Auckland University of Technology

The relationship between investment and free cash flow: Evidence from New Zealand firms.

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ABSTRACT

Free cash flow plays an important role in explaining firms' investment activities. The aim of this Master dissertation is to determine whether and how free cash flow affect firm-level investments in New Zealand (NZ) listed companies. To investigate and interpret the relationship between firms' investment decisions in present of free cash flow, this study process in three parts. The first part aims to determine whether there exists a relationship between a firm's level of investment and its level of internally generated cash flow. The second part intends to examine the association between firm-level overinvestments and free cash flows. The third part proposes to investigate the impact of corporate governance factors on overinvestment-FCF sensitivity.

Based on the methods from previous studies, this study analyzes the data from 63 New Zealand listed firms on the New Zealand Stock Market between financial year (FY) 2004 to FY2018. Consistent with prior literature (Alti, 2003; Hubbard, 1998; Vogt,1997), this study discovers that NZ companies' investment expenditures are positively related to their internal funds. Similar to previous studies on U.S. data (Richardson, 2006), the results in this study indicate that the firms' over-investment is positively connected with positive free cash flow. Specifically, overinvestment activities are more pronounced in companies with positive free cash flows. Moreover, this study finds that certain corporate governance characteristics, such as insider-dominated ownership composition and small board size, are significantly and positively related to overinvestment-FCF sensitivity. This study further divides the full sample into two subsamples: over-investment firms and under-investment firms. For over-investment firms, the evidence indicates that firms with larger board size, higher percentage of independent directors on the board, higher leverage, or large firm size are less likely to experience over-investment. For under-investment firms, the findings show that larger board size can boost the under-investment issue, while concentrated ownership, higher proportion of independent directors on the board, higher leverage, or large firm size can mitigate it.

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Attestation of Authorship

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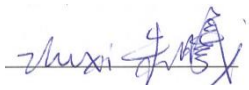
Signed:  Date: 28-05-2019

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1.0 Introduction

Firm level investment activities are always influenced by the available cash flows the company can use. The objective of this study is to better understand the role of free cash flows as one of the key impacts on firm investing decisions. Using a sample of New Zealand listed firms, this study first examines the relationship between firm investing decisions and internally generated cash flow. It then investigates firm investing decisions in the presence of free cash flow. Following Richardson's approach, this study provides a powerful test of agency-based explanation for why firm level investment is related to internally generated cash flow and why overinvestment is associate with free cash flow. To expand previous studies, this paper finally tests whether and how corporate governance characteristics impact on the relationship between free cash flow and firm level investments.

1.1 Research background

The interaction between firms' investment decisions and free cash flow (FCF) has received substantial attentions from both researchers and practitioners. In the world of perfect capital markets, the level of FCF would not relate to the firm's investment decision (Modigliani & Miller, 1958). In the corporate finance world, however, the firm-level investment expenditure is highly associated with the available cash flow the firm generate (Hubbard, 1998; Lewellen & Lewellen, 2016; Richardson, 2006). According to Jensen (1992) and Myers and Majluf (1984), the issuance costs, agency conflicts, and corporate governance mechanisms can affect firms' cost of capital, drive the cost of internal and external funds, and alter firms' decision making on taking different types of projects.

1.1.1 Investment decision

Investment decision of a firm is generally known as the capital budgeting decision, which is the process to select investment projects to increase firms' value. Pandey (2005) defined it as the firm's decision that use its current funds to invest in profitable projects. Such decisions include divestment or acquisition, maintenance or replacement of the long-term assets, and research and development program (Pandey, 2005). According to Richardson

(2006), firms' investment includes maintenance investment expenses and new investment costs. The maintenance expenditure is used to maintain existing assets in place, while the new investment expense is required to finance expected new investment projects and abnormal over-investment projects (Richardson, 2006). Companies listed on the stock exchange usually report their yearly investment expenditures in annual reports. These reported financial details allow stakeholders to know how the firm is spending internal/external funds and whether it is investing in its long-term growth.

1.1.2 Internally generated cash flow

Companies engage in various ways to finance their investments, which involves internally generated funds and externally raised funds, and debt. Internally generated cash flow (CF) refers to operating earnings after interest, taxes, and dividend payments (Lewellen & Lewellen, 2016). This type of fund normally relates to various factors among the stage in the firm's life cycle. These factors determine whether the CF will be invested in projects that generate positive net present values (NPV). Unlike the internally generated funds, the external equity financing or new equity attracts a higher cost of raising funds. Considering the cost, most of the corporations like to use internally generated cash flow to finance investment projects rather than external funds.

Financing firms' investment expenditure by utilizing the internally generated cash flow is highly recognized. Myers and Majluf (1984) clearly illustrated the internal funds can first be used to finance the investment needs of the firm. According to the pecking order theory, companies prefer to raise internal financing as the priority financing means (Cummins, Hasset, & Oliner, 2006). Moreover, the debt is preferred over equity if external financing is required (Cummins et al., 2006; Myers & Majluf, 1984). Specifically, internally generated cash flow is always used as a primary financing source by the firm. When internal funds depleted, debts as external funds are then adopted to finance firms' investment projects. A company issues equity to raise funds, only when it is no longer sensible to issue any more debt.

1.1.3 Free cash flow

Free cash flow (FCF) is a measure of financial performance and an important source of corporation' investment. Various authors have defined FCF as prior period net investment spending. Bilicic and Connor (2004) defined free cash flow as operating income before depreciation, subtract interest expenditure on debt, subtract income taxes, and subtract dividend payment. The definition, however, lacks accounting preciseness (Wang, 2010). A more precise measurement by Richardson (2006) calculated free cash flow as "cash flow beyond what is necessary to maintain assets in place and to finance expected new investments" (p. 167). FCF can also determine as the current period generated cash flow that is sufficient to cover investment expenditures in the next investment period (Hirshleifer, Hou, & Teoh, 2007). Furthermore, Subramanyam and Wild (2009) suggested that free cash flow to the firm equals the operating cash flow less the investments in operating assets. They further implied that FCFs reflect the additional impacts of investments in operating assets (Subramanyam & Wild, 2009).

Managers can either disburse the available cash to shareholders in the form of dividends after keeping aside the money required to expand or maintain its asset base, or hold it back for developing new products, making acquisitions, and reducing debt. Therefore, a stable and positive FCF has a significant impact on the organization's investment decision-making process. Meanwhile, it is important to note that a negative FCF does not always a bad sign for the company. Because many young companies spend a lot of their cash flows to finance value-added investment projects, the negative FCF could mean the company is making larger investments (Hribar & Yehuda, 2015; Vogt, 1997).

1.1.4 Effect of internally generated cash flow on firms' investment

An issue that has received particular attention in the corporate finance world is the sensitivity of firm-level investment to internally generated cash flow. Although some people believe there is no link between CF and firm-level investment (Modigliani & Miller, 1958), others document a significant positive association between them (Hubbard, 1998; Lewellen & Lewellen, 2016). Theoretically, this positive relationship expresses the imperfections in the capital market. The information asymmetries in the imperfect market

rise the cost of capital and then increase the cost of external funds (Ascioglu, Hegde, & McDermott, 2008). The costly external funds encourage firms to use internally generated cash flows to extend the investment opportunities on this imperfect market (Chowdhury, Kumar, & Shome, 2016). According to Chen, Sun, and Xu (2016), companies listed in the imperfect capital markets prefer to use the internally generated cash flows to invest feasible investments due to its lower cost of capital. Drobetz, Haller, and Meier (2016) further indicated that companies with uncertain cash flows are more difficult to access external funds. This because the cost of external funds will increase due to the cash flow uncertainty of the firms. As a result, those firms' investment must depend on their internally generated cash flow (Chowdhury et al., 2016; Drobetz et al., 2016).

1.1.5 Effect of free cash flow on firms' investment

Prior researchers have suggested that firms' expenditures on overinvestment projects are positive relate to their free cash flows (Jensen & Mekling, 1976; Richardson, 2006). Such positive relation is a manifestation of an agency problem. Jensen and Meckling (1976) discovered that when there is an interesting conflict between managers and shareholders, the cash flows that after paying investment maintenance costs and new positive NPV projects could be wasted. They found that managers in firms with a higher level of free cash flow have a strong incentive to invest negative NPV projects (Jensen & Meckling, 1976). According to Stulz (1990), management, especially those with weak corporate monitor system, is more likely to invest in projects that benefit managers but not good for company owners. Namely, instead of paying dividends to stockholders, managers may overspend cash flow to finance wasteful investment projects. Following the agency costs explanation, Richardson (2006) also reported that higher level of FCF contributes to firms' over-investment issue. Richardson further examined the impact of governance characteristics and determined certain governance factors appear to control over-investment problems (Richardson, 2006).

1.2 Statement of research purpose

This study intends to answer the research question, whether and how free cash flow affect firm-level investments in New Zealand listed companies? It focuses on the listed firms in

the New Zealand capital market and conducts an empirical analysis based on the companies' annual report data from the financial year (FY) 2004 to FY 2018.

This study process in three part to answer the research question. First, it investigates the relationship between internally generated cash flow and firms' investing decision. By analyzing firms' investment expenditure, internally generated cash flow and various control variables (such as financial constraints and macroeconomic factors), it provides a powerful test on investment of internally generated cash flow. The hypothesis tests confirm the existence of a positive association between internally generated cash flow and firms' investment. For a sample of 945 firm-years observations during the period FY2004-FY2018, I find that for companies with positive CF the average firm level investment 55.51% of its internally generated cash flow. The evidence of the study also shows that control variables such as firm leverage, firm size, and GDP appear to negatively/positively effect on firm level investment.

Second, this study studies whether firms' overinvestment activities associate with free cash flow. Following Richardson' (2006) definitions, this study adopts accounting information to calculates the free cash flow and over-investment expenditure. FCF in this study is defined as available cash flows after what is paying maintenance expenses and expected new investment expenditures. Over-investment is new investment expenditure in negative NPV projects. It is the expenditure that beyond maintenance investment costs and positive-NPV investment costs. According to Richardson (2006), it usually changes with the firm's growth opportunities, financing constraints, and past firm performance. Consistent with the agency cost explanation, I discover a significant and positive relationship between overinvestment and free cash flow. NZ listed companies with positive FCF are more likely to spend money on over-investment project.

The study further examines whether corporate governance factors are validity in impacting on overinvestment-FCF sensitivity. The findings of this study display that firms with large board size alleviate over-investment, while companies with insider-dominated ownership boost over-investment. I then extend Richardson's (2006) study and test the

impact of corporate governance factors on over-investment in both over-investment and under-investment firms. In this study, I define the over-investment firm as the firm with positive over-investment expenditure, and the under-investment firm as the firm with negative over-investment expenditure. Collectively, I find out a higher quality of corporate governance mechanisms moderates the over-investment while a lower quality of governance deteriorates under-investment.

1.3 Value of the study

Previous literature supports that firms' investment related to internally generated cash flow, as well as over-investment associated with free cash flow. However, there are no studies focus on New Zealand evidence. The main contribution for this study is to fill the gap in the limited literature on the relationship between free cash flows and investments of firm quoted at the New Zealand stock exchange market. The conclusions of the study can help the companies to understand whether investment decisions wholly rely on the free cash flows of the firm or not. Additionally, it can help managers to determine which corporate governance mechanisms can help to control the over-investment issue.

1.4 Research structure

This research contains six chapters. Chapter 1 provides an overview of research background, research purpose, and value of this dissertation. Chapter 2 reviews relevant literature, which involves journal articles, textbook, and online reports. The detailed literature review supplies the theoretical and empirical grounding for the study. Chapter 3 discusses a detailed hypothesis of the research. Chapter 4 shows the methodology that uses to investigate whether and how free cash flow influence NZ listed firms' investments. Chapter 5 presents the analysis of results that compute through chapter 4. Chapter 6 concludes the main findings of this study, offers some recommendations for managers to control the overinvestment issue and provides a proposal for future work in this area.

2.0 Literature Review

In order to answer the research question, this study firstly reviews theoretical and empirical literature relevant to the relationship between internally generated cash flow and firms' investment activities and the association between FCF and companies' overinvestment. To determine suitable control variables for the regression models, it also reviews various literature researches on the financial constraints (such as growth opportunities, firm leverage, firm liquidity, dividend policy, firm size, and macroeconomic factors) of firms' investment decisions. For the purpose of extending the existed studies, this study then reviews literature on the impact of corporate governance factors on the FCF-overinvestment relationship. Additionally, a review of New Zealand literature provides the major motivation for conducting this study.

Companies' investment behaviors have been deeply studied over the century. Some people argue that a corporation's financial status is irrelevant in its investment activities (Modigliani & Miller, 1958). However, the majority of the empirical literature found evidence to suggest that a company' investment decision is closely related to its financial choices.

2.1 Firms' investment decision and internally generated cash flow

According to Modigliani and Miller's theory, if a company needed additional money to fund an investment activity it would simply raise that money from external capital markets (Modigliani & Miller, 1958). Thus, the firm's investment policy only relies on positive NPV investment opportunities. Following Modigliani and Miller's theory, Gatchev, Pulvino, and Tarhan (2010) established a dynamic multi-equation model to test companies' financial to investment decision relationship. They defined that there is no interactional association between financial choices and investment decisions.

However, Modigliani and Miller's theory is based on the perfect market assumption. In the real world, the capital markets are either imperfect or incomplete. There are lots of empirical studies suggested that companies' investment behaviors and their internally generated cash flows are indeed related. According to Vogt (1997), the more available

internal funds in a firm, the more investment projects company can undertake. This significant positive impact of cash flows on investments indicates that cash flows contain valuable information about firms' investment decisions (Ascioglu et al., 2008; Moyen, 2004). Although companies' investment expenditure does not only rely on internal cash flows (Becker & Sivadasan, 2010; Chen & Chen, 2012), the internal fund is the primary source to finance investment projects (Cummins et al., 2006; Myers & Majluf, 1984). Cleary (2002, 2006) provided strong evidence to suggest the internal cash flows have relatively lower costs compared to external funds. As a result, firms' investment decisions highly rely on the internally generated cash flow (Ferreira & Vilela, 2004; Khurana, Martin, & Pereira, 2006). Namely, investment expenditure increases with large internal funds and decreases with low funds (Cleary, Povel, & Raith, 2007). Recent studies further confirmed that the imperfections of the capital markets limit companies' availability of accessing external funds and push them to use internally generated cash flow to finance investment projects (Hovakimian, 2009; Lewellen & Lewellen, 2016).

2.2 Firms' over-investment and free cash flow

There are lots of studies that have examined the implications of the free cash flow (FCF) on firms' investment activities in listed companies both in developed and developing countries. Many of them found out firms' over-investment is positively related to FCF due to the agency conflict (Harford, 1999; Hovakimian & Hovakimian, 2009; Jensen & Meckling, 1976; Rubin, 1990; Stulz, 1990). According to Jensen and Meckling (1976), managers in firms with abundant cash flows are more likely to spend free cash flow on investment projects that are profitable from a management perspective but wasteful from a shareholder's perspective. Rubin (1990) and Stulz (1990) also discovered that managers in companies with high FCFs prefer investing them in projects even these with a negative net present value, overpaying them to stakeholders as dividends. Drobetz, Grüninger, and Hirschvogl (2010) argued that managers can avoid market controlling when the firm has abundant cash flow. It means managers are free to make investment decisions without shareholders' agreement. To benefit own interest, managers could invest project with zero or even negative net present values (Drobetz et al., 2010; Opler et al., 1999, 2001).

During the last few decades, the debate on the strength of investment-FCF relationship

has generated a rich body of literature. On the one hand, many researchers believe that the free cash flow of a corporation has a strong impact on its capital spending. Hubbard (1998) and Opler, Pinkowiz, Stulz, and Williamson (1999, 2001) documented that companies with excess free cash flows have higher investment expenses, and spend more on acquisitions, even when they appear to have poor investment opportunities. Hovakimian and Hovakimian (2009) determined that overinvestment is highly related to higher FCF while underinvestment is associated with lower FCF.

On the other hand, many recent studies argued that the strength of overinvestment-FCF association is weak. For instance, Baker, Stein, and Wurgler (2003) focused on the "equity-dependent" firms and reported a lower investment-FCF sensitivity value of 0.05-0.15. Allayannis and Mozumdar (2004) and Hennessy, Levy, and Whited (2007) examined the effect of free cash flows on firms' investment in the financially unconstrained firms and recorded sensitivity of 0.20-0.70. More recent studies argued that the effect of FCF on firms' investment is limited since the investment-FCF sensitivity is just around 0.01-0.09 (Almeida, Campello, & Galvao, 2010; Erickson & Whited, 2012). Such lower sensitivity means firms' investment does not only depend on the internal cash flows but also the external funds. Chen and Chen (2012) found that firms with investment opportunities and lower available FCF would not be expected to invest any less than firms with the same opportunities and higher cash flow. This because the external fund can substitute the internal resources. Chen and Chen (2012) further explained that the correlation between free cash flow and investment is lower when the issuance costs of the external fund are low. Furthermore, financial constraints can also contribute to the reduced investment-FCF sensitivity. Becker and Sivadasan (2010) explained that higher financial constraints can reduce agency costs and then spend less cash on wasteful projects.

2.3 Determinants that impact on investment

A large number of literature researches suggested that the firms' investment can be affected by firms' financial constraints, such as growth opportunities, firm leverage, firm liquidity, dividend policy, firm size, and macroeconomic factors (Agca & Mozumdar,

2008; Amir, Zaman, & Ali, 2012; Atting, Cleary, EI Ghoul, & Guedhami, 2012; Brown & Petersen , 2009; Cleary, 2006; Ding, Guariglia, & Knight, 2013; Hsiao & Tahmiscioglu, 1997; Islam & Mozumdar, 2007). However, there are still some researchers argued that the effect of the firm size, dividend and financial leverage on the investment become less (André & Jankensgård, 2015; Gomes, 2001) or even invalid (Kaplan & Zingales, 1997, 2000).

2.3.1 Growth opportunities

Some researchers suggest the investment options increase with the growth opportunities climb. Firstly, higher growth opportunities signify the greater need for external funds to finance acquisitions and projects. Companies are forced to seek funding from external capital markets and hence be subject of the scrutiny of external capital markets (Almeida & Capello, 2010). Therefore, firms with higher growth opportunities less likely to experience the overinvestment to free cash flow.

Moreover, over-investment issues are less common in companies have higher growth opportunities (Jensen & Meckling, 1976). Berk, Green, and Naik (2002) studied the effect of the optimal investment on firms' assets and growth opportunities. They discovered that an increase in growth opportunity increases the likelihood for managers to retain cash in order to invest in non-negative NPV projects and to fund positive acquisitions in the futures (Berk et al., 2002). In other words, firms with positive FCF but low growth opportunities are more likely to finance negative NPV investment projects. When the shareholders cannot monitor the managerial actives effectively, the managers of companies with low growth opportunities will more likely invest in marginal or negative net present value projects (Bates, 2005; Griff, Lont, & Sun, 2010). This because of managers more likely to seek investments to guarantee their employment and salary increases rather than shareholders' (Bates, 2005; Griff et al., 2010).

2.3.2 Financial leverage

Firm leverage is an important determinant of firm's investment behaviors. According to Chen et al. (2016), the level of investment depends on the level of leverage in the firm.

Moreover, leverage also plays an important role in controlling overinvestments (Jeon & Nichihara, 2015).

Many studies confirm there is a negative correlation between financial leverage and the investment. According to Jensen (1992), leveraged buyout activities are one way of controlling over-investment, because the increased debt forces managers to reduce the negative NPV projects. Kaplan and Zingales (1997, 2000) construct a measure of firm leverage for a small sample of firms and found that the investment expenses for firms negatively associated with this measure. Cleary (2006) and Whited (1992) used panel data to study investment activities in firms with/without financial constraint. The analysis revealed that firms facing high leverage would be inclined to remain cash, thereby decreasing the investments (Cleary, 2006; Whited 1992).

2.3.3 Firm liquidity

Theoretically, investment decision can also be affected by the working capital of companies. Appuhami (2008) studied working capital management in Thailand listed companies and found it is negatively associated with operating cash flows and positively related to investment costs. By investigating the investments effect on working capital management, Ilyas (2014) and Soumaya (2012) also observed a strong positive relationship between the working capital requirements and investment expenditure.

Several studies revisited the financial constraints issue on investment-cash flow sensitivity and found the investment of working capital-intensive companies is particularly sensitive to fluctuations in internal funds (Agca & Mozumdar, 2008; Brown & Petersen, 2009; Faulkender & Petersen, 2012; Hsiao & Tahmiscioglu, 1997). Ding et al. (2013) examined over 116,000 firms in China and discovered that firms with higher working capital have higher capital investment-cash flow sensitivity and lower fixed investment-cash flow sensitivity. Ding et al. (2013) then suggested that active management of working capital may help corporations to mitigate the financial constraints impact fixed investment.

2.3.4 Dividend policy

Dividend policy is an essential and debatable impact on investment-free cash flow sensitivity. Some researchers believe that dividend decisions are not a thing of investment sensitivity. Modigliani and Miller (1958, 1961) proved that in a perfect capital market firm's dividend policy does not affect its value and have no significant impact on the firms' investment sensitivity. Fama (1974) also studied the association between investment behaviors and dividend policy decisions. He suggested that there is no relationship between firms' dividend policy and investment activities (Fama, 1974).

However, and perhaps not surprisingly, the majority of the researchers believe firms' dividends payment affects firms' investment negatively. In an imperfect capital market, companies cannot gain limitless money to support their investment and dividend expenditures (Bhattacharya, 1979; Gordon, 1963; Lintner, 1962). Thereby, they must depend on internal cash (Bhattacharya, 1979; Gordon, 1963; Lintner, 1962). The more dividend the company pays to shareholders, the less cash flow the managers can use to invest. Moreover, considering the conflict between firms' value-added and shareholders' wealth-added, companies either use internal cash to fund investment or issue dividends (DeAngelo, DeAngelo, & Skinne, 2004; Farsio, Geary, & Moser, 2004). Such findings indicate there is a negative correlation between dividend payout and investments.

Therefore, dividend policy can be used to mitigate the overinvestment issue. Amidu (2007) discovered that the dividend and interest payments reduce the free cash flows that management can use in investing profitable and/or unprofitable projects. Mizuno (2007) recommend that if the investment project cannot bring higher returns than expected, firms should not finance it, instead the money should be distributed to shareholders as dividends. Additionally, Noori and Aslani (2014) and Yeo (2018) investigated how free cash flow influences the levels of investment and dividends. They concluded that there is a significant positive relationship between free cash flow and firm investment and this relationship can be strengthened with dividend reduce (Noori & Aslani, 2014; Yeo, 2018).

2.3.5 Firm size

Some people suggest the impact of CF on firm investment raises as firm size declines. Gearing towards rapid firm growth, small companies spending most or all of their cash flows to fund value-adding projects (Vogt, 1994, 1997). Therefore, small firms with growth prospects have a significantly higher investment-cash flow sensitivity (Alti, 2003). In addition, the size of the firm is negatively connected to overinvestment. Using three measures of firm size, Hechmi (2012) examined the impact of cash flow availability on firm investment. He discovered that a firm is more financially constrained if its size is small (Hechmi, 2012). Thereby, companies allocate less free cash flow towards overinvestment (Chang, Dasgupta, Wong, & Yao, 2014).

However, other researchers hold the opposite opinion. For example, Jalilvand and Harris (1986) explained that small firms tend to have more unexploited investment opportunities. Because the higher transaction costs of external funds and asymmetrical information issues on the external capital market, small companies have limited access to external funds (Jalilvanf & Harris, 1986). Specifically, companies with smaller firm size are more vulnerable to experience cash flow restraint. Therefore, this type of firms usually invests in the lowest proportion of their total outflows in the capital (Gilchrist & Himmelberg, 1995; Kadapakkam, Kumar, & Riddick, 1998).

2.3.6 Macroeconomic factors

The macroeconomic factors such as economic growth and inflation rate can also influence companies' investment. According to Amir et al., (2012), firm's investment decision relies on the economic growth. If the future demand is reducing, companies would decrease the spend on investment. In contrast, if the economic prospects improve, firms expect further demand would increase, and they would spend more money on investments. There is strong empirical evidence that investment is cyclical. Namely, firms' investment reduces in an economic recession and increase with economic growth (Amir et al., 2012; Islam & Mozumdar, 2007).

High and variable inflation tends to increase the uncertainties of economic growth, and

raise the uncertainties of the final cost of the investment (Amir et al., 2012). Orsua, Herce, and Bueno (2011) studied the time series analysis of macroeconomic determinants of investment expenditure and discovered an inverse relationship between inflation and investment. They further indicated that firms in the country with a prolonged period of low and stable inflation have often experienced higher rates of investment (Orsua et al., 2011). However, if low inflation is due to a fall in demand and economic growth, then this low inflation will not be sufficient to boost investment (Orsua et al., 2011).

2.4 Corporate governance factors on overinvestment-FCF association

Governance structures have a significant impact on the overinvestment-free cash flow relationship. Brush, Bromile, and Hendrickx (2000) discovered weak corporate governance causes inefficiency when allocating FCF due to a higher agency cost. This issue occurs because of the corporate board of directors directed at the policies that favor managers' interest at the expense of shareholders wealth. Bates (2005) and Griffin et al. (2010) also expounded that the concentrated ownership and insider-dominated governance structure can lead to a less efficient management monitoring system for the company. This inefficient control system then increasing free cash flows abusively used to finance over-investment. A more recent study investigated whether corporate governance factors influence investments-FCF sensitivity and suggest that certain governance factors, like concentrated ownership, can strong the correlation between overinvestment and free cash flow (Chen et al., 2016).

By separating corporate ownership and control, the over-investment can be exhibited (Richardson, 2006). In detail, dispersed ownership can reduce the potential agency costs and then lower the sensitivity of over-investment to free cash flow (Huang, Jiang, Liu, & Zhang, 2011). Furthermore, Khan, Kaleem, Nazir, and Khan (2012) seen free cash flows as a proxy for agency costs in their study. The study observed that separated ownership and independent board mechanism plays an important role in reducing manager controlled FCF (Khan et al., 2012). As a result, there are fewer free cash flows managers can use to fund negative NPV investment projects. Financial Market Authority [FMA] (2018) announce that one of the most essential roles of the board of directors is to monitor

the management on behalf of the shareholders. If a dual CEO works closely with the board and aligns the agency conflict between managers and shareholders, the company would create profits. However, the monitor system could become weaker when the CEO take control of the board. Therefore, the larger board size and higher proportion of independent directors on the board, the less over-investment decision the firm would have. Furthermore, the positive relationship between over-investment and cash holdings is weaker when corporations have lower agency costs (Guiso, Sapienza, & Zingales, 2015). Atting, El Ghoul, Guedhami, and Suh (2013) mentioned that firms with a culture of high integrity have a higher quality of corporate governance mechanisms and a lower agency cost because the managers in those companies are more self-governing and less self-serving. Namely, management in such firms as likely to respect shareholders' rights and interests when they make investment decisions (Atting et al., 2012). Therefore, these companies may less likely to experience over-investment.

2.5 Literature in New Zealand

There are a large number of researches aim to examine whether free cash flows can be used to explain companies' earning ability and guide their investment decisions. However, most of them only focused on large equity markets such as the United States or the United Kingdom market. Only a few studies partially associate the investment to cash flow have been done in New Zealand (Adms, 1996; Habib, 2008).

In an insurance industry-based study, Adams (1996), made inquiries of the association between investment earnings and various organizational characteristics, namely organization form, size, leverage, asset and liability-mix, and underwriting risk in life insurance industry in New Zealand. By analyzing the annual reports of NZ life insurance firms, the study indicated a statistically significant and positive relationship between investment earnings and firm characteristics such as firm form, size, leverage, operating cash flow, and underwriting risk. This empirical evidence made Adams conclude that cash flow position determines the extent of net profit performance of organizations in the life insurance sectors.

In another quantitative study, Habib (2008) assessed whether earnings and cash flows have incremental information content for investment earnings (stock returns) in the small economies using New Zealand as a case study. They reported that both earnings and cash flows are value-relevant in NZ (Habib, 2008). Habib's further analysis suggests that earnings lose conjunction when earnings permanence is involved in the regression model. However, there is no relevant improve in the cash flow variable. The authors, therefore, recommended that the earnings and cash flow ratios should be used to evaluate performance for the purposes of helping investors and organizations make the right investment decisions.

However, there is no literature focuses on the relationship between free cash flows and investments decisions. It becomes one of the most important motivations for me to conduct this study.

3.0 Hypothesis

I develop several hypotheses in this study to answer whether and how free cash flow affect firm-level investments in New Zealand listed companies.

In perfect capital markets, an association between firm-level investment and internally generated cash flow is not expected (Modigliani & Miller, 1958). In the real world, however, most firms prefer to use internal funds as their priority financing sources, because it is cheaper than external finance (Kaplan & Zingales, 1997; Lewellen & Lewellen, 2016; Myers & Majluf, 1984). Specifically, a firm's investment expenses should positively connect to its internally generated cash flows (Kaplan & Zingales, 1997; Lewellen & Lewellen, 2016). Hence, the first hypothesis (stated in alternate form) for this study is:

- H_{1a}: Overall, there is a positive relation between investment and internally generated cash flow.

However, firms could generate negative internally generated cash flows at the growth stage (Hovakimian, 2009). According to Allayannis and Mozumdar (2004) and Hovakimian (2009), both positive and negative internally generated cash flows play an important role in firms' investment decision-making process. Hovakimian (2009) demonstrated that increased negative internally generated cash flows can restrict firm-level investment activities. Therefore, this study further examines the investment in firms with negative CFs and the hypothesis is:

- H_{1b}: For firms with negative internally generated cash flow, there may exist a negative relation between investment and internally generated cash flow.

Previous studies also suggest that a company's investment decisions can be impacted positively by its FCF level. According to Jensen and Meckling (1997) and Richardson (2006), corporations with more free cash flows are more likely to finance investment on managers' self-serving projects rather than assign the money to stockholders. Focus on the "abnormal" cash flows (i.e. free cash flow) that companies can use after maintaining

existing asset and financing new investments, this study follows Richardson's (2006) method to test whether firms' over-investment is associated with their free cash flow. Therefore, the second alternate hypothesis for this study is:

- H_2: Firm's over-investment has positive relationship with positive free cash flow.

This study focuses on the firms with positive FCF, because companies are forced to access external funds to finance investment projects when they have negative free cash flow.

Additionally, some literatures point out that over-investment issue can be reduced by several corporate governance structures, such as dispersed ownership, larger board size and a higher proportion of independent directors on board (Jensen & Meckling, 1976; Moshirian, Nanda, Vadilyev, & Zhang, 2017; Richardson, 2006). To extend Richardson's (2006) study, I further examine the relationship between corporate governance factors, free cash flows, and overinvestment using the full sample and two subsamples (over-investment firms and under-investment firms). The third hypothesis expressed in alternative form is:

- H_3: The strength of the overinvest-FCF relationship is negatively related to the corporate governance quality.

4.0 Methodology

This chapter drew a systematic description of research methods that employ to answer the research question in this study. It explained the sample design and the methods of data collection. It also illustrated the regression models and the statistical instruments the study used to analyze data. The definitions for all variables used in the regression models are displayed in Appendix 1.

4.1 Data collection and analysis procedures

4.1.1 Statement of data collection

Since my study focus on explore the cash flow-investment relationship in New Zealand, I select a sample of 63 listed companies on the New Zealand Stock Exchange market (see Appendix 2) or 945 firm-year observations between FY 2004 and FY 2018 from NZX database and DataStream. My selection procedures use the criteria below:

(1) Firms must remain in business for the whole study period (FY2004 to FY2018).

(2) Firms that remained listed from 1 July 2003 to 30 June 2018.

4.1.2 Statement of data analysis

This study adopts secondary sources of data, which is obtained from audited financial statements and annual reports of individual firms. The collected data was sorted, cleaned, coded, and then constructed into a panel data. The main purpose of using panel data in this study is to increase the number of observations for the analysis. In order to investigate the relationship between a dependent variable and several independent variables, I employ the Eviews software to carry out the descriptive statistics and multiple linear regression analysis of the panel data. The results are presented in the form of tables. The regression models that used to analyze the dependent variables on the independent variables are described in section 4.3.

4.2 Definition of the internally generated cash flow, free cash flow and investment

Adopting Lewellen and Lewellen's (2016) definition, I refer firms' internally generated cash flow (CF) as operating earnings after interest, taxes, and dividend payments. The calculation of the value of firms' internally generated cash flow based on the financial

statistics report in each company's annual report. CF is measured as:

CF = EBIT - interest expenses - tax expenses - dividend payment

Where EBIT is the earnings before interest and taxes.

Consistent with Richardson (2006), I define free cash flow (FCF) as cash flow beyond what is necessary to maintain assets in place (I_{MAINT}) and to finance optimal new investments (I^*_{New}). Total investment (I_{TOTAL}) is calculated as the sum of capital expenditure (CapEx), acquisition expenditure (ACQ) and research and development expenditure (R&D), and then subtracts receipts from the sale of property, plant and equipment (Sale PPE). However, not all companies have R&D and ACQ every year, I assume them equal to zero if the firm has not reported the R&D and ACQ in its annual report. According to Strong and Meyer (1990) total investment can be decomposed into two components that are investment expense to maintain assets in place (I_{MAINT}) and investment cost on the new project (I_{NEW}). In this study, I_{MAINT} is equal to firms' depreciation and amortization expenditures. Meanwhile, investment expenditure on new investment projects (I_{NEW}) can be seen as the sum of expected investment expenditure in new positive NPV project (I^*_{New}) and abnormal investment (I^{ε}_{New}). The NPV of the abnormal investment can be either positive or negative. Positive value corresponds to overinvestment, while negative value corresponds to underinvestment. The relation among those components is specified in the following equations:

$I_{TOTAL,t}$ = CapEx $_t$ + ACQ $_t$ + RD $_t$ - Sale PPE $_t$ (1)

$I_{MAINT,t}$ = Depreciation & Amortization $_t$ (2)

$I_{NEW,t} = I_{TOTAL,t} - I_{MAINT,t}$ (3)

$I_{NEW,t} = I^*_{New,t} + I^{\varepsilon}_{New,t}$ (4)

CF $_{AIP,\,t}$ = CFO - $I_{MAINT,t}$ (5)

FCF $_t$ = CF $_{AIP,\,t}$ - $I^*_{New,t}$ (6)

Where CF $_{AIP}$ is the cash flow generated from assets in place; CFO is the cash flow from operating activity.

4.3 Regression models

4.3.1 Internally generated cash flow and investment model

This study uses the multiple linear regression model to explain the nature and significance of the relationship between the changes in the dependent variable (investment expenditure) and change in the explanatory variable (internally generated cash flow) as well as other control variables (leverage, interest coverage, current ratio, dividend, firm size, economic growth, and inflation rate). By applying Equation 1 in section 4.2, this study computes firms' total investment (I_{TOTAL}). Next step is to measure internally generated cash flow (CF). According to Lewellen and Lewellen (2016), a company's CF can be measured by adding back the depreciation expenditures to earnings after interest, taxes, and dividend payments.

To examine the first hypothesis (H_{1a}) whether there is a positive relationship between firm level investment and internally generated cash flow, I run the following regression:

$$I_{TOTAL,i,t} = \alpha + \beta_1 CF_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 TIE_{i,t-1} + \beta_4 CUR_{i,t-1} + \beta_5 DPR_{i,t-1} + \beta_6 SIZE_{i,t-1} + \beta_7 GDP_{i,t-1} + \beta_8 INF_{i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon \quad (1)$$

Where α is the constant; i represent the cross-section (company) and t indicate the time period (FY 2004 - FY 2018); β_1 to β_8 are the coefficients for chosen independent and control variables; $\varepsilon_{i,t}$ is the error term. I_{TOTAL} and CF variables in Regression 1 are scaled by average total assets.

The null hypothesis (H_0) for Regression 1 declares that there is no relationship between the firm's total investment and its internally generated cash flow, which would suggest the coefficient for β_1 equals zero (H_0: $\beta_1 = 0$). The alternative hypothesis (H_{1a}) declares that there is a positive association between a company's CF and investment activities, which would recommend a positive value of the coefficient for β_1 (H_{1a}: $\beta_1 > 0$). Based on previous studies (Alti, 2003; Chowdhury et al., 2016; Moyen, 2004; Vogt, 1997), I expect a significant and positive relationship between investment and internally generated cash flow.

However, enterprises especially those at the growth stage may have negative CF. Several

studies such as Allayannis and Mozumdar (2004), Almeida and Campello (2010), Gracia and Mira (2014), and Hovakimian (2009) documented strong evidence that firms' investing decisions depend on both positive and negative CF. Therefore, I further examine the investment in firms with positive or negative cash flows. The regression model is:

$$I_{TOTAL,i,t} = \alpha + \beta_1 CF_{i,t-1} > 0 + \beta_2 CF_{i,t-1} < 0 + \beta_3 LEV_{i,t-1} + \beta_4 TIE_{i,t-1} + \beta_5 CUR_{i,t-1} + \beta_6 DPR_{i,t-1} + \beta_7 SIZE_{i,t-1} + \beta_8 GDP_{i,t-1} + \beta_9 INF_{i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon \quad (2)$$

Where CF > 0 (CF < 0) is equal to CF if the value is great (less) than zero and zero otherwise.

Regression 2 is used to test the H_{1a} and H_{1b}. If both the coefficient β_1 and β_2 in Regression 2 equal zero (H_0: $\beta_1 = \beta_2 = 0$), I can accept the null hypothesis. Namely, a firm's investment activity does not relate to its internally generated cash flow. If $\beta_1 > 0$, I cannot reject the H_{1a} that companies' investing decisions positively associated with CFs. If $\beta_2 < 0$, I can then accept the H_{1b} that companies' investing decisions may negatively associated with negative CFs.

In this study, I employ seven control variables to capture the effect of financial constraints and macroeconomics on firms' investment. The first set of five financial constraints variables include leverage (LEV), interest coverage ratio (TIE), current ratio (CUR), dividend pay-out ratio (DPR), and firm size (SIZE). According to Hubbard (1998), the lower financial constraint a company has, the higher the firm investment. Thus, I expect reduced LEV, TIE, CUR, DPR, and SIZE would increase the investment expenditure since more cash amount available for spending at the discretion of manager. In this study, LEV is measured as the book value of total debt deflated by the book value of total asset. TIE is divided a firm's earnings before interest and taxes (EBIT) by its interest expenditures for the same period. Both LEV and TIE are used to assess the ability of a company to meet its financial obligations. CUR is a basic metric of liquidity, which measures current assets as a percentage of current liabilities. DPR is calculated as dividend as a percentage of earnings, is a critical factor of dividend policy. SIZE is the natural logarithm (ln) of total assets measured at the start of the year.

The second set of two macroeconomic factors include Gross Domestic Product (GDP) and Inflation Rate (INF). Where GDP represents the economic growth, which is calculated as a rate of increase in the gross domestic product of a given economy, and INF indicates the proportion change in the consumer price index (CPI) of a given time. Firms' investment decision strongly relates to the economic cycle (Islam & Mozumdar, 2007). Theoretically, an increase in GDP and INF will cause an increase in investment (Amir et al., 2012). However, if low inflation is due to a decrease in demand and economic growth, it will not boost investment (Orsua et al., 2011).

Moreover, year and firm dummy variables are used to control for time and firm effects which may affect the outcomes. Year indicator is a vector of indicator variables to capture annual fixed effects, while firm indicator is a vector of indicator variables to capture industry fixed effects. There are 15 year-periods and 63 companies in this regression model.

4.3.2 The investment expenditure model

Before examining the relationship between firm level overinvestment and free cash flow, I first forecast the expenses of the company's expected new investment and abnormal investment using the investment expectation model established by Richardson in 2006. The regression model for predicting expected investments and overinvestments is expressed as:

$$I_{New,i,t} = \alpha + \beta_1 Growth_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 CASH_{i,t-1} + \beta_4 AGE_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_6 STOCK\ RETURNS_{i,t-1} + \beta_7 I_{\mathrm{New},i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon \quad (3)$$

Following Richardson (2006), I apply V/P as a measure of growth opportunities in the model for expected new investment and expect a negative association between V/P and firms' investment. Prevalent constructs for growth opportunities are book-to-market of equity (BM), earnings-to-price (EP) and Tobin's Q (Lewellen & Lewellen, 2014; Vogt, 1994). However, use BM or EP along as a measure of growth opportunities could lead to

an incorrect result, since firms' earnings cannot represent complete persistence between years (Dechow, Hutton & Sloan, 1999). Thus, BM and EP are insufficient statistics for growth opportunities when used separately. In line with Richardson's (2006) method, I will measure companies' fundamental value using the residual income framework, which is originally developed by Ohlson (1995). Specifically, I calculate the value of assets in place (V_{AIP}) based on the book value of equity and the current value of earnings. V_{AIP} is predicted as:

$$V_{AIP} = (1 - \alpha \times r)\, BV + \alpha\,(1 + r)\, X - \alpha \times r \times d$$

Where $\alpha = \omega / (1 + r - \omega)$; r is discount rate; ω is the fixed abnormal earnings persistence parameter from the Ohlson (1995) framework; BV represents the book value of common equity; d indicates annual dividends; and X is operating income after depreciation.

Following Richardson's approach, I use the same discount rate (r = 4.62%) in the calculation of V_{AIP} for each firm every year. As this study focuses on the New Zealand listed companies, I cannot resort to use the earning persistence parament (ω) of 0.62 that Richardson applies based on data for U.S firms. I, therefore, compute ω based on net earnings, the book value of equity and the cost of equity for the firms in my data sample based on the NZ market. I specify the ω by running a pool regression on the abnormal return on earnings for the current period against the abnormal return on earnings for the previous period. The regression expressed as:

$$\text{Abnormal return}_t = \alpha + \omega \times \text{abnormal return}_{t-1} + \varepsilon$$

Where abnormal earnings are equal to the difference between net earnings and the required return on equity that the firm's cost of capital demands. The resulting coefficient (0.196) from the regression (ω) is then used as my measure for earning persistence in the calculation of V_{AIP} for each individual firm year.

The remaining explanatory variables includes leverage, cash balance, firm age, firm size, previous stock return and prior new investment expenditure. First, financial constraint factors such as leverage, firm size, and firm age, have a significant impact on firm investment (Hubbard, 1998). Because financially constrained companies are considered to have a weaker financial condition, they will have greater difficulty to extend their

investments (Love, 2003; Richardson, 2006; Soumays, 2012). Namely, a young and small firm with higher leverage would have a lower investment level. By including these financial constraints variables as control variables in the regression, I can monitor the financial constraint effect on firms' investment decision. I measured leverage (LEV) as the ratio of the book value of total debt to the book value of total asset; firm age (AGE) as the ln of the number of years the firm has been listed on the stock market; and firm size (SIZE) as the ln of total assets measured at the start of the year. Second, corporate's fixed assets can also influence its investment activities positively (Richardson, 2006; Soumays, 2012). Thus, I adopt companies' cash balance (CASH) as a control variable in Regression 3. It is calculated as the balance of cash and short-term investments deflated by total assets measured at the start of the year. Third, firms' past performance has a considerable positive effect on their investment behaviors (Richardson, 2006; Soumays, 2012). Stock returns and investment expenditures for the previous investment year are then selected as control factors to measure the growth opportunity. In addition, year and firm dummy variables are applied to control fixed effects in this regression. There are 15 annual and 63 firm indicator variables in Regression 3.

4.3.3 Free cash flow and over-investment

By applying investment model (Richardson, 2006), I forecast the over-investment expenditure ($I^{\varepsilon}{}_{NEW}$) which is the residual from Regression 3 in section 4.3.2. Next step is to compute free cash flow (FCF) use Equation 5 in section 4.2. Finally, the study adopts Richardson's regression model to establish the relationship between FCF and over-investment ($I^{\varepsilon}{}_{New}$) at the firm level. By using the same methodology as Richardson (2006), the regression model used to examine the second hypothesis is portrayed below:

$$I^{\varepsilon}{}_{New,t} = \alpha + \delta_1 FCF < 0_t + \delta_2 FCF > 0_t + \varepsilon \quad (4)$$

Where FCF < 0 (FCF > 0) is equal to FCF if the value of FCF is less (great) than zero and zero otherwise.

This regression model allows me to check the impact of free cash flows on firms' investments asymmetrically for more information. The null hypothesis is that a company's overinvestment does not relate to its free cash flow. It represents as H_0: δ_1 =

$\delta_2 = 0$. The alternative hypothesis suggests that there is a positive relationship between a firm's over-investment and FCF, which would recommend a positive δ_2 value (H_2: $\delta_2 > 0$).

4.3.4 Impact of corporate governance

I further extend the study and explore in nature to identify whether and which governance mechanisms can minimize the over-investment of free cash flow. There are a large set of mechanisms that shareholders/corporate owners can adopt to test firms' management activities. Following Larcker, Richardson, and Tuna's (2007) model, I choose eight governance factors from two general categories: the characteristics of the ownership structure and the board of directors. The data applied to construct these governance measures are collected primarily from the firm's annual reports. Additionally, I involve leverage and firm size as control variables in the regression model, since the governance variables do not contain any financial constraints elements of the firm.

Among the chosen governance variables, the first set of four ownership variables include Largest shareholding D1, Largest shareholding D2, Herfi3, and Insider. To focus on the effects of ownership concentration on the investment-FCF sensitivity, I employ the Largest shareholding D1, Largest shareholding D2, and Herfi3 respectively, to run the regression model (Model I, II, and III). Dummy variable Largest shareholding D1 (Largest shareholding D2) is equal to one if the largest shareholding is less (great) than 25%, and zero otherwise. The ownership concentration variable, Herfi3, is measured as the average of the square of the first three largest shareholders ownership. To measure the impact of insider/manager dominated ownership, I use a dummy variable - Insider. Insider equals one if the largest shareholder is an insider shareholder, and zero otherwise.

The second set of four variables include CEO duality, Board Size, Executive Directors, and Independent Directors, measuring the structures of board. Where CEO duality is a dummy variable, which is equal to one if the CEO also holds the position of the chairman of the board, and zero otherwise. Board Size is the total number of directors on the board. Executive Directors is the percentage of the total number of executive directors to the

total number of directors on the board. Like the U.S firms, NZ companies have a one-tier board system. Specifically, firms' board is composed by both executive and non-executive directors (FMA, 2018). However, not all non-executive directors match the criteria of independent director. Thus, I employ a further control variable - Independent Director. Independent Director is computed as the percentage of the number of independent directors to the total number of directors on the board.

To test the third hypothesis that the effect of corporate governance factors on the overinvestment-FCF relationship, I use the following regressions:

$$I^{\varepsilon}{}_{New,t} = \alpha + \beta_1 FCF_t + \sum \phi_i \text{ Governance Factor}_t + \sum \psi_j \, Governance\ Factors_t * \text{FCF}_t + LEV_t + \text{SIZE}_t + \varepsilon \quad (5)$$

The null hypothesis stats that there is no impact of corporate governance on the overinvestment-FCF sensitivity (H_0: $\psi_j = 0$). The alternative hypothesis is the governance factors quality negatively impact on strength of overinvestment-FCF correlation. Based on prior literature (Jensen & Mecking, 1976; Malmendier & Tate, 2005; Richardson, 2006), I expect a significantly positive relationship between over-investment and free cash flow. Meanwhile, many studies suggest a concentrated and insiders/managers dominated corporate structure will promote the over investing activities (Bates, 2005; Brush et al, 2000; Griffin et al, 2010). Therefore, I assume a negative coefficient estimation ($\psi_j < 0$) for each of the "good" governance factors (such as largest shareholding D2, Herfi3, Board Size, Executive Directors, and Independent directors) and a positive estimate ($\psi_j > 0$) for "bad" factors (Largest shareholding D1, Insider, and CEO duality).

The majority of previous studies only focus on overinvestment. To extend the study, I investigate whether the firm's governance mechanisms are related to the overinvestment of free cash flow by separating the positive value of abnormal investment expenditures from the negative value. In this study, I define listed firms with positive abnormal investment expenses as real over-investment firms, while companies with negative abnormal investment expenses as under-investment firms. Using the absolute value of

abnormal investment expenditures, I apply Regression 5 to examine the impact of the governance factors on the relationship between overinvestment/underinvestment and free cash flow.

$$\left|I^{\varepsilon}{}_{New,t}\right| = \alpha + \beta_1 FCF_t + \sum \phi_i \,\text{Governance Factor}_t + \sum \psi_j \, Governance\ Factors_t * \text{FCF}_t + LEV_t + \text{SIZE}_t + \varepsilon$$

I suppose the corporate governance quality negatively influence the strength of overinvestment-FCF association.

4.4 Sample bias

Not all companies report detailed financial position in their annual report every year. It can cause a bias in my sample since a number of observations have been omitted. As I discussed above, I assumed the expenditures on research and development equals zero if the corporation has not reported these expenses in the annual report. This assumption would impose the bias in my sample. To minimize the bias, I winsorized the original data at the 5% and 95% percentile and use the winsorized data to run regressions. Moreover, I did not involve delisted firms in my sample. The missing data of a significant number of delisted firms make the sample of the population not representative.

4.5 Robustness test

To examine the validity and efficiency of the regression model, this study uses variance inflation factor test and heteroscedasticity test.

4.5.1 Multicollinearity

Multicollinearity is a common issue which exists when there is a linear relationship between one or more of independent variables. If the variables are all influencing each other, the model can create a misleading result in the multiple regression. In this study, I use the Variance Inflation Factors (VIF) test to check whether the regression model is subject to multicollinearity.

4.5.2 Heteroskedasticity

Heteroscedasticity is the other common issue that affects the validity and efficiency of

the regression, especially for regressions with cross-sectional data. Because the sample data of this study is selected across various firms, heteroscedasticity is very likely to happen. Hence, I use the Breusch-Pagan and Whites method to check the heteroscedasticity problem in the sample.

4.6 Tests of significance

For all the regression models, I use adjusted R^2 to examine the explanatory power of the model. Meanwhile, T-test and F-test are used to examine the significance of the relationship between the explanatory and response variable. The t-test is used to measure the individual significance of the estimated independent variables, while F-test are employed to test the overall statistical significance of the models. I examine them at 90%, 95%, and 99% confidence level or 10%, 5%, and 1% significant level. For example, if the P value of the T-Statistics/F-Statistics is less than 5% of the significant level, I can conclude that the explanatory variable/model is significant in explaining the respond variable/relationship at a 95% confidence level.

5.0 Research Finding and Discussion

In this chapter, the study displays data analysis and results to answer whether and how NZ listed companies' cash flow related to their investment activities. The interpretation of descriptive statistics based on the statistical analysis of accounting data, while the interpretation of inferential statistics relied on the regression analysis of panel data.

5.1 Relationship between firms' investment expenditure and internally generated cash flow

5.1.1 Descriptive statistics

To understand the relationship of the investment expenditure in New Zealand listed firms in respect to the internally generated cash flows and a set of control variable (such as leverage ratio, interest coverage ratio, current ratio, dividend payout ratio, firm size, GDP, and inflation ratio), descriptive statistics are yielded and displayed in Table 5.1 for the full sample.

Panel A of Table 5.1 shows the descriptive statistical analysis for the original data. Regarding mean value, all variables represent a positive value except the CF and TIE. It indicates that over the sample period the average firm generates negative internal cash flows which are about 10.68% of the firm's asset bases. According to the first and third quartile, there are 25% of the data are less than -0.51% of firms' asset bases and 75% of the data are larger than 6.9% of firms' asset bases. The second quartile, also called median, shows 50% of CF is smaller than 3.58% of firms' asset bases. Table 5.1 also informs the average firm total investment expenditure is around 24.67% of its asset bases with a standard deviation of 4.33. The change in total investment varies significantly through the sample period from its mean value. The difference between maximum and minimum I_{TOTAL} value is around 137 of firms' asset bases. Similar findings can be discovered in control variables especially the TIE factor.

The skewness/kurtosis tests further test the normality of the data. According to Doane & Seward (2011), skewness considers the extremes of the data set rather than focusing solely

on the average. Therefore, these tests are useful for identify the existence of the outliers that may affect the accuracy of the model. Panel A of Table 5.1 shows the skewness value for each variable is different to zero. The positive skewness value indicates the distribution with a long right tail (I_{TOTAL}, LEV, TIE, CUR, DPR, and INF), while the negative value implies with a long-left tail (CF, SIZE, and GDP). Meantime, the kurtosis test also expresses the distribution for each variable is asymmetric. A greater kurtosis value (Kurtosis > 3) also implies all variables have leptokurtic (peaked) distribution, except the GDP. Additionally, Jarque-Bera (JB) tests notify a very close to zero p-values. All statistic evidence above confirms the dataset for each variable is asymmetrically distributed and outliers could exist in the original data.

Grubbs (1969) suggest that a skewed data with outliers can raise serious problems in statistical analysis. If using skewed data in the model, it will always underestimate skewness risk, which is the increased risk of turning up a data point of high skewness in a skewed distribution, in its predictions (Doane & Seward, 2011; Tabor, 2010). The more skewed the data, the less accurate the model will be. To reduce the effect of possibly spurious outliers, I limit extreme values in the statistical data by winsorizing the original data at the 5th and 95th percentile. Panel B of Table 5.1 reports the descriptive statistics summary for the winsorized data at the 5th and 95th percentile. Compare to the original data the winsorized data has a lower standard deviation, range, and skewness. Thereby, it can help to minimize the outlier bias and provide more accurate regression analysis results.

5.1.2 Diagnostic tests

Before testing the association between internally generated cash flow and firms' investment, I adopt several diagnostic tests, such as correlation test, VIF test and Heteroskedasticity test, to evaluate the efficiency of Regression 1.

In statistics, the multicollinearity issue can increase standard error for the multiple regression model. I use the correlation matrix to illustrate the strength and direction between variables of the study. According to Table 5.2, all the variables weakly associated with each other in either a positive or negative way. Expect the CUR, GDP, and INF

variable, all explanatory variables negatively associated with the dependent variable. A further important diagnostic tool, VIF test, is employed to detect the level of collinearity between these variables. Table 5.3 reveals that the VIF statistic is less than five for each independent variable. It implies the absence of multicollinearity among the explanatory variables, thereby my regression model is efficient.

Furthermore, I use Heteroskedasticity test to diagnose the heteroskedasticity problem of the panel data. Table 5.3 reports the detail of Breusch-Pagan (BP) and Whites tests for heteroskedasticity. The null hypothesis for the heteroskedasticity tests is that all residuals have constant variance (homoscedastic). The result of BP and Whites tests state that I can reject the null hypothesis of homoscedastic because both BP and White tests discover the presence of heteroskedasticity in the sample (Prob F = 0.0000 < 0.01). Hence, I will employ robust standard errors in the regressions to minimize the heteroskedasticity bias.

5.1.3 Inferential statistics

To test hypothesis 1a and 1b, I develop two models (Model I and Model II). Model I employs Regression 1 to explore the relationship between firms' total investment expenditure and internally generated cash flow for the sample. Model II adopts Regression 2 to examines the impact of positive/negative CF on firms' investment. Table 5.4 illustrates that CF variable can explain only 7.69% of the systematic variation in I_{NEW} (Model I). By separating positive CF from negative, the CF variables can determinate more than 13% of the firms' investment variation in the full sample (Model II). Hence, the null hypothesis that is the union of all used regressors has an insignificant effect on the dependent variable can be rejected. Namely, cash flow measures inclusive of the control variables, able to predict firms' investment.

Panel A of Table 5.4 represents the regression analysis for the CF-investment association. Considering CF as the explanatory factor, Model I discovers a significant and positive relationship between firms' CF and investment expenditure. Although, this correlation seems weak as the coefficient estimate equals 0.0304. It implies that a one standard deviation increases in the firm's internally generated cash flow (Std. Dev. = 0.1736)

results in an increase of 6.62% in its total investment expenditure while holding other variables in the model constant. Such result is consistent with recent literature which argued that a firm's internal fund has a weak influence on its investment (Almedia et al, 2010; Erickson & Whited, 2012). Thus, I can accept the H_{1a} that firms' investment has a significant positive relationship with internally generated cash slow.

Further analysis in Model II (see Panel A of Table 5.4) indicates that the total firm investment expenditure positively associates with "CF > 0" and negatively relates to "CF < 0" (at a significance level of 1%). Consistent with the previous study (Vogt, 1997), such results represent that listed firms with positive internally generated cash flow are more likely to spend money on investment projects. Hence, I cannot reject H_{1a}. Meanwhile, the negative beta of "CF < 0" means the firms with negative internally generated cash flow may fund less on investment projects. This finding is consistent with Hovakimian (2009). Consequently, I can accept the H_{1b} that firms' investment has a negative association with negative internally generated cash flow.

Regarding the control variables, both Model I and Model II show that the LEV, SIZE, and GDP have significant impacts on CF-investment relationship, while TIE, CUR, DPR and INF factors do not present any sign of statistical significance. Similar to the findings from previous studies (Alti, 2003; Cleary, 2006; Ilyas, 2014), I discover firms' investment negatively related to leverage and size and positively associated with GDP.

Overall, the outcomes of Regression 1 and 2 support my hypotheses (H_{1a} and H_{1b}). Although the relationship is weak, Model I demonstrates there is a significant positive relationship between internally generated cash flow and firms' total investment especially. Meanwhile, Model II reports that investment has a significant positive relation with internally generated cash flow for companies with positive CFs. In contrast, there is a significant negative association between CF and investment for companies with negative internally generated cash flow.

5.1.4 Robustness tests

To address the concern about the robustness of the primary finding in Model I, I perform an alternative measurement. Model III investigates the strength of the correlation between investment and CF in the subsample, which only contains firms with positive CF value. By minimizing the unsystematically biased caused by negative CF value, Model III discovers a positive link between investment and CF. This finding consistent with the finding in Model I. Overall, the regression results (see Panel B of Table 5.4) support H_{1a} by showing investment expenditure is concentrated in companies with positive internally generated cash flow. [1]

5.2 Investment expectation model

Since the relationship between NZ listed firms' investment and internally generated cash flow proved in section 5.1, I then focus on investigating the overinvestment-FCF sensitivity in New Zealand listed companies between FY 2004 to FY 2018. To comprehend the association between firms' over-investing decisions and free cash flows, I first analyze the investment expenditure and its decomposition.

5.2.1 Descriptive statistics

Table 5.5 displays the descriptive statistical analysis of investment expenditure for 63 New Zealand companies over the 15-year-period. Based on the winsorized data, the average expenses the firm spend on investment activity is around 7.98% of its asset bases in my sample (see Panel B of Table 5.5). It is lower than 13.1% in the previous study (Richardson, 2006). The further analysis of total investment expenses reflects that the capital expenditure contributes (4.99%) to the main component of the firm's investment, followed by research and development cost (1.36%) and acquisition expenditure (1.20%). Moreover, Table 5.5 demonstrates the maintenance cost (I_{MAINT}) and new investment

[1] I also test whether corporate governance can affect the relationship between NZ listed firms' internally generated cash flow (CF) and their investment actives. By adding the governance factors and interaction variables in the regression:

$I_{TOTAL,t} = \alpha + \beta_1 CF_{t-1} + \sum \phi_i \, Governance\ Factors_{t-1} + \sum \psi_j \, Governance\ Factors_{t-1} * FCF_{t-1} + \mathrm{LEV}_{t-1} + \mathrm{SIZE}_{t-1} + \varepsilon$

I find that firms' investment expenses are significant and positively relate to their CF. The strength of the relation between firm investment and internally generated cash flow depends on the quality of corporate governance.

expenditure (I_{NEW}) is about 3.39% and 4.46%, respectively. Namely, there are almost 55.89% of the total investment expense is used to invest new investment projects while 44.11% is spent on maintaining existing assets. Such findings are very similar to Richardson's study, where I_{NEW} occupy 56% of the total investment expenditure and the remaining 44% is I_{MAINT}.

I use the winsorized data in my study because the original data for each variable has a large skewness value (see Panel A of Table 5.5). It means the original data contains outliers which may heavily affect the accuracy and valid of the regression model (Tabor, 2010). To reduce the effect of possibly spurious outliers, I winsorizing the original data at the 5th percentile and the 95th percentile. By limiting extreme values in the original data, I get a more "robust" data set for regression testing.

5.2.2 Inferential statistics

In this study, the investment expenditure is determined by several determinant variables which are firms' growth opportunities, age, size, leverage, cash balance, stock returns, and investment expenditure in the previous year. Following Richardson's approach (Richardson, 2006), I apply five models to analyze the determinants of investment expenditure overs 63 NZ listed firms through FY 2004 - FY 2018. Model I only tests the growth opportunities, while the remaining models extend the series of explanatory variables. Table 5.6 illustrates the regression results for the sample with Huber-White robust standard errors. In order to minimize the outlier bias, I use the winsorized data at the 5th and 95th percentile.

Unlike Richardson (2006), the explanatory power of this study is weak at Model I and Model II. The adjusted R^2 indicates Model I can only explain 0.41% of firms' new investment expenses by using only the firms' growth opportunities. Meantime, Model II, which examines the cross-section and financial period fixed effects, can only interpret 1.55% of the variation in I_{NEW}. By employing more explanatory variables, more than 40% of the investment variation can be interpreted by Model III, IV, and V.

Table 5.6 informs all of my explanatory factors consistent with the predicted sign, which also means my findings keep a line with the result from Richardson (2006). Namely, NZ listed firms' new investment expense could reduce with their firm leverage, firm size, and firm age. In contrast, this type of expenditure could raise with the growth opportunities, prior cash balance, previous stock return, and prior new investment costs. Unlike Richardson (2006), however, this study discovers only LEVERAGE, CASH, SIZE, and $I_{NEW, t-1}$ have a statistically significant effect on companies' new investment expenditures. This suggests that there is a linear relationship between these four determination factors and firm's expenditures on new investment projects. Other factors, such as growth opportunities, firm age and stock return, is more likely have nonlinear relationship with NZ companies' new investment expenditures. Moreover, the coefficient estimates for each variable is smaller than what pointed out in Richardson (2006). It means the relationship between the determination factors and firms' expense on new investment projects is weaker in NZ firms comparing to U.S. companies.

As a price-based factor, V/P probably comprises the likelihood of over-investment. To address the possible bias, I introduce the book-to-market ratio as a substitute for V/P as growth opportunities to retest Model IV. Table 5.6 represents similar results between Model IV and V. Therefore, this study will follow Richardson's approach and use Model IV to forecast companies' investment expenses and free cash flows.

5.3 Relationship between over-investment expenditure and free cash flow

In this study, I use the same definition of free cash flow (FCF) as what is in the previous literature. Namely, the free cash flow is the cash flow that the firm can use after maintaining its existing assets (I_{MAINT}) and financing expected new investment projects (I^*_{NEW}) (Richardson, 2006). Following Richardson's method, I use the investment expenditure Model IV described in section 5.2 to analyze the association between the firm's free cash flow and its over-investment expenses on the New Zealand Stock Market.

5.3.1 Descriptive statistics

Table 5.7 illustrates New Zealand listed firms have lower FCF and over-investment level

on average compared to the United States (Richardson, 2006). Consistent with previous study (Richardson, 2006), I focus on the winsorized data in order to increase the accuracy of the model. In terms of the winsoried data (see panel B of Table 5.7), the mean value of cash flow from operating activities after maintenance investment expenditure (CF_{AIP}) is approximate -1.46% of firms' asset bases. After investing in the expected new investment projects (I^*_{NEW} = 4.54%), the FCF is around -20% on the average firm level, which is far less than -3.6% in Richardson (2006). Furthermore, there is evidence shows the average over-investment on NZ listed firms is a negative value. This result, however, does not necessarily mean NZ companies have a lower impulse to over-investment than U.S. corporations when they hold the same level of positive FCF. A further regression analysis then applies to explore the relationship between FCF and overinvestment (I^{ε}_{NEW}).

5.3.2 Inferential statistics

Overall, the regression results in Table 5.8 recommend that the NZ listed firm with positive/negative FCF experience over-investment on average. Such finding supports H_2 that is a company's free cash flow is positive correlate with its over-investing expenditure.

By running Regression 4, I discover that FCF can explain around 0.15% of the over-investment variation in pooled model and 6.6% in Fama-MacBeth model. Consistent with Richardson (2006), the δ value of FCF > 0 is significant and positive in both pooled (with Huber-White standard error) and Fama-MacBeth regression model. Such finding suggests the over-investment associated with the NZ listed firm with positive FCF. A one standard deviation increases in FCF > 0 can increase NZ firms' expenditures on over-investment projects by 0.56% (pooled model) or 2.08% (Fama-McBeth model).

Unlike Richardson (2006), I find out an insignificant and negative association between FCF < 0 and over-investment. Table 5.8 states δ_1 value equals to -0.0081 in the pooled regression and -0.0835 in the Fama-McBeth annual regression. Comparing to positive free cash flow, negative FCF appears a weak and insignificant impact on companies' overinvestment. Thus, the impact of negative free cash flow on firms' over-investing activities is very limited.

5.3.3 Robustness tests

Several robustness tests are performed to confirm the validity of the finding that firm's over-investment relate to their free cash flow positively.

First of all, I use an alternative growth opportunity factor to investigate the strength of the overinvestment-FCF relationship. As I mentioned in section 5.2, the possibility of over-investment may include in the V/P variable. Therefore, I retest my analysis by applying a price-free growth opportunity to replace V/P. According to the alternative model (investment expenditure model V), the price-free estimation (BM) has a weaker impact on new investment expenditure than VP (see Table 5.6). By adopting the BM variable, I re-estimate the strength of the overinvest-FCF relationship and discover a similar outcome as what is using VP (see Panel A of Table 5.9). Such evidence demonstrates the bias of using price-based measures to identify over-investment is limited. Therefore, the primary finding that FCF positively impacts on firms' over-investment is valid.

To test whether my primary finding is attributable to measurement error, I introduce Richardson's portfolio approach to the study to re-check the relationship between over-investment and FCF. By ranging the full sample into 190 random portfolios, I perform a regression of portfolios' mean over-investment on mean FCF. Panel B of Table 5.9 informs the mean over-investment is positive related to mean positively FCF and negatively associated with negative mean FCF. When I apply a regression of median value, I find a similar result. Such outcomes are similar to the conclusion I draw in section 5.3.2. Hence, I can reject the assumption that the positive correlation between over-investment and positive FCF is contributed by measurement error.

Moreover, the regression model I use in this study is developed by Richardson in 2006. It is a mature model which is adopted by many researchers to explore the FCF-overinvestment relationship (Chen, et al., 2016; Chowdhury, et al., 2016; Huang, et al., 2011). However, Richardson (2006) has not considered the effect of choosing explanatory factors with or without a time lag in his model on the regression results. To address this

concern, I rerun Regression 4 using time-lagged explanatory variables. Panel C of Table 5.9 shows a similar result as my primary finding in the previous section (see Table 5.8). It demonstrates that a time lag impact of explanatory variables is very limited on the regression result, and my primary finding is effective.

5.4 Impact of corporate governance on the overinvest-FCF relationship

Many previous literature studies mentioned that firms' corporate governance has a significant effect on the investment-FCF sensitivity (Griffin et al., 2010; Huang et al., 2011; Khan et al., 2012). Since the over-investment problem discovered in the earlier section (section 5.3), I further extend the study and investigate whether corporate governance can alleviate the over-investment issue that associate with NZ listed firms' free cash flow.

5.4.1 Analyzing the corporate governance impact in full sample

Consistent with my earlier analysis, Table 5.11 reveals that free cash flow is positively correlate with companies' overinvestment. Among the eight corporate governance variables, only Insider, Board Size, and Executive Directors are statistically related to overinvestment (see Table 5.10). As a result, I can conclude that NZ listed firms' over-investment decision could positively associate with their board size and executive directors on the board and negatively link to the insider-dominated ownership.

Regarding the interaction variables between governance factors and free cash flow, almost all coefficients are in the expected direction except the CEO Duality * FCF and Independent Directors * FCF. Among them only the Insider * FCF and Board Size * FCF are statistically significant (see Table 5.10). Such finding expresses firms with inside shareholders dominant governance structure experience higher levels of overinvestment of free cash flow. In contrast, firms with larger board size are less likely to exposed to the overinvestment issue. Although the remained factors are not statistically significant link to the overinvestment-FCF sensitivity, my regression results indicate that firms with concentrated and insider/manager dominated ownership could experience over-investment when they have a higher level of free cash flow. Meantime, the dual CEO and

higher proportion of executive directors on the board can help to mitigate the overinvestment issue when the CEO/executors work closely with the board and align the agency conflict between managers and shareholders. Moreover, control variables leverage and firm size shows a negative coefficient. As a result, firms with higher debt level and small firm size can inhibit over-investment issue.

Overall, similar to previous literature (Jensen & Mecking, 1976; Malmendier & Tate, 2005; Richardson, 2006), I find the evidence that over-investment expenditure is increasing in the "bad" governance factor (Insider * FCF) and decreasing in the "good" governance factor (Board Size * FCF). Thus, I can accept hypothesis 3.

5.4.2 Analyzing the corporate governance impact in subsample

In this section, I extend Richardson's work and investigate the governance impact on both over-investment and under-investment. By separating positive and negative abnormal investment expenditures, I define firms with positive $I^{\varepsilon}{}_{NEW}$ value as over-investment firms and companies with negative $I^{\varepsilon}{}_{NEW}$ value as under-investment companies.

To examine the governance effect on the over/underinvest-FCF relationship, I first test the mean and median difference of FCF and other governance variables. The descriptive statistics results in Table 5.11 suggest the results can be driven by the different governance mechanisms between overinvestment and underinvestment companies because several variables are statistically different between the two sub-samples.

Second, I apply Regression 5 in two subsamples using absolute value of $I^{\varepsilon}{}_{NEW}$. Panel A of Table 5.12 reports the corporate governance impact on the overinvest-FCF association. Similar to the regression results in Table 5.11, there is a positive connection between FCF and over-investment. In respect to the interactional governance control factors, all variables load as expected, beside CEO Duality * FCF. It means dispersed ownership and independent board can help to reduce over-investment. According to Panel A of Table 5.12, corporates' board structures have statistical association with overinvestment of free cash flow in the sub-sample. The regression results point out that a larger and more

independent board appears to reduce firms' overinvesting activities. Namely, the regression results for the subsample of over-investment firms confirm the corporate governance hypothesis. Additionally, the negative correlation between over-investment and Leverage and firm size imply the investment impulse can be inhibited when small firms experience heavy debt burden.

Panel B of Table 5.12 focuses on the underinvestment firms. Consistent with earlier descriptive statistical analysis, the regression results for under-investment firms are different from over-investment firms. Although all governance factors load as expected, nearly half of the interactional variables load as unexpected. According to Panel B of Table 5.12, more governance factors show statistical association with under-investment of free cash flow, compare to the regression result for the subsample of over-investment firms. Among the interaction factors, the ownership factors (Largest Shareholdings D1 * FCF and Largest Shareholdings D2 * FCF), Board Size * FCF and Independent Directors * FCF report significant relationships with under-investment. Considering the agency problems for companies with insider-dominated ownership, it is not surprising that concentrated ownerships and independent board structures are negatively linked to under-investment. Furthermore, a negative coefficient estimate of LEV indicates under-investment reduces when companies need external funding. It may be caused by the strong monitoring system from the bank. Additionally, under-investment issue can reduce with small firm size, because small companies would normally seek opportunities to invest value-added projects. In conclusion, the evidence shows corporate governance factors have a significant impact on firms' underinvestment decision.

5.4.3 Robustness test

By conducting the robustness checks in the division between subsamples, the endogeneity of governance measures, and a time lagged impact on the regression model, I confirm the primary finding that the strength of governance quality has a negative effect on the overinvestment-FCF relationship.

This study employs Richardson's (2006) investment model to calculate the over-

investment expenditure. According to Richardson (2006), the over-investment expenditure defined as the residual from an econometric model of expected investment. As a residual, the measured over-investment has a zero-mean value. It means that if either the overinvestment or the underinvestment plays a dominant role, Richardson's approach is incapable to discern whether the expenditure is used for overinvesting or underinvesting. To address this issue, I repeat the regression analysis using the sorted sample. Firstly, I sort the abnormal investment expenses (residuals from Regression 3). Next, I define the overinvesting companies as the top one-third of the sorted sample, and the underinvesting companies as the bottom one-third of the sample. Then I evaluate the governance impact based on this new dataset. The regression result for the new sub-sample of over-investment firms (see Table 5.13) remains qualitatively the same as what is reported in Table 5.12. In contrast, the result for the subsample of under-investment firms indicates corporate governance factors have an insignificant impact on under-investment since all governance factors and interactive variables report statistically insignificance.

To address the concern about the endogeneity of corporate governance variables, I add the firm and year effects to the regression model shown below:

$$I^{\varepsilon}{}_{New,i,t} = \alpha + \beta_1 FCF_{i,t-1} + \sum \phi_i \text{ Governance Factor}_{i,t-1} + \sum \psi_j \, Governance\ Factors_{i,t-1} *$$
$$\text{FCF}_{i,t-1} + LEV_{i,t-1} + \text{SIZE}_{i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon$$

By using the panel data approach, I apply the above regression and get similar results (see Table 5.14) consistent with the early analysis in Table 5.11. It indicates the reverse causality is not a serious concern, and my findings of governance impact on over-investment are valid.

Additionally, Richardson's model that I use in this study does not consider the impact of a time lag on the regression model. To test whether lagged explanatory variables could affect the findings, I use the lagged explanatory variables to retest the relationship between free cash flow and overinvestment for both the full sample and subsample. The time lagged regression model shown as:

$$I^{\varepsilon}{}_{New,i,t} = \alpha + \beta_1 FCF_{i,t-1} + \sum \phi_i \text{ Governance Factor}_{i,t-1} + \sum \psi_j \, Governance\ Factors_{i,t-1} *$$

$\mathrm{FCF}_{i,t-1} + LEV_{i,t-1} + \mathrm{SIZE}_{i,t-1} + \varepsilon$

I find that the regression model with a time lag (see Table 5.15) reports very similar results as the model without a time lag (see Table 5.10 & 5.12). Namely, choosing explanatory variables with or without a time lag is not a big issue in the regression analysis, and my primary findings are valid.

6. Conclusion

6.1 Conclusion

This study aims to investigate the relationship between free cash flow and investment for New Zealand listed firms. Using a sample of 63 NZ listed firms from FY2004 to FY2018, I first investigate how internally generated cash flow affects firms' investment. Consistent with previous studies (Jensen, 1992; Vogt, 1997), I discover that firms' investment is positively associated with internally generated cash flow. Similar to prior studies (Amir et al., 2012; Atting et al., 2012; Cleary, 2006; Vogt, 1997), I find that higher firms' investments rely on a lower leverage ratio, small firm size or, strong GDP.

Second, I examine whether and how free cash flow influence over-investment on NZ listed firms. I find out companies' overinvestment behaviors are more sensitive to positive free cash flows. Like the previous empirical study on U.S. data (Richardson, 2006), this study provides evidence that firms with higher positive free cash flow are more likely to experience over-investment.

Third, I test whether and how corporate governance mechanisms affect overinvest-FCF relationship for the full sample. The evidence suggests that governance structures, such as outsider-dominated corporate structure and larger board size, appear to alleviate over-investment to free cash flow. Such findings are consistent with the conclusions in Bates (2005), Griffin et al. (2010), and Richardson (2006).

Finally, I further study the governance impact on two subsamples: overinvestment firms and underinvestment firms. I define overinvestment firms are companies with positive abnormal investment expenditures, and underinvestment firms are companies with negative abnormal investment expenditures. I discover that interactional corporate governance factors affect overinvestment and underinvestment differently. For overinvestment companies, the result reveals that Board Size * FCF and Independent Director * FCF can alleviate overinvestment. For underinvestment firms, the regression evidence reports that Largest Shareholdings D1 * FCF, Independent Director * FCF,

Executive Director * FCF can mitigate under-investment, while Board Size * FCF can exacerbate underinvestment. Additionally, leverage ratio and firm size have a negative influence on both overinvestment and underinvestment.

Although there is extensive literature studying the links between firm-level investment and free cash flow, similar literature on New Zealand firms is very limited. This study fills the gap. Another contribution is that I extend Richardson's study. Unlike the previous literature (Richardson, 2006), which focuses mainly on overinvestment, I study both over-investment and under-investment.

6.2 Recommendation

With the recognition that leverage and firm size are a negative impact on overinvestment-FCF sensitivity, this study recommends that companies can consider raising debt and increasing firm size to mitigate agency conflict and therefore to alleviate overinvestment issue. Regarding to the corporate governance impact on overinvestment-FCF sensitivity, this study recommends that a company can alleviate overinvestment issue by extending board size and employing more independent directors on the board. Meanwhile, if the firm faces an underinvestment issue, concentrated ownership, smaller board size, and a higher proportion of independent and executive directors on the board should be considered.

6.3 Limitations and future research

Although there are a few limitations of this research, it provides grounds for further examinations on the investment-FCF relationship in the NZ capital market. First, the sample size could be reassessed. The sample in this study excludes the delisted companies on the NZ capital market. For future studies, I could involve those firms and make the sample of population more representative. Thus, the result from a dynamic panel data model would be more accurate. Moreover, the industry effect could also influence the investment-cash flow relationship. By examining the industry impact, it could provide a more specific study than the current analysis.

Tables

Table 5.1: Descriptive statistics of internally generated cash flow and firm' investment

This table shows the descriptive statistics summary of dependent variable (investment expenditure), independent variable (internally generated cash flow) and various control variables. The sample includes 945 firm-year observations from FY2004 to FY2018.

Panel A: Original data

	I_{TOTAL}	CF	LEV	TIE	CUR	DPR	SIZE	GDP	INF
Mean	0.2467	-0.1068	0.4829	-1204.8	2.8165	0.5826	18.812	0.0268	0.0210
Bottom Quartile	0.0139	-0.0051	0.2725	0.0000	0.8603	0.0000	17.374	0.0197	0.0113
Median	0.0487	0.0358	0.4161	3.7820	1.4200	0.3750	19.112	0.0275	0.0212
Top Quartile	0.1105	0.0690	0.5835	8.3605	2.5250	0.7534	20.592	0.0414	0.0304
Maximum	132.95	12.059	13.864	36302.6	145.60	91.667	22.833	0.0458	0.0423
Minimum	-4.0799	-57.621	0.0000	-1105672	0.0000	-23.250	0.0000	-0.0042	0.0029
Std. Dev.	4.3338	2.0460	0.6227	36302.6	6.7809	3.6113	2.4494	0.0147	0.0110
Skewness	30.433	-24.234	12.876	-30.1234	12.0136	18.2543	-1.0600	-0.6362	0.2494
Kurtosis	932.34	671.77	243.97	916.35	219.52	446.48	6.4758	2.4708	21.140
Jarque-Bera	34152832	17702841	2312573	2312573	1868710	7793809	652.66	74.765	38.919
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Winsorized data (at the 5th and the 95th percentile)

	I_{TOTAL}	CF	LEV	TIE	CUR	DPR	SIZE	GDP	INF
Mean	0.0797	0.0137	0.4452	2.7085	1.9698	0.4244	18.8227	0.0268	0.0209
Bottom Quartile	0.0140	-0.0055	0.2727	0.0000	0.8698	0.0000	17.365	0.0197	0.0113
Median	0.0489	0.0357	0.4161	3.7800	1.4200	0.3727	19.111	0.0275	0.0212
Top Quartile	0.1105	0.0690	0.5833	8.2973	2.5200	0.7534	20.585	0.0414	0.0304
Maximum	0.5274	0.1625	2.5636	10.512	8.8361	1.5898	22.565	0.0458	0.0403
Minimum	-0.0073	-1.0476	0.0331	0.0000	0.1301	-0.1675	11.385	-0.0042	0.0029
Std. Dev.	0.0927	0.1736	0.2691	26.075	1.6849	0.4299	2.2566	0.0147	0.0109
Skewness	1.9741	-2.4599	2.2831	-2.5644	1.6340	0.5492	-0.6028	-0.6359	0.2482
Kurtosis	7.6054	9.3299	16.156	19.195	5.4527	2.1253	2.8070	2.4713	2.1402
Jarque-Bera	1448.9	2530.8	7635.5	11363	657.41	77.632	58.707	74.713	38.812
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

I_{TOTAL} is total expenditure on investment projects. This variable is scaled by average total assets.

CF is the internally generated cash flow. This variable is scaled by average total assets.

LEV is leverage ratio, which is the ratio of total debt to total asset.

TIE is interest coverage ratio, which is EBIT to interest expenses.

CUR is current ratio, which is the ratio of current asset to current liability.

DPR is dividend pay-out ratio, which is the dividend per share to the earning per share.

SIZE is firm size which equals to natural logarithm of total asset.

GDP is economic growth rate.

INF is inflation ratio.

Table 5.2: The correlation matrix

This table reports the correlation among dependent variable (I_{TOTAL}), independent variable (CF) and various control variables (LEV, CUR, DPR, SIZE, and GDP). The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Correlation	I_{TOTAL}	CF	LEV	TIE	CUR	DPR	SIZE	GDP	INF
I_{TOTAL}	1.0000								
CF	-0.0747	1.0000							
LEV	-0.1567	-0.1964	1.0000						
TIE	-0.0794	0.4614	-0.0417	1.0000					
CUR	0.1137	-0.1073	-0.4479	-0.0856	1.0000				
DPR	-0.0639	0.3682	-0.0683	0.2680	-0.1673	1.0000			
SIZE	-0.2259	0.5697	0.0017	0.3163	-0.2611	0.4271	1.0000		
GDP	0.0823	0.0402	-0.0583	0.0542	0.0217	0.0082	-0.0273	1.0000	
INF	0.0330	-0.0140	-0.0032	-0.0441	0.05589	-0.0619	-0.0496	-0.5112	1.0000

I_{TOTAL} is total expenditure on investment projects. This variable is scaled by average total assets.

CF is the internally generated cash flow. This variable is scaled by average total assets.

LEV is leverage ratio, which is the ratio of total debt to total asset.

TIE is interest coverage ratio, which is EBIT to interest expenses.

CUR is current ratio, which is the ratio of current asset to current liability.

DPR is dividend pay-out ratio, which is the dividend per share to the earning per share.

SIZE is firm size which equals to natural logarithm of total asset.

GDP is economic growth rate.

INF is inflation ratio.

Table 5.3: Diagnostic tests

This table shows the multicollinearity and Heteroskedasticity examinations of the dataset that is used to test the relationship between firms' investment and internally generated cash flow. The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Panel A: Variance Inflation Factors Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
CF	0.0005	1.8536	1.8422
LEV	0.0002	5.1210	1.3693
TIE	1.60E-08	1.3114	1.2973
CUR	4.12E-06	3.2956	1.3916
DPR	5.86E-05	2.5495	1.2908
SIZE	2.82E-06	120.68	1.7082
GDP	0.0537	5.9799	1.3757
INF	0.0955	6.3730	1.3741

See earlier tables for definitions of the variables

Panel B: Heteroskedasticity Tests

Heteroskedasticity Test: Breusch-Pagan			
F-statistic	21.53104	Prob. F (8,936)	0.0000
Obs*R-squared	146.8756	Prob. Chi-Square (8)	0.0000
Scaled explained SS	354.2935	Prob. Chi-Square (8)	0.0000

Heteroskedasticity Test: White			
F-statistic	8.047233	Prob. F (44,900)	0.0000
Obs*R-squared	266.8127	Prob. Chi-Square (44)	0.0000
Scaled explained SS	643.6057	Prob. Chi-Square (8)	0.0000

Table 5.4Analysis of internally generated cash flow and firms' investment

This table shows the linear functional relationship between investment expenditure and internally generated cash flow for the full sample and sub-sample. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Panel A: Full sample which contains 945 firm-year observations from FY2004 to FY2018

Variable	Predicted sign	Model			
		I		II	
		Coefficient	t-Statistic	Coefficient	t-Statistic
CF	+	0.0304	(1,94) *		
CF > 0	+			0.5551	(6.72) ***
CF < 0	-			-0.0982	(-3.06) ***
LEV	-	-0.0517	(-4.49) ***	-0.0548	(-4.79) ***
TIE	-	-0.0001	(-0.68)	-0.0003	(-1.28)
CUR	-	-0.0011	(-0.43)	-0.0009	(-0.36)
DPR	-	0.0054	(0.74)	0.0078	(1.10)
SIZE	-	-0.010	(-4.55) ***	-0.0073	(-3.57) ***
GDP	+	0.6377	(2.56) **	0.4576	(1.87) *
INF	+	0.5518	(1.36)	0.5906	(1.49)
Year Dummy		Yes		Yes	
Firm Dummy		Yes		Yes	
Adjusted R^2		0.0769		0.1372	
Observations		945		945	

Panel B: Robustness test to check on the relationship between firms with positive internally generated cash flow and their investment. The sample includes 688 firm-year observations from FY 2004 to FY2018.

Variable	Predicted sign	Model III	
		Coefficient	t-Statistic
CF > 0	+	0.5374	(8.82) ***
LEV	-	-0.0149	(-1.05)
TIE	-	0.0001	(0.73)
CUR	-	-0.0065	(-2.87) ***
DPR	-	0.0159	(2.45) **
SIZE	-	-0.003	(-1.75) *
GDP	+	0.4048	(1.22) **
INF	+	0.4048	(1.22)
Year Dummy		Yes	
Firm Dummy		Yes	
Adjusted R^2		0.1635	
Observations		688	

I_{TOTAL} is total expenditure on investment projects. This variable is scaled by average total assets.

CF is the internally generated cash flow. This variable is scaled by average total assets.

CF < 0 (CF > 0) is equal to CF if the value is less (great) than zero and zero otherwise.

LEV is leverage ratio, which is the ratio of total debt to total asset.

TIE is interest coverage ratio, which is EBIT to interest expenses.

CUR is current ratio, which is the ratio of current asset to current liability.

DPR is dividend pay-out ratio, which is the ratio of dividend per share to earnings per share.

SIZE is firm size which equals to natural logarithm of total asset.

GDP is economic growth rate.

INF is inflation ratio.

Year Dummy is a vector of indicator variables to capture annual fixed effects. There are 15 year-period in this regression.

Firm Dummy is a vector of indicator variables to capture industry fixed effects. There are 63 firms in this regression.

Model I and Model III uses Regression 1:

$$I_{TOTAL,i,t} = \alpha + \beta_1 CF_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 CUR_{i,t-1} + \beta_4 DPR_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_6 GDP_{i,t-1} + \sum Yesr\ Dummy + \sum Firm\ Dummy + \varepsilon$$

Model II uses Regression 2:

$$I_{TOTAL,i,t} = \alpha + \beta_1 CF_{i,t-1} > 0 + \beta_2 CF_{i,t-1} < 0 + \beta_3 LEV_{i,t-1} + \beta_4 CUR_{i,t-1} + \beta_5 DPR_{i,t-1} + \beta_6 SIZE_{i,t-1} + \beta_7 GDP_{i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon$$

The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of t-Statistics.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.5: Descriptive statistics of investment expenditure

This table describes the investment expenditure. All investment expenditure variables are scaled by average total assets. The sample includes 945 firm-year observations from FY2004 to FY2018.

Panel A: original data

	I_{TOTAL}	CAPEX	ACQ	R&D	SALE PPE	I_{MAINT}	I_{NEW}
Mean	0.2469	0.1943	0.0115	0.0535	0.0123	0.0515	0.1955
Median	0.0488	0.0359	0.0000	0.0000	0.0003	0.0244	0.0182
Maximum	132.95	132.95	0.5006	5.0636	0.9207	12.398	120.56
Minimum	-4.0799	-0.0046	-4.1137	0.0000	-8.61E-05	0.0000	-4.0799
Std. Dev.	4.3361	4.3259	0.1435	0.2759	0.0559	0.4073	3.9346
Skewness	30.433	30.682	-25.005	10.258	10.960	29.597	30.389
Observations	945	945	945	945	945	945	945

Panel B: Winsorized data (5th and the 95th percentile) to minimize the outlier bias.

	I_{TOTAL}	CAPEX	ACQ	R&D	SALE PPE	I_{MAINT}	I_{NEW}
Mean	0.0798	0.0499	0.0120	0.0136	0.0067	0.0339	0.0446
Median	0.0489	0.0358	0.0000	0.0000	0.0003	0.0244	0.0181
Maximum	0.5274	0.2067	0.1466	0.3400	0.0758	0.1495	0.4813
Minimum	-0.0073	0.0000	0.0000	0.0000	0.0000	0.0000	-0.1133
Std. Dev.	0.0927	0.0493	0.0301	0.0426	0.0141	0.0364	0.0881
Skewness	1.9741	1.3127	2.6898	4.3887	2.5981	1.4240	1.8943
Observations	945	945	945	945	945	945	945

I_{TOTAL} is total investment expenditure. It is measure as Capital Expenditure (CAPEX) plus Acquisition Expenditure (ACQ) plus Research & Development Expenditure (R&D) less Sale of Property, Plant & Equipment (SALE PPE).

$I_{TOTAL,t} = CAPEX_t + ACQ_t + R\&D_t - SALE\ PPE_t$

I_{MAINT} is investment expenditure that spend to maintain existing asset. In this report, I use the reported depreciation and amortization to represent the value of maintaining investment expenditure.

$I_{MAINT,t}$ = Depreciation & Amortization $_t$

I_{NEW} is investment expenditure on new investment projects. It equals to the difference between I_{TOTAL} and I_{MAINT}.

$I_{NEW,t} = I_{TOTAL,t} - I_{MAINT,t}$

Table 5.6: Analysis of investment expenditure

This table develops an investment expenditure model. The determinates of investment involve the growth opportunities measurement, leverage, firm age, firm size, cash balance, annual fixed effects and firm fixed effects. The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Regression 3:

$$I_{NEW,i,t} = \alpha + \beta_1 Growth_{i,t-1} + \beta_2 LEVERAGE_{i,t-1} + \beta_3 CASH_{i,t-1} + \beta_4 AGE_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_6 STOCK\ RETURNS_{i,t-1} + \beta_7 I_{New,i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon$$

Variable	Predicted sign	Model				
		I	II	III	IV	V
V/P	-	-0.0128			-0.0042	
		(-2.22) **			(-0.93)	
BM	-					-0.0004
						(-0.09)
LEVERAGE	-			-0.0295	-0.0281	-0.0266
				(-3.55) ***	(-3.29) ***	(-3.09) ***
CASH	+			0.0869	0.0869	0.0925
				(2.52) **	(2.47) **	(2.65) ***
AGE	-			-0.0019	0.012	0.0012
				(-0.56)	(0.32)	(0.31)
SIZE	-			-0.0022	-0.0018	-0.0020
				(-1.87) *	(-1.55)	(-1.71) *
SOCK RETURN	+			0.0047	0.0042	0.046
				(0.79)	(0.71)	(0.78)
$I_{NEW, t-1}$	+			0.5520	0.5497	0.5496
				(14.98) ***	(14.88) ***	(14.93) ***
Year Dummy		No	Yes	No	Yes	Yes
Firm Dummy		No	Yes	No	Yes	Yes
Adjusted R^2		0.0041	0.0155	0.4026	0.4042	0.4037

V/P is a measure of growth opportunities. It is calculated as the ratio of the value of the firm (V_{AIP}) and market value of equity. V_{AIP} is estimated as:

$V_{AIP} = (1 - \alpha \times r)\ BV + \alpha\ (1 + r)\ X - \alpha \times r \times d$ where, $\alpha = (\omega / (1 + r - \omega))$

Where r = 4.62% and ω = 0.196. ω is the abnormal earnings persistence parameter from the Ohlson (1995) framework; BV is the book value of common equity; d is annual dividends and; X is operating income after depreciation.

BM is the book to market ratio, which is the ratio of equity book value to equity market value. It is an alternative measure of growth opportunities.

AGE is firm age which is calculated as the natural logarithm of the number of years the firm had been listed by the start of the year.

SIZE is firm size which is calculated as the natural logarithm of total assets measured at the start of the year.

LEVERAGE is measured as the book value of total debt divided by the book value of total assets.

CASH is the balance of cash and short-term investments divided by total assets measured at the start of the year.

STOCK RETRUN is the stock return during the year prior to the investment year. It is measured as the change in market value of the firm over that in prior year.

$I_{NEW, t-1}$ is the new investment expenditure in prior year. It is scaled by average total assets.

Year Dummy is a vector of indicator variables to capture annual fixed effects. There are 15 year-period in Regression 3.

Firm Dummy is a vector of indicator variables to capture industry fixed effects. There are 63 firms in Regression 3.

The t-Statistic is reported in parentheses below the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of the coefficient.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.7: Descriptive statistics of free cash flow and over-investment

This table displays the descriptive statistics summary of free cash flow and overinvestment. The sample includes 945 firm-year observations from FY2004 to FY2018.

Panel A: Original data

	CF_{AIP}	I^{*}_{NEW}	I^{ε}_{NEW}	FCF
Mean	-0.0460	0.0453	-5.79E-18	-0.2429
Median	0.0351	0.0303	-0.0089	-0.0303
Maximum	0.5936	0.3312	0.4638	1.4705
Minimum	-12.8262	-0.0577	-0.2092	-14.5184
Std. Dev.	0.5386	0.0565	0.0679	0.8266
Skewness	-15.8622	2.0375	0.9764	-7.0745
Observations	945	945	945	945

Panel B: Winsorized data (5th and the 95th percentile) to minimize the outlier bias.

	CF_{AIP}	I^{*}_{NEW}	I^{ε}_{NEW}	FCF
Mean	-0.0146	0.0454	-3.80E-18	-0.2008
Median	0.0350	0.0304	-0.0090	-0.0304
Maximum	0.1885	0.3313	0.4637	0.3708
Minimum	-0.9711	-0.0577	-0.2095	-2.5371
Std. Dev.	0.1906	0.0565	0.0679	0.5225
Skewness	-2.5837	2.0343	0.9820	-1.6643
Observations	945	945	945	945

FCF is free cash flow which is the cash flow beyond what is necessary to maintain asset in place and to finance expected new investment. It is calculated as:

$$FCF_{t} = CF_{AIP,t} - I^{*}_{NEW}$$

Where $CF_{AIP,t}$ is the cash flow from operating activities after maintenance investment expenditure. It is calculated as:

$$CF_{AIP,t} = CFO_{t} - I_{MAINT,t}$$

Where CFO is cash flow from operating activities; $I_{MAINT,t}$ is maintenance investment expenditure. In this study I use depreciation and amortization as $I_{MAINT,t}$.

I^{*}_{NEW} is the expected new investment expenditure. It is the fitted value from Model IV of Regression 3.

I^{ε}_{NEW} is the over-investment expenditure. It is the unexplained portion/residual from Regression 3 Model IV.

$$I_{NEW,i,t} = \alpha + \beta_1 V/P_{i,t-1} + \beta_2 LEVERAGE_{i,t-1} + \beta_3 CASH_{i,t-1} + \beta_4 AGE_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_6 STOCK\ RETURNS_{i,t-1} + \beta_7 I_{New,i,t-1} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon$$

All variables are scaled by average total assets.

Table 5.8Analysis of free cash flow and over-investment

This table shows the relationship between free cash flow and over-investment. The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Regression 4: $I^{\varepsilon}_{NEW,t} = \alpha + \delta_1 FCF < 0_t + \delta_2 FCF > 0_{i,t} + \varepsilon$				
Method	α	δ_1	δ_2	Adjusted R^2
Pooled	-0.0049	-0.0081	0.0351	0.0015
	(-1.41)	(-1.24)	(1.92) *	
F-Statistic for test $\delta_1 = \delta_2$				3.8551 **
Fama-MacBeth	-0.0042	-0.0835	0.1303	0.0660
(15 years)	(-2.34)	(-0.80)	(1.73) *	
t-Statistic from annual coefficient estimation for test $\delta_1 = \delta_2$				-1.0710

I^{ε}_{NEW} is the over-investment expenditure. It is the unexplained portion/residual from Regression 3 Model IV.

FCF is free cash flow which is the cash flow beyond what is necessary to maintain asset in place and to finance expected new investment. FCF < 0 (FCF > 0) is equal to FCF for values of FCF less (greater) than zero and zero otherwise.

All variables are scaled by average total assets.

t-Statistics are reported in parentheses underneath coefficient estimates.

The significance is indicated to the right of the coefficient.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

For the pooled regression, t-Statistics is reported based on Huber–White robust standard errors.

For the firm and firm-year group regression (Fama-MacBeth regression), the parameter estimates and are the weighted average (using the square root of the number of observations in each group as the weight) of individual group regression parameters. Test statistics are based on the across group variation in these parameters.

Table 5.9: Robustness tests for over-investment and free cash flow

This table reports the robustness test for overinvestment-FCF relationship. The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Panel A: Alternative measures of growth opportunities

Using investment expenditure Model V (use BM as the measure of growth opportunity) to determine $I^{\varepsilon}{}_{New}$ (residual from Regression 3). Then retest the over-investment-FCF relationship by running Regression 4: $I^{\varepsilon}{}_{New,t} = \alpha + \delta_1 FCF < 0_t + \delta_2 FCF > 0_t + \varepsilon$

Model	α	δ_1	δ_2	Adjusted R^2
Pooled	-0.0053	-0.0085	0.0381	0.0020
	(-1.51)	(-1.32)	(2.08) **	
F-Statistic for test $\delta_1 = \delta_2$				4.4894 **
Fama-MacBeth	-0.0042	-0.0669	0.1303	0.0416
(15 years)	(-2.34)	(-0.80)	(0.73)	
t-Statistic from annual coefficient estimation for test $\delta_1 = \delta_2$				-1.071 *

Panel B: Measurement error in over-investment and FCF

Running regression of portfolios' mean/median over-investment on mean/median free cash flow. The sample covers 190 random portfolios for the financial period 2004-2018.

Model	α	δ_1	δ_2	Adjusted R^2
Mean value regression	-0.0208	-0.0330	0.1514	0.0042
		(-1.10)	(1.69) *	
Median value regression	-0.0022	-0.0035	0.0471	0.0038
		(-0.13)	(1.00)	

Panel C: Using lagged explanatory variables

Using explanatory variables with a time lag. The regression shown as:
$I^{\varepsilon}{}_{New,t} = \alpha + \delta_1 FCF < 0_{t-1} + \delta_2 FCF > 0_{t-1} + \varepsilon$

Model	α	δ_1	δ_2	Adjusted R^2
Pooled	-0.1433	-2.3270	1.3031	0.2541
	(-2.27)	(-2.37) *	(2.53) **	
F-statistic for test $\delta_1 = \delta_2$				7.5241 ***
Fama-MacBeth	-0.1435	-0.3195	0.2492	0.3987
(15 years)	(-7.58)	(-1.11) *	(1.98) *	
T-statistic from annual coefficient estimation for test $\delta_1 = \delta_2$				-3.6734 ***

See earlier tables for definitions of the variables.

t-Statistics are reported in parentheses underneath coefficient estimates.

The significance is indicated to the right of the coefficient.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.10: Analysis of the relationship between governance factors, free cash flow and over-investment for full sample

This table represents the corporation governance impacts influence the relationship between free cash flow and over-investment. The sample includes 945 firm-year observations from FY2004 to FY2018. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

Regression 5:

$I^{\varepsilon}_{New,t} = \alpha + \beta_1 FCF_t + \sum \phi_i \, Governance\ Factors_t + \sum \psi_j \, Governance\ Factors_t * FCF_t + \mathrm{LEV}_t + \mathrm{SIZE}_t + \varepsilon$

Variable	Predict sign	Model					
		I		II		III	
Intercept		-0.0058	(-0.19)	-0.0052	(-0.18)	-0.0057	(-0.19)
FCF	+	0.0454	(1.98) **	0.0430	(1.91) *	0.0395	(1.73) *
Largest Shareholdings D1	+	0.0040	(1.08)				
Largest Shareholdings D2	-			-0.0045	(-1.22)		
Herfi3	-					-0.0039	(-0.38)
Insider	+	-0.0156	(-2.55) **	-0.016	(-2.56) **	-0.0161	(-2.63) ***
CEO Duality	+	0.0017	(0.02)	-7.85E-05	(-0.0008)	-0.0011	(-0.01)
Board Size	-	0.0028	(1.88) *	0.0029	(1.94) *	0.0028	(1.89) *
Executive Directors	-	0.0377	(1.99) **	0.0386	(2.05) *	0.0407	(2.17) **
Independent Directors	-	0.0096	(1.00)	0.0103	(1.09)	0.0104	(1.09)
Largest Shareholdings D1 * FCF	+	0.0077	(0.96)				
Largest Shareholdings D2 * FCF	-			-0.0109	(-1.27)		
Herfi3 * FCF	-					-0.0183	(-0.75)
Insider * FCF	+	0.0367	(3.31) ***	0.0369	(3.32) ***	0.0369	(3.29) ***
CEO Duality * FCF	+	-0.0469	(-0.49)	-0.0503	(-0.54)	-0.0511	(-0.54)
Board Size * FCF	-	-0.0034	(-1.33) *	-0.0024	(-1.07) *	-0.0027	(-1.18) *
Executive Directors * FCF	-	-0.0065	(0.20)	-0.0002	(-0.01)	0.0016	(0.05)
Independent Directors * FCF	-	0.0123	(0.63)	0.0173	(0.84)	0.0173	(0.85)
LEV		-0.0031	(-0.43)	-0.0039	(-0.55)	-0.0028	(-0.39)
SIZE		-0.0016	(-0.97)	-0.0014	(-0.87)	-0.0015	(-0.90)
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.0261		0.0268		0.0253	
Observations		945		945		945	

Largest Shareholdings D1 is a dummy variable which equals one if the largest shareholdings are less than 25%, and zero otherwise.

Largest Shareholdings D2 is a dummy variable which equals one if the largest shareholdings are greater

than 25%, and zero otherwise.
Herfi3 is the ownership concentration variable, which is defined by the average of the square of the 3 largest shareholders ownership.
Insider is a dummy variable which is equal to one if the largest shareholder is an insider shareholder, and zero otherwise.
CEO Duality is a dummy variable which equals one if the CEO and the chairman of the board of directors is the same person, and zero otherwise.
Board Size is the total number of directors on the board
Executive Directors is the proportion of the number of executive directors on the board to the total number of directors on the board.
Independent Directors is the proportion of the number of independent directors on the board to the total number of directors on the board.
LEV is defined as the ratio of total debt to total asset.
SIZE is the firm size which equals to the natural logarithm of total asset.
Fixed Effects control the fixed effects of calendar years and firms.
I use ordinary least squares (OLS) models to estimate the coefficients, and at the same time I take into account the heteroskedasticity of the samples and the multicollinearity of the variables.
The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.
The significance is indicated to the right of t-Statistics.
*** indicates significant at the 1% level.
** indicates significant at the 5% level.
* indicate significant at the 10% level.

Table 5.11: Descriptive statistics between over-investment firms and under-investment firms

This table reports the descriptive statistics of mean and median between overinvestment (Over-inv.) firms and underinvestment (Under-inv.) firms. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias.

	Mean			Median		
	Over-inv.	Under-inv.	t-Statistic	Over-inv.	Under-inv.	Wilcoxon Z
FCF	-0.1791	-0.2165	1.08	0.0246	-0.0639	2.89 ***
Largest Shareholdings D1	0.5733	0.5647	0.26	1.0000	1.0000	0.22
Largest Shareholdings D2	0.4268	0.4353	-0.26	0.0000	0.0000	0.22
Herfi3	0.1505	0.1548	-0.36	0.0689	0.0664	0.04
Insider	0.0657	0.1858	-5.40 ***	0.0000	0.0000	3.07 ***
CEO Duality	0.0076	0.0036	0.82	0.0000	0.0000	0.10
Board Size	6.0934	5.989	1.70	6.0000	6.0000	1.95 *
Executive Directors	0.1135	0.1202	-0.82	0.1250	0.1250	0.62
Independent Directors	0.6398	0.6019	2.69 ***	0.6667	0.6000	2.71 ***
LEV	0.4649	0.4311	1.91 *	0.4389	0.4059	1.41
SIZE	18.9930	18.6998	1.97 **	19.3143	19.0164	2.50 **
Observations	396	549		396	549	

See earlier tables for definitions of the variables.

The significance is indicated to the right of the t-Statistic/Wilcoxon Z.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.12: Analysis of the relationship between governance factors, free cash flow and over-investment for subsample

This table shows the corporation governance impacts influence the relationship between free cash flow and overinvestment/underinvestment. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias. To examine the relationship between governance factors, free cash flow, and overinvestment/underinvestment, I use the absolute value of $I^{\varepsilon}{}_{New,t}$ to run Regression 5:

$$\left|I^{\varepsilon}{}_{New,t}\right| = \alpha + \beta_1 FCF_t + \sum \phi_i \, Governance\ Factors_{\ t} + \sum \psi_j \, Governance\ Factors_{\ t} * FCF_t + \mathrm{LEV}_t + \mathrm{SIZE}_t + \varepsilon$$

Panel A: Relationship between over-investment ($I^{\varepsilon}{}_{NEW} > 0$) and FCF.

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.1919	(6.41)	0.1988	(6.64)	0.1992	(6.53)
FCF	+	0.0037	(0.15)	0.0014	(0.06)	0.0027	(0.11)
Largest Shareholdings D1	+	0.0091	(2.37) **				
Largest Shareholdings D2	-			-0.0092	(-0.67) **		
Herfi3	-					-0.0214	(-1.84) *
Insider	+	-0.0051	(-0.66)	-0.0052	(-0.67)	-0.0069	(-0.88)
CEO Duality	+	-0.0245	(-0.44)	-0.0255	(-0.45)	-0.0301	(0.53)
Board Size	-	0.0047	(2.96) ***	0.0047	(2.99) ***	0.0048	(3.00) ***
Executive Directors	-	0.0276	(1.46)	0.0283	(1.51)	0.0308	(1.64)
Independent Directors	-	0.0073	(0.77)	0.0079	(0.83)	0.0081	(0.85)
Largest Shareholdings D1 * FCF	+	0.0055	(0.79)				
Largest Shareholdings D2 * FCF	-			-0.0063	(-0.84)		
Herfi3 * FCF	-					-0.0337	(-1.40)
Insider * FCF	+	0.0187	(0.58)	0.0189	(0.58)	0.0174	(0.54)
CEO Duality * FCF	+	-0.0388	(-0.68)	-0.0404	(-0.07)	-0.0468	(-0.82)
Board Size * FCF	-	-0.0031	(1.73) *	0.0037	(2.26) **	0.0037	(2.22) **
Executive Directors * FCF	-	-0.0115	(-0.43)	-0.0079	(-0.29)	0.0002	(0.01)
Independent Directors * FCF	-	-0.0243	(-1.72) *	-0.0209	(-1.49)	-0.0192	(-1.37)
LEV		-0.0301	(-4.49) ***	-0.0306	(-4.51) ***	-0.0314	(-4.64) ***
SIZE		-0.0083	(-4.89) ***	-0.0082	(-4.84) ***	-0.0083	(-4.82) ***
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.1959		0.1988		0.1918	
Observations		398		398		398	

Table 5.12 (continued)

Panel B: Relationship between under-investment ($I^{\varepsilon}_{NEW} < 0$) and FCF.

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.0867	(4.40)	0.0981	(5.01)	0.0878	(4.46)
FCF	-	-0.0284	(-1.53)	-0.0249	(-1.15)	-0.0224	(-1.24)
Largest Shareholdings D1	-	-0.0016	(-0.53)				
Largest Shareholdings D2	+			0.0023	(0.76)		
Herfi3	+					0.0071	(0.90)
Insider	-	-0.0057	(-1.20)	-0.0054	(-1.15)	-0.0057	(-1.20)
CEO Duality	-	-0.0219	(-0.25)	-0.0193	(-0.22)	-0.0273	(-0.31)
Board Size	+	0.0002	(0.17)	5.75E-05	(0.05)	0.0002	(0.15)
Executive Directors	+	0.0069	(0.48)	0.0054	(0.37)	0.0051	(0.35)
Independent Directors	+	0.0103	(1.44)	0.0093	(1.29)	0.0097	(1.35)
Largest Shareholdings D1 * FCF	-	-0.0111	(-2.10) **				
Largest Shareholdings D2 * FCF	+			0.0146	(2.53) **		
Herfi3 * FCF	+					0.0212	(1.64)
Insider * FCF	-	-0.0008	(-0.09)	-0.0009	(-0.10)	-0.0001	(-0.01)
CEO Duality * FCF	-	0.0036	(0.03)	0.0087	(0.08)	-0.0015	(-0.01)
Board Size * FCF	+	0.0028	(1.68) *	0.0014	(0.86)	0.0017	(1.03)
Executive Directors * FCF	+	-0.0148	(-0.71)	-0.0228	(-1.10)	-0.0228	(-1.08)
Independent Directors * FCF	+	-0.0104	(-0.87) **	-0.0170	(-1.43)	-0.0169	(-1.41)
LEV		-0.0143	(-2.36) **	-0.0131	(-2.16) **	-0.0132	(-2.19) **
SIZE		-0.0022	(-1.88) *	-0.0025	(-2.22) **	-0.0024	(-2.11) **
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.0542		0.0576		0.0512	
Observations		547		547		547	

See earlier tables for definitions of the variables.

For the effects of ownership concentration on the investment-FCF sensitivity, I employ the Largest shareholding D1, Largest shareholding D2, and Herfi3 respectively, to run the regression model (Model I, II, and III).

I use OLS models to estimate the coefficients, and at the same time I take into account the heteroskedasticity of the samples and the multicollinearity of the variables.

The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of t-Statistics.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.13: Robustness check on the relationship between governance factors, free cash flow and over-investment

This table reports the impact of governance factors on the relationship between free cash flow and over-investment/under-investment, using sorted residual data. I use the winsorized data (at the 5th and the 95th percentile) to minimize the outlier bias. I use the absolute value of $I^{\varepsilon}_{New,t}$ to run Regression 5:

$$\left|I^{\varepsilon}_{New,t}\right| = \alpha + \beta_1 FCF_t + \sum \phi_i \, Governance\ Factors_{\,t} + \sum \psi_j \, Governance\ Factors_{\,t} * FCF_t + \mathrm{LEV}_t + \mathrm{SIZE}_t + \varepsilon$$

Panel A: Relationship between over-investment ($I^{\varepsilon}_{NEW} > 0$) and FCF

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.1699	(5.58)	0.1723	(5.67)	0.1663	(5.49)
FCF	+	0.0168	(0.67)	0.0178	(0.71)	0.0158	(0.67)
Largest Shareholdings D1	+	0.0035	(0.86) *				
Largest Shareholdings D2	-			-0.0036	(-0.87)		
Herfi3	-					-0.0079	(-0.65)
Insider	+	-0.0151	(-0.94) *	-0.0151	(-1.94) *	-0.0158	(-2.04) *
CEO Duality	+	0.0764	(1.19)	0.0758	(1.18)	0.0719	(1.12)
Board Size	-	0.0049	(2.99) ***	0.0049	(3.00) ***	0.0049	(3.02) ***
Executive Directors	-	0.0236	(1.18)	0.0237	(1.18)	0.0237	(1.19)
Independent Directors	-	0.0019	(-0.18)	0.0021	(0.21)	0.0021	(0.20)
Largest Shareholdings D1 * FCF	+	0.0021	(0.31)				
Largest Shareholdings D2 * FCF	-			-0.0026	(-0.34)		
Herfi3 * FCF	-					-0.0295	(-1.19)
Insider * FCF	+	0.0300	(0.94)	0.0302	(0.94)	0.0312	(0.97)
CEO Duality * FCF	+	0.0239	(0.41)	0.0231	(0.39)	0.0176	(0.30)
Board Size * FCF	-	0.0043	(2.45) **	0.0045	(2.80) ***	0.0045	(2.77) ***
Executive Directors * FCF	-	-0.0105	(-0.37)	-0.0097	(-0.33)	-0.0022	(-0.08)
Independent Directors * FCF	-	-0.0259	(-1.87) *	-0.0244	(-1.77) *	-0.0227	(-1.65)
LEV		-0.0269	(-3.71) ***	-0.0269	(-3.71) ***	-0.0272	(-3.74) ***
SIZE		-0.0066	(-3.71) ***	-0.0066	(-3.70) ***	-0.0064	(-3.58) ***
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.1465		0.1466		0.1485	
Observations		315		315		315	

Table 5.13 (continued)

Panel B: Relationship between under-investment ($I^{\varepsilon}_{NEW} < 0$) and FCF

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.0626	(2.85)	0.0644	(2.98)	0.0634	(2.91)
FCF	-	-0.0259	(-1.13)	-0.0239	(-1.06)	-0.0201	(-0.91)
Largest Shareholdings D1	-	-0.0015	(-0.41)				
Largest Shareholdings D2	+			0.0015	(0.41)		
Herfi3	+						
Insider	-	-0.0080	(-1.39)	-0.0079	(-1.39)	-0.0009	(-0.11)
CEO Duality	-	-0.0209	(-0.23)	-0.0187	(-0.74)	-0.0217	(-0.47)
Board Size	+	0.0012	(0.88)	0.0011	(0.82)	0.0011	(0.79)
Executive Directors	+	0.0241	(1.39)	0.0230	(1.34)	0.0223	(1.30)
Independent Directors	+	0.0149	(1.75)	0.0142	(1.67) *	0.0146	(1.71) **
Largest Shareholdings D1 * FCF	-	-0.0057	(-0.93)				
Largest Shareholdings D2 * FCF	+			0.0059	(0.89)		
Herfi3 * FCF	+					0.0071	(0.55)
Insider * FCF	-	0.0044	(0.48)	0.0043	(0.47)	0.0042	(0.46)
CEO Duality * FCF	-	0.0031	(0.02)	0.0085	(0.07)	-0.0012	(-0.01)
Board Size * FCF	+	0.0015	(0.83)	0.0009	(0.48)	0.0010	(0.55)
Executive Directors * FCF	+	0.0118	(0.52)	0.0088	(0.39)	0.0079	(0.35)
Independent Directors * FCF	+	-0.0118	(-0.89)	-0.0147	(-1.13)	-0.0149	(-1.13)
LEV		0.0103	(1.29)	0.0108	(1.47)	0.0103	(1.40)
SIZE		-0.0009	(-0.71)	0.0011	(-0.81) *	-0.0010	(-0.73) *
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.0296		0.0293		0.0281	
Observations		315		315		315	

See earlier tables for definitions of the variables.

For the effects of ownership concentration on the investment-FCF sensitivity, I employ the Largest shareholding D1, Largest shareholding D2, and Herfi3 respectively, to run the regression model (Model I, II, and III).

I use OLS models to estimate the coefficients, and at the same time, I take into account the heteroskedasticity of the samples and the multicollinearity of the variables.

The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of t-Statistics.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.14: Robustness check on the endogeneity of governance factors with panel data approach

This table shows the results of examining the endogeneity of governance factors with panel data approach. I use the winsorized data (at 5th and the 95th percentile) to minimize the outlier bias. The firm and year indexes are added into the model to run following regression:

$$I^{\varepsilon}{}_{New,i,t} = \alpha + \beta_1 FCF_{i,t} + \sum \phi_i \, Governance\ Factors_{i,t} + \sum \psi_j \, Governance\ Factors_{i,t} * FCF_{i,t} + \mathrm{LEV}_{i,t} + \mathrm{SIZE}_{i,t} + \sum Year\ Dummy + \sum Firm\ Dummy + \varepsilon$$

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.1401	(0.06)	0.1481	(2.35)	0.1491	(2.39)
FCF	+	0.0182	(0.50)	0.0192	(0.53)	0.0143	(0.39)
Largest Shareholdings D1	+	0.0063	(1.16)				
Largest Shareholdings D2	-			-0.0075	(-1.39)		
Herfi3	-					-0.0127	(-0.91)
Insider	+	0.0349	(2.56) **	0.0346	(2.56) **	0.0347	(2.57) **
CEO Duality	+	-0.0079	(-0.09)	-0.0114	(-0.14)	-0.0141	(-0.17)
Board Size	-	0.0043	(2.21) **	0.0043	(2.23) **	0.0041	(2.11) **
Executive Directors	-	0.0216	(0.84)	0.0232	(0.89)	0.0242	(0.93)
Independent Directors	-	-0.0002	(-0.01)	0.0001	(0.01)	0.0020	(0.14)
Largest Shareholdings D1 * FCF	+	0.0023	(0.27)				
Largest Shareholdings D2 * FCF	-			-0.0127	(-1.20)		
Herfi3 * FCF	-					-0.0211	(-1.02)
Insider * FCF	+	0.0477	(3.46) ***	0.0478	(3.51) ***	0.0485	(3.54) ***
CEO Duality * FCF	+	-0.0374	(-0.43)	-0.0422	(-0.49)	-0.0439	(-0.51)
Board Size * FCF	-	-0.0033	(-1.20)	-0.0029	(-1.14)	-0.0029	(-1.16)
Executive Directors * FCF	-	-0.0081	(-0.23)	-0.0035	(-0.09)	-0.0031	(-0.09)
Independent Directors * FCF	-	-0.0014	(-0.07)	0.0009	(0.04)	0.0020	(0.09)
LEV		0.0123	(1.09)	0.0125	(-1.10)	0.0132	(1.14)
SIZE		-0.0099	(-2.95)	-0.0100	(-2.99) ***	-0.0101	(-3.06) **
Year Dummy		Yes		Yes		Yes	
Firm Dummy		Yes		Yes		Yes	
Adjusted R^2		0.1146		0.1152		0.1147	
Observations		945		945		945	

See earlier tables for definitions of the variables.

For the effects of ownership concentration on the investment-FCF sensitivity, I employ the Largest shareholding D1, Largest shareholding D2, and Herfi3 respectively, to run the regression model (Model I, II, and III).

I use OLS models to estimate the coefficients, and at the same time, I take into account the heteroskedasticity of the samples and the multicollinearity of the variables.

The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of t-Statistics.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

Table 5.15: Robustness check on the relationship between governance factors, free cash flow and over-investment, using a time-lagged regression model

This table reports the impact of governance factors on the relationship between free cash flow and overinvestment/underinvestment, using a time-lagged regression model. I used the winsorized data (5th and the 95th percentile) to minimize the outlier bias. I use the lagged explanatory variables in the regression:

$$I^{\varepsilon}{}_{New,t} = \alpha + \beta_1 FCF_{t-1} + \sum \phi_i \, Governance\ Factors_{\,t-1} + \sum \psi_j \, Governance\ Factors_{\,t-1} * FCF_{t-1} + \mathrm{LEV}_{t-1} + \mathrm{SIZE}_{t-1} + \varepsilon$$

Panel A: Relationship between FCF and overinvestment for full sample

Variable	Predict sign	Model					
		I		II		III	
Intercept		-0.0032	(-0.09)	-0.0028	(-0.08)	-0.0023	(-0.07)
FCF	+	0.0521	(1.71) *	0.0500	(1.68) *	0.0473	(1.60)
Largest Shareholdings D1	+	0.0037	(0.76)				
Largest Shareholdings D2	-			-0.0042	(-0.86)		
Herfi3	-					-0.0057	(-0.42)
Insider	+	-0.0158	(-1.90) *	-0.0159	(-1.92) *	-0.0163	(-1.97) **
CEO Duality	+	0.0003	(0.003)	-0.0016	(-0.02)	-0.0027	(-0.03)
Board Size	-	0.0035	(1.89) *	0.0036	(1.94) *	0.0035	(1.91) *
Executive Directors	-	0.0508	(2.13) **	0.0516	(2.18) **	0.0531	(2.25) **
Independent Directors	-	0.0109	(0.92)	0.0116	(0.98)	0.0116	(0.98)
Largest Shareholdings D1 * FCF	+	0.0072	(0.83)				
Largest Shareholdings D2 * FCF	-			-0.0103	(-1.09)		
Herfi3 * FCF	-					-0.0223	(-0.93)
Insider * FCF	+	0.0458	(2.71) ***	0.0461	(2.72) ***	0.0460	(2.72) ***
CEO Duality * FCF	+	-0.0479	(-0.49)	-0.0513	(-0.53)	-0.0527	(-0.55)
Board Size * FCF	-	-0.0030	(-1.21)	-0.0021	(-0.91)	-0.0023	(-0.98)
Executive Directors * FCF	-	-0.0024	(-0.50)	-0.0038	(-0.11)	0.0062	(0.18)
Independent Directors * FCF	-	0.0008	(0.04)	0.0056	(0.30)	0.0060	(0.32)
LEV		-0.0066	(-0.72)	-0.0075	(-0.82)	-0.0066	(-0.72)
SIZE		-0.0017	(-0.89)	-0.0016	(-0.82)	-0.0016	(-0.84)
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.0212		0.0217		0.0211	
Observations		945		945		945	

Table 15.5: (continued)

Panel B: Relationship between FCF and overinvestment ($I^{\varepsilon}_{NEW} > 0$) for subsample

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.1899	(6.98)	0.2017	(6.84)	0.2024	(6.72)
FCF	+	0.0033	(0.14)	0.0022	(0.09)	0.0031	(0.13)
Largest Shareholdings D1	+	0.0092	(2.40) **				
Largest Shareholdings D2	-			-0.0092	(-2.37) **		
Herfi3	-					-0.0212	(-1.82) *
Insider	+	-0.0065	(-0.85)	-0.0068	(-0.92)	-0.0083	(-1.12)
CEO Duality	+	-0.0333	(-0.39)	-0.0332	(-0.61)	-0.0371	(0.69)
Board Size	-	0.0048	(3.17) ***	0.0044	(2.77) ***	0.0045	(2.79) ***
Executive Directors	-	0.0270	(1.53)	0.0045	(1.45)	0.0047	(1.51)
Independent Directors	-	0.0082	(0.89)	0.0080	(0.85)	0.0082	(0.87)
Largest Shareholdings D1 * FCF	+	0.0051	(0.85)				
Largest Shareholdings D2 * FCF	-			-0.0064	(-0.86)		
Herfi3 * FCF	-					-0.0337	(-1.43)
Insider * FCF	+	0.0187	(0.58)	0.0189	(0.58)	0.0174	(0.54)
CEO Duality * FCF	+	-0.0453	(-0.71)	-0.0462	(-0.82)	-0.0520	(-0.93)
Board Size * FCF	-	-0.0032	(2.00) *	0.0039	(2.34) **	0.0039	(2.29) **
Executive Directors * FCF	-	-0.0108	(-0.51)	-0.0027	(-0.46)	0.0015	(0.26)
Independent Directors * FCF	-	-0.0249	(-1.81) *	-0.0218	(-1.57)	-0.0195	(-1.41)
LEV		-0.0297	(-4.94) ***	-0.0300	(-4.45) ***	-0.0310	(-4.62) ***
SIZE		-0.0083	(-5.28) ***	-0.0083	(-4.88) ***	-0.0083	(-4.87) ***
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.1959		0.1953		0.1920	
Observations		391		391		391	

Panel C: Relationship between FCF and underinvestment ($I^{\varepsilon}_{NEW} < 0$) for subsample

Variable	Predict sign	Model					
		I		II		III	
Intercept		0.1053	(4.60)	0.1092	(4.81)	0.1061	(4.65)
FCF	-	-0.0329	(-1.51)	-0.0283	(-1.32)	-0.0260	(-1.23)
Largest Shareholdings D1	-	-0.0014	(-0.41)				

Table 15.5: (continued)

Variable	Predict sign	Model					
		I		II		III	
Largest Shareholdings D2	+			0.0022	(0.61)		
Herfi3	+					0.0070	(0.76)
Insider	-	-0.0067	(-1.19)	-0.0065	(-1.15)	-0.0069	(-1.22)
CEO Duality	-	-0.0309	(-0.30)	-0.0300	(-0.29)	-0.0347	(-0.33)
Board Size	+	0.0003	(0.21)	-0.0004	(0.32)	-0.0003	(0.25)
Executive Directors	+	0.0014	(0.52)	0.0012	(0.44)	0.0015	(0.52)
Independent Directors	+	0.0151	(1.82) *	0.0138	(1.67) *	0.0144	(1.74) *
Largest Shareholdings D1 * FCF	-	-0.0126	(-2.01) **				
Largest Shareholdings D2 * FCF	+			0.0152	(2.30) **		
Herfi3 * FCF	+					0.0250	(1.68) *
Insider * FCF	-	-0.0010	(-0.10)	0.0009	(0.08)	0.0010	(0.09)
CEO Duality * FCF	-	-0.0016	(-0.01)	0.0015	(0.01)	-0.0048	(-0.04)
Board Size * FCF	+	0.0026	(1.27)	0.0011	(0.52)	0.0013	(0.67)
Executive Directors * FCF	+	-0.0043	(-0.79)	-0.0057	(-1.05)	-0.0054	(-0.96)
Independent Directors * FCF	+	-0.0048	(-0.34)	-0.0124	(-0.88)	-0.0131	(-0.92)
LEV		-0.0149	(-2.28) **	-0.0128	(-1.93) *	-0.0138	(-2.10) **
SIZE		-0.0031	(-2.35) **	-0.0033	(-2.55) **	-0.0032	(-2.23) **
Fixed Effects		Yes		Yes		Yes	
Adjusted R^2		0.0559		0.0581		0.0536	
Observations		554		554		554	

See earlier tables for definitions of the variables.

For the effects of ownership concentration on the investment-FCF sensitivity, I employ the Largest shareholding D1, Largest shareholding D2, and Herfi3 respectively, to run the regression model (Model I, II, and III).

I use OLS models to estimate the coefficients, and at the same time I take into account the heteroskedasticity of the samples and the multicollinearity of the variables.

The t-Statistic is reported in parentheses beside the regression coefficient based on Huber-White robust standard errors.

The significance is indicated to the right of t-Statistics.

*** indicates significant at the 1% level.

** indicates significant at the 5% level.

* indicate significant at the 10% level.

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Appendix

Appendix 1: Variable definition

Variables	Definitions
Dependent variable	
I_{TOTAL}	Total investment on investment projects. It is measured as Capital Expenditure (CAPEX) plus Acquisition Expenditure (ACQ) plus Research & Development Expenditure (R&D) less Sale of Property, Plant & Equipment (SALE PPE)
I^{ε}_{NEW}	Over-investment expenditure. It is the unexplained portion/residual from Regression 3 Model IV.
Independent variable	
CF	Internally generated cash flow, which equals operating earnings minus interest, taxes, and dividend payment.
FCF	Free cash flow, which is the cash flow beyond what is necessary to maintain asset in place and to finance expected new investment.
Control variable	
LEV	Leverage, which equals to total debt to total assets.
TIE	Interest coverage ratio, which is earning before interest and taxes to interest expenses.
CUR	Current ratio, which is the ratio of current asset to current liability.
DPR	Dividend pay-out ratio, which is the dividend per share to the earning per share.
SIZE	Firm size, which equals to natural logarithm of total asset.
GDP	Economic growth ratio.
INF	Inflation ratio.
V/P	A measure of growth opportunities. It is calculated as the ratio of the value of the firm (V_{AIP}) and market value of equity.
BM	The book to market ratio, which is the ratio of equity book value to equity market value. It is an alternative measure of growth opportunities.
CASH	The balance of cash and short-term investments divided by total assets measured at the start of the year.

AGE	Firm age which is calculated as the natural logarithm of the number of years the firm had been listed by the start of the year.
STOCK RETURN	Stock return during the year prior to the investment year. It is measured as the change in market value of the firm over that in prior year.
GOVERANCE FACTORS	
Largest Shareholdings D1	A dummy variable which equals one if the largest shareholdings are less than 25%, and zero otherwise.
Largest Shareholdings D2	A dummy variable which equals one if the largest shareholdings are greater than 25%, and zero otherwise.
Herfi3	The ownership concentration variable, which is defined by the average of the square of the 3 largest shareholders ownership
Insider	A dummy variable which is equal to one if the largest shareholder is an insider shareholder, and zero otherwise.
CEO Duality	A dummy variable which equals one if the CEO and the chairman of the board of directors is the same person, and zero otherwise.
Board Size	The total number of directors on the board
Executive Directors	The proportion of the number of executive directors on the board to the total number of directors on the board.
Independent Directors	The proportion of the number of independent directors on the board to the total number of directors on the board.

Appendix 2: List of companies involved in the sample

1. Abano Healthcare Group Ltd (ABA NZ)
2. Air New Zealand Ltd (AIR NZ)
3. Allied Farmers Ltd (ALF NZ)
4. Aorere Resources Ltd (AOR NZ)
5. Argosy Property Ltd (ARG NZ)
6. Asset Plus Ltd (APL NZ)
7. Auckland International Airport Ltd (AIA NZ)
8. BLIS Technologies Ltd (BLT NZ)
9. Briscoe Group Ltd (BGP NZ)
10. Cavalier Corp Ltd (CAV NZ)
11. CDL Investments New Zealand Ltd (CDI NZ)
12. Colonial Motor Co Ltd/The (CMO NZ)
13. Comvitas Ltd (CVT NZ)
14. Contact Energy Ltd (CEN NZ)
15. EBOS Group Ltd (EBO NZ)
16. Finzsoft Solutions Ltd (FIN NZ)
17. Fisher & Paykel Healthcare Corp Ltd (FPH NZ)
18. Fletcher Building Ltd (FBU NZ)
19. Foley Family Wines Ltd (FFW NZ)
20. Freightways Ltd (FRE NZ)
21. Future Mobility Solutions Ltd (FMS NZ)
22. Goodman Property Trust (GMT NZ)
23. Green Cross Health Ltd (GXH NZ)
24. Hallenstein Glasson Holdings Ltd (HLG NZ)
25. Infratil Ltd (IFT NZ)
26. Kiwi Property Group Ltd (KPG NZ)
27. Mainfreight Ltd (MFT NZ)
28. Marsden Maritime Holdings Ltd (MMH NZ)
29. Mercer Group Ltd (MGL NZ)

30. Metlifecare Ltd (MET NZ)
31. Millennium & Copthorne Hotels New Zealand Ltd (MCK NZ)
32. New Talisman Gold Mines Ltd (NTL NZ)
33. New Zealand Oil & Gas Ltd (NZO NZ)
34. New Zealand Refining Co Ltd/The (NZR NZ)
35. NZX Ltd (NZX NZ)
36. Pacific Edge Ltd (PEB NZ)
37. PGG Wrightson Ltd (PGW NZ)
38. Plexure Group Ltd (PLX NZ)
39. Port of Tauranga Ltd (POT NZ)
40. Precinct Properties New Zealand Ltd (PCT NZ)
41. Promisia Integrative Ltd (PIL NZ)
42. Property for Industry Ltd (PFI NZ)
43. Restaurant Brands New Zealand Ltd (RBD NZ)
44. Ryman Healthcare Ltd (RYM NZ)
45. Sanford Ltd/NZ (SAN NZ)
46. Scott Technology Ltd (SCT NZ)
47. SeaDragon Ltd (SEA NZ)
48. Seeka Ltd (SEK NZ)
49. Skellerup Holdings Ltd (SKL NZ)
50. SKYCITY Entertainment Group Ltd (SKC NZ)
51. Smartpay Holdings Ltd (SPY NZ)
52. Smiths City Group Ltd (SCY NZ)
53. South Port New Zealand Ltd (SPN NZ)
54. Spark New Zealand Ltd (SPK NZ)
55. Steel & Tube Holdings Ltd (STU NZ)
56. TIL Logistics Group Ltd (TLL NZ)
57. Tourism Holdings Ltd (THL NZ)
58. TOWER Ltd (TWR NZ)
59. TRS Investments Ltd (TRS NZ)
60. Turners Automotive Group Ltd (TRA NZ)

61. Vital Healthcare Property Trust (VHP NZ)
62. Warehouse Group Ltd/The (WHS NZ)
63. Wellington Drive Technologies Ltd (WDT NZ)