The Relationship between Corporate Governance Practices and Firm Performance in the Junior Canadian Life Sciences Sector

By

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Abstract

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The relationship between four corporate governance characteristics and six measures of firm performance are examined in a sample of sixty-two Life Sciences firms listed on Canada's TSX-Venture stock exchange. Results from univariate and logistic regression analyses support prior corporate governance research by demonstrating that the effect of good corporate governance structures on firm performance may be contingent on the specific circumstances within the firm or even the industry as a whole. Majority independence of the Board of Directors was found to have minor negative impact on firm performance. CEO duality was shown to enhance firm performance as proxied by return on assets; this result is contrary to expectations based on the agency model of corporate governance, but consistent with this study's hypothesis. Gender diversity of the Board indicated mixed results, showing a negative association with firm performance. Equity ownership by the Board was associated with better firm performance. In sum, this study shows that significant associations are present among the selected corporate governance factors and relevant measures of performance for junior Canadian Life Sciences firms. These findings should be used as a basis for further investigation which may include expanding the sample and the time frame. Ultimately, this research may serve to provide guidance to industry and indicators to investors of future firm performance.

Executive Summary

The Life Sciences sector is a key contributor to Canada's innovation economy. Canadian Life Sciences firms (LSF) create value by continually advancing research and development of new products, technologies, and services that are highly valued by society as they become realized through improvements in medical and healthcare delivery, agri-food, and the environment. LSFs, particularly those on the junior Canadian TSX-Venture stock exchange, are often formed to support the development and commercialization of novel innovations. These firms seek public listing status in order to gain access to the significant investment funding needed to support the weighty hurdles posed by extensive clinical trials and lengthy approval-to-sell processes governed by industry regulators.

The need for significant investment in the junior Canadian LSFs is often critical as access to sufficient capital to see the product through to its revenue generating stages can make or break firms in this industry sector. Competition for funding is high, particularly in the wake of the turmoil of recent years in the global financial systems and the trend towards off-shoring of expensive processes such as research and development. Thus, firms with structures that elicit investor confidence have a competitive advantage in the "battle for funding".

In light of the past decade's devastating corporate scandals, the value of good corporate governance structures to shareholders has become a prominent issue. The principal-agent model (Agency Theory) of corporate governance

highlights the problems that occur when ownership and control of the firm is separated. In the context of this model, good corporate practices are intended to aid in aligning the interests of the firm's owners and its managers, ultimately creating long term value for the firm's shareholders. Thus, their presence could provide an indicator to investors of the potential for return on their investments. Numerous studies have been conducted in the area of corporate governance seeking to establish consistent linkages between corporate governance best practices and firm performance (Belkir, 2004; Elloumi & Gueyie, 2001; Rouf, 2011; Bhagat & Bolton, 2008; Brown & Caylor, 2006). To date, no consistent model supporting this association has been identified. The purpose of this study is to examine six firm performance measures and determine if any are associated with four indicators of "corporate governance best practices" specifically in the junior Canadian Life Sciences industry. Identification of such positive associations could be used as a basis for LSFs, helping to design and support their corporate structures to drive strong firm performance and gain competitive advantage in the view of investors.

Results from regression analyses support prior corporate governance research by demonstrating that the effect of good corporate governance structures on firm performance may be contingent on the specific circumstances within the firm. First, a majority of independent directors on the Board was found to have little impact on firm performance. Second, CEO duality was shown to enhance firm performance in terms of return on assets. Third, gender diversity on the Board showed mixed results, with an inclination towards a

negative association with firm performance. Fourth, equity ownership by the Board was found to be associated with better firm performance.

In conclusion, this study provides preliminary evidence that several significant associations exist, linking firm performance with corporate governance characteristics in the junior Canadian Life Sciences industry. It is recommended that these findings be used to seek a more definitive answer to the central research question by expanding the sample and the time frame. Therefore, further research is needed in order to better define the identified associations among the variables and provide basic guidance for industry players, investors and regulators.

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CHAPTER 1: INTRODUCTION

1.1. Purpose of the Study

The Life Sciences sector is a key contributor to Canada's innovation economy; creating value by continually advancing societal goals of medical and healthcare delivery, agri-food, and the environment (Government of Canada, 2012; Chataway, Tait, & Wield, 2006). Thus, this sector's value to society is great, opening untold possibilities to advance public health and wellness, making it an attractive investment prospect. Great potential is generally accompanied by high risk, an inevitable truth in the Life Sciences industry. This sector's rapid advancements lead to breakthrough technologies and innovations which form the basis for continual research and development (R&D), ownership of intellectual property rights, and ultimately, in many cases, a commercially viable product pipeline, all potentially lucrative opportunities for the Life Sciences firm (LSF) and its shareholders. On the other hand, LSFs are highly regulated and thus, a young firm often requires periodic, significant capital injections to sustain it through the R&D phase to prototype development and validation, followed by regulatory approval prior to commercialization. Further, a unique combination of scientific, compliance-oriented and business acumen is often necessary to support the young firm through its pre-revenue generation phases. Evidence of a firm's ability to attain this balance is valuable to shareholders and other stakeholders when considering investment in or collaboration/partnership with that firm.

Because of the challenging state of the global economy in recent years, the Canadian Life Sciences industry has been forced to explore numerous options to raise the funds to support the start-up or early stage firm in its quest for profitability. According to a recent report on the Canadian Life Sciences industry by PwC and BIOTEC Canada, the commercialization of science is a challenge for which fundraising is becoming more difficult as globalization allows more research, development and supporting activities to be effectively moved offshore (PWC & BIOTECanada, 2011). In this light, it becomes even more important that potential investors be able to clearly view, not only the firm's value proposition but also, have confidence in the underlying structures that support the firm's capability for success in both the short and the long run.

Corporate governance has been well-documented as a central and dynamic system whereby an organization is directed and controlled by the set of relationships among the company's management, its Board of Directors, and its stakeholders (Kim, Nofsinger, & Mohr, 2010). Good governance is essentially a system of checks and balances intended to protect the welfare of stakeholders and drive the organization's success. Its presence "*clarifies authority, simplifies decision–making, and ensures that people and organizations are accountable for their decisions*," (Institute on Governance, 2012; Larcker & Tayan, 2011). Therefore, evidence of good corporate governance can be a valuable indicator of a company's worthiness of investor and stakeholder confidence. Its prominence as an indicator of the integrity of a firm's supporting structures over the past decade has arisen with the wave of catastrophic corporate failures such as Enron, Worldcom, Parmalat, and others. However, these scandals also

served to highlight the fact that the appearance of good corporate governance and/or high quality organizational practices may not necessarily be indicative of its true state, since some of these organizations were renowned for what appeared to be excellence in corporate governance. As a result, securities laws have evolved, becoming more restrictive, particularly in the United States with the enactment of the Sarbanes-Oxley Act of 2002 (SOX) that set new governance standards for Boards and management of publically-traded firms. The Canadian response to SOX has been to incorporate much of its context into its own decentralized securities regulatory system, using and learning from the results of the SOX implementation (Gray, 2005). In particular, Canada's regulatory response to SOX by securities administrators included rules affecting auditors' oversight, personal accountability in terms of CEO and CFO certifications of disclosures, audit committee structure and responsibilities, along with requirements for specific corporate governance and disclosure controls (Sibold, 2009). The success of this implementation, however, is questionable as recent literature indicates that the SOX model may have been inappropriate for Canadian securities regulatory policy due to the distinct differences in size, structure and composition of the Canadian and American capital markets (Sibold, 2009). It has been noted that the lack of adequate testing of the model in Canada prior to implementation accompanied by the lack of critical analysis of the underpinnings of SOX (i.e., its reliance on independent directors as effective monitors of management) may have precluded a successful implementation (Sibold, 2009). In essence, Canadian securities regulators adopted "*a response to a solution rather than to a problem,"* (Sibold, 2009).

Although the effects of good corporate governance practices on firm performance have been well investigated by researchers, the results, which are discussed in detail below, have been mixed. A growing body of evidence indicates that there is a significant statistical relationship between bad corporate governance and poor firm performance (Solomon, 2010; Core, Holthausen, & Larcker, 1999). Other findings, such as the positive association between the prevalence of independent directors and the ability raise capital due to the availability of more growth opportunities and financial resources from the external environment (Murphy & McIntyre, 2007), are relevant to the current state of the Canadian Life Sciences sector and the ability of its firms to succeed in advancing societal goals relating to healthcare, food, and the environment. The purpose of this study is to examine the association, if any, between a selection of the most relevant corporate governance practices and firm performance indicators within the junior Canadian Life Sciences industry. This study aims to contribute to the body of literature that seeks to identify linkages between good corporate governance practices and firm performance with a focus on the Canadian Life Sciences sector.

Specifically, this study investigates whether firm performance is associated with good corporate governance principles in publically-listed, Life Sciences companies on the TSX-Venture Exchange (TSX-V). The firms chosen for this study represent those whose core business are mainly focused in healthcare and include the design, development and/or manufacturing of medical devices and equipment, drugs and/or biologics. Firms listed on the TSX-V exchange in the Life Sciences sector are generally in the early stages of

growth, development and commercialization, en route to stable, ongoing production and revenue generation. To these firms, financial growth and performance is a critical factor determining their ongoing viability and successful future growth.

The contribution of this study to practice is twofold. First, the identification of associations among the selected variables could provide start-up venture companies in this industry with a framework for development of a corporate governance system that supports organizational growth and performance expectations, thereby increasing the firm's probability of future success. Second, linkages between measures of firm performance and the examined good corporate governance practices will help early-stage firms form structures that may signal their worthiness to investors and stakeholders, thus eliciting confidence and affording better access to funding to bridge the gap between product development and revenue generation.

1.2. Background

Governance of an organization defines the system under which it is controlled, through certain processes, structures, plans, policies, rules and agreements. Thus, it can be regarded as a driver of an organization's success, as its presence clarifies authority, simplifies decision–making, and ensures that people and organizations are accountable for their decisions (IOG, 2012). Used in combination with good management and good leadership, good corporate governance can keep the organization pointed in the right direction and performing strongly, creating the best value possible for its shareholders by

earning long term profits. Good corporate governance principles exist to ensure that this occurs, protecting investors and placing Boards of Directors in an organizational leadership role, representing the owners and ensuring that their capital is directed towards the right purposes while, at the same time, acting as the voice of management to the owners (Brown Governance Inc., 2004). Corporate governance can also be defined as a collection of control mechanisms that are put in place to deter self-serving behaviour by increasing the probability of detection and shifting the risk/reward balance so that payoff from crime is decreased (Larcker & Tayan, 2011). A firm's ability to control risks, gain access to capital and provide long term value to shareholders are critical contributors in the success or failure of a firm (Kim, Nofsinger, & Mohr, 2010).

The principal-agent model of corporate governance (or Agency Theory) is concerned with the problems associated with the separation of ownership and control of the firm. In particular, it addresses the difficulties in motivating the firm's management (the agents) to act in the best interests of the shareholders (the principals), rather than in their own interests (Kim, Nofsinger, & Mohr, 2010). Although the agents technically work for the principals, shareholders often cannot directly monitor their behavior, particularly when the interests of the parties are different. Information asymmetry is another contributing factor to the agency problem; i.e., agents have access to considerably more and superior information than the principals (Healy & Palepu, 2001). The role of the Board of Directors in this model is that of a primary monitor of a firm's agents, ensuring that their actions align with the best interests of its owners. Appointed by

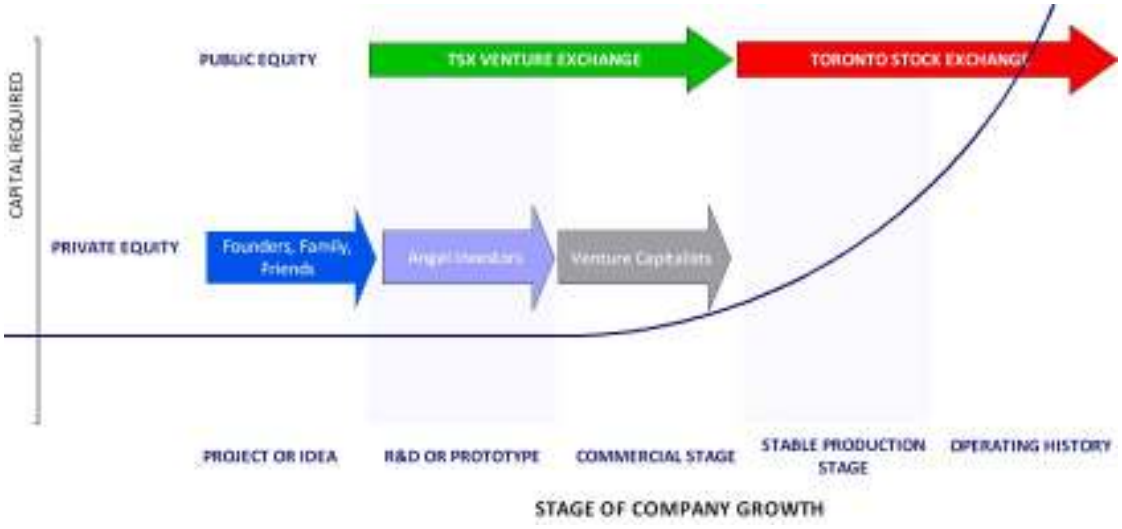
shareholders, the Board's mandate is to run the corporation on their behalf, appointing, compensating, incenting, directing and removing executives with the goal of long term success (Kim, Nofsinger, & Mohr, 2010). A gap in the underlying premise of the principal-agent model lies in the fact that the agents play a leading role in the selection of director nominees and thus, depending on management's desired outcomes, the Board elected by shareholders may or may not be motivated to serve the shareholders' best interests. For this reason, an examination of Board structure in terms of good corporate governance practices is relevant.

Linkages between governance practices and firm performance have been investigated by researchers and will be discussed in more detail in a later section. In short, although a trend towards a positive relationship between good financial performance and good governance practices is evident, a clear relationship between poor firm performance and poor corporate governance practices has been documented (Core, Holthausen, & Larcker, 1999; Solomon, 2010). Identification of such a trend among Canadian LSFs listed on the TSX-Venture Exchange (TSX-V), Canada's junior equities market, could provide start-up venture companies in this industry with a framework for development of a governance system to support the inherent growth and organizational performance expectations.

Many of the listed firms in the TSX-V Life Sciences sector are junior, growth-oriented companies that have evolved from a novel idea or invention with commercialization potential. The TSX-V provides a marketplace with access to North American and global capital, allowing these early- stage firms to

remain on the exchange until a stable production stage accompanied by consistent revenue generation is reached, as depicted Figure 1 below. At December 31, 2012, the Life Sciences sector of the TSX-V was comprised of 63 issuers and maintained a quoted market value (QMV) of C$955,743,912 (TMX Global Leaders in Life Sciences, 2012).

Figure 1: Company Growth Stage versus Capital Requirements and Listing Status on the TSX and TSX-V Exchange



Source: http://www.tmx.com/en/listings/listing_with_us/considerations.html; January 18, 2012

There is a growing perception in the financial markets that good corporate governance is associated with prosperous companies. Research evidence indicates that corporate governance is as important for small companies as it is for large ones, although it may be harder to achieve (Solomon, 2010). Although any TSX-V listed company must maintain a least a minimum level of corporate governance practices in order to meet the requirements of the exchange and securities regulations, implementation

beyond compliance may not be a key priority for these companies, whose focus often remains on its core science behind the product development through commercialization stages.

The ultimate test of whether or not the corporate governance reform of the past few decades is having a positive impact on industry is establishing empirically whether or not there is a positive relationship between corporate financial performance and corporate governance (Solomon, 2010). This study was designed to examine whether selected "good" corporate governance practices are associated with positive firm performance in junior, growth-oriented Canadian LSFs. Governance indicators were selected based on characteristics of the principal-agent model most relevant to the industry sector. Firm performance indicators were chosen to reflect financial and non-financial measures that would provide an indication to an investor of an LSF's ability to control risks, gain access to capital and thus, provide long term value to shareholders (recalling that the ability to obtain investment to support a prolonged pre-commercialization phase is a necessity to the junior, growth-oriented LSFs in Canada). The results of this study indicate the impact of what are commonly perceived to be good corporate governance practices on performance of TSX-V listed LSFs. They can be used as a basis for guidance to these firms in defining and prioritizing their governance strategies by providing a framework for development of a governance system to support the inherent growth and organizational performance expectations for the Life Sciences sector.

1.3. Research Question

The central question of this research project is:

Are good corporate governance practices associated with positive firm performance in publically listed Canadian growth-oriented companies in the Life Sciences sector?

CHAPTER 2: LITERATURE REVIEW

2.1. Purpose and Scope of the Literature Review

Good corporate governance practices should provide a foundation to support a firm's strategic initiatives. A firm exists to maximize shareholder value, be it through financial measures, societal obligations or in a configuration that includes environmental responsibilities known as the *Triple Bottom Line*. Regardless of a firm's strategic focus, corporate governance, the system of checks and balances aimed at protecting the welfare of its shareholders and stakeholders, plays an important role in controlling and monitoring the firm's direction and accountability. In short, "*the corporate governance framework should ensure that the strategic guidance of the company, effective monitoring of management by the Board and the Board's accountability to the company and the shareholders,"* (Larcker & Tayan, 2011). Thus, the structure and role of the Board of Directors may be a key factor in a firm's success.

The absence of good corporate governance practices has been felt in capital markets worldwide, causing investors to rethink the level of risk that they are willing to undertake. This situation has posed a significant barrier to accessing capital for high-risk, growth-oriented industry sectors. Over the past two decades, the wake of major corporate collusion and fraud scandals has spurred significant regulatory reforms that have, in turn, driven the need for stronger corporate controls; a significant quest for investors, firms and regulators alike. This rapid rise in corporate governance reforms has been aimed at increasing the amount and effectiveness of monitoring and control

within firms and reducing the ability of executives to perpetrate self-interested activities to the detriment of stakeholders. This movement has intensified public awareness about the power possessed by corporate executives and the corresponding perceived lack of power of shareholders and stakeholders. Researchers have sought to determine the impacts of reforms on the performance of publically traded firms. Central to the issue of corporate control is the role of the Board of Directors; that is, which governance characteristics make Boards more effective and how can effectiveness best be measured? (Murphy & McIntyre, 2007). This question forms the root of the following review of prior research and motivates the hypotheses in this study.

In addition to the corporate controls imposed by securities commissions and exchanges, the Canadian Life Sciences industry is highly regulated in its own right, which creates a barrier to success for young firms. Innovation in healthcare, agri-food and the environmental space requires that an element of high quality imbedded into a firm's operations that may not necessarily be present in other industries. The question then becomes whether the firm is willing and able to transfer its operational quality standards into the corporation's business practices and governance structures and, if so, to what degree. In an attempt to examine this question, this research study seeks to add to the current body of literature by investigating the impact of several good corporate governance practices on firm performance under the unique conditions presented by the Canadian Life Sciences industry.

2.2. Review of Prior Research

2.2.1. Good Corporate Governance as an Industry Competitive Advantage

The Canadian Life Sciences industry is a valuable contributor to economic and technological growth in both international and domestic markets. Researchers, developers and manufacturers of diagnostics, pharmaceuticals and medical devices aim at improving societal goals through advancement of quality, access and usability of food, healthcare and environmental protection measures (Government of Canada, 2012; Chataway, Tait, & Wield, 2006). Challenges facing early-stage life sciences firms are great, with a constant need for capital accompanied by the growing shift to offshoring of research activities beginning to affect the industry's competitive landscape topping the list (PWC & BIOTECanada, 2011).

Particularly true to the early-stage firms listed on the TSX-V exchange is a deep need for continuous financing to surpass the extremely demanding regulatory systems, with very high costs, significant risks and long delays requiring many years and millions of dollars to gain approval to market their products and to support ongoing innovation and rapid commercialization (Chataway, Tait, & Wield, 2006). Of the 119 life sciences companies listed on the TSX and TSX-V exchanges at the end of 2012, more than half are listed on the Venture Exchange, providing investors with a source of both risk and opportunity (TMX Global Leaders in Life Sciences, 2012). Competition for funding is high within this industry sector, particularly since today's capital markets are more cautious than ever in the wake of the 2008-2009 financial

crisis, creating barriers to access to capital, particularly for high-risk firms (Webster, Yatscoff, & Smythe, 2012). Many biotechnology companies are currently undervalued due to their dependence on the development of one technology (a binary event that could lead to a large win or loss) and investor fatigue as they tire of awaiting expected returns, causing their support to evaporate and stock price to drop. On the other hand, the need for new products and technologies to enhance societal goals, diversification of investments to mitigate risk, and the potential for high returns in therapeutic or diagnostic arenas that are “en vogue” are leading reasons for investment into Life Sciences (Webster, Yatscoff, & Smythe, 2012). Thus, high competition for capital is driving firms to align their priorities with securing funding which may place limitations on innovation, a key fundamental attribute responsible for the firm’s existence. For example, PWC & BIOTECanada’s 2011 survey found that, among those not yet earning revenues in the Life Sciences sector, 25% believed that it would take greater than five years for their companies to earn revenues. For those who did not have products for sale, 73% did not expect to have any for at least two more years, and only one-third of the surveyed companies were profitable, with one-half of those generating $5 million or less. Fifty-four percent of respondents were seeking funding at the time of the survey, with an additional 33% expecting to be seeking funding within the next two years to support long term growth activities (PWC & BIOTECanada, 2011). Thus, the better is the ability of a firm to position itself in a positive light in the eyes of the investment community, the higher are its chances for success in

accessing the capital required to achieve its milestones en route to long-term prosperity.

Despite these challenges, industry continues the drive towards feeding the growing demands for better healthcare, better resource management and greater agricultural innovation and animal health; bringing life-improving products to market on both domestic and international forums (PWC & BIOTECanada, 2011). To accomplish this, small life sciences companies generally aim for one of two outcomes. First, firms may aim to achieve success in their own right by surpassing industry hurdles through internal or outsourced expertise and by obtaining funding through any number of capital raising mechanisms. This route will allow the firm to retain control over its decisions and will not inhibit innovation. A second outcome is firms setting their aim to become attractive merger/acquisition targets for large multinational enterprises. This strategy restricts the firm's innovation targets to complementary technologies rather than opening their playing field to potentially competing with these large firms due to their need for resources from the bigger players to take the products through the regulatory channels and then leverage their sales networks to reach the market (Chataway, Tait, & Wield, 2006; PWC & BIOTECanada, 2011). Indeed, ninety percent of PWC & BIOTECanada (2011)'s survey respondents listed being acquired or participating in a merger as one of the top three most likely scenarios for a successful Life Sciences business; seventy percent believed that licensing or selling IP or co-development/partnership to fill the large firm's product pipelines is also a likely option. To achieve either success outcome, the company's structures, risks,

performance and future potential must be apparent and desirable to investor, whether it is a multinational firm or an individual investor.

Investors look for some key indicators within firms in an attempt to predict the future. Those firms that can exhibit the desired structures will gain a competitive advantage in the eyes of the investor and thus display a higher probability for future success. Deloitte & Thompson Reuters (2011) suggest that strong industry indicators require greater emphasis on commercializing more products of greater value at less cost. Thus, revenue, R&D cost, R&D cycle times, late stage success rates, and gross profit margin are good indicators of firm performance. Research analysts suggest that financiers should seek investment into LSFs that have achieved one or more of the following: (1) products that have a unique mechanism of action; (2) proprietary ownership of technologies or processes; (3) revenue increases by product and sales growth year over year; (4) late-stage clinical assets (such as phase 1, 2 and 3 clinical data); (5) a robust late-stage product pipeline; (6) multiple levers that drive earnings growth; (7) good partnering position and market opportunity; (8) strong risk profile versus opportunity; (9) market readiness; (10) robust manufacturing capability; (11) strong performance in comparison to competitors; (12) regulatory success; (13) products related to “hot” topics such as cancer and HIV; and/or (13) a solid leadership team with strong management of the firm’s business aspects (Life Sciences Report, 2012; Mack, 2012).

In addition to industry-focused, non-financial performance indicators, investors must also consider financial measures in determining where to place their resources. This need forms the basis for the indicators of firm performance

selected for this study. In particular, this study seeks evidence that the presence of selected corporate governance processes and/or structures predict a higher potential for firm performance and thus, their presence would provide a competitive advantage to the firm in the view of a potential investor.

2.2.2. Firm Performance Indicators: an Overview

In prior research, LSF firm performance has been evaluated using a balance of financial and non-financial indicators various measures. Financial measures including stock market performance, insider ownership, revenue, EBITDA and EPS, balance sheet analysis (short term liquidity, debt to equity, interest coverage, revenue growth, EBIDTA growth, EPS growth), return on capital (ROA, ROE) and valuation (P/E, P/book) have been considered (TMX Equicom, 2010). However, as noted above, the junior companies in this industry sector are often in the pre-commercialization lifecycle stages, requiring significant funds but not yet earning profits, or revenue in some cases. Therefore, performance measures for this study were chosen to accommodate these firms' financial state and with consideration of risk faced by, and expectations of, a potential investor.

This study investigates whether the presence of four corporate governance characteristics that have been selected for their relevance to the Life Sciences industry sector are associated with six measures of firm performance. Measures of the dependent variables are based on the metrics of firm performance used in prior literature. Indicators such as debt financing costs and yield spreads (Anderson, Manos, & Reeb, 2004), financial distress (Elloumi

& Gueyie, 2001), Tobin's Q (Belkir, 2004), ROA (Bonna, Yoshikawab, & Phan, 2004), and market value (Vafeas, 1999) have been used in previous studies. Cumulatively, the results of prior studies indicate that there a positive association between good corporate governance practice and good firm performance; however, the basis for this relationship cannot yet be clearly defined (Core, Holthausen, & Larcker, 1999; Solomon, 2010). Consequently, it has alternatively been suggested that a more holistic approach to examining Board effectiveness, with consideration of organizational behavior literature linking team composition, tasks and roles to firm performance could be a more effective model for investigation (Murphy & McIntyre, 2007). Further, it has been argued that, due the complexity of dynamic corporate governance systems, it may be difficult to assess the impact of single element of good governance on firm performance (Larcker & Tayan, 2011), thus indicating that an indexed approach might be more revealing (Bhagat, Bolton, & Romano, 2010; Brown & Caylor, 2004; Gompers, Ishii, & Metrick, 2003).

2.2.2.1 Non-Financial Firm Performance Indicators

Intellectual Property Ownership

The breakthrough innovations achieved in the Life Sciences sector are important to Canadians and attractive to investors; they serve as a primer for the formation of start-up companies based on novel technologies. This situation drives the need for strong intellectual property protection which can enhance a firm's competitive advantage threefold. First, the firm can use the intellectual property to build products and generate revenue. Second, it can prevent others

from making, using, selling, offering for sale or importing the invention for a number of years from the date of filing. Third, it can license the intellectual property to other firms and monetize the value that, without patent protection, would not exist (Chataway, Tait, & Wield, 2006; Singleton, 2013; Pelletier, 2007). Thus, a firm's ownership of intellectual property can create a valuable asset that significantly improves its ability to generate revenue (Pelletier, 2007), an attractive characteristic to financial investors.

Major Regulatory Approval

Life Sciences products are highly regulated, so a major regulatory approval is indicative of the quality (i.e., the safety and effectiveness) of the product, a major input into the firm's value stream. In this study, a major regulatory approval was classified as one received from one or more of the world's most stringent regulatory authorities: those in Canada, the United States, and/or the European Union. Approval is defined as "approval to market" and thus, is a preliminary step to commercialization and validation of the product's efficacy. The presence of a major regulatory approval is an indicator to the investor of the target market and commercialization potential of a Life Sciences product, technology, or service.

2.2.2.2. Financial Firm Performance Indicators

Firm Value – Market-to-Book Ratio

The market-to-book ratio is a measure of the relative value of a company on its balance sheet as compared to its stock price (or market value). This is a useful measure to investors as it allows them to judge whether a company is

under or over-valued. A low market-to-book ratio signifies that the firm may be a prime investment opportunity. It may also signify that something is fundamentally wrong with the company (Investopedia, 2013). Ideally, a return on equity, investment, or assets ratio would have been used to compare how well each firm's assets were being used to generate earnings growth. However, due to the fact that most of the TSX-V LFSs are not yet profitable, these measures were not deemed appropriate. (Return on assets (ROA) was evaluated (below) to determine the validity of this supposition). As a result, the market-to-book measure was chosen as a proxy to compare firm value across the industry.

Operating Performance – Solvency

The cash debt coverage ratio is a measure of a firm's solvency. This ratio measures the company's ability to repay its liabilities using cash generated from operating activities, i.e., without having to liquidate its assets. A strong cash debt coverage ratio indicates to investors the company's ability to cover its total debt with its yearly cash flow from operations. As discussed above, the TSX-V's junior LSFs often require significant funding for many years to support pre-commercialization activities prior to achievement of earnings. Thus, the status of a firm's solvency is a useful measure for comparison of firm performance across the industry sector.

Operating Performance - Leverage

The debt ratio is a measure of the ratio of total debt to total assets of the firm, providing potential investors with an estimation of the level of risk

associated with investment into that firm. A high debt ratio indicates that the firm is highly leveraged, creating a much higher risk that creditors could begin to demand repayment of debts. A high debt ratio may also impair the firm's borrowing capacity and financial flexibility to fund capital investment and further its growth strategies, a high risk to the firm's operation. The cost of debt financing has been shown to inversely relate to Board independence and size (Anderson, Manos, & Reeb, 2004). The level of risk relative to expected returns is a particularly important factor that would be considered prior to investment into early-stage LSFs, particularly in light of the fact high debt ratios (greater than one) are present in some junior Canadian LSF firms with liabilities being greater than assets to fund operations, resulting in negative retained earnings.

Profitability – Return on Assets

A common proxy used to measure operating performance, Return on Assets (ROA) is a basic measure of a firm's performance showing profits earned per asset dollar. ROA indicates to investors how efficiently management is using its assets to generate earnings. ROA is highly industry dependent and thus, useful for comparing the performance of firms within an industry (Investopedia, 2013). However, due to the fact that most of the firms in the industry sector under investigation are not yet generating profits, ROA was negative for many of the firms investigated, indicating that this measure may not be appropriate for this study. A negative ROA indicates that the company is investing a high amount of capital into its production but receiving no income (operating at a net loss); a common characteristic of a junior LSF. This measure

was investigated, however, in order to determine whether ROA was an appropriate measure for this study.

2.2.3. Corporate Governance and Firm Performance

Corporate governance can be defined as, "*the economic, legal and institutional framework in which the corporate control and cash flow rights are distributed among shareholders, managers and other stakeholders of the company*" (Eun, Resnick, & Brean, 2008). In short, corporate governance exists to address the agency problem (Brown Goverance, 2004) where there is a separation of ownership and control between the three parties in corporations – shareholders, Boards of Directors and executives (Kim, Nofsinger, & Mohr, 2010). In this triad, shareholders must rely on Boards of Directors to act as governors and communicators with management. However, despite the ability of directors to hire and fire the CEO, it is arguable that the bulk of the power has traditionally remained with management as investors have historically been dispersed, passive and Boards have often lacked independence, time and vested interested to carry out their fiduciary responsibilities (Kim, Nofsinger, & Mohr, 2010). Although the impact of good corporate governance practices has not been consistently linked to good firm performance in prior research, it has been shown that investors are willing to pay more for a corporation's stock if the firm demonstrates good governance. This is based on the belief that good use of governance structures is strategic and it will result in better firm performance in the long run, reducing the risk that the company will get into trouble (Wheelan, Hunger, & Wicks, 2005). In essence, the belief that governance best practices lead to superior firm performance is widespread, but consistent proof

of this theory remains elusive (Young, 2003). Combining good management and good leadership to create good corporate governance structures and practices should keep the organization pointed in the right direction and performing strongly (Davis, 2007), allowing it to deliver the best value possible for its shareholders by creating an environment conducive to earning long term profits (Kim, Nofsinger, & Mohr, 2010). Thus, if linkages between good corporate governance practices and good firm performance could be identified within a specific industry, then not only would investors gain access to a potentially predictive tool to assist in determining where to invest, but firms would also gain through understanding which corporate structures are necessary to support their quest for strong performance and to win an edge in the highly competitive race for capital investment.

There is a growing perception in the financial markets that good corporate governance is associated with prosperous companies and that good corporate governance practices are just as important for small firms are they are to large ones (Solomon, 2010). Core, Holthausen & Larcker (1999) found that firms with weaker governance structures had greater agency problems and that firms with greater agency problems performed worse than those that did not. Thus, prior research indicates that there is evidence to date that corporate governance practices, or lack thereof, have the potential to significantly impact a firm's value to its shareholders (Solomon, 2010). However, prior research has been unable to consistently identify exactly *which* governance practices will consistently elicit positive or negative effects on the performance of the firm

(Bhagat, Bolton, & Romano, 2010). Thus, this subject remains of continued interest to both scholars and practitioners.

Prior research has also linked corporate governance to firm performance using varying compositions of indices and measures. Inconsistencies in single-variable governance analyses have been suggested to be limited by the focus of the research design on only one dimension when the interaction effects among variables are possible and even probable (Bhagat, Bolton, & Romano, 2010). Gompers, Ishii & Metrick (2003)'s well-cited GIM index measured twenty-four corporate governance characteristics compiled by the Investor Responsibility Research Center (IRRC). Gompers et al. (2003) concluded that good governance, according to their index, had a positive impact on firm performance, realizing higher firm value, higher profits, higher sales growth and lower capital expenditures. Weak shareholder rights were shown to associate with poor firm performance in the same study (Gompers, Ishii, & Metrick, 2003). Brown & Caylor (2004) used an index based on the Institutional Shareholder Services (ISS) data to evaluate fifty-one factors from eight corporate governance categories in over more than 2000 firms. They found that better-governed firms are relatively more profitable, more valuable and pay out more cash to shareholders and vice versa. Also identified in their study were factors representing good governance (such as absence of a staggered Board and absence of a poison pill) that were shown to be associated with bad firm performance (Brown & Caylor, 2004). Despite these findings, a satisfactory establishment of a robust relationship between governance indices and firm performance has not yet been established, leading some governance scholars

to believe that the critical determinants of good corporate governance lie within specific Board characteristics due to its pivotal role as the decision-maker for the firm (Bhagat, Bolton, & Romano, 2010).

Industry effects of corporate governance practices have been identified in prior research. Giroud and Mueller (2011) found that firms with weak governance structures produced lower equity returns, worse operating performance and lower firm value, but only in non-competitive industries, where lower labour productivity, higher input costs and more "*value-destroying acquisitions"* were identified as the causes of the inefficiencies. The same effects were not evident in competitive industries driven towards maximizing profits through advantages gained in reducing inefficiencies (Giroud & Mueller, 2011). In a 2006 IMF working paper, De Nicolo, Laevena & Ueda provide evidence that the impact of improvements in corporate governance quality on traditional measures of real economic activity are positive and significant, particularly in industries that are dependent on external financing, such as the Life Sciences industry. Similarly to Giroud and Mueller (2011), the De Nicolo et al. (2006), found that well-governed firms provided better managerial incentives that were likely to promote growth and productivity and thus strong firm performance which, in turn, allowed them to attract outside financing (De Nicolo, Laeven, & Ueda, 2006).

Specific good governance indicators were selected for this study to portray characteristics representative of TSX-Venture LSFs. Of particular interest to this industry is the premise that the Life Science industry is highly regulated in terms of products and quality which should, but often doesn't,

translate into quality in the “business” side of the company. Junior companies led by scientists and inventors may focus more on chasing innovation than on good governance, employing principles only to achieve the bare minimum of compliance. Thus, the structure of the Board may be representative of the firm’s ability to perform under management with its primary focus on science and innovation.

2.2.4. Corporate Governance Indicators

The principal-agent model of corporate governance suggests a number of control mechanisms to mitigate the problems associated with the separation of ownership and control within a firm. In this study, good corporate governance practices were considered in relation to the industry under investigation and used as a basis selecting the governance indicators to be evaluated. Central to Agency Theory is the role of the Board of Directors in overseeing the firm.

2.2.4.1. Governance Indicators - Board Structure

Changes to the structure of Boards of Directors were among the major themes in corporate governance reform over the past decade due to the critical nature of its monitoring and oversight roles (Young, 2003). The impact of Board structure and its role as a control and monitoring mechanism on firm performance has been investigated at great length throughout the literature. Of the numerous studies conducted examining the impact of Board composition on performance, no consistent linkages have become apparent (Bhagat, Bolton, & Romano, 2010; Core, Holthausen, & Larcker, 1999), and individual findings have varied. In its decision-making role, the composition of the Board of

Directors has been noted to affect the resource allocation process, a critical factor affecting growth in junior LSFs. Three structural corporate governance characteristics have been selected for investigation in this study based on linkages identified in the literature along with their particular relevance to the Canadian Life Sciences Industry: Board independence, CEO duality and Board diversity.

Board Independence

This study hypothesizes that, in the case of the junior TSX-V LSFs, Board independence will have *no* effect on firm performance. Theoretically, independent (or outside) directors are expected to perform their duties without the influence of management, particularly the CEO, and, as such, have been considered better suited to serve as monitors against self-interested activities than inside directors (Larcker & Tayan, 2011; Kim, Nofsinger, & Mohr, 2010). The accompanying prevailing belief says that inside directors lack objectivity and independence from management (Elloumi & Gueyie, 2001). Investors consider outside directors to be the critical corporate governance mechanism for monitoring managers, but no decisive linkage has been found that relates director independence to firm performance using either accounting measures or stock returns (Bhagat, Bolton, & Romano, 2010). Larcker and Tayan (2011) agree, indicating that most studies fail to find a significant relationship between formal Board independence and improved corporate outcomes. Brown and Caylor (2006) further note that Board control by more than fifty percent independent, outside directors was unrelated to firm value. This is likely to hold true for LSFs due to their small size and the interrelationships among

constituents, clouding true director independence. For example, Kim et al. (2010) note that it may be very difficult to find directors that are *entirely and unambiguously independent* of the firm's management, particularly among industry experts. They state that independence is not a black and white issue, but varying shades of grey (Kim, Nofsinger, & Mohr, 2010). Also true of the Life Sciences industry is the need for decision-makers to have access to adequate information about the firm's technology and operations in order to form strategies and allocate resources destined to enhance innovation and drive firm growth; a job better performed by inside directors with intimate knowledge about the inner workings of the firm, a contrary supposition to traditional good governance practices (Lacetera, 2001).

Brown & Caylor (2004) find that firms with independent boards have higher returns on equity, higher profit margins, larger dividend yields and larger stock purchases but lower Tobin's Q, suggesting that Board independence is associated with some important measures of firm performance. Rosenstein & Wyatt (1990) indicate that the stock market reaction to the public announcement of outside directors results in a stock price increase, thus showing that higher value to shareholders can be achieved. Elloumi & Gueyie (2001) note that the market itself provides incentives for outside directors to monitor management, while Bhagat and Bolton (2008) argue that Board members with appropriate levels of stock ownership will have the incentive to provide effective monitoring and oversight of corporate board decisions. Thus, Board independence or ownership can be used as a proxy for good governance. Indeed, Rouf (2011) finds a positive significant relationship between Board independence and both

return on assets and return on equity. The composition of the Board of Directors has been linked with financial distress, with healthier firms having a higher proportion of outsiders on their boards and more audit committees comprised of only outsiders (Elloumi & Gueyie, 2001).

Increasing independence of the Board can arguably extend a firm's network of contacts and external sources of knowledge, allowing the firm to enhance its performance by, for example, directly impacting the ability of the Board to secure sources of funding through its higher number of external contacts; a very important factor in junior Canadian LSFs (Murphy & McIntyre, 2007). In sum, research has shown that investors generally look favourably on a firm's addition of outside directors to the Board, but the true effectiveness of this action is not clear, since an individual's true independence can be blurred by tenure and his/her true interests (Larcker & Tayan, 2011). Further, the role of outsiders on the Board has been questioned based on concerns that outside Board members often lack sufficient knowledge, involvement, and enthusiasm to provide beneficial guidance to management of the firm (Wheelan, Hunger, & Wicks, 2005; Larcker & Tayan, 2011).

The TSX Venture exchange requires only that the Board contains two independent directors and not a majority, as is required by securities regulations in most developed countries including the main TSX Board and the United States Stock Exchanges. In light of the mixed findings regarding the impact of Board of Directors independence on firm performance in the literature and considering the relatively small scale of the industry sector under investigation, it

was hypothesized that no significant association between Board independence and firm performance would be identified within this study.

H1: Board independence has no effect on firm performance in junior Canadian Life Sciences firms.

CEO Duality

A second characteristic of Board structure is whether the firm has dual leadership, i.e., the CEO and Chairman of the Board is the same person. Such duality is generally considered to be less desirable than separation of the CEO and Chairman's roles (Murphy & McIntyre, 2007; Yermack, 1996). It has been expressed frequently in the governance literature that agency problems are more likely to occur when the same person holds both the CEO and Chairman of the Board positions and that separation of these roles has become a governance best practice, ensuring a balance of power and authority at the top of the firm (Larcker & Tayan, 2011; Solomon, 2010) and *"entrenching a check at the heart of their corporate governance systems"* (Solomon, 2010). In contrast to this theory, this study hypothesizes that CEO/Chairman duality will be positively associated with firm performance due to the leadership required for LSFs' success. Early stage science-based firms are often led by the founder or inventor of the novel innovation upon which the company was built. In these cases, s/he is likely to be motivated towards long term growth and success of the firm and thus aligned with shareholder values in his/her decisions. Duality, under such circumstances, maybe beneficial in that greater "unfettered" control of the decision-making process is held by one individual who presumably holds

a long run view rather than two individuals with potentially opposing viewpoints. Further, the integration of scientific knowledge into these firms' strategies and processes should go beyond legal boundaries and become a foundational element in their corporate governance practices, particularly in the decision-making process (Lacetera, 2001). Thus, it is argued that agency problems should have minimal impact via CEO/Chairman duality in this industry sector and that firm performance would be enhanced by the CEO and Chairman roles being held by a single individual.

However, Larker and Tayan (2011) indicate that splitting the Chairman and CEO roles is gaining widespread support as a best corporate governance practice for public companies. The benefits of the distinction lie in the following: a clearer separation of responsibility between the Board and management; elimination of conflicts in terms of evaluation, compensation and succession planning surrounding the CEO; allocation of a clear authority position to one Director in the eyes of shareholders, management and the public; and allowance for the CEO of more time to focus on strategy, operations and company culture (Larcker & Tayan, 2011). The drawbacks in the separation of the Chairman and CEO roles may include an artificial nature of such separation, making recruiting a CEO difficult when one expects to hold both titles; creating duplication of leadership and internal confusion, leading to inefficient decision-making through shared leadership; creating an information gap between the Chairman and CEO; and weakening leadership during a crisis (Larcker & Tayan, 2011). Brown and Caylor (2004) tested the effects of CEO duality on firm performance, showing that firms had higher market valuation when the

CEO and Board Chairman positions were separate. Rouf (2011) found that a positive significant relationship existed between role separation and both return on assets and return on equity. Bhagat and Bolton (2008) contributed to the literature through their finding that separation of the CEO and Chairman roles in a firm were significantly positively correlated with firm operating performance. Elloumi & Gueyie (2001) did not document any differences between financially distressed and healthy firms with respect to CEO/Chair duality in the Board structure. Belkhir (2004) found that CEOs with long tenure were more likely to hold a dual CEO/Chairman role, while Larker and Tayan (2011) noted that most studies found little or no evidence that separation of the Chairman and CEO roles led to improved firm performance outcomes. They concluded that it might not make sense to separate the CEO and Chairman roles without considering who the CEO is as well as the structural, cultural, and governance features of the company.

H2 – CEO Duality is positively associated with firm performance in the Canadian Life Sciences' industry's junior firms.

Board Diversity

The third structural characteristic investigated in this study is the composition of Board of Directors in terms of diversity. Recently, Boards have been coming under scrutiny as a number of studies suggested that diversity makes a difference in the performance of a firm due to the fact that a company's success depends on its ability to "*understand, serve and conduct business with an increasingly diverse population,"* (Ernst & Young, 2012; Scott, 2012). This

study predicts that diversity in the boardroom, as measured by the percentage of female directors, is positively associated with firm performance in the Life Sciences industry sector.

Female directors generally are underrepresented on corporate Boards, holding few corporate Board seats and displaying a significantly varied profile from their male counterparts with more directorships, shorter tenure, lower age, higher tendency towards being independent and higher likelihood of being retired from their main occupation (Ferreira, 2010). These differences indicate that, in general, including a female director may increase Board diversity in other categories as well. Board diversity has been noted to promote better decision-making as it allows access to a wide range of perspectives and minimizes the potential for "groupthink", i.e., a quick and sometimes biased decision due to similarities in intentions and viewpoints within the group (Larcker & Tayan, 2011). Diversity in terms of gender, ethnicity and competency, particularly in relation to finance, technology and risk management are becoming more and more valuable to shareholders who are pressing for a broad range of perspectives, backgrounds and skills in corporate management and governance roles (Ernst & Young, 2012). Boards also may benefit from diverse sets of expertise, skills sets, age, and tenure (Murphy & McIntyre, 2007). In attaining diversity, however, a firm must be careful, since allowing the Board to become too large and cumbersome is likely to hinder efficient coordination and the meaningful involvement of each Board member (Murphy & McIntyre, 2007).

A significant positive relationship has been identified between the proportion of women and minorities on the Board and the firm value, as measured by Tobin's Q (Carter, Simkins, & Simpson, 2003). Carter et al. (2003) also found that the fraction of women and minorities directors decreases as the number of insider directors increases. However, some research suggests that diversity in the Boardroom may detract from quality decision-making due to less and lower quality of information sharing, higher conflict, and lack of common goals in heterogeneous groups (Larcker & Tayan, 2011). Further to their 2003 work, Carter et al. (2010) did not find a significant association between the number of women or ethnic minority directors on the Board and firm financial performance. They suggested that gender and ethnic diversity may have a contingent positive, negative, or neutral effect on firm performance under different circumstances at different periods of time. They concluded that Board appointments of women and ethnic minorities should be based on criteria other than expectations for firm financial performance (Carter, D'Souza, Simkins, & Simpson, 2010). Finally, there is a risk that attempts of a firm to gender-balance the Board could result in "tokenism" by recruiting under-qualified directors (Larcker & Tayan, 2011).

In the context of the Life Sciences Industry, the role of Boards in strategic decision making is critical and, as such, should be set up to optimize a combination of the elements of business and science, allowing it to take a proactive view and an integrated approach to management of the firm. According to Ernst and Young (2012), "*Boards that lack a breadth of diversity across gender, ethnicity, age, geography and experience and that are not*

challenging their composition and effectively conducting board assessment and development strategies, risk becoming under-performing boards… and may lack the diversity and dynamism required to compete in today's global markets". Thus, a heterogeneous set of directors may support enhanced shareholder value. Therefore, it is expected that there is a positive association between Board diversity and firm performance.

H3 – Board diversity is positively associated with firm performance in junior Canadian Life Sciences firms.

2.2.4.2. Governance Indicators – Director Equity Ownership

Director Equity Ownership

This study hypothesizes that higher equity ownership of directors is positively associated with the selected measures of firm performance because high share ownership can align the interests of directors with shareholders with a view to the long term. This expectation is based on a premise that corporate governance issues tend to arise when ownership and control are separated (McConnell, McKeon, & Xu, 2010).

Governance of Canadian public firms has been characterized, in contrast to United States firms, with the prevalence of large block or controlling shareholders, such as extended families (such as the Westons, Thompsons, Beaudoins, Irvings, Aspers or McCains) who control firms through pyramiding or dual-class shares; a system long-abandoned in the United States (Eun, Resnick, & Brean, 2008). Although this model is beginning to change in Canada, in the face of recent governance reforms and activist shareholder

activities, strong family ownerships have historically not traded shares or retained control through ownership of traded shares, potentially extracting private benefits from control (Eun, Resnick, & Brean, 2008). In the junior Life Sciences sector, founders and/or technology inventors often display similar control attributes. Founders and inventors in many cases will maintain a large equity ownership stake in the firm and thus, control of the firm, which theoretically would force decisions that will drive strong firm performance in the long term. Nonetheless, it is possible that centralized control in a firm's ownership structure could create governance problems with the interests of public shareholders being contrary to those of the controlling shareholders and/or managers of the firm. Canada's relatively small market for board members, particularly with expertise that translates into the Life Sciences sector, and relatively few institutional investors in comparison to the United States, further contributes to the potential for this problem (Scott, 2012).

On the question of whether equity ownership by directors increases operating performance or firm value, the results in the literature are mixed. Equity ownership by directors should minimize self-interested behaviours and create greater incentive to engage in activities that create long-term value for the firm. Thus, low inside share ownership can contribute to greater agency problems (Larcker & Tayan, 2011). While Boards with heavy share ownership are considered to be less independent (Murphy & McIntyre, 2007), stock ownership by Board members has been shown to increase the value of firms, through its significant positive association with firm operating performance (Bhagat & Bolton, 2008). However, these results only hold at low levels of equity

ownership because larger ownership positions (5% to 25%) may allow for management entrenchment and weakened oversight (Larcker & Tayan, 2011). Brown and Caylor (2004) found no evidence that operating performance or firm valuation were positively related to directors receiving all or some of their fees in equity, but noted in later studies that value is significantly higher in firms with stock ownership guidelines for directors (Brown & Caylor, 2006). Bhagat et al. (2010) note in their review article that studies that calculate ownership as the percentage of shares owned by outside directors did not show a significant association between ownership and firm performance. Elloumi & Gueyie (2001) showed that outside director's ownership and directorship affected the likelihood of financial distress in a sample of Canadian firms by showing that Boards of financially distressed firms had significantly fewer outsider members and were less likely to have blockholders who were not affiliated with management holding more than 20% of the outstanding shares as compared to financially healthy firms. Belkhir (2004) found a significant inverse relationship between Board structures and ownership, where higher equity ownership by managers and directors tended towards lower proportions of outside directors. Even though both of these characteristics (high equity ownership and proportion of outside Directors) are aimed at reducing agency conflict, Belkhir (2004) showed that smaller insider ownership was associated with better performance, but causality may not be established by this results since poor firm performance may lead insiders to reduce their equity ownership holdings (Belkir, 2004).

H4: High equity ownership by directors is positively associated with firm performance in junior Canadian Life Sciences firms.

In conclusion, both theory and prior research indicate that good corporate governance can create value for a firm's shareholders, but the exact channels remain undefined (Kadyrzhanova & Rhodes-Kropf, 2011). Prior research shows that there is not yet a well-established consensus regarding the impact of good corporate governance processes and Board structures on firm performance. This study attempts to identify industry-specific linkages between the selected variables and contribute to the current body of knowledge on this topic by attempting to answer the research question, "*Are good Corporate Governance practices associated with positive firm performance in publically listed Canadian growth-oriented companies in the Life Sciences sector*?" by testing the individual hypotheses above.

CHAPTER 3: METHODOLOGY

3.1. Data Sources

Data for this study (see Appendix) were obtained from publicly available information as at March 16, 2013 for sixty-two of the sixty-three public companies listed in the Life Sciences sector of TSX-Venture Exchange at December 31, 2012 (http://www.tmx.com/en/listings/sector_profiles/life_sciences.html). The sampling period was defined by the firms' fiscal years ended between October 31, 2011 and December 31, 2012. Fiscal year 2012 financial data were not yet published for four firms (firms 38, 43, 46, 47) with years ended in October and November during the sampling period. For these four firms, data from the 2011 fiscal year-end was used. Specifically, information was sourced from each company's website, *The Stock Market, Canadian Stock Exchange, TMX Group (www.tmx.com)* under each firm's trading symbol, and the *System for Electronic Document Analysis and Retrieval (SEDAR) (www.sedar.com)*. Specifically, the audited annual financial statements and Management's Discussion and Analysis (MD&A), and the corresponding Management Information Circulars and Annual Information Forms (AIF) for the period under investigation were the primary sources of data, while press releases, material change reports and public notices obtained from SEDAR and the firms' websites were used as secondary sources to fill information gaps. No public information was available for one of the sixty-three companies; this firm was removed from the data set. In four instances, the Chairman of the Board of Directors, and thus, CEO duality was not possible to identify from any source.

3.2. Research Design

The study was designed to test the central research question by examining whether firm performance is a function of its governance characteristics. Firm performance, a dependent variable, was measured using both financial and non-financial measures. Financial measures included the market-to-book ratio, cash debt coverage ratio, debt ratio, and the return on assets ratio. Non-financial measures included the firm's ownership of patents and approval to market its products by a major global regulator. Corporate governance indicators, the independent variables, were examined using three structural measures of each firm's Board of Directors: independence, CEO duality, diversity, and equity ownership by directors. Control variables included the size of the Board of Directors, the size of the firm, the presence of a significant stockholder, and cross-listing of each firm on at least one other stock exchange. Details regarding the study variables are listed in Tables 1 through 4 below. The following four hypotheses were tested using univariate linear and logistic regression analyses in the study.

H1: Board independence has no effect on firm performance in junior Canadian Life Sciences Firms;

H2: CEO Duality is positively associated with firm performance in the Canadian Life Sciences industry's junior firms;

H3: Board diversity is positively associated with firm performance in junior Canadian Life Sciences firms; and

H4: High equity ownership by directors is positively associated with firm performance in junior Canadian Life Sciences firms.

Table 1: Study Variables

Dependant Variables	Firm Performance: Market-to-Book Ratio, Cash Debt Coverage Ratio, Debt Ratio, Return on Assets, Patent Ownership and Major Regulatory Approval
Independent Variables	Good Corporate Governance Practices: Board Independence, CEO Duality, Board Diversity, and Director Equity Ownership
Control Variables	Board Size, Firm Size, Regulatory Regime, Presence of a Blockholder

Dependent Variables – Firm Performance Indicators

Six dependant variables were used in the analyses. These variables were chosen as measures of firm performance. They were selected to highlight factors of particular interest to investors considering capital financing of firms listed in the Canadian Life Sciences sector on the TSX-Venture exchange. A detailed description of each variable and methods of calculation are described in Table 2 below.

Table 2: Description of Dependent Study Variables

Dependant Variable	Description
Major Regulatory Approval *MAJORREGAPPROVAL*	Firms with no major regulatory approval for their products, defined as an approval to market their product(s) from Canadian, American or European authorities were coded as 0. Firms with one or more major regulatory approval for their products, defined as an approval to market its product(s) from Canadian, American or European authorities were coded as 1.
Patent Ownership *PATENTS*	Firms with no ownership of patents in the time period under investigation were coded as 0. Firms with ownership of one or more patents in the time period under investigation were codes as 1.
Debt Ratio *DEBTRATIO*	Debt Ratio was calculated as Total Debt[1], designated by Total Liabilities per Total Assets as listed in the Audited Annual Financial Statements issued in the time period under investigation.
Market to Book Ratio *MARKETTOBOOK*	Market to Book ratio was calculated as Market Capitalization at the most recent year end per Total Assets[2] as listed in the Audited Annual Financial Statements issued in the time period under investigation.
Return on Assets *ROA*	Return on Assets was calculated as the Net Income per Average Total assets of the current and previous year as listed in the Audited Annual Financial Statements issued in the time period under investigation.
Cash Debt Coverage Ratio *CASHDEBTCOVERAGE*	Cash Debt Coverage was calculated as the ratio of Net Cash from Operating Activities per Average Total Liabilities of the current and previous year as listed in the Audited Annual Financial Statements issued in the time period under investigation

Notes: [1] Total debt was defined as total liabilities; [2] Total Assets was used instead of net assets since, due to the nature of the firms under investigation, net assets were negative in most cases.

Independent Variables – Good Corporate Governance Indicators

The impact of good corporate governance practices on firm performance was discussed in detail in the literature review. Four corporate governance characteristics were selected for investigation based on linkages identified in the literature along with their particular relevance to the Canadian Life Sciences

industry. Detailed descriptions of these variables of interest and explanations of calculation of these measures are listed in Table 3 below.

Table 3: Description of Independent Study Variables

Independent Variable	Description
Board Independence *%IND* *CODEIND*	Board independence was classified by two measures: 1. Percentage of Independent Directors was calculated as the number of independent directors, as classified according to NI 52-110 in the Management Information Circular for the time period under investigation per Board size. 2. Independence Classification: • If a firm had less than 2 independent directors according to its Management Information Circular for the period in question, it was considered to be in non-compliance with the TSX-Venture exchange rules and was coded as 0 • If a firm had only 2 independent directors according to its Management Information Circular for the period in question, it was considered to be in compliance with the TSX-Venture exchange rules and was coded as 1 • If a firm had more than 2 but less than majority independent directors according to its Management Information Circular for the period in question, it was coded as 2 • If a firm had a majority independent directors according to its Management Information Circular for the period in question, it was coded as 3
CEO Duality[1] *CEODUALITY*	The presence of CEO Duality was determined by a single individual holding both the Chairman and CEO roles during the time period under investigation. This circumstance was determined by a review of various sources. Firms displaying CEO Duality were coded as 0. Firms displaying separation between the Chairman and CEO roles to different individuals were coded as 1.
Board Diversity[2] *%FEMALE*	Calculated as the number of women directors on the Board per Board size as reported in the in the Management Information Circular for the time period under investigation
Director Equity Ownership *DIRAVEQOWN* *BODTOT%EQOWN*	Classified by two measures: 1. Average equity ownership by Directors was calculated by dividing the total equity ownership by the Board of Directors, according to the Management Information Circular for the time period under investigation, by the size of the Board. 2. Total percentage of equity ownership by the Board of Directors was calculated by dividing the total equity ownership by the Board according to the Management Information Circular for the time period under investigation by the total number of shares at year end, according to the Audited Year End Financial Statements.

Notes: [1] In 4 cases, the individual holding the Chairman's role were not able to be identified; no data for these points was included in the analysis. [2] Board Diversity was determined using the percentage of female Directors on each firm's Board. Gender was chosen as a representative measure of diversity due to its definitiveness where other measures, such as ethnicity and competency, are more difficult to determine from a study of the firm's public documents.

Control Variables

Four control variables were used. Control variables were selected to provide a constant, unchanging standard of comparison among the firms in order to clarify the relationship between the dependent and independent variables. In essence, because corporate governance quality may contribute to, but is not fully attributable to, differences in firm performance, control variables were selected to control for the variability within the dependent variables. The control variables are described in Table 4 below.

Table 4: Description of Control Variables

Control Variable	Description
Board Size *BODSIZE*	Calculated as the number of Directors elected at the annual shareholder meeting held in 2012 according to the Management Information Circular for the time period under investigation.
Firm Size *FIRMSIZE*	Calculated as the value for Total Assets listed in the Audited Annual Financial Statements issued in the time period under investigation.
Regulatory Regime *REGREGIME*	Firms listed only on the TSX-Venture exchange were coded as 0 and firms with a listing in the United States, Europe or other exchange were coded as 1.
Presence of a Blockholder *BLOCKHOLDER*	Firms with no blockholder holding more than 10% of the firm's outstanding shares, according to the Management Information Circular for the time period under investigation, were coded as 0. Firms with at least one blockholder holding from 10 to 30% of total shares outstanding, according to the Management Information Circular for the time period under investigation, were coded as 1. Firms with at least one blockholder holding greater than 30% of total outstanding shares, according to the Management Information Circular for the time period under investigation, were coded as 2.

3.3. Data Analysis Procedures

Sample observations from the sixty-two firms in this study were first analyzed for descriptive statistics including mean, maximum and minimum values and standard deviation for the variables. A correlation matrix was then created and analyzed for associations among the variables. Data were then used to conduct univariate linear and logistic regression analyses of the dependent variables on the independent variables to determine whether significant associations, in any, were present, testing the predictive accuracy of the corporate governance indicators on firm performance. Regression models were executed with and without the presence of control variables to evaluate whether control variables impacted the predictive ability of the independent variables.

CHAPTER 4: RESULTS

4.1. Descriptive Statistics

Descriptive statistics for the continuous and binary variables obtained from the sample observations are presented in Tables 5 and 6, respectively. These results include mean, maximum, and minimum values along with standard deviation for each variable included in the sample.

Of the four corporate governance indicators tested, the descriptive statistics show that the majority of the firms in the sample have implemented three of the four good governance practices chosen for this study. The mean value for the proportion of independent directors on the Board (*%IND*) is 66.5%; complimentary to the good governance practice of maintaining a majority of independent directors on the Board. The coding system for best practices in Board independence (*CODEIND*) supports this result with 72.6% of firms classified as code 3, indicating the prevalence of majority Director independence for firms in the sample. Separation of the Chairman and CEO roles was prevalent as well, with 68.4% of firms displaying this good governance practice.

Table 5: Descriptive Statistics – Continuous Dependant and Independent Variables

	N	Minimum	Maximum	Mean	Std. Deviation
BODSIZE	62	3	8	5.52	1.198
%IND	62	33.33%	100.00%	66.46%	15.48%
%FEMALE	62	0%	40.00%	4.68%	8.98%
DIRAVEQOWN	62	3987.50	9659588.50	2051327.98	2384004.05
BODTOT%EQOWN	62	.08%	77.05%	20.67%	20.33%
FIRMSIZE	62	19751	61586000	6398369.32	11515449.3
MARKETCAP	62	487177.60	1.46 E8	19862088.64	27507185.6
MARKETTOBOOK	62	.03	563.55	17.30	71.29
TOTALDEBT	62	-13000	38385000	3644367.71	6385998.1
ROA	62	-89.79	14.26	-3.93	12.27
CASHDEBTCOVERAGE	62	-12.68	1.76	-2.00	2.86
DEBTRATIO	62	-.008	65.94	3.48	11.53

Total equity ownership (*BODTOT%EQOWN*) by the Board of Directors ranged widely from 0.08% to 77.05%, averaging at 20.7%. Because equity ownership by directors is considered to align the Board with shareholders' interests and enhance its oversight and monitoring functions, its presence can be considered a good corporate governance indicator. The wide range of equity holdings by Directors in this category is likely due to the fact that inventors and founders in this industry tend towards retaining a large block of controlling shares, which is a distinguishing characteristic of Canadian public companies in general, as discussed above in the review of prior research. Also, because many of these firms are cash-poor, compensation containing an equity component may be used in lieu of monetary compensation for Directors with the anticipation of high returns resulting from growth of the firm.

Fewer firms in the sample embraced diversity as measured by the percentage of female Directors on the Board, with only 15 of the 62 firms having one or more female Directors (average 4.0%, min 0%, max 40%). It is possible that female directorships may not be truly representative of Board diversity in

this industry and that diversity in ethnicity or core competency expertise might be a better indicator. Under these alternative circumstances, the firms in the sample may also be embracing diversity, but the evidence remains outside the scope of this study.

Table 6: Descriptive Statistics – Binary Dependent and Independent Variables

	# in sample	Proportion in sample (%)
CODEIND		
0 – Noncompliance (less than 2 independent)	1	1.6
1 – Compliance (2 independent)	8	12.9
2 – Less than 2 but less than majority independent	8	12.9
3 – Majority independent	45	72.6
TOTAL	62	100.0
CEODUALITY		
0 – Single individual holds CEO and Chairman roles	18	31.6
1 – Roles held by different individuals	39	68.4
TOTAL	57	100.0
PATENTS		
0 – Does not own patents	28	45.2
1 – Owns at least one patent	34	54.8
TOTAL	62	100.0
MAJORREGAPPROVAL		
0 – Does not hold a major (Can, US, EU) regulatory approval	38	61.3
1 – Does hold a major (Can, US, EU) regulatory approval	24	38.7
TOTAL	62	100.0
REGREGIME		
0 – Listed only on TSX-V exchange	43	69.4
1 – Listed on TSX-V exchange and at least one other	19	30.6
TOTAL	62	100.0
BLOCKHOLDER		
0 – No holder owns greater than 10% of outstanding shares	21	33.9
1 – At least one holder owns between 10 and 30%	30	48.4
2 – At least one holder owns greater than 30%	11	17.7
TOTAL	62	100.0

4.2. Correlations among Study Variables

A correlation matrix (Table 7) using the Spearman's rank correlation coefficient was used to determine whether any significant correlations existed among the variables, highlighting points where significant predictive relationships were likely to be found and measuring the extent to which positive or negative correlations were present. Sample correlations indicated that significant positive and negative associations existed between the independent variables and both the dependant and control variables at both the $p<0.01$ and $p<0.05$ significance levels. In terms of the associations between the independent and the control variables, average equity ownership by Directors (*DIRAVEEQOWN*) and total equity ownership by Directors (*BODTOTEQOWN*) were significantly positively correlated with the size of the Board of Directors (*BODSIZE*) at $p<0.05$ and $p<0.01$, respectively. Total equity ownership by Directors was also positively correlated with the presence of a shareholder with greater than 10% ownership of the total outstanding shares (*BLOCKHOLDER*) at the $p<0.05$. *CODEIND*, representative of four classifications of Board independence was significantly negatively correlated with the presence of a Blockholder ($p<0.05$).

Table 7: Correlations among Study Variables

	CORRELATIONS		BODSIZE	FIRMSIZE	REGREGIME	BLOCKHOLDER	MAJORREGAPPROVAL	PATENTS	DEBTRATIO	MARKETTOBOOK	ROA	CASHDEBTCOVERAGE	%IND	CODEIND	CEODUALITY	%FEMALE	DIRAVEQOWN	BODTOT%OWN
SPEARMAN'S RHO	BODSIZE	CORR COEFF	1	.257*	0.155	0.033	-0.063	-0.052	-0.143	-0.066	-0.128	-0.197	0.156	0.231	0.099	0.173	**.252***	**.330****
		SIG (2TAILED)	.	0.044	0.228	0.799	0.627	0.686	0.269	0.608	0.32	0.126	0.225	0.07	0.463	0.179	0.048	0.009
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	FIRMSIZE	CORR COEFF	.257*	1	-0.09	0.235	0.02	0.071	-.567**	-.574**	.564**	-0.029	0.223	0.243	-0.062	-0.112	-0.04	-0.064
		SIG (2TAILED)	0.044	.	0.501	0.066	0.875	0.585	0	0	0	0.824	0.081	0.057	0.647	0.385	0.733	0.621
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	REGREGIME	CORR COEFF	0.155	-0.087	1	-0.003	-0.169	0.181	0.159	0.116	-0.196	-0.038	-0.004	0.032	-0.107	0.172	0.135	0.091
		SIG (2TAILED)	0.228	0.501	.	0.98	0.189	0.158	0.216	0.368	0.126	0.769	0.976	0.802	0.429	0.182	0.296	0.482
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	BLOCKHOLDER	CORR COEFF	0.033	0.235	-0	1	0.15	-0.107	-0.099	-0.215	0.228	0.222	-0.235	**-.298***	-0.233	-0.029	0.195	**.313***
		SIG (2TAILED)	0.799	0.066	0.98	.	0.244	0.41	0.446	0.093	0.075	0.082	0.066	0.019	0.081	0.821	0.129	0.013
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	MAJORREG	CORR COEFF	-0.063	0.02	-0.17	0.15	1	0.056	0.098	-0.08	0.009	0.218	-0.088	-0.157	0.097	-0.215	0.004	0.068
	APPROVAL	SIG (2TAILED)	0.627	0.875	0.189	0.244	.	0.667	0.448	0.539	0.943	0.088	0.498	0.223	0.472	0.092	0.977	0.597
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	PATENTS	CORR COEFF	-0.052	0.071	0.181	-0.107	0.056	1	-0.074	0.087	-0.174	-0.223	-0.116	-0.08	0.06	-0.016	0.227	0.004
		SIG (2TAILED)	0.686	0.585	0.158	0.41	0.667	.	0.566	0.502	0.177	0.082	0.369	0.538	0.658	0.904	0.076	0.978
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	DEBTRATIO	CORR COEFF	-0.143	-.567**	0.159	-0.099	0.098	-0.074	1	.319*	-.388**	.501**	-0.227	**-.305***	0.216	0.057	0.231	0.131
		SIG (2TAILED)	0.269	0	0.216	0.446	0.448	0.566	.	0.011	0.002	0	0.076	0.016	0.107	0.658	0.071	0.312
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	MARKETTOBOOK	CORR COEFF	-0.066	-.574**	0.116	-0.215	-0.08	0.087	.319*	1	-.571**	-.325**	-0.004	-0.004	-0.023	0.217	0.136	-0.079
		SIG (2TAILED)	0.608	0	0.368	0.093	0.539	0.502	0.011	.	0	0.01	0.978	0.978	0.865	0.09	0.294	0.539
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	ROA	CORR COEFF	-0.128	.564**	-0.2	0.228	0.009	-0.174	-.388**	-.571**	1	.342**	-0.023	0.02	**-.298***	**-.332****	-0.12	-0.017
		SIG (2TAILED)	0.32	0	0.126	0.075	0.943	0.177	0.002	0	.	0.007	0.856	0.876	0.024	0.008	0.337	0.896
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	CASHDEBT	CORR COEFF	-0.197	-0.029	-0.04	0.222	0.218	-0.223	.501**	-.325**	.342**	1	-0.107	-0.162	-0.142	-0.108	0.175	**.288***
	COVERAGE	SIG (2TAILED)	0.126	0.824	0.769	0.082	0.088	0.082	0	0.01	0.007	.	0.407	0.21	0.291	0.405	0.174	0.023
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	%IND	CORR COEFF	0.156	0.223	-0	-0.235	-0.088	-0.116	-0.227	-0.004	-0.023	-0.107	1	.779**	-0.04	-0.047	-0.2	-0.205
		SIG (2TAILED)	0.225	0.081	0.976	0.066	0.498	0.369	0.076	0.978	0.856	0.407	.	0	0.765	0.719	0.125	0.109
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	CODEIND	CORR COEFF	0.231	0.243	0.032	**-.298***	-0.157	-0.08	**-.305***	-0.004	0.02	-0.162	.779**	1	-0.036	0.03	-0.17	-0.118
		SIG (2TAILED)	0.07	0.057	0.802	0.019	0.223	0.538	0.016	0.978	0.876	0.21	0	.	0.792	0.818	0.197	0.363
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	CEODUALITY	CORR COEFF	0.099	-0.062	-0.11	-0.233	0.097	0.06	0.216	-0.023	**-.298***	-0.142	-0.04	-0.036	1	0.228	-0.02	-0.174
		SIG (2TAILED)	0.463	0.647	0.429	0.081	0.472	0.658	0.107	0.865	0.024	0.291	0.765	0.792	.	0.088	0.912	0.195
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	%FEMALE	CORR COEFF	0.173	-0.112	0.172	-0.029	-0.216	-0.016	0.057	0.217	**-.332****	-0.108	-0.047	0.03	0.228	1	0.227	0.24
		SIG (2TAILED)	0.179	0.385	0.182	0.821	0.092	0.904	0.658	0.09	0.008	0.405	0.719	0.818	0.088	.	0.076	0.061
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	DIRAVEQOWN	CORR COEFF	**.252***	-0.044	0.135	0.195	0.004	0.227	0.231	0.136	-0.124	0.175	-0.197	-0.166	-0.015	0.227	1	.716**
		SIG (2TAILED)	0.048	0.733	0.296	0.129	0.977	0.076	0.071	0.294	0.337	0.174	0.125	0.197	0.912	0.076	.	0
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62
	BODTOT%OWN	CORR COEFF	**.330****	-0.064	0.091	**.313***	0.068	0.004	0.131	-0.079	-0.017	**.288***	-0.205	-0.118	-0.174	0.24	.716**	1
		SIG (2TAILED)	0.009	0.621	0.482	0.013	0.597	0.978	0.312	0.539	0.896	0.023	0.109	0.363	0.195	0.061	0	.
		N	62	62	62	62	62	62	62	62	62	62	62	62	57	62	62	62

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

In terms of the associations between the dependent and independent variables, a significant negative association was present between *CODEIND* and the debt ratio at the $p<0.05$ level. Both the percentage of female Directors and CEO duality were negatively correlated with return on assets (at $p<0.01$ and $p<0.05$ levels, respectively). These results indicate that, within each of the described relationships, as one variable increases, the other will decrease. The only significant positive correlation identified was between total equity ownership of the Board of Directors and the cash debt coverage ratio, indicating that firms with higher equity ownership by directors have more cash from operating activities (or lower average total liabilities).

4.3. Regression Analysis

4.3.1. Board Independence

Univariate linear regressions of the continuous dependent variables (*DEBTRATIO, MARKETTOBOOK, CASHDEBTCOVERAGE* and *ROA*) were performed on two measures of director independence, the percentage independent directors on the Board *(%IND*) and a coding system designed to classify the level of independence on the Board (*CODEIND*).

%IND:

Consistent with H1, no significant associations were identified at $p<0.1$ using *%IND* as the independent variable with or without control variables included in the regression model (Table 8).

Table 8: ANOVA Results for Debt Ratio, Market to Book, Cash Debt Coverage and ROA on Percentage Independent Directors

Model		Sum of Squares	df	Mean Square	F	Sig.
1 – Debt Ratio	Regression	235.265	1	235.265	1.795	.185[a]
	Residual	7862.692	60	131.045		
	Total	8097.957	61			
2 – Market to Book	Regression	5988.252	1	5988.252	1.182	.281[a]
	Residual	304014.650	60	5066.911		
	Total	310002.903	61			
3 – Cash Debt Coverage	Regression	16.875	1	16.875	2.106	.152[a]
	Residual	480.762	60	8.013		
	Total	497.637	61			
4– ROA	Regression	99.924	1	99.924	.660	.420[a]
	Residual	9078.049	60	151.301		
	Total	9177.973	61			
5 – Debt Ratio With Controls	Regression	801.435	5	160.287	1.230	.307[b]
	Residual	7296.522	56	130.295		
	Total	8097.957	61			
6 – Market to Book With Controls	Regression	14211.136	5	2842.227	.538	.747[b]
	Residual	295791.767	56	5281.996		
	Total	310002.903	61			
7 – Cash Debt Coverage With Controls	Regression	42.676	5	8.535	1.051	.397[b]
	Residual	454.961	56	8.124		
	Total	497.637	61			
4– ROA With Controls	Regression	307.578	5	61.516	.388	.855[b]
	Residual	8870.396	56	158.400		
	Total	9177.973	61			

a. Predictors: (Constant), %IND

b. Predictors: (Constant), BLOCKHOLDER, REGREGIME, BODSIZE, %IND, FIRMSIZE

Logistic regression was used to regress the binary dependent variables *MAJORREGAPPROVAL* and *PATENT* (representing firm ownership of at least one major regulatory approval and at least one patent, respectively) on *%IND*. No significant associations were identified with or without inclusion of the control variables in the model, which is consistent with H1 (Tables 9 and 10).

Table 9: Model Summary for Major Regulatory Approval and Patents on Percentage of Independent Directors

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1 - MAJORREGAPPROVAL	82.314	.007	.010
2- PATENT	84.853	.008	.011

Table 10: Coefficients with Major Regulatory Approval and Patents on Percentage of Independent Directors

		B	S.E.	Wald	df	Sig.	Exp(B)
1 [a] MAJORREGAPPROVAL	IND	-1.137	1.705	.445	1	.505	.321
	Constant	.293	1.153	.065	1	.800	1.340
2 [b] MAJORREGAPPROVAL With controls	IND	-.950	1.921	.244	1	.621	.387
	BODSIZE	-.023	.250	.009	1	.926	.977
	FIRMSIZE	.000	.000	.052	1	.820	1.000
	REGREGIME(1)	.759	.634	1.433	1	.231	2.136
	BLOCKHOLDER			3.164	2	.206	
	BLOCKHOLDER(1)	-.572	.906	.398	1	.528	.565
	BLOCKHOLDER(2)	.553	.807	.470	1	.493	1.739
	Constant	-.315	1.784	.031	1	.860	.730
3 [a] PATENT	IND	-1.200	1.680	.511	1	.475	.301
	Constant	.994	1.150	.746	1	.388	2.701
4 [b] PATENT With Controls	BODSIZE	-.115	.244	.222	1	.637	.891
	FIRMSIZE	.000	.000	.097	1	.756	1.000
	REGREGIME(1)	-1.002	.625	2.572	1	.109	.367
	BLOCKHOLDER			2.265	2	.322	
	BLOCKHOLDER(1)	1.134	.895	1.606	1	.205	3.109
	BLOCKHOLDER(2)	1.269	.850	2.227	1	.136	3.556
	IND	-1.949	1.935	1.014	1	.314	.142
	Constant	1.890	1.798	1.105	1	.293	6.618

a. Variable(s) entered: IND.

b. Variable(s) entered 1: IND, BODSIZE, FIRMSIZE, REGREGIME, and BLOCKHOLDER.

Results of the univariate and logistic regression analyses of the dependent variables on the percentage of independent directors on the Board were consistent with H1 which suggested that percentage of independent directors on the Board was *not* associated with firm performance. Although

many investors view majority of independent directors on the Board as a critical governance mechanism for monitoring managers, prior research shows that results supporting this belief are mixed. This section of the analysis confirms the stream of thought indicating a lack of a significant relationship between presence of the majority of independent directors on the Board and improved firm outcomes (Larcker & Tayan, 2011; Brown & Caylor, 2006) in the junior Canadian Life Sciences sector.

CODEIND:

Using the second measure of Board independence, *CODEIND*, several significant associations ($p<0.1$) resulted from the univariate linear regression of the continuous dependent variables. *CODEIND* was found to have an association with the market to book ratio, return on assets and cash debt coverage. Regression models and results of these analyses are shown in Tables 11 to 13 below.

Table 11: Model Summary for Market to Book, ROA and Cash Debt Coverage on CODEIND

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 – Market to Book	.256[a]	.065	**.050**	69.487
2 - ROA	.217[a]	.047	**.031**	12.074
3 – Cash Debt Coverage	.229[a]	.053	**.037**	2.803
4- Debt Ratio	.180[a]	.032	.016	11.428

a. Predictors: (Constant), CODEIND

In the presence of control variables, the associations among the variables remained unchanged. Table 11 shows that the proportions of the total variability in the market to book ratio, ROA and the cash debt coverage ratio that can be explained by *CODEIND* are 5.0%, 3.1%, and 3.7%, respectively, while debt ratio, with a non-significant association, was 1.6%.

Table 12: ANOVA Results for Market to Book, ROA and Cash Debt Coverage on CODEIND

Model		Sum of Squares	df	Mean Square	F	Sig.
1 – Market to Book	Regression	20293.360	1	20293.360	4.203	**.045**[a]
	Residual	289709.543	60	4828.492		
	Total	310002.903	61			
2 – ROA	Regression	431.113	1	431.113	2.957	**.091**[a]
	Residual	8746.861	60	145.781		
	Total	9177.973	61			
3 – Cash Debt Coverage	Regression	26.181	1	26.181	3.332	**.073**[a]
	Residual	471.456	60	7.858		
	Total	497.637	61			
4 – Debt Ratio	Regression	261.415	1	261.415	2.002	.162[a]
	Residual	7836.542	60	130.609		
	Total	8097.957	61			

a. Predictors: (Constant), CODEIND

Analysis of the coefficients of the significant associations (Table 13) showed that the relationship between each dependent variable and *CODEIND* can be explained by the following models respectively:

Market to Book Ratio = 77.165 – 23.343 (CODEIND);

ROA = -12.651 + 3.402 (CODEIND);

Cash Debt Coverage Ratio= 0.146 – 0.838 (CODEIND).

These models indicate that both the market to book ratio and the cash debt coverage ratio have negative associations with *CODEIND*. In the case of the market to book ratio, the results imply that, as the Board includes more outside

directors, the firm's value decreases. This is consistent with previous research by Lacetera (2001) which indicated that inside Directors had intimate knowledge about the inner workings of a firm, and thus may be better equipped to lead the organization with appropriate strategies and resource allocation decisions, supporting the firm's technology and operations in order to enhance innovation and drive firm growth. These results do not support H1 or the prevailing belief in the investment community that Board independence is an indicator of good corporate governance. They do, however, document the unique characteristics of the Canadian Life Sciences sector and its requirement for industry expertise in top-level decision making.

Table 13: Coefficients with Market to Book, ROA and Cash Debt Coverage on CODEIND

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	77.165	30.505		2.530	.014
Market to Book	CODEIND	-23.343	11.386	-.256	-2.050	**.045**
2	(Constant)	-12.651	5.301		-2.387	.020
ROA	CODEIND	3.402	1.978	.217	1.720	**.091**
3	(Constant)	.146	1.231		.119	.906
Cash Debt Coverage	CODEIND	-.838	.459	-.229	-1.825	**.073**

Similarly, the regression model indicates a negative association of cash debt coverage on *CODEIND* showing that, as Boards gain more outside directors, the cash debt coverage ratio is predicted to decrease. A higher cash debt coverage ratio is representative of better firm performance as it represents that amount of cash (liquidity) available from operations to cover a firm's liabilities. Thus, as the proportion of outside directors goes up, the model

predicts that the amount of cash available to cover a firm's liabilities lowers, indicating worse firm performance. The explanation for this observation is likely similar to that discussed above for the market to book ratio and may also be attributed to the fact that independence is often not clear-cut within the relatively small pool of specialized expertise and the relatively low availability of corporate directors to the Canadian Life Science industry.

The marginally positive association between CODEIND and return on assets indicates that, as the number of independent directors increases, the profitability of the firm is predicted to increase, indicating management's efficiency at utilizing its assets to generate earnings. This association opposes the other two discussed in this section which may be due to the fact that most of the firms in the junior Canadian Life Sciences sector are not yet earning a profit (mean ROA for the data set of -3.03). Only 6 of 62 firms showed a positive ROA for the period under investigation. As such, the results could be interpreted to mean that ROA was less negative when Director independence was higher, or that ROA may not be an appropriate measure of firm performance for this industry sector. Alternatively, this result may support Brown and Caylor (2004)'s findings that independent Boards have higher returns on equity and higher profit margins, suggesting that Board independence is associated with some important measures of firm performance. Further investigation would be beneficial in determining the impact of Board independence on ROA. Expanding the data set to include the firms listed in the Canadian Life Sciences sector on the main TMX board, where firm profitability potential is higher would provide further insight.

Logistic regression was used to regress the binary dependent variables MAJORREGAPPROVAL and PATENT (representing firm ownership of at least one major regulatory approval and at least one patent respectively) on CODEIND. Consistent with H1, no significant associations were identified, with or without inclusion of the control variables in the model (Tables 14 and 15).

Table 14: Model Summary for Major Regulatory Approval and Patents on CODEIND

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1 - MAJORREGAPPROVAL	82.039	.012	.016
2- PATENT	85.365	.000	.000

Table 15: Coefficients with Major Regulatory Approval and Patents on CODEIND

		B	S.E.	Wald	df	Sig.	Exp(B)
1 [a] - MAJORREGAPPROVAL	CODEIND	-.282	.332	.723	1	.395	.754
	Constant	.260	.882	.087	1	.769	1.297
2 [a] - PATENT	CODEIND	-.021	.330	.004	1	.949	.979
	Constant	.248	.884	.079	1	.779	1.282

a. Variable(s) entered: CODEIND.

Taken together, the results for *%IND* and *CODEIND* suggest that the dependent variables were generally unaffected by the proportion of outside Directors comprising the Board, which is consistent with both H1 and numerous findings in prior research (i.e., no consistent significant relationship has yet been identified linking Board independence to firm performance). This is possibly due to the factors discussed above, or may be due to the fact that true Director independence is difficult to ascertain, particularly among industry experts and interrelationships in a small, specific industry sector such as the junior Canadian Life Sciences Industry.

Two regression models showed a negative association with *CODEIND*. This result should be taken into consideration by industry firms in ensuring that Boards of Directors maintain sufficient knowledge and involvement to make the best decisions for the firm. The results in this section were unaffected by the presence of the control variables, possibly due to the fact that the firms in the sector under investigation are homogeneous, with too little variation to be visible in the sample. As suggested above, expansion of this study to include the Life Sciences firms listed on the main TMX exchange over a period of several years instead of one year would produce more variability and provide further insight into the results reported herein.

4.3.2. CEO Duality

Results of univariate linear regressions of the continuous dependent variables on CEO duality showed a significant association only between CEO duality and ROA ($p=.095$) at a significance value threshold of $p<0.1$, as shown in Table 16. This finding is consistent with H2. No significant associations were evident with CEO duality and any of the other continuous dependant variables. Addition of the control variables into the regression model did not affect the test results.

Table 16: Regression of ROA on CEO Duality; Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
ROA Equal variances assumed	1.786	.187	1.697	55	**.095**
Equal variances not assumed			2.341	50.073	.023

Analysis of the coefficients (Table 17) showed that the relationship between CEO duality and ROA can be explained by the following model:

ROA = 0.207 – 6.077 (CEO Duality)

indicating that, when the CEO and Chairman roles are held by the same individual (value = 0), ROA is higher than when the CEO and chairman roles are held by separate individuals (value = 1).

Table 17: Coefficients with CEO Duality and ROA

Model		Unstandardized Coefficients[a]		Standardized Coefficients[a]	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.207	2.962		.070	.945
	CEODUALITY	-6.077	3.581	-.223	-1.697	**.095**

a. Dependent Variable: ROA

Tables 18 and 19 show the Chi Square test results for the binary dependent variables representing ownership of patents and of a major regulatory approval by the firm. Neither dependent variable showed a significant relationship with CEO duality ($p<0.1$) with or without inclusion of the control variables in the analysis.

Table 18: Chi Square Test with CEO Duality and Patents

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.204[a]	1	.652		
Continuity Correction[b]	.027	1	.868		
Likelihood Ratio	.204	1	.652		
Fisher's Exact Test				.777	.433
Linear-by-Linear Association	.200	1	.654		
N of Valid Cases	57				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.21.

b. Computed only for a 2x2 table

Table 19: Chi Square Test with CEO Duality and Major Regulatory Approval

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.538[a]	1	.463		
Continuity Correction[b]	.196	1	.658		
Likelihood Ratio	.545	1	.460		
Fisher's Exact Test				.567	.331
Linear-by-Linear Association	.529	1	.467		
N of Valid Cases	57				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.26.

b. Computed only for a 2x2 table

The presence of CEO duality, or the holding by a single individual of both the Chairman and the CEO roles within a firm, has been linked in the literature to weak governance structures in that agency problems have been deemed to be more likely to occur. This study predicted that not only would CEO duality not have a negative impact on firm performance, but that "unfettered control" would actually effect a positive response due to the nature of the industry and the predilection of its founders to maintain a controlling hand in the firm, aligning

with shareholder interests for the long term. The results of this section showed this hypothesis to be supported in one instance, when ROA was regressed on CEO duality.

Using all other measures of the dependent variable, CEO duality had no statistically significant effect on firm performance. This indicates that this corporate governance indicator is generally not predictive of firm performance in the junior Canadian Life Sciences sector and thus, its presence is neither a threat to, nor an indicator of, good corporate governance structures. Therefore, Larker and Tayan (2011)'s advice that the value of separating the CEO and Chairman's roles should be carefully considered by firms in terms of who the CEO is along with the structural, cultural and governance features of the company, is very relevant to the LSFs.

4.3.3. Board Diversity

The results from univariate linear regression analyses of the continuous dependent variables on Board diversity, as measured by the percentage of female directors, showed a significant association with the debt ratio, the market to book ratio, and return on assets. No significant relationship was identified between the cash debt coverage ratio and the percentage of female directors.

The models showing the proportion of variability in each dependent variable with and without inclusion of the control variables are in Table 20 below. From these results, it is clear that the presence of control variables may have impacted the results and required consideration in the regression model. Using the adjusted R square value, the variance explained by proportion of

female directors in the debt ratio increased slightly to 14.9% from 12.5% in the presence of the control variables; in the market to book ratio, it increased to 17.0% from 7.7%, and in ROA, it decreased from 15.0% to 10.5%, respectively.

Table 20: Model Summary for Debt Ratio, Market to Book and ROA on Percentage Female Directors with and without Controls

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 – Debt Ratio	.373[a]	.139	.125	10.779
2 – Market to Book	.303[a]	.092	.077	68.497
3- ROA	.405[a]	.164	.150	11.310
4 - Debt Ratio with controls	.468[b]	.219	.149	10.627
5 – Market to book with controls	.445[b]	.198	.170	10.493
6 – ROA with controls	.423[b]	.179	.105	11.602

a. Predictors: (Constant), %FEMALE

b. Predictors: (Constant), BLOCKHOLDER, REGREGIME, %FEMALE, BODSIZE, FIRMSIZE

Results of the of the Analyses of Variance showed that each of the measures of the dependent variable, i.e., debt ratio, market to book ratio, and ROA, are significantly associated with the percentage of female directors on the Board (Table 21).

Table 21: ANOVA Results for Debt Ratio, Market to Book and ROA on Percentage Female Directors

Model		Sum of Squares	df	Mean Square	F	Sig.
1 – Debt Ratio	Regression	1126.516	1	1126.516	9.695	**.003**[a]
	Residual	6971.441	60	116.191		
	Total	8097.957	61			
2 – Market to Book	Regression	28494.428	1	28494.428	6.073	**.017**[a]
	Residual	281508.474	60	4691.808		
	Total	310002.903	61			
3 – ROA	Regression	1502.428	1	1502.428	11.745	**.001**[a]
	Residual	7675.546	60	127.926		
	Total	9177.973	61			

a. Predictors: (Constant), %FEMALE

Analysis of the coefficients (Table 22) showed that the relationship between each dependent variable and the percentage of female Directors can be explained by the following models:

Debt Ratio = 1.264 + 47.835 (% Female)

Market to Book Ratio = 6.039 + 240.581 (% Female)

ROA = -1.339 – 55.243 (% Female)

The regression model showing the positive association between the debt ratio and the percentage female directors indicates that a higher percentage of female directors may be predictive of higher debt ratios and, as a result, more highly leveraged, higher risk firms, pointing towards lower performance. This finding contradicts H3 and the inferences from prior research that Board diversity enhances firm performance. Similarly, the regression model showed a negative relationship between return on assets and percentage female directors indicating that, as the percentage of female directors increases, ROA is predicted to decrease, lowering firm performance; also contradictory to H3.

There are several possible explanations for these results. Larcker and Tayan (2011) note that the risk of "tokenism" in attempting to gender-balance the Board can result in recruiting under-qualified Directors. They further note that increasing diversity in the Boardroom can detract from quality decision making due to smaller and lower quality information sharing, higher conflict and lack of common goals. Since only 15 of the 62 firms considered in this study had female representation on the Board of Directors (mean 4.68%, max 40%), the percentage of female directors was generally underrepresented in this study. To further examine the meaning of these results, an expansion of the sample to include the LSFs listed on the main TSX exchange and expanding the investigation period to several years is recommended. Alternatively, in consideration of the nature of the Life Sciences industry sector, Board diversity may be better measured using a different indicator, such as diversity within the core competencies and expertise of the directors.

However, the regression model for the market to book ratio indicated that higher firm value is associated with a higher percentage of female directors, meaning that the investors value the presence of female directors, which is reflected in the market capitalization of the firm; a positive firm performance indicator consistent with both H3 and with a number of studies in prior literature.

Table 22: Coefficients with Debt Ratio, Market to Book and ROA on Percentage Female Directors

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.264	1.546		.817	.417
DV: Debt Ratio	%FEMALE	47.835	15.363	.373	3.114	**.003**
2	(Constant)	6.039	9.826		.615	.541
DV: Market to book	%FEMALE	240.581	97.623	.303	2.464	**.017**
3	(Constant)	-1.339	1.623		-.825	.412
DV: ROA	%FEMALE	-55.243	16.120	-.405	-3.427	**.001**

Each of the results reported in this section remained significant with the addition of control variables into the model, and no new significant relationships were identified among the dependent variables. A significant association was identified between a control variable, size of the Board of Directors, and both the debt and market to book ratios. Table 23 shows that 17.0% of the variability in the debt ratio and 10.9% of the variability in the market to book ratio can be explained by the overall size and percentage females comprising the Board of Directors. The results of the analyses of variance are presented in Table 24 which shows the significance of the models at $p<0.1$.

Table 23: Model Summary for Debt Ratio and Market to Book with Size of Board and Percentage Female Directors

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 – Debt Ratio	.445[a]	.198	.170	10.494
2 – Market to Book	.371[a]	.138	.109	67.305

a. Predictors: (Constant), BODSIZE, %FEMALE

Table 24: ANOVA Results for Debt Ratio and Market to Book on Percentage Female Directors and Size of the Board

Model		Sum of Squares	df	Mean Square	F	Sig.
1 – Debt Ratio	Regression	1600.861	2	800.430	7.269	**.002**[a]
	Residual	6497.096	59	110.120		
	Total	8097.957	61			
2 – Market to Book	Regression	42735.589	2	21367.794	4.717	**.013**[a]
	Residual	267267.314	59	4529.954		
	Total	310002.903	61			

a. Predictors: (Constant), BODSIZE, %FEMALE

Analysis of the regression coefficients (Table 25) shows that the relationship between each dependent variable and the percentage of female directors and the size of the Board can be explained by the following models:

Debt Ratio = 14.035 + 52.573 (%FEMALE) - 2.355 (BODSIZE);

Market to Book Ratio = 76.018 + 266.537 (%FEMALE) – 12.906 (BODSIZE)

The size of the Board of Directors was negatively associated with both the debt ratio and the market to book ratio. Thus, Board size and percentage of female directors on the Board have opposing effects on firm performance, according to these analyses. As Board size increases, the debt ratio decreases (positive firm performance); however, as the percentage of female directors increases, so does the debt ratio (negative firm performance). This result is consistent with Anderson, Manos and Reeb (2004)'s finding that the cost of a firm's debt is inversely related to its Board size.

Conversely, as Board size increases, the market to book ratio decreases (a negative performance indicator), while increasing the percentage of female directors predicts positive increases in the market to book ratio, according to the

regression model. These mixed results regarding gender diversity may be interpreted as consistent with Carter et al. (2010)'s observation that the effect of gender and ethnic diversity on firm financial performance is contingent on the circumstances and period of time. The fact that a control variable, Board size, is predictive of higher firm performance in terms of the debt ratio and lower firm performance in terms of the market to book ratio further supports this contingency theory of the effect of Board diversity on firm performance. In particular, the debt ratio is generally high in this industry sector (mean 3.48) indicating that debt levels are, on average, three and a half times higher than total assets[1]. Combined with the fact that female Board representation is low (mean 4.0%; max 40%), both factors may have impacted the results. This warrants further investigation with an expanded data set. Alternatively, extrapolation of Murphy and McIntyre (2007)'s suggestion that increasing Board independence can extend a firm's network of contacts, directly impacting the ability of the Board to secure sources of funding could explain this inverse relationship with the debt ratio, since access to a wider range of funding sources might enable the firm to avoid undertaking debt. The negative effect of Board size on the market to book ratio may be the result of the firms in this industry sector being generally undervalued (low market to book ratio) due to under-realization of the value of the firm's products, technologies or intellectual property by the market or by virtue of their financial state, with high debt levels and low earnings. Indeed, larger Boards have been associated with lower

[1] High debt ratios (greater than one) were present in seventeen of the sixty-two LSF firms studied. Due to the long cycle times and high-cost activities required to bring Life Sciences products to commercialization, liabilities were, in several cases, significantly greater than assets, resulting in negative retained earnings for the firm.

involvement, lack of sufficient information sharing, and less effective monitoring and oversight (Larcker & Tayan, 2011), which could affect the market's view of the firm's value.

In sum, results of the regression analyses on H3 are mixed when considering the associations between continuous independent variables and the percentage of female directors on the Board. This is not a surprising outcome given the mixed results in prior research. H3 is supported with the market to book ratio regression model and it is not supported in the models including return on assets and the debt ratio. In the presence of control variables, the regression model is affected by the size of the Board in an opposing manner to percentage female directors when the debt and market book ratios are used as dependent variables.

Table 25: Coefficients with Debt Ratio and Market to Book on Percentage Female Directors and Board Size

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.035	6.335		2.216	.031
DV: Debt Ratio	%FEMALE	52.573	15.129	.410	3.475	**.001**
	BODSIZE	-2.355	1.135	-.245	-2.075	**.042**
2	(Constant)	76.018	40.632		1.871	.066
DV: Market to book	%FEMALE	266.537	97.035	.336	2.747	**.008**
	BODSIZE	-12.906	7.279	-.217	-1.773	**.081**

Regression analysis of the binary dependent variables, firm ownership of patents and of at least one major regulatory approval, indicated a significant relationship ($p<0.1$) between the percentage of females on the Board of

Directors and a major regulatory approval (Tables 26 and 27). This association remained significant with control variables included in the regression model. No significant association was found between patent ownership and the percentage of female directors.

Table 26: Model Summary for Major Regulatory Approval and Percentage of Female Directors

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	79.398	.053	.072

Analysis of the regression coefficients (Table 27) showed that the negative relationship predicted by this model contradicts H3, since it indicates that increasing the percentage of female directors will result in a decrease of major regulatory approval for the firm's products, an important factor in LSF's growth strategy. Consistent with governance literature, this result could be explained by Larcker and Tayan (2011)'s observation that, within heterogeneous Boards, lower quality information sharing, higher conflict and lack of common goals may be evident. Alternatively, the low representation of females on the Boards included in the sample may have affected the results, creating a basis for further study.

Table 27: Coefficients with Major Regulatory Approval and Percentage of Female Directors

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	FEMALE	-6.247	3.801	2.701	1	.100	**.002**
	Constant	-.216	.291	.548	1	.459	.806

a. Variable(s) entered on step 1: FEMALE.

Overall, as with much of the prior research published to date, female representation on Boards has shown mixed results in this study. Carter et al.

(2003) identified a significant positive relationship between women and minorities sitting on the Board and firm value. However, their later study published in 2010, found no significant relationship. Therefore, it is concluded that gender and ethnic diversity may have a contingent positive, negative, or neutral effect on firm performance under different circumstances at different periods of time (Carter, D'Souza, Simkins, & Simpson, 2010). This could serve as an explanation to results in this study.

4.3.4 Board Equity Ownership

Univariate linear regression of the continuous dependent variables was performed on two measures of Director Equity Ownership; average equity ownership by Directors (*DIRAVEEQOWN*) and percentage of equity owned by Directors in terms of the total number of outstanding shares (*BODTOT%EQOWN*).

Average Equity Ownership by Directors

Results of the univariate linear regression of the continuous dependent variables on *DIRAVEEQOWN* showed that a significant relationship existed only with the cash debt coverage ratio, indicating that 3.5% of the total variance in the cash debt coverage ratio can be explained by the average equity ownership of the Board of Directors (Table 28).

Table 28: Model Summary for Cash Debt Coverage on Average Director Equity Ownership

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.225	.051	.035	2.806

a. Predictors: (Constant), DIRAVEQOWN

Results of the Analyses of Variance (Table 29) showed that firm value, represented by the cash debt coverage ratio is associated with the average equity ownership by directors in the firm ($p=0.079$ at $p<0.1$).

Table 29: ANOVA Results for Cash Debt Coverage on Average Director Equity Ownership

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.170	1	25.170	3.196	**.079**[a]
	Residual	472.467	60	7.874		
	Total	497.637	61			

a. Predictors: (Constant), DIRAVEQOWN

b. Dependent Variable: CASHDEBTCOVERAGE

Analysis of the regression coefficients (Table 30) shows that the relationship between the cash debt coverage ratio and average director equity ownership can be explained by the following model:

$$\textit{Cash Debt Coverage} = -2.557 + 2.694 \times 10^{-7} \textit{ (DIRAVEQOWN)}$$

The positive association between these variables indicates that, as average equity ownership by directors increases, the cash debt coverage ratio will also increase, consistent with H4. A higher cash debt coverage ratio is representative of better firm performance as it denotes the amount of cash (liquidity) available from operations to cover a firm's liabilities. Thus, as average equity ownership by directors increases, the model predicts that the amount of cash available to cover a firm's liabilities will also increase. This finding is

consistent with Bhagat and Bolton (2008)'s results and supports agency theory in that share ownership by directors aligns their interests with the other shareholders with a view to the long term. Further, only when ownership and control are separate should corporate governance issues arise (McConnell, McKeon, & Xu, 2010), which is not an issue when directors are the owners.

Table 30: Coefficients with Cash Debt Coverage on Average Director Equity Ownership

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.557	.472		-5.419	.000
	DIRAVEQOWN	2.694E-7	.000	.225	1.788	**.079**

a. Dependent Variable: CASHDEBTCOVERAGE

When control variables were included in the model, the above-noted relationship remained significant and no new significant relationships were identified between the dependent and independent variables. A significant association was, however, identified between a control variable, size of the Board of Directors, and cash debt coverage ratio. Table 31 shows that the model predicts that 4.8% of the variability in the cash debt coverage ratio can be explained by the size of the Board and its average equity ownership The results of the analysis of variance is presented in Table 32 which shows the significance of the model at $p<0.1$ ($p=0.088$).

Table 31: Model Summary for Cash Debt Coverage on Average Director Equity Ownership and Board Size

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.281[a]	.079	.048	2.786

a. Predictors: (Constant), BODSIZE, DIRAVEQOWN

Table 32: ANOVA[b] Results for Cash Debt Coverage on Average Director Equity Ownership and Board Size

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.430	2	19.715	2.539	**.088**[a]
	Residual	458.207	59	7.766		
	Total	497.637	61			

a. Predictors: (Constant), BODSIZE, DIRAVEQOWN

b. Dependent Variable: CASHDEBTCOVERAGE

Analysis of the regression coefficients (Table 33) shows that the relationship between the cash debt coverage ratio and average director equity ownership can be explained by the following model:

$$\textit{Cash Debt Coverage} = -0.366 + 2.984 \times 10^{-7} (\textit{DIRAVEQOWN}) - 0.408 (\textit{BODSIZE})$$

This regression model predicts that the cash debt coverage ratio will, as discussed above, increase with a corresponding increase in average equity ownership by directors. Having an opposite effect, the model shows through its negative relationship that, as the Board size increases, the cash debt coverage ratio will decrease, an indicator of poorer firm performance. A similar relationship was found in the Board diversity regression model (section 4.3 above); suggesting that deeper investigation into the effect of Board size on corporate governance indicators may be warranted in future research.

Table 33: Coefficients[a] with Cash Debt Coverage on Average Director Equity Ownership and Board Size

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.366	1.683		-.218	.828
	DIRAVEQOWN	2.984E-7	.000	.249	1.974	**.053**
	BODSIZE	-.408	.301	-.171	-1.355	.181

a. Dependent Variable: CASHDEBTCOVERAGE

Logistic regression analysis of the binary dependent variables, firm ownership of patents and of at least one major regulatory approval, indicated a significant relationship ($p=0.076$ at $p<0.1$) between the average equity ownership by directors and ownership by the firm of at least one patent (Tables 34 and 35). This relationship remained significant when control variables were included in the regression model. This result could be interpreted to mean that average equity ownership by directors may be predictive of firm performance in terms of patent ownership. It is more likely, however, that average directors' equity ownership increases as a result of the firm receiving patent grants, from which a true source of value to the firm is derived. No significant association was found between holding a major regulatory approval and the average equity ownership of directors.

Table 34: Model Summary for Patent and Average Director Equity Ownership

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	81.593	.059	.079

Table 35: Coefficients with Patent on Average Director Equity Ownership

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	DIRAVEQOWN	.000	.000	3.145	1	.076	1.000
	Constant	-.253	.348	.529	1	.467	.776

a. Variable(s) entered on step 1: DIRAVEQOWN.

Total Percentage of Equity Ownership by Directors

Results of univariate linear regression of the continuous dependent variables on *BODTOT%EQOWN* showed that, similar to average director equity ownership, a significant relationship existed only with the cash debt coverage ratio, indicating that 6.5% of the total variance in the cash debt coverage ratio can be explained by the total percentage equity ownership of the Board of Directors (Table 36).

Table 36: Model Summary for Cash Debt Coverage on Total Percentage Director Equity Ownership

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.283[a]	.080	.065	2.762

a. Predictors: (Constant), BODTOT%EQOWN

Results of the of the Analyses of Variance (Table 37) showed that firm value, represented by the cash debt coverage ratio, is significantly associated with the total percentage of equity ownership by directors in the firm (p=0.026).

Table 37: ANOVA Results for Cash Debt Coverage on Total Percentage Director Equity Ownership

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.837	1	39.837	5.221	**.026**[a]
	Residual	457.801	60	7.630		
	Total	497.637	61			

a. Predictors: (Constant), BODTOT%EQOWN

b. Dependent Variable: CASHDEBTCOVERAGE

Analysis of the regression coefficients (Table 38) shows that the relationship between the cash debt coverage ratio and total percentage of director equity ownership can be explained by the following model:

Cash Debt Coverage = -2.826 + 3.976 (BODTOT%EQOWN)

The positive association between these variables indicates that, as the total percentage of equity ownership by directors increases, the cash debt coverage ratio will also increase, consistent with H4 and with the regression models representing average director equity ownership.

Table 38: Coefficients with Cash Debt Coverage on Total Percentage Director Equity Ownership

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-2.826	.502		-5.624	.000
	BODTOT%EQOWN	3.976	1.740	.283	2.285	**.026**

a. Dependent Variable: CASHDEBTCOVERAGE

When control variables were included in the model, the above-noted relationship remained significant and no new significant relationships were identified. A significant association was identified between a control variable, size of the Board of Directors, and cash debt coverage ratio. Table 39 shows

that the model predicts that 9.2% of the variability in the cash debt coverage ratio can be explained by the size of the Board and its total percent of equity ownership by directors. The results of the analysis of variance is presented in Table 40 which shows the significance of the model at p<0.1 (p=0.021).

Table 39: Model Summary for Cash Debt Coverage on Total Percentage Director Equity Ownership and Board Size

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.350[a]	.122	.092	2.721

a. Predictors: (Constant), BODSIZE, BODTOT%EQOWN

Table 40: ANOVA[b] Results for Cash Debt Coverage on Total Percentage Director Equity Ownership and Board Size

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	60.796	2	30.398	4.106	**.021[a]**
	Residual	436.842	59	7.404		
	Total	497.637	61			

a. Predictors: (Constant), BODSIZE, BODTOT%EQOWN

b. Dependent Variable: CASHDEBTCOVERAGE

Analysis of the regression coefficients (Table 41) shows that the relationship between the cash debt coverage ratio and total percentage director equity ownership can be explained by the following model:

Cash Debt Coverage = -0.193 + 4.646 (BODTOT%EQOWN) –

0.503(BODSIZE)

This regression model predicts that the cash debt coverage ratio will, as discussed above, increase with a corresponding increase in total percentage of equity ownership by directors. The model also shows through its negative relationship that, as the Board size increases, the cash debt coverage ratio will

decrease. Explanation of these results follows the same reasoning as was discussed above in the average director equity ownership section. Thus, H4 is supported.

Table 41: Coefficients[a] with Cash Debt Coverage on Total Percentage Director Equity Ownership and Board Size

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.193	1.642		-.117	.907
	BODTOT%EQOWN	4.646	1.760	.331	2.640	**.011**
	BODSIZE	-.503	.299	-.211	-1.682	**.098**

a. Dependent Variable: CASHDEBTCOVERAGE

Results of the logistic regression analysis of the dependent variables on total percentage equity ownership by the Board showed no significant associations either with or without inclusion of control variables in the model

In sum, similar associations were evident using average equity ownership by directors and total percentage share ownership by the Board as measures of director ownership in the firm. Significant positive relationships were identified between both independent variables and the cash debt coverage ratio, a positive firm performance indicator. These results are consistent with H4 and with Agency Theory. Other tested associations were not significant. It can be concluded that equity ownership by directors may enhance firm performance in the junior Canadian Life Sciences industry.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine whether good corporate governance practices are associated with firm performance in the growth-oriented firms of the junior Canadian Life Sciences sector. An examination of whether firm performance is a function of its governance characteristics was conducted by testing four specific hypotheses. Results from this study revealed several distinguishing characteristics of the junior LSFs listed on the TSX Venture Exchange. In general, these firms are implementing corporate governance best practices as modelled by Agency Theory. The prevalence of the proportion of firms with majority independent Directors (72.6%), the proportion of firms separating the CEO and Chairman's roles (68.4%) and relatively high average equity ownership by Directors (20.7%), aligning the interests of the Board with the shareholders, are evidence of this trend. Few firms (mean 4.0%) embraced gender diversity as the corporate governance best practice associated with Board diversity. With these results, it appears that the junior, high-growth oriented firms under investigation are aiming at implementing what is perceived to be the right governance structures to drive performance of the firm toward success. What isn't clear, neither from prior research nor from the results of this study, is whether the presence of single corporate governance best practices can drive good firm performance.

The results of this study showed that maintaining a majority of outside, independent directors has no significant effect on firm performance and may be more apt to produce poorer results as the percentage of independent directors increases. This is a finding of note for the Life Science industry as it is likely a

function of the sector, where inside, specialized expertise is valuable in setting strategic direction for the firm. Although the individual regression models varied in terms of the predictive value of maintaining a majority of independent directors on the Board, H1 was generally supported, indicating that this Board structure characteristic has no effect on firm performance.

Investigation of the effect of CEO duality in this study indicated that this governance characteristic has minimal effect on firm performance, except in association with return on assets where it was found that better firm performance could be predicted when the CEO and Chairman roles were held by a single individual. This finding supported H2. Generally, no positive or negative impact on firm performance was identified when the roles were separated. Thus, for the junior Canadian Life Sciences industry, CEO duality, or lack thereof, should be contingent upon the firms' situation.

Gender diversity on the Board was low in the study sample, but several significant relationships were identified. Contrary to recent corporate governance literature, results show that gender diversity may have a dampening effect on firm performance in the junior Canadian Life Sciences sector, contrary to H3. These results warrant further investigation with an expanded sample size.

The most consistent finding in this study was that higher equity ownership by Directors is predictive of better firm performance, consistent with the idea that the gap in the separation between ownership and control is minimized when the Directors are also owners of the firm.

In conclusion, this study provides preliminary evidence that several significant associations exist linking firm performance with corporate governance characteristics in the junior Canadian Life Sciences industry. It is recommended that these findings be used to seek a more definitive answer to the central research question. In some circumstances, good corporate governance practices were associated with positive firm performance in the industry. In other circumstances, the effect of the governance practices was neutral or negative. These mixed findings are consistent with the prior corporate governance literature which claims that although corporate governance best practices are thought to lead to superior firm performance, consistent proof of this association has not yet been identified and may be contingent on specific circumstances within the firm or the industry as a whole.

Further research in this area is recommended, using the results of this study as a starting point. Next steps would include expanding the sample to include LSFs listed on the main TSX stock exchange over a period of several years to seek more definitive associations between the variables investigated in the study. Better definition of the identified associations may be used as guidance for the industry firms and for investors.

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APPENDIX

APPENDIX: Complete Data Set

	CV1	CV2	CV3	CV4	DV1	DV2	DV3	DV4	DV5	DV6	IV1a	IV1b	IV2	IV3	IV4a	IV4b
ID #	BODSIZE	FIRMSIZE	REGREGIME	BLOCKHOLDER	MAJORREGAPPROVAL	PATENTS	DEBTRATIO	MARKETTOBOOK	ROA	CASHDEBTCOVERAGE	%IND	CODEIND	CEODUALITY	%FEMALE	DIRAVEQOWN	BODTOT%EQOWN
1	5	$15,729,000	0	2	0	0	0.08	9.28	-1.20	-1.76	80%	3	1	0	286,139	1.97%
2	4	$149,000	0	0	0	0	1.27	43.91	-4.88	-1.72	75%	3	1	0	65,675	0.34%
3	5	$19,751	1	0	0	0	63.64	24.67	-2.77	-0.57	60%	3	0	20%	563,532	40.49%
4	5	$157,455	0	1	1	1	0.78	12.62	-7.83	-1.59	60%	3		20%	913,193	59.76%
5	6	$2,194,615	0	1	1	1	2.22	1.11	-6.94	-0.63	50%	2	1	0%	4,426,454	43.72%
6	6	$395,092	0	0	1	1	11.68	15.91	-10.94	-0.45	50%	2	1	17%	1,119,500	6.95%
7	7	$1,106,000	0	1	0	1	0.15	44.32	-2.31	-12.68	57%	3	0	0%	926,810	18.53%
8	5	$5,227,000	0	1	1	1	0.11	2.44	-2.56	-7.70	60%	3	1	0%	238,692	1.36%
9	5	$1,585,000	0	1	1	0	0.27	1.80	0.91	1.76	60%	3	0	0%	322,772	23.43%
10	6	$7,323,000	0	2	1	1	0.61	0.95	-2.11	-0.58	50%	2	1	0%	344,211	2.81%
11	5	$638,000	0	1	1	0	0.85	5.11	-2.89	0.16	80%	3	0	0%	967,005	32.61%
12	6	$164,242	0	1	0	0	0.43	4.49	-1.04	-1.58	33%	1		0%	286,469	30.33%
13	6	$798,000	1	2	1	1	1.22	4.37	-2.80	-0.13	50%	2	1	0%	9,659,589	74.85%
14	5	$4,171,000	0	0	0	1	0.88	1.23	0.41	0.23	80%	3	1	0%	906,649	7.52%
15	7	$45,760,000	1	2	0	0	0.39	0.62	0.44	0.02	57%	3	0	0%	6,880,995	73.42%
16	6	$5,964,000	0	0	1	1	0.46	1.12	-1.29	-1.30	50%	2	1	0%	1,840,096	13.27%
17	8	$41,149,000	1	0	0	1	0.01	0.38	-1.10	-5.75	75%	3	1	13%	2,299,271	24.71%
18	8	$1,202,000	1	1	0	0	3.36	27.40	-23.73	-0.59	88%	3	1	25%	1,969,059	11.96%
19	6	$6,460,000	0	1	0	1	0.06	9.81	-1.49	-7.58	83%	3	0	0%	152,858	1.95%
20	5	$6,607,000	0	1	0	1	0.36	2.71	0.23	0.61	60%	3	1	40%	9,188,637	77.05%
21	4	$2,733,000	1	1	0	0	2.25	3.03	-2.30	-0.86	75%	3	1	0%	53,127	0.41%
22	5	$1,260,000	1	0	0	1	0.29	6.68	-4.25	-4.73	80%	3		20%	221,776	4.22%
23	4	$37,974,000	0	2	0	0	1.01	0.03	0.00	0.05	50%	1	0	0%	1,435,834	45.53%
24	8	$2,765,000	1	2	0	0	2.01	1.26	-1.52	-0.28	63%	3	1	13%	2,565,576	44.03%
25	5	$4,776,000	1	1	1	0	0.07	0.57	0.10	1.46	80%	3	0	0%	586,350	11.87%
26	5	$2,946,000	0	1	1	0	0.09	4.04	-0.97	-7.07	80%	3	1	0%	452,957	4.86%
27	6	$19,932,000	0	2	0	1	0.40	0.71	0.01	0.29	83%	3	0	0%	5,843,075	50.86%
28	7	$7,142,000	0	0	0	0	0.29	2.49	-1.07	-3.01	86%	3	1	14%	673,222	8.73%
29	7	$1,247,000	0	0	0	0	0.46	15.28	-1.58	-2.63	71%	3	1	0%	813,681	22.13%
30	6	$4,666,000	1	1	1	1	0.15	5.76	-2.76	-4.61	83%	3	0	0%	902,955	11.08%
31	4	$2,471,000	0	0	0	1	0.04	2.08	-1.95	-10.22	100%	3	1	0%	469,429	3.10%
32	6	$2,263,000	1	0	0	1	0.68	6.42	-15.61	-2.06	83%	3	1	0%	349,334	5.77%
33	4	$959,000	0	0	0	0	0.41	2.43	14.26	0.25	75%	3	0	0%	981,870	5.06%
34	4	$4,744,000	0	1	1	1	1.38	20.25	9.08	0.02	75%	3	0	0%	8,011,175	17.52%
35	6	$4,341,000	1	1	1	1	0.69	1.58	-0.47	-0.28	83%	3	1	0%	3,586,501	62.89%
36	5	$2,970,230	1	2	1	1	3.93	6.60	4.52	-0.13	40%	1	1	0%	864,229	1.10%
37	4	$762,000	0	1	1	1	6.90	2.09	-4.15	0.02	75%	3	1	0%	1,932,013	21.86%
38	5	$1,954,000	0	0	1	0	0.97	2.85	-2.43	-1.60	80%	3	1	0%	237,000	1.27%
39	6	$6,300,000	0	2	1	0	0.15	9.43	-1.96	-1.88	67%	3	1	17%	870,024	11.42%
40	7	$304,000	0	1	0	0	2.54	5.44	-5.47	-0.08	86%	3	1	0%	2,246,704	33.31%
41	6	$2,543,000	0	1	0	0	0.56	1.77	-0.44	-0.77	67%	3	1	0%	2,913,038	27.13%
42	6	$397,000	1	1	0	1	5.90	28.50	-17.80	-1.07	50%	2	1	17%	6,068,627	25.75%
43	8	$61,586,000	0	1	1	0	0.45	0.70	0.14	0.16	88%	3	0	0%	208,213	19.99%
44	5	$6,212,513	0	1	1	1	0.29	0.18	-0.24	0.37	40%	1	1	0%	654,400	19.31%
45	4	$276,000	1	0	0	1	9.29	12.06	-6.90	-0.36	75%	3	1	0%	378,178	1.82%
46	5	$3,977,000	0	0	0	1	0.03	4.06	-1.00	-6.85	60%	3	1	0%	526,583	2.20%
47	7	$3,432,000	1	0	0	1	0.21	2.90	-5.20	-5.02	57%	3	1	14%	2,391,200	21.01%

Appendix 1: Complete Data Set (continued)

	CV1	CV2	CV3	CV4	DV1	DV2	DV3	DV4	DV5	DV6	IV1a	IV1b	IV2	IV3	IV4a	IV4b
	BODSIZE	FIRMSIZE	REGREGIME	BLOCKHOLDER	MAJORREGAPPROVAL	PATENTS	DEBTRATIO	MARKETTOBOOK	ROA	CASHDEBTCOVERAGE	%IND	CODEIND	CEODUALITY	%FEMALE	DIRAVEQOWN	BODTOT%EQOWN
48	7	$1,805,000	0	0	0	1	3.14	7.05	-9.07	-1.09	57%	3	1	0%	6,402,496	14.09%
49	7	$7,530,000	0	1	1	0	0.14	6.35	-2.67	-3.71	71%	3	1	0%	982,457	17.27%
50	6	$1,523,000	1	1	0	1	0.45	8.80	-2.20	-3.34	50%	2	0	0%	1,148,375	15.17%
51	6	$2,764,000	0	1	0	1	0.13	33.76	-1.63	-5.49	83%	3	0	0%	3,273,507	10.52%
52	6	$3,921,000	0	2	0	0	0.08	0.73	-0.37	-2.87	50%	2		17%	6,810,083	56.75%
53	6	$12,522,000	0	0	0	0	0.83	0.18	0.37	-0.16	67%	3	1	0%	32,170	0.60%
54	4	$922,000	0	0	1	0	7.22	16.19	-1.43	0.05	50%	1	1	0%	1,370,575	9.55%
55	4	$1,079,000	0	1	1	1	0.89	13.52	-2.11	-1.68	50%	1	1	0%	4,830,185	46.35%
56	5	$5,721,000	1	0	0	1	0.19	14.21	-1.37	-4.97	60%	3	0	0%	2,083,258	15.38%
57	6	$2,436,000	0	0	1	0	1.95	7.30	-3.96	-0.88	83%	3	1	0%	2,487,820	13.86%
58	3	$1,024,000	0	2	0	0	0.20	0.50	-0.42	-1.38	33%	0	0	0%	8,542	0.37%
59	5	$8,761,000	0	1	0	1	0.08	4.85	-4.65	-4.54	80%	3		20%	2,054,319	15.96%
60	4	$8,174,000	0	1	0	1	0.39	0.07	3.18	-0.21	75%	3	1	0%	3,988	0.08%
61	4	$62,000	0	1	0	0	65.94	563.55	-89.79	-0.25	50%	1	1	25%	3,049,944	16.76%
62	4	$723,000	1	1	0	1	5.32	32.19	-3.38	-1.00	50%	1	0	0%	3,049,944	17.82%