIC increases, all else equal. This finding is opposite to the negative coefficient estimate for unconstrained new firms that had survived 10 years (Baldwin et al., 2002). It appears that for those firms that innovate and

are financially constrained, they take on additional leverage to increase their relative level of innovation and in the absence of improved growth this additional leverage results in them being financially constrained.

When considering the regressors of growth, leverage, and innovation, there are two regressors which have significantly different coefficients estimates between the unconstrained and constrained group. Since the results using sales growth rate and the employment growth rate are quantitatively the same, only the sales growth rate results will be used for this discussion. The coefficient estimate for age, when leverage is regressed on it, has a much larger negative value for the constrained group when compared to the unconstrained group (-0.494 versus -0.167). In addition, the R-squared value for the constrained leverage model is much higher than the unconstrained value (0.374 versus 0.220). So being older has a much greater influence on reducing leverage and increasing explanatory power for financially constrained firms than unconstrained firms even though the mean ages of the two groups are not significantly different. The second difference for the two groups is the coefficient estimate for size. When innovation is regressed on size, it has a much larger value for the constrained group when compared to the unconstrained group (1.580 versus 0.131). In this case, larger constrained firms are more likely to innovate than larger unconstrained firms all else equal. This has intuitive appeal in that larger firms even when financially constrained have relatively more resources to invest in innovation than smaller firms. For the coefficient estimates for age and size, being financially constrained amplifies their effect which is consistent with stress exacerbating any given situation.

In summary, unlike the general firm population, financially constrained firms that innovate have lower leverage than financially constrained firms that don't innovate. Though, for those financially constrained firms that do innovate, greater leverage indicates a greater proportion of the firm's sales that are devoted to R&D. Furthermore, leverage is not a significant regressor of growth for financially constrained firms while it is a significant positive regressor for the general population. Lastly, innovating financially constrained firms are likely to be larger than non-financially constrained firms. These findings point to a strong relationship between leverage and innovation for financially constrained firms which isn't apparent in the general firm population. Consistent with the theory of financing innovation, innovating constrained firms have reduced leverage and since they express constraint, they are have difficulties in finding alternative sources of finance. Nevertheless, for those innovating, constrained firms that are able to borrow funds, they use these additional moneys to fund proportional greater rates of innovation.

5.4.6 Employment Size Group Comparison

For the employment size group comparison, the sample was divided into three groups based on number of employees. The first group were those firms with greater than zero employees and less than 10. The second group was firms with 10 employees and less than 20. The third group was firms with 20 employees up to 500. Group comparisons were performed with both sales growth and employment growth rates. The hypotheses for this comparison are repeated in Table 42 below. The hypotheses predict that there will be significant bidirectional relationships between growth, leverage and innovation with the

size and sign of the coefficient estimates varying depending on the firm size group. The results of the group mean tests and the SEM analyses are in Table 43 through Table 47.

Area being tested	**Hypothesis**
Investigates leverage-growth relationship	H33. Leverage <= Growth (negative for the smallest two size groups with the larger of the two groups having a smaller effect; positive for the largest firm grouping)
	H34. Growth <= Leverage (positive effect weakening as the firm size grouping increases)
Investigates innovation-growth relationship	H35. Growth <= Innovation (positive but larger effect for largest firm size grouping)
	H36. Innovation <= Growth (no relationship)
Investigate leverage-innovation relationship	H37. Leverage <= Innovation (negative but larger effect for largest firm size grouping)
	H38. Innovation <= Leverage (negative but larger effect for largest firm size grouping)

Table 42: Summary of Size based Group Comparison Hypotheses

	Group 1 0< x<10	**Group 2 10<=x <20**	**Group 3 20<= x <=500**	**Group Comparison p-values**		
				1&2	**1&3**	**2&3**
Sales growth	0.175	0.241	0.285	0.168	0.002	0.405
Untransformed sales growth	0.347	0.456	0.493			
Employment Growth	-0.006	0.084	0.078	0.041	0.022	0.886
Untransformed employment growth	0.146	0.211	0.198			
Leverage	-0.432	-0.598	-0.578	0.010	0.003	0.763
Innovation	0.379	0.707	1.093	0.120	0.000	0.128
Tangible Assets	0.300	0.280	0.291	0.373	0.673	0.663
Earnings Volatility	0.191	0.121	0.092	0.000	0.000	0.087
Cash Flow	0.117	0.121	0.108	0.735	0.436	0.280
Age	2.835	3.060	3.138	0.000	0.000	0.191
Untransformed Age	20.45	25.34	27.29			
Size	1.155	2.639	3.628	0.000	0.000	0.000
Untransformed Size	4.044	14.25	45.449			
Export	0.115	0.119	0.281	0.857	0.000	0.000
Financial Constraint	0.032	0.067	0.022	0.242	0.375	0.136
Government Support	0.009	0.027	0.122	0.024	0.000	0.000

Table 43: Means Comparison for Firm Size Groups

	Sales Growth Rate											
Variable	Sales Growth				Leverage				Innovation			
	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3
Sales Growth	-	-	-	-	0.082 (0.093)	-0.171 (0.132)	a	a	-0.145 (0.222)	a	a	a
Leverage	0.083 (0.065)	a	a	a	-	-	-	-	-0.038 (0.119)	a	a	a
Innovation	-0.002 (0.012)	a	a	a	-0.011 (0.013)	a	a	a	-	-	-	-
Tangible Assets	-	-	-	-	0.538*** (0.092)	a	a	-0.086 (0.175)	-	-	-	-
Earnings Volatility	-	-	-	-	0.721*** (0.087)	a	1.941*** (0.155)	a	-	-	-	-
Cash Flow	0.718*** (0.122)	a	a	a	-1.062*** (0.150)	a	a	-0.510* (0.312)	-	-	-	-
Age	-0.092*** (0.031)	a	a	a	-0.172*** (0.032)	a	a	a	-0.234* (0.125)	a	a	a
Size	0.077*** (0.026)	a	a	-0.071* (0.038)	-	-	0.450** (0.219)	0.140*** (0.052)	0.021 (0.113)	a	a	a
Export	-	-	-	-	0.101** (0.051)	a	a	a	0.417*** (0.159)	a	a	a
Financial Constraint	-	-	-0.363 (0.278)	-	0.015 (0.060)	a	a	a	-	-	-	4.454*** (1.291)
Government support	0.117* (0.061)	a	a	a	-	-	-	-	1.594*** (0.565)	a	a	a
Constant	-	0.299*** (0.088)	0.306*** (0.105)	0.792*** (0.173)	-	-0.099 (0.106)	-1.542*** (0.592)	-0.575** (0.236)	-	0.965** (0.413)	1.287** (0.381)	1.358** (0.580)
R-squared	-	0.071	0.106	0.092	-	0.232	0.386	0.135	-	0.021	0.024	0.099
Number of observations	-	1585	545	918	-	1585	545	918	-	1585	545	918

Table 44: SEM Path Analysis Results for Firm Size Group Comparisons using Sales Growth Rate[17]

Model Chi-Square	Chi-Square Group1	Chi-Square Group2	Chi-Square Group3	RMSEA	CFI	SRMR
60.762, p=0.4845	16.907	22.256	21.599	0.000	1.000	0.023

Table 45: Firm size group comparison using sales growth rate model fit indexes

[17] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 a => is the common value to the left. Group 1 contains firms with between 0 and 10 employees. Group 2 is 10 to less than 20. Group 3 includes firms with 20 to 500 employees.

	Employment Growth Rate											
Variable	Employment Growth				Leverage				Innovation			
	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3	Common	Group1	Group2	Group3
Employment Growth	-	-	-	-	-	-0.074 (0.119)	0.212 (0.152)	0.106 (0.123)	-0.037 (0.222)	a	a	a
Leverage	0.001 (0.073)	a	a	a	-	-	-	-	-0.037 (0.124)	a	a	a
Innovation	-0.009 (0.013)	a	a	a	-0.010 (0.012)	a	a	a	-	-	-	-
Tangible Assets	-	-	-	-	0.531*** (0.092)	a	a	-0.072 (0.181)	-	-	-	-
Earnings Volatility	-	-	-	-	0.727*** (0.087)	a	1.986*** (0.170)	a	-	-	-	-
Cash Flow	0.341** (0.140)	a	a	a	-1.111*** (0.140)	a	a	-0.466 (0.304)	-	-	-	-
Age	-0.072** (0.030)	a	a	a	-0.167*** (0.031)	a	a	a	-0.219* (0.127)	a	a	a
Size	0.038 (0.030)	a	a	-0.094** (0.046)	-	-	0.458** (0.219)	0.144*** (0.055)	0.015 (0.114)	a	a	a
Export	-	-	-	-	0.103** (0.052)	a	a	a	0.418*** (0.158)	a	a	a
Financial Constraint	-	-	-	-	0.021 (0.063)	a	a	a	-	-	-	4.453*** (1.291)
Government support	0.164** (0.082)	a	a	a	-	-	-	-	1.584*** (0.567)	a	a	a
Constant	-	0.116 (0.093)	0.164 (0.118)	0.598*** (0.216)	-	-0.135 (0.099)	-1.574*** (0.592)	-0.598** (0.240)	-	0.903** (0.397)	1.226** (0.519)	1.296** (0.567)
R-squared	-	0.026	0.021	0.049	-	0.244	0.398	0.122	-	0.019	0.023	0.101
Number of observations	-	1585	545	918	-	1585	545	918	-	1585	545	918

Table 46: SEM Path Analysis Results for Firm Size Group Comparisons using Employment Growth Rate [18]

Model Chi-Square	Chi-Square Group1	Chi-Square Group2	Chi-Square Group3	RMSEA	CFI	SRMR
57.034, p=0.5848	18.887	22.420	15.727	0.000	1.000	0.025

Table 47: Firm size group comparison using employment growth rate model fit indexes

[18] Dependent variables are at the top of each column and independent variables are in the left-most column. Robust standard errors are in parentheses under the coefficients. Variable definitions are in Table 12. * is significant at p <.10, ** is p <.05, and *** is p < .01 a => is the common value to the left. Group 1 contains firms with between 0 and 10 employees. Group 2 is 10 to less than 20. Group 3 includes firms with 20 to 500 employees.

Comparing the means between the groups illustrates the considerable differences between the very small (group 1) and larger firms (group 3). Larger firms have higher sales and employment growth rates, lower leverage, greater innovation, less earnings volatility, greater age, greater exports and they make more use of government support. These findings are not very surprising since larger firms have more resources, an apparent desire for growth and a track record of success since they grew to a larger size and their larger size then allows them to withstand economic shocks.

The results of the SEM multi-sample analysis provided further insights into the differences among very small, small and medium sized firms. For the three dependent variables, the results for the three different sized groups were virtually the same as the results for the sample as a whole with one interesting though not significant difference. Like the results for the whole sample, there were no significant relationships among the dependent variables. So unlike some of the previous group comparisons, differentiating on size alone is not a sufficient filter for revealing growth, finance, and innovation interactions amongst SMEs. This result notwithstanding, it is interesting to note that for both the sales growth rate and the employment growth rate analysis, the smallest firm size group had the predicted negative coefficient estimate for growth rate in the leverage model while the coefficient estimate was positive for the larger two groups even though all values were insignificant. Even with the insignificant coefficient estimates, the model Chi-square fit values were significantly different by freeing the growth rate parameter in the leverage model.

In considering the model R-squares for the three groups, there are some notable differences between the results for the group comparison and the sample as a whole. For

both the growth model and the innovation model, the R-squared values noticeably improved for the largest group. Using the results for the sales growth analysis as an example, the R-squared for the growth model improved from 0.076 for the whole sample to 0.092 for the medium-sized firm group while the R-squared for the innovation model had the greatest improvement changing from 0.045 to 0.099. The exception is the leverage model where the R-squared is lower for the larger group (0.229 versus 0.135) but is markedly better for the middle size group (0.386). One can use these results to support the argument that SMEs exhibit distinct characteristics based on their size and that modeling firm growth, finance and innovation based on size provides a more nuanced understanding of firm behaviour.

Notwithstanding these findings, there are certain characteristics that are universal (though maybe not in magnitude) across all SME sizes. For example: cash flow has a positive coefficient estimate and age has a negative coefficient estimate for growth; age and cash flow both have negative coefficient estimates and earnings volatility has a positive coefficient estimate for leverage; and export and government support both have positive coefficient estimates and age has a negative coefficient estimate for innovation.

Though there are regressors which have similar coefficient estimates across the different size groups and the group as a whole, there are also some which have significantly different values for the different size groups. There were a total of six such differences: growth on size, leverage on size and export; innovation on age, size and financial constraint. Each of these differences is discussed in turn. Since the results are substantially the same for both the sales growth rate and employment growth rate analyses, the following discussion focuses on the sales growth rate results.

For the full sample, size had a significant, positive coefficient estimate in the growth model (0.062, $p < 0.000$). When the sample was divided into the three different group sizes, the coefficient estimate for size had a similar value to the full sample for the smaller two groups (0.077, $p < 0.003$) but the larger firm SME group had a significant, negative coefficient estimate (-0.071, $p < 0.062$). So when controlling for age (which is universally negative), the effect which size has on firm growth varies depending on the size of the SME that is being considered. For firms with between 0 and 20 employees, bigger is better with respect to positive growth. Once firms have 20 or more employees, their growth prospects diminish with size, all else equal. This also indicates that regression to the mean issues dissipate as firms grow, such that size has an unequivocal negative coefficient estimate for growth.

In the full sample, size did not have a significant coefficient estimate for leverage and though export had a moderate sized coefficient estimate (0.105, $p < 0.128$), it was not significant. By dividing the sample into different sized groups, export now has a significant coefficient estimate for leverage even though the size of the coefficient estimate barely changed (0.101, $p < 0.047$). In this case, by dividing the sample into groups based on size appears to have increased intra-group homogeneity thereby reducing the standard error which resulted in the coefficient estimate for export becoming significant. With regards to size as a regressor of leverage, it had a large, significant, coefficient estimate for the middle-sized group (0.450, $p < 0.040$) and a moderate, significant coefficient estimate for the largest firm size group (0.140, $p < 0.007$). This is in contrast to the full sample where size did not have a significant coefficient estimate for leverage. It should be noted that the smallest firm size group has the largest number of

observations with 1585. The second firm size group has 545 observations and the largest firm size group has 918 observations. So in the full sample analysis, the firms in the smallest firm size group would have a tendency to influence the results given that they make up over half of the total observations. Consistent with this, size did not have a significant coefficient estimate for leverage for the smallest firm size group and it appears these smaller firms mask the influence of size for the larger firms. So once firms reach a certain size (10 employees is used for this research), there is a strong positive relationship between size and leverage. This strong positive relationship moderates once the firm grows beyond a larger size (20 employees is used as the cut-off). In summary, for truly small firms which are very heterogeneous by nature, there is no leverage-size relationship. As firms grow beyond a size threshold, they greatly increase their leverage as they grow and beyond yet another threshold this leverage increase moderates.

With regards to the three differences for the size group effects on the innovation model, two of the differences are opposite effects due to increased or decreased heterogeneity induced by dividing the sample into groups based on size. Specifically, age has a significant, negative coefficient estimate (-0.234, $p < 0.061$) and size's coefficient estimate is no longer significant (0.021, $p < 0.853$). In the case of the age coefficient estimate, its value is exactly the same and it is only the standard error that has changed. Once again subdividing the sample has reduced heterogeneity. It appears that the opposite has occurred for the size coefficient estimate. By subdividing the sample into groups based on firm size has resulted in a much smaller and insignificant value. In this case, the individual groups are apparently more heterogeneous than the sample as a whole. The last firm size difference for the innovation model is that financial constraint

has a large, significant, positive coefficient estimate (4.454, $p < 0.001$) but only for the largest firm size group. For the whole sample the coefficient estimate was much small and not significant (0.757, $p < 0.157$). This result is consistent with the results of the previous section which compared financially constrained SMEs to unconstrained SMEs. Specifically, financially constrained SMEs had a much larger coefficient estimate for size in the innovation model which indicates that larger, financially constrained SMEs are more likely to be greater innovators. For the case of the group of larger SMEs, those that are financially constrained are more likely to innovate. The two results point to the same behaviour.

In summary, by performing multi-sample SEM analysis on the sample divided into groups based on firm size, provided several examples of how important a role that firm size plays in SME behaviour. By analysing all SMEs as a monolithic group, characteristics distinct to different sizes of SMEs get lost. No significant differences were found in the interactions between the dependent variables, which were contrary to the hypotheses. Nevertheless, there were several significant differences that were found with respect to the regressors. Specifically, size was a negative regressor of growth (controlling for age) for firms with 20 or more employees while it was a significant positive regressor for the sample as a whole. It appears that the effect of size changes from positive to negative as a firm grows. Similarly, tangible assets is a significant positive regressor of leverage for firms with less than 20 employees but it is negative and insignificant for firms with greater than 20 employees. Lastly, financial constraint isn't a significant regressor of innovation in the full sample but it is a large and significant positive regressor for firms with 20 or more employees.

6.0 Conclusion

6.1 Research Overview

This thesis investigated the interrelationship between growth, finance, and innovation. Specifically, based on a review of the existing literature, a novel conceptual model was developed that had growth, finance, and innovation modeled in an endogenous interrelationship. The model was then tested using a dataset which was stratified and weighted to represent all incorporated small businesses in Canada with 500 employees or less. The dataset came from a Statistics Canada survey titled 2007 Survey of Financing of Small-and Medium-Enterprises (SFSME) combined with payroll, balance sheet and income statement data that SMEs file with the Canada Revenue Agency (CRA). After testing the model using the full data sample, a set of additional research questions were pursued that asked "How does the interrelationship between growth, finance, and innovation differ when comparing different groups of SMEs?" The developed conceptual model was then used to compare different groups of SMEs to investigate how the model interactions differed among the groups. A total of six group comparisons were performed: different growth rate groups; exporting to non-exporting; innovators to non-innovators; receipt of government finance versus not receiving government finance; financially constrained to non-constrained; and different firm size groups.

This study was motivated by several different factors. From an academic viewpoint, the research literature had hinted at the possibility of there being a three-way relationship between finance, leverage and growth, yet up until now it had not been investigated. From a government policy perspective, gaining a better understanding of the dynamics of SME growth, finance and innovation will enable more informed policy development in

order to help young, predominantly small businesses that are the drivers of job creation in the economy. Lastly, from an SME owner perspective, the findings of this research hopefully provides a better understanding of the tradeoffs that need to be made when considering their firm's growth, finance and/or innovation strategy.

6.2 Results Summary

The results of the endogeneity tests indicated that growth, leverage, and finance were not endogenous to each other such that OLS could be used rather than 2SLS. This lack of endogeneity also allowed SEM modeling without correlated disturbances between the dependent variables. The results of the full sample modeling for sales growth and employment growth were substantively the same with only minor differences between the two. Also the SEM and OLS results were essentially the same. For these reasons, only the results of SEM sales growth are summarized in Figure 2 below. Table 48 below lists each of the literature predicted relationships for the variables and whether this study was consistent with or differed from the previous studies. The primary finding using the full sample was that the three dependent variables did not have significant estimated coefficients with respect to each other. Other than the hypothesized no relationship for innovation on growth, the lack of significant coefficient estimates were contrary to the hypotheses. As will be discussed subsequently, when the sample was divided into groups based on the six selected criteria, relationships between the three dependent variables did emerge. When the sample was analysed as a whole, it seems that the SMEs are too heterogeneous, such that no relationship between the dependent variables was realizable.

With regards to the independent variables, for those which had significant coefficient estimates, all were of the predicted sign except for sales volatility which was positive

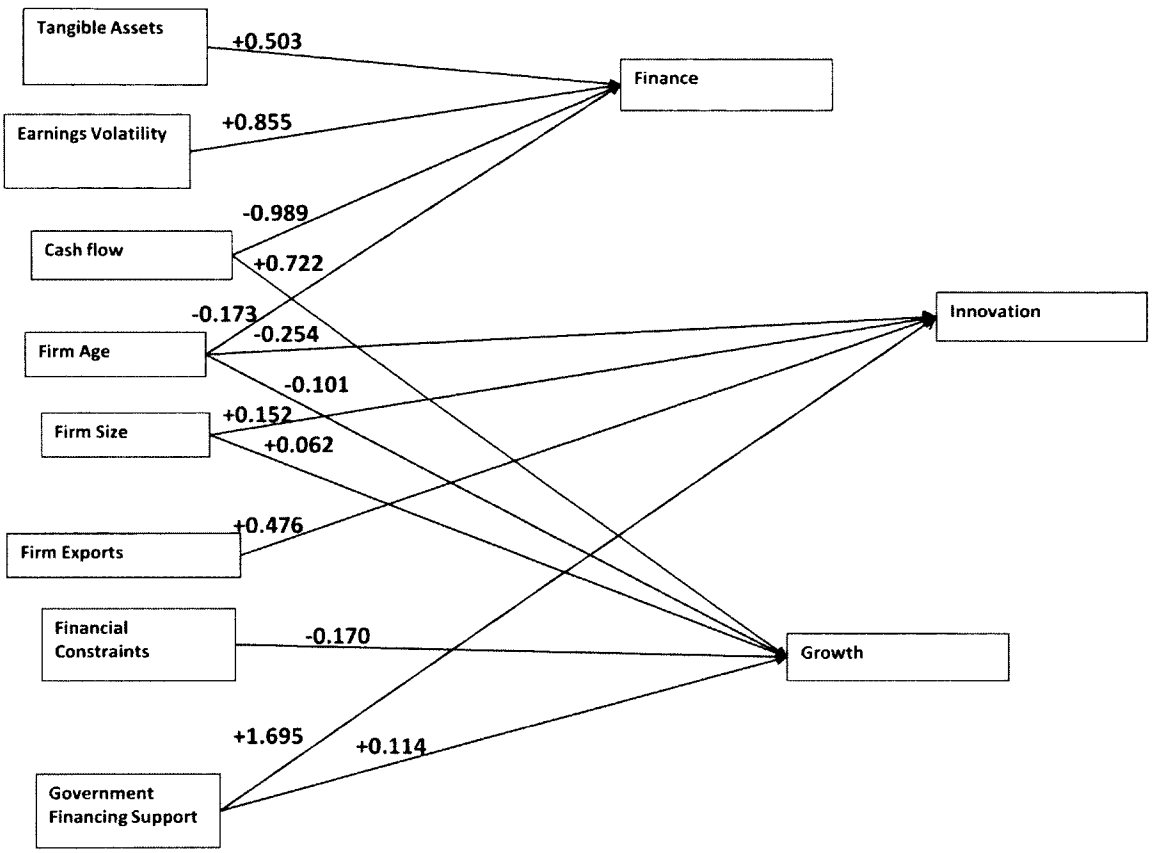


Figure 2: Conceptual Model Significant SEM Model Results for Full Sample (Sales Growth)

rather than negative and innovation on size which was positive rather than negative. With regards to sales volatility, based on the large firm finance literature, inconsistent sales results in less consistent revenue with which to pay interest on debt which in turn reduces the amount a firm can borrow. As previously discussed, the opposite result observed by this study of SMEs was likely due to the fact that SMEs start life with higher leverage

Dependent Variable	**Independent Variable**	**Literature supporting SME relationship**	**Result of this study**	**Match previous research?**
Leverage	Growth rate	indeterminate – (Baldwin et al., 2003; Brav, 2009)	none	Yes
Growth rate	Leverage	positive not significant – (Becchetti & Trovato, 2002)	none	Yes

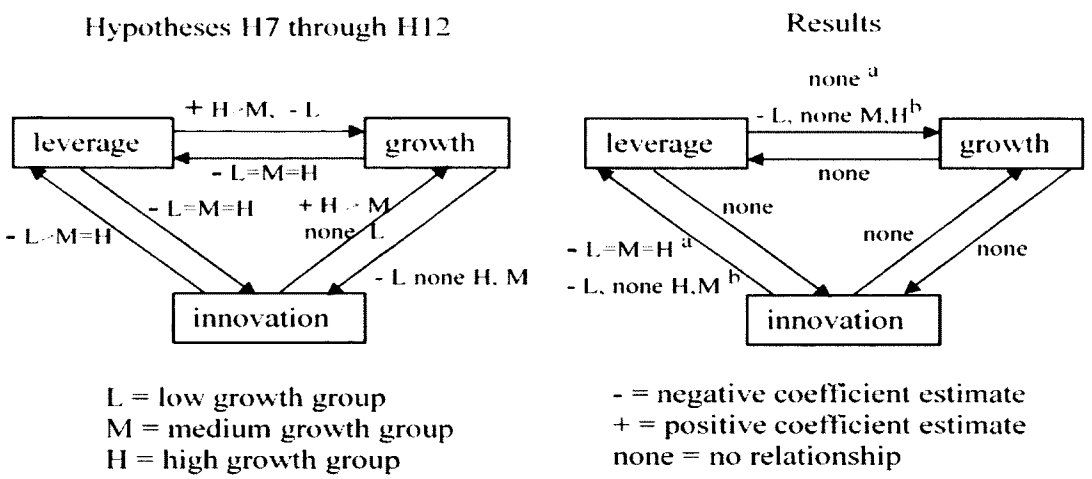
Dependent Variable	Independent Variable	Literature supporting SME relationship	Result of this study	Match previous research?
Leverage	Innovation	negative – (Baldwin et al., 2002; Gellatly et al., 2003)	none	No
Innovation	Leverage	negative – (Baldwin et al., 2002)	none	No
Growth	Innovation	positive– (Rosenbusch et al., 2011; Johnson et al., 1997)	none	No
Innovation	Growth	none – (Audretsch, 1995a; Bhattachary & Bloch, 2004)	none	Yes
Leverage	Tangible assets	positive – (Brav, 2009)	positive	Yes
	Earnings volatility	theory only – negative – (E. Walker & Petty, 1978)	positive	No
	Cash flow	negative – (Brav, 2009; Beck et al., 2008)	negative	Yes
	Firm age	negative – (Brav, 2009; Van Auken & Doran, 1989)	negative	Yes
	Firm size	Size as # of employee – positive for firm with more than 50 employees (Brav, 2009) and not significant when including all firm sizes (Baldwin et al., 2002)	none	Yes
	Firm exports	positive – (Beck et al., 2008)	none	No
	Financial constraints	positive (Angelini & Generale, 2008; Beck et al., 2008)	none	No
	Government support	positive – (Beck et al., 2008)	none	No
Growth	Cash flow	positive – (Angelini & Generale, 2008)	positive	Yes
	Firm age	negative – (Freel & Robson, 2004; Angelini & Generale, 2008)	negative	Yes
	Firm size	positive – (Haltiwanger et al., 2010; Dixon & Rolin, forthcoming)	positive	Yes
	Firm exports	positive – (Becchetti & Trovato, 2002;McMahon, 2000)	none	No

Dependent Variable	Independent Variable	Literature supporting SME relationship	Result of this study	Match previous research?
	Financial Constraints	negative – (Angelini & Generale, 2008; Becchetti & Trovato, 2002)	negative	Yes
	Government Support	positive – (Becchetti & Trovato, 2002)	positive	Yes
Innovation	Cash flow	positive (Audretsch, 1995a; Hall 2002)	none	No
	Firm age	negative – (Hansen, 1992; Klepper, 1996)	negative	Yes
	Firm size	negative – (Kenney, 1986; Acs & Audretsch, 1988)	positive	No
	Firm exports	positive – (Baldwin et al., 2002; Bhattacharya & Bloch, 2004)	positive	Yes
	Financial Constraints	positive – (Freel, 2007)	none	No
	Government Support	positive – no empirical evidence	positive	Yes

Table 48: Results Comparison to Literature Based Predictions

than large firms and those SMEs with inconsistent earnings are not able to reduce their leverage in comparison to SMEs that have more consistent earnings. For size having a positive coefficient estimate for innovation, as discussed earlier, this is a result of proportionally more large firms that have R&D spending even though they spend less on average.

For the six group comparisons, hypotheses were made with regards to the interactions between the three dependent variables. The hypotheses and the results are summarized in Figure 3 through Figure 8 below.



L = low growth group
M = medium growth group
H = high growth group

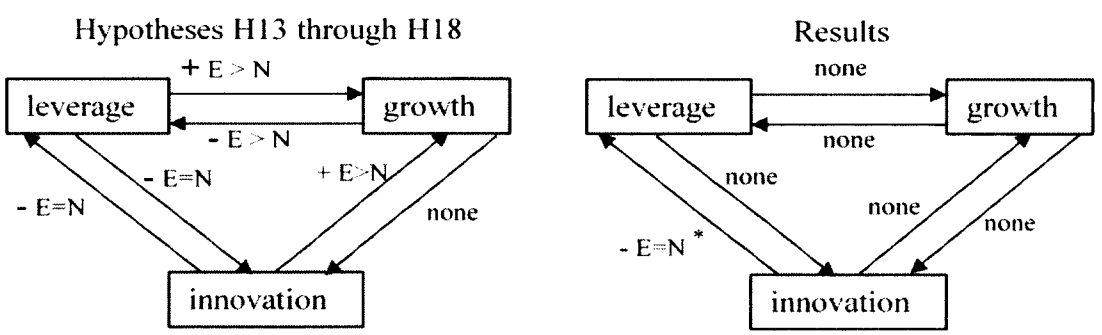
- = negative coefficient estimate
+ = positive coefficient estimate
none = no relationship

e.g. + H > M means both high and medium groups have a positive coefficient estimate with high having the larger coefficient

[a] sales growth rate analysis

[b] employment growth rate analysis

Figure 3: Hypotheses and results for growth rate group comparison



E = exporter
N = non-exporter

- = negative coefficient estimate
+ = positive coefficient estimate
none = no relationship

e.g. + E > N means both groups have a positive coefficient estimate with exporter group having the larger coefficient

* Only for employment growth rate analysis

Figure 4: Hypotheses and results for exporter/non-exporter group comparison

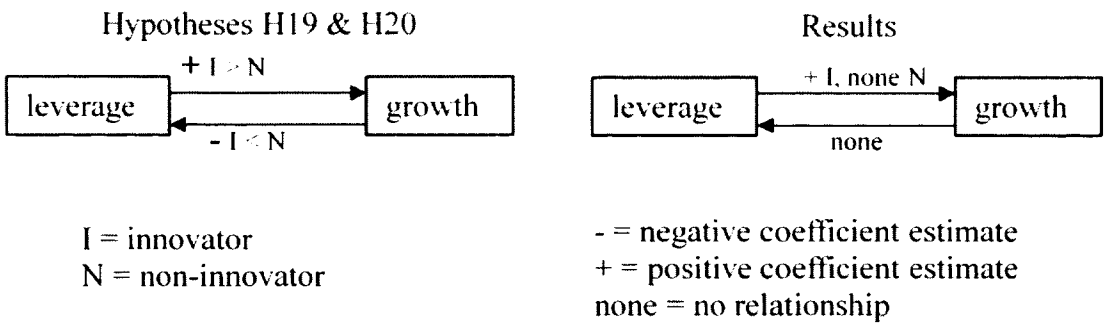


Figure 5: Hypotheses and results for innovator/non-innovator group comparison

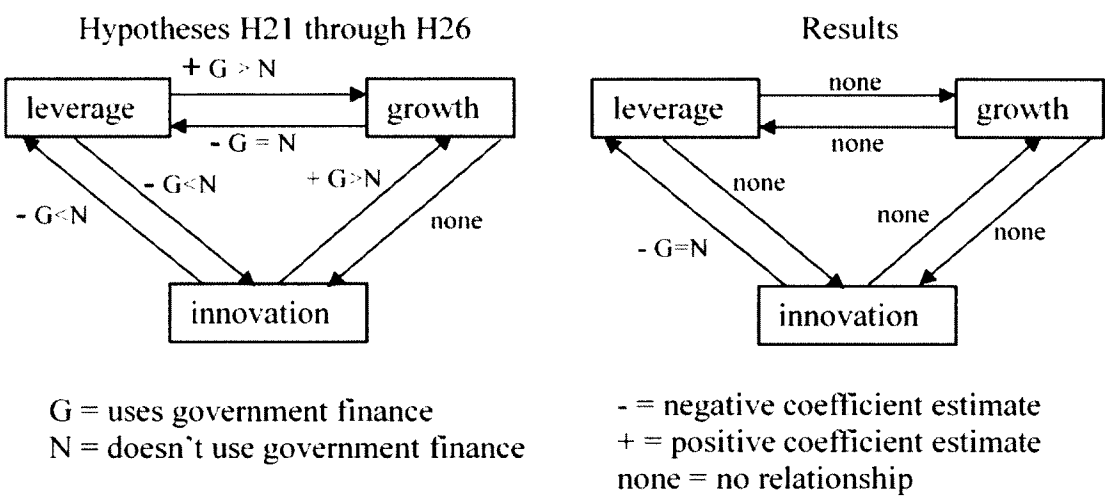
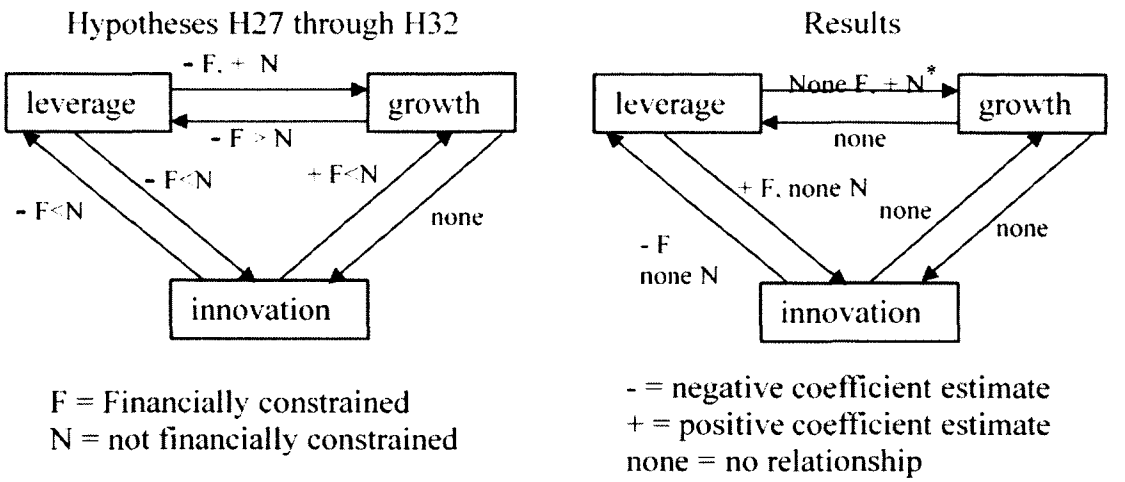


Figure 6: Hypotheses and results for comparing firms using government financing and not using government financing

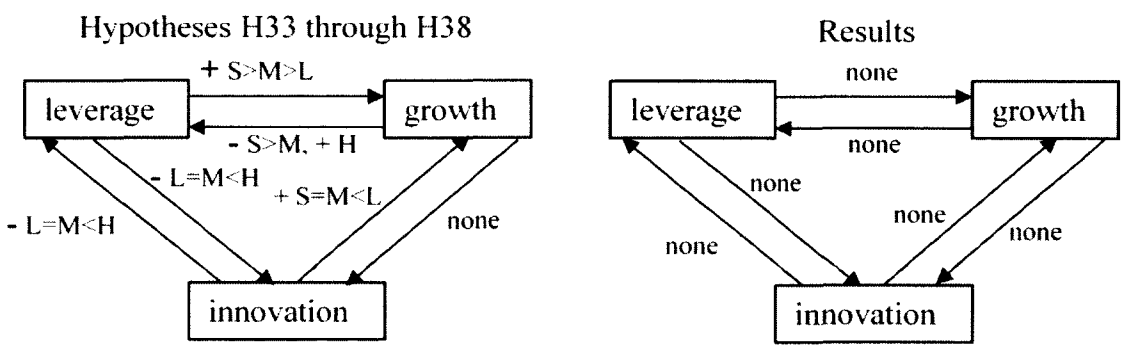


F = Financially constrained
N = not financially constrained

- = negative coefficient estimate
+ = positive coefficient estimate
none = no relationship

e.g. + F > N means both groups have a positive coefficient estimate with exporter group having the larger coefficient
*Only for sales growth rate analysis

Figure 7: Hypotheses and results for comparing financially constrained firms and not financially constrained



S = 0< < 10 employees
M = 9 < <20 employees
L = 19 < employees

- = negative coefficient estimate
+ = positive coefficient estimate
none = no relationship

e.g. + L > M means both L am M groups have a positive coefficient estimate with L having the larger coefficient

Figure 8: Hypotheses and results for comparing firms grouped by number of employees (i.e. size)

By looking at the results for all of the group comparisons, several consistent relationships among the dependent variables begin to emerge that are not present when the whole sample is analysed. This points to the idea that SMEs as a group are quite

heterogeneous and it is necessary to divide the sample into more homogeneous groups in order for relationships to emerge. Specifically, innovation as a negative predictor of leverage, consistent with theory, occurred in four of the six group comparisons (really four out of five since one group comparison involved innovation). Another relationship that appeared a couple of times was leverage having a significant coefficient estimate for growth (innovator group and firms not financially constrained). As predicted, leverage had a significant positive coefficient estimate for innovators. Also as predicted, leverage had a negative coefficient estimate for employment growth for those firms experiencing negative employment growth. Shrinking employment and increasing leverage leads to further shrinking of employment. Lastly, contrary to what was predicted, leverage was found to have a positive coefficient estimate for innovation for financially constrained firms. Possibly this is caused by the innovating firm having borrowed money to innovate and the innovation was not successful in generating revenue, which in turn caused the firm to be financially constrained.

Innovation was not found to have a positive coefficient estimate for growth in either the full sample model or for any of the group comparisons. This finding should not be taken as an indictment against R&D spending but rather a result of R&D spending from tax data for SMEs being an inaccurate measure of innovation. Even though ranked within industries, the innovation measure was still based on R&D spending which is known to be a weak measure. Furthermore, as discussed previously, due to the difficulty of SMEs tracking their R&D spending, R&D tax data isn't an accurate representation of SME R&D spending. Perhaps a better measure, such as an SME's innovation culture, would have resulted in innovation having a positive coefficient estimate for growth.

Now briefly looking at the independent variables, their coefficient estimates in the group comparisons were consistent with the overall sample analysis with a few interesting exceptions. On one level it is reassuring that SMEs behave in much the same way as larger corporations do. Cash flow has a positive coefficient estimate for growth and a negative coefficient estimate for leverage. Tangible assets have a positive coefficient estimate for leverage. Age has a negative coefficient estimate for growth rate, leverage and innovation. Consistent with Haltiwanger et al. (2010) and Dixon and Rollin (forthcoming), size when averaged over the growth period has a positive coefficient estimate for growth. Export has a positive coefficient estimate for innovation and financial constraint has a negative coefficient estimate for growth though only for the full sample. Lastly, receiving government support has a positive coefficient estimate for both growth and innovation.

The six group comparisons revealed an additional six findings with regards to independent and dependent variable interactions. Each is discussed in turn. Since the results using sales growth rate and employment growth rate were substantively the same, only the sales growth results are presented.

For the full sample, size had a positive coefficient estimate for innovation. Size also had a positive coefficient estimate for innovation for all group comparisons other than the one based on size. Interestingly, when the sample was divided based on exporting, it was only those firms which exported that had a significant coefficient estimate for size (0.460, $p < 0.000$). Also, when the sample was divided based on financial constraint, the coefficient for size was over 13 times larger for firms experiencing financial constraint (1.580, $p < 0.01$) versus those that were not (0.131, $p < 0.054$). It appears that it is these

two groups of firms (exporters and financially constrained) which are responsible for the size/innovation relationship. This is not surprising since these two groups are more likely to be innovators.

It was predicted that export would have a positive coefficient estimate for leverage for the full sample, but the coefficient estimate was insignificant (though positive). In contrast, export's coefficient estimate for innovation was positive and significant for all groups when the sample was divided by size, financial constraint or whether the firm had innovation spending or not. Dividing the sample by growth rate or government support had the same insignificant result as the full sample. With respect to the export and leverage relationship, there appears to be more homogeneity in the sub-samples when dividing the sample based on size, financial constraint or innovation than either growth rate or government support. It is not clear what could be causing this difference.

For the full sample and all but one group comparison, tangible assets had a significant coefficient estimate for leverage as predicted. The one exception was for those firms receiving government support. One would think that this was possibly due to innovators which have mostly intangible assets receiving government support (IRAP, SRED). But both the innovator and non-innovator groups had significant coefficient estimates for tangible assets in the leverage model with innovators having a much larger value (1.217, $p < 0.001$ versus 0.468, $p < 0.000$). Similarly, it is unlikely that exporters are causing this due to export subsidies (e.g. Export Development Corporation) since the group comparison based on exporting resulted in both groups with the same significant coefficient estimate (0.503, $p < 0.000$). Possibly, another form of government subsidy that is unrelated to tangible assets is causing this result.

The final three independent variable coefficient estimate differences occurred when dividing the sample based on the size of the firm. These differences were discussed previously in the section titled Employment Size Group Comparison on page 195 and are briefly repeated here. For firms with 20 or more employees, size has a negative coefficient estimate for growth indicating that the firm size regression to the mean issue dissipates once firms reach a certain size (20 employees or more in this study) and size then has a truly negative coefficient estimate for growth. Additionally, for firms with 10 or more employees, size has a positive coefficient estimate for leverage while there is no relationship for firms with less than 10 employees. So for truly small firms, which are very heterogeneous by nature, there is no leverage-size relationship. As firms grow beyond a size threshold, they increase their leverage as they grow with this increase being greater for firms with 10 to 19 employees than for firms with 20 or more employees. Lastly, dividing the sample based on size revealed that it is firms with 20 or more employees that are financially constrained in their innovating activities.

6.3 Research Implications

6.3.1 Scholars

For researchers investigating SMEs, this study has shown that assuming data linearity across all SMEs is tenuous at best. It is necessary to divide the SME population into different groups to reveal specific SME behaviour since analysing the population as a whole masks group specific characteristics.

From a contribution to the extant theory of growth, this research has provided several insights. First, firm behaviour differences exist when comparing sales growth rates and employment growth rates. Firms appear to be much more conservative in increasing their

level of employment than their level of sales. This is illustrated by the estimated coefficient for growth rate on cash flow being almost twice as large in the sales growth rate analysis as in the employment growth rate analysis. This is also the case for financial constraint where its estimated coefficient is negative and significant for sales growth rate but not significant for employment growth rate. Second, as a further addition to the size, age and growth debate, this research found that when averaging size over the measurement period and controlling for age, size has a positive coefficient except for firms in the highest growth rate quartile where size has a negative coefficient. This is likely an artefact of the relative growth rate measure which favours small firms when considering high growth rates. Third, earnings volatility was found to be a positive indicator for high sales growth rate firms while a negative indicator for low/negative growth rate firms. This was another example of an SME characteristic that is not apparent when analysing the sample as a whole.

This research has also provided both SME finance theory support and insights. The study found that cash flow is the largest coefficient for growth rate consistent with small firm finance and growth theory. Contrary to extant finance theory, earnings volatility has a positive coefficient for SME leverage rather than negative which was interpreted as SMEs with volatile earnings being unable to reduce their debt. Lastly, the estimated coefficient for size in the leverage regression was not significant for the full sample but had different and significant values for firms with 10 to 19 employees and for firms with 20 or more employees. This once again shows that the linear assumption for SMEs as whole does not hold.

From an innovation research viewpoint, even though some insights were found (e.g. export has the largest estimated coefficient for innovation and that innovating SMEs leverage tangible assets more), the need to improve how firm innovation is measured by using a firm innovation orientation metric was highlighted.

6.3.2 Policy

The findings from this research provide positive feedback for existing government policies as well as some direction for future policies. From a job growth perspective this research has shown that government support is positive for firm growth rate with the influence being larger on employment growth rate (the intended target) than sales growth rate. Though this is only an associative relationship, it is still reassuring that the government support has a positive association rather than negative or none. The research also illustrated the tenuous relationship between innovation and the ability to finance it. It was found that in comparison to non-innovating SMEs, innovating SMEs make greater of use of their tangible assets to borrow funds and that those innovating SMEs that can borrow have higher growth rates. These findings combined with the finding that it is innovating SMEs with 20 or more employees that experience financial constraint, points to a possible area where policies can be of assistance. Targeting programs that encourage financing of innovating SMEs with 20 or more employees would seem a prudent policy. An example of such a policy would be tax incentives for venture capitalists which fund this type of firm. The targeting of specific types of SMEs is consistent with the previously described finding that SMEs are quite diverse and just like researchers need to target specific groups for their research; policies need to be targeted as well. As a final policy suggestion, this research has added further support for the need to focus not only

new SMEs but larger SMEs as well when targeting SME growth. This fits with the previous policy suggestion of targeting innovating SMEs with 20 or more employees.

6.3.3 Practitioners

From a practitioner viewpoint, based on the findings, if a person is considering an innovating SME with 20 or more employees they should be aware that these types of firms typically face financial constraints and that they should plan accordingly.

6.4 Limitations

There are a number of limitations to this research. First, given that this research was a secondary data analysis, the innovation measure that was available was weak and the results that were obtained with it were disappointing if not unexpected. It would be fruitful to use a different innovation measure such as firm innovation orientation to see if the results would be different. Also, would using a different measure of innovation result in innovation being endogenous to either growth or leverage?

Second, given that part of the data is based on a survey, the issue of key informant and non-response bias must be kept in mind. Key informant concerns are minimized due to the small size of the firms being surveyed such that it would be more likely that the respondent would have appropriate firm knowledge. Non-response bias is minimized by the large number of strata used in the survey as well as including enough respondents to minimize the coefficient of variance.

A third limitation is the issue of omitted variables of which there are several. Known missing variables are intention to grow, management competency, marketing competency, macroeconomic activity, firm ownership structure, whether the firm had venture capital and specific industry characteristics. As previously described, these

variables were absent from the analysis due to either a lack of proxies available in SFSMSE dataset or in the case of specific industry characteristics, insufficient firm numbers to obtain statistically significant results. Each of these constructs would have added further insight into the dynamics of SME growth, finance and innovation. Their absence from the analysis means that the explanatory power of the regressions was lower and the resultant regression coefficients could be either smaller or larger. Nevertheless, even with these limitations, the survey combined with the linked-in tax data for the preceding five years provided an invaluable resource which was unique because of its longitudinal nature and comprehensive representation of Canadian SMEs. It may not have been perfect, but the dataset was better than anything else that was available in Canada.

Yet another possible concern is the quality of the tax data that was linked with the survey data. As was described previously, the balance sheet information which CRA receives from the firm is entered "as is" with no audits to check the validity of the information. Through a combination of filtering out extreme values and checks to make sure that the balance sheet items that were used made logical sense, it is hoped that the misinformation effects were minimized. No doubt the large sample size also helped in reducing possible balance sheet information errors. It should also be noted that by filtering out extreme values, the regression results lose predictive capability but nevertheless contribute to the understanding of SME behaviour.

A further limitation to this research was that very young firms were not included. Since a firm must have had five years of growth data (2002-2007) to be included, firms five years old or younger were not included. Also, firms must have had more than zero

employees to be included in the study. Employee numbers were obtained through CRA's payroll deduction database which only existed for a firm if there were at least one person on the payroll. If this person worked part-time, they would be considered a fractional person based on the amount of hours they worked. This was a reasonable restriction. Considering that one of the areas targeted by this research was firm growth, a firm that doesn't have anyone on its payroll after five years is unlikely to be pursuing growth.

Measurement error is another concern. The SEM technique of path analysis assumes "that the exogenous variables are measured without error" (Kline, 2005, p. 118). If this assumption is grossly violated, biased estimators (both in a positive and/or negative direction) will occur making any research conclusions misleading at best. By using proxies that have been shown to be representative and reliable in previous research, it is thought that the likelihood of this potential problem was mitigated.

6.5 Future Research

There are a several possible opportunities for future research. As was mentioned above, due to the limitations of the original survey there were several missing variables from this current research including behavioural variables such as management and marketing competency as well as organization innovation orientation. By the inclusion of several well focused questions it would be possible to capture this information in a subsequent survey with minimal increase in respondent burden. The addition of these questions would greatly increase the understanding of the growth, finance and innovation relationship.

Another possible research avenue would be to test the proposed model using only publicly traded firms to see how the group comparisons differ for them in comparison to

the SMEs used in this study. Also, the possible combination of more accurate financial information and less overall heterogeneity that comes with using publically traded firms might result in more significant bidirectional relationships between growth, finance and innovation for the sample as a whole. This paper chose a five-year growth rate as the proxy for both its growth constructs in order to smooth out the stochastic nature of growth. By following this methodology, it was hoped that a more deterministic growth would be captured. This limited the sample to firms which were greater than five years of age. What differences would be found if a growth rate of one year was used? Lastly, the proxy that was used for firm size was the average size of the firm over the five year period in order to control for regression to mean. Another possibility would be to investigate the effect of using various lagged values for size as an alternative to averaging size over the five-year period.

6.6 Concluding Remarks

Though there are a number of limitations to this study as well as additional questions yet to be answered, this study provides several contributions to the study of SME growth, finance and innovation. First, consistent with the RBV theory of growth and the findings of Carpenter and Petersen (2002), cash flow is the single most important factor affecting both sales and employment growth. This illustrates that SMEs do in certain cases exhibit behaviours similar to those of small public firms. Second, SMEs by their very nature are a heterogeneous group and to reveal generalizations of their behaviour, it is necessary to divide them into subgroups which results in increased homogeneity. Different groupings reveal different characteristics. Grouping SMEs by size revealed that the rate of change in leverage with respect to size varies depending on size itself. Grouping by size also

revealed that it is innovating firms with 20 or more employees, not smaller firms, which experience financial constraint. Innovation has a negative coefficient estimate for leverage for most groupings but not by size and not for the sample as a whole. Innovating firms and firms that are financially constrained have higher growth rates if they have greater leverage. Access to funding supports growth. With this in mind, policies should be targeted to support innovating SMEs with 20 or more employees. From an innovation perspective, this research has shown the need to develop more effective measures for innovation. Based on Rosenbusch et al. (2011) who found that measuring an organization's innovation orientation had the strongest correlation with growth, it is suggested that learning organization measures similar to those used by Statistics Sweden (Statistics Sweden, 2011) be adopted as a possible better innovation measure. Lastly, there is a level of confidence with these findings since they were obtained using a large, weighted, representative sample of Canadian SMEs and that similar coefficient estimates were obtained independent of whether sales growth rate or employment growth rate were used as the proxy for growth.

Appendix A – Excluded NAICS

NAICS	Description
22	Utilities
52	Finance and Insurance
55	Management of Companies and Enterprises
61	Educational Services
91	Public Administration
5321	Automotive Equipment Rental and Leasing
5324	Machinery and Equipment Rental and Leasing
6214	Out-Patient Care Centres
6215	Medical and Diagnostic Laboratories
6219	Other Ambulatory Health Care Services
6221	General Medical and Surgical Hospitals
6222	Psychiatric and Substance Abuse Hospitals
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals
6242	Community Food and Housing, and Emergency and Other Relief Services

Table 49: NAICS Excluded From Sample Frame

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