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INVESTMENT EFFICIENCY AND COMPENSATION COMMITTEE EXPERTISE

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Abstract

Building upon agency, resource dependence, and group decision making theories, this thesis aims to investigate investment efficiency in the light of compensation committee attributes. With US data from 2003 to 2010, the results of this thesis show that business expertise, which is particularly proxied by CEO experience, and legal expertise are important attributes for compensation committee members if they are to design efficient compensation contracts that encourage CEOs to undertake efficient investment projects. While both CEO and legal expertise are found to enhance investment efficiency, the latter, i.e., legal expertise has a more pronounced effect in mitigating under- and over-investment. Contrary to expectation, accounting/finance expertise appears to exacerbate over-investment. In the presence of business – CEO and legal attributes, however, the effect of accounting/finance expertise is significant to enhance investment efficiency, particularly when the accounting/finance attribute is mixed or joint with the other two types of expertise, although not all regression models used in the study are consistent in predicting this significant effect. Relative to the results reported in the single expertise regressions, mixed and joint expertise amongst compensation committee members are documented to have stronger effects on investment efficiency.

A further analysis that disaggregates the total investment into three components: capital expenditure, acquisition and R&D investment is then undertaken to provide an explanation for the inconsistency in the main regression results. The additional analysis indicates that of the three components of total investment, the effect of the single, mixed and joint expertise of the compensation committee is more pronounced on R&D investments due to the distinct features of this type of investment.

Finally, this thesis does not only complement the existing literature of investment efficiency and executive compensation through the examination of more aligned compensation contracts arranged by compensation committee members with significant attributes, but it also recommends to the market authorities the importance of regulating these attributes as a mandatory requirement for the members of compensation committees in performing their governance function effectively, which has been overlooked in the past.

Keywords: Investment Efficiency, Compensation Committee Expertise, Efficient Compensation Contract

Declaration

I, hereby, certify that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Joa  ndaan

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"The roots of education are bitter, but the fruit is sweet" (Aristotle)

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This thesis is dedicated to the two greatest blessings in my life,

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And in loving memory of my beloved father and father-in-law,

Herbertus J. J. Mangindaan, and Tonasius Manossoh

Table of Contents

List of Tables

List of Appendices

Chapter 1
Introduction

This chapter provides an introduction to a research study examining investment efficiency within the context of compensation committees' attributes[1]. The first section highlights the theoretical background of the issues to be examined. It is followed by a discussion of a motivation and research questions to be addressed. The third section summarises the empirical findings of the thesis. Also, the contribution of the thesis to the extant literature and to regulatory bodies is discussed in the fourth section. Finally, in the last section, the structure of this thesis is presented.

1.1 Background to the Study

Investment decisions in corporations are important to the creation of shareholder wealth and, thus, the examination of investment decisions by executives has been a prominent research area for decades (Datta, Iskandar-Datta, & Raman, 2001; Hubbard, 1998). Under a perfect capital market, the rule for investment decisions is simple and straightforward: firms should and are able to undertake all investment projects with positive net present value. However, in the presence of agency conflicts and information asymmetry, which are the most pervasive and important factors that distort optimal investment allocation (Stein, 2003), executives may act opportunistically to maximise their own utility at the expense of shareholders (Dey, 2008; Eisenhardt, 1989; Jensen & Meckling, 1976)

Self-interested executives may impede optimal investment allocation, leading to investment inefficiency, in the form of over- and under-investment (Biddle, Hilary, & Verdi, 2009; Fama & Jensen, 1983a, 1983b; Jensen, 1986; Jensen & Meckling, 1976; Lambert, 1986; Myers & Majluf, 1984; Pawlina & Renneboog, 2005). Managers may over-invest when they choose a negative present value investment project and proceed

[1] In this study, the words ‘attributes’ and ‘expertise’ are used interchangeably and represent the human capital of compensation committee members developed through academic qualifications and/or professional experience.

with empire-building activities by enlarging their companies beyond the optimal size in order to acquire perks and gain power over more assets (Aggarwal & Samwick, 2006; Blanchard, Lopez-de-Silanes, & Shleifer, 1994; Brancato, 2002; Hart & Moore, 1995 ; Jensen, 1986; Yermack, 2006b). On the other hand, managers may under-invest by opting out of optimal and profitable investment projects due to the high risks associated with those projects (Dey, 2008; Lambert, 1986; Myers & Majluf, 1984; Shavell, 1979). Both types of investment inefficiency ultimately destroy the value of businesses.

Acknowledgement of sub-optimal investment decisions made by executives, as a consequence of agency conflicts, encourages the provision of incentives through managerial compensation contracts to mitigate agency costs and discourage managerial opportunism (Rehnert, 1985)}. Previous studies conclude that more aligned compensation contracts motivate senior executives to extend their efforts and disclose private information to shareholders, thereby reducing agency problems and information asymmetry (e.g. Berhold, 1971; Bizjak, Brickley, & Coles, 1993; Brickley, Coles, & Terry, 1994; Fama & Jensen, 1983b ; Grenadier & Wang, 2005; Heckerman, 1975; Lewellen, Loderer, & Martin, 1987; Ross, 1973; Watts, 1977). A well-designed executive compensation plan is also claimed to provide an alignment of incentives between executives and shareholders in relation to investment decisions, which thus may substantially mitigate under-investment problems by encouraging risk-taking behaviour (Faulkender, Kadyrzhanova, Prabhala, & Senbet, 2010; Gray & Cannella, 1997; Kanagaretnam & Sarkar, 2011). Furthermore, Chang (1993) particularly contends that a certain contractual arrangement of executive compensation may discourage executives to over-spend the firms' free cash flow, hence preventing over-investment. It is also documented that firms with better incentives in their executive compensation programs are found to be less likely to over-invest (Datta, et al., 2001).

Due to agency conflicts and information asymmetry that obstruct shareholders from properly observing managerial efforts and ability, firms are more likely to link executives' pay packages with key performance indicators, such as accounting and market measures, to mitigate misalignment of interests when they have a considerable number of investment opportunities (Bizjak, et al., 1993; Burns & Kedia, 2006; Ittner,

Larcker, & Rajan, 1997; Lambert & Larcker, 1987; Ryan & Wiggins, 2002; Smith Jr & Watts, 1992). Incentive-based compensation, such as equity-based pay, is deemed a direct solution for alleviating conflicts of interest between executives and their shareholders (Bergstresser & Philippon, 2006; Hall & Liebman, 1998; O'Connor, Rafferty, & Sheikh, 2013; Ryan & Wiggins, 2002). Previous literature shows that, when CEOs are granted equity-based pay, they will act in line with shareholder interests, which improves the efficiency of investment decision making and, thus, results in a reduction in over- and under-investment problems (Broussard, Buchenroth, & Pilotte, 2004; Cheng, 2004; Duru, Iyengar, & Thevaranjan, 2002; Ghosh, Moon, & Tandon, 2007; Morgan & Poulsen, 2001; Xian, Chen, & Moldousupova, 2011; Zhang, 2009).

However, providing an efficient compensation contract that maximises the expected utilities of both shareholders and executives is problematic, since the literature on executive compensation also presents evidence on the ineffectiveness of performance-based compensation policies and that managerial opportunism still exists under equity-based compensation contracts (Ashley & Simon, 2004; Bebchuk & Fried, 2005; Bergstresser & Philippon, 2006; Cheng & Warfield, 2005; Dechow & Sloan, 1991; Hall & Liebman, 1998; Jensen & Murphy, 1990; Ryan & Wiggins, 2002; Shen & Zhang, 2013; Yermack, 1995; Yim, 2013). O'Connor et al. (2013), for example, maintain that equity-based compensation may have perverse effects, in which executives may seek to boost the short-term value of their shares and options. Moreover, an excessive focus on current stock price and accounting-based performance evaluations may provide an incentive for executives to make sub-optimal investments and sacrifice long-term profitability for short-term profits (Bizjak, et al., 1993; Dechow & Sloan, 1991; Smith Jr & Watts, 1992).

The inability of an executive compensation contract to prevent the executives from making sub-optimal investment decisions is seen under the managerial power hypothesis as an agency problem symptom and perceived as a product of rent seeking by opportunistic executives (Bebchuk & Fried, 2003; Bebchuk & Fried, 2006; Boyle & Roberts, 2013). Bebchuck and Fried (2003) view executive compensation not only as the instrument to address agency problems, but also as part of the agency problems

itself. They further argue that executive compensation is inefficient, because the compensation setting process is ‘captured’ by the chief executive officers (CEOs), and thus the latter may camouflage the excessive size of their pay by using more complex compensation arrangements. The market regulator, together with the press, has raised a ‘red flag’ over the insufficiency of current compensation contracts to prevent opportunistic executive actions (Donaldson, 2003). The presence of a compensation committee is, therefore, deemed necessary to ensure that the firm’s executive pay policy will not only protect shareholders’ value but also are sufficiently attractive to retain qualified executives in the company (Anderson & Bizjak, 2003; Kumar & Sivaramakrishnan, 2008). In this context, it is necessary that compensation committees provide the correct incentives to executives in designing efficient compensation contracts (Ozerturk, 2005).

Most large firms appoint compensation committees, who are mandated with the authority of evaluating CEO performance and making recommendations relating to executive compensation (Brancato, 2002; Hourihan, 1990; Jensen, Murphy, & Wruck, 2004; Veasey & Wander, 2007). Bebchuk and Fried (2006, p. 8) suggest that compensation arrangements designed by compensation committees provide the motivation for managers to maximise shareholder value, because both parties, who contract at arm’s length, are rational and informed, and thus possess “powerful incentives to avoid inefficient provisions that shrink the pie produced by their contractual arrangements”. As such, compensation committees play a role as an agency institution with the responsibility of enforcing effective compensation contracts (Healy & Palepu, 2001). Given this role, the compensation committee assumes a crucial role in stimulating efficient investment by establishing remuneration contracts that align the interests of shareholders and managers. Therefore, the compensation committee becomes a critical element in a firm’s corporate governance structure (Brancato & Rudnick, 2006). Strong regulatory improvements involving the major reformation of the compensation committee as a shareholder protection mechanism against managerial opportunistic actions reflect the significance of the committee as an agency institution that aligns shareholders and manager interests (Anderson & Bizjak, 2003; Benson,

2006). In the absence of a compensation committee that oversees the arrangement of executive compensation contracts, managers may reward themselves with excessive compensation that ultimately jeopardises shareholder value (Conyon & Peck, 1998; Williamson, 1985).

1.2 Motivation and Research Question

It has been established that appropriately structured executive pay plans provide interest alignment between shareholders and executives (Core, Guay, & Larcker, 2003; Walker, 2010a). For instance, quoting the proxy statements of Apple Inc., the goal of its executive compensation program is:

> *"to attract, motivate and retain a talented, entrepreneurial and creative team of executives who will provide leadership for the Company's success in dynamic and competitive markets. The Company seeks to accomplish this goal in a way that rewards performance and is aligned with its shareholders' long-term interests."* (Apple Inc, 2010)

Therefore, in order to prevent CEOs from acting opportunistically through inefficient investment decisions, firms through their compensation committees try to design compensation contracts that strike the balance between keeping the CEO motivated and appropriately compensated and addressing shareholder interests (Conyon, 2006).

However, the efficiency of CEO compensation contracts are generally not observable (De Angelis & Grinstein, 2015). The determinants of executive compensation are also complex and therefore structuring executive incentives has become an important issue in an enormous body of literature, with no clear and convincing answer to the question, despite the considerable amount of theory and research on the topic (Finkelstein & Hambrick, 1989; Main, O'Reilly, & Wade, 1995; Rehnert, 1985). The design of optimal compensation is difficult as there is no typical compensation plan for an executive, since the efficiency of compensation contracts will vary considerably across firms and industries (Morgan & Poulsen, 2001; Walker, 2010a; Williams, 1998). Morgan and Poulsen (2001) further argue that, even in a world without agency costs, it is challenging to choose benchmarks and methods of compensation appropriately, and thus it will even be more difficult to efficiently reward the executive in the presence of agency problems.

Crocker and Slemrod (2007) demonstrate that, in a hidden action model, in which shareholders can never observe management action of increasing profit, efficient managerial contracts will permit earnings manipulation.

Core, Guay and Larcker (2003, p. 27) define an efficient contract as the "one that maximizes the net expected economic value to shareholders after transaction costs… contracts (that) minimize agency costs." Based on this definition, they argue that efficient compensation contracts at any particular time are a function of various transaction costs, and thus efficient contracts will vary over time, because the contracting arrangements evolve with changes in contracting mechanism. Further, Conyon (2006) explains that improvement in board governance, for example, may result in different patterns of compensation contracts that are desirable for one company but not for another. In addition, Wright, Kroll, and Elenkov (2002, p. 601) argue that more vigilant monitoring by the board "may to a greater extent beneficially impact contractual arrangements, ensuring the stipulation of appropriate incentive agreements while structuring effective control mechanisms." The result of their work shows that active monitoring mechanism by the board may reduce agency cost and control executive opportunistic actions (Wright, et al., 2002). It is suggested that the efficiency of an executive compensation contract is determined by the compensation committee of the board of directors (O'Reilly & Main, 2007). A compensation committee, charged with responsibility for designing efficient executive compensation contracts, serves as an oversight mechanism that aligns the interests of shareholders and management and this ultimately results in investment efficiency. Compensation committees that are not set up to efficiently arrange pay may impose significant agency costs and inefficiencies on firms (Anderson & Bizjak, 2003)

Following from the above, it can be argued that the efficiency of a compensation contract can be reflected in the efficiency of CEOs' investment decisions in their firms. Thus, rather than trying to disentangle the complexity of executive compensation provisions that are considered efficient, this thesis is motivated to take a different approach by capturing the efficiency of compensation contracts from a measurable proxy, i.e. firms' investment efficiency. Since the ability and strength of a compensation

committee depends, to a great extent, on the attributes of its members, this thesis argues that, with the right attributes, compensation committee members will structure efficient compensation contracts that alleviate agency conflicts and information asymmetry, and thus ultimately provide less incentive for executives to act opportunistically, but rather to encourage them to invest efficiently. In support, the Business Roundtable (2007, p. 7) recommends that "a diversity of professional backgrounds is important to the effective functioning of a compensation committee".

While recent rules governing compensation committees have focussed on the necessity for firms to establish such committees, no regulatory requirements have been developed on the attributes of committee members. Unlike the requirement in Section 407 of the Sarbanes–Oxley Act (SOX) of 2002, specifically mandating public firms to include at least one member who is a financial expert on the audit committee, among other requirements (Dhaliwal, Naiker, & Navissi, 2010), various regulatory initiatives governing compensation committees in the United States have only emphasised that directors serving on the compensation committees are to be independent. Although the SEC Proxy Disclosure Enhancement (2009a) demands a disclosure of the qualifications, skills or experience of directors, this requirement is limited to a disclosure of attributes at board level, not at the committee level. Regulatory requirements imposed on the compensation committee, including the most current listing standard, are predominantly concerned with the issue of member independence (Rindova, 1999; SEC, 2012). The lack of regulatory requirements governing compensation committee member expertise is one motivation for this thesis.

Despite the growing literature that has examined how a board's human capital may enhance the directors' effectiveness in performing their agency function (Hermalin & Weisbach, 2003; Hillman & Dalziel, 2003; Hillman, Shropshire, Certo, Dalton, & Dalton, 2008), few studies specifically address the question of what attributes are significant for building a high-quality compensation committee. Under the resource dependence framework, it is argued that a pool of human capital with a distinct mixture of expertise results in competitive advantage (Nicholson & Kiel, 2004; Wright, McMahan, & McWilliams, 1994). Analysis of the right mixture of expertise on

compensation committees that enables them to create a competitive advantage through arranging efficient compensation contracts is yet to be undertaken[2].

Although some anecdotal evidence suggest, and theoretical works note the importance of expertise either at board level or at committee level (e.g. Cunningham, 2010; Gordon, 2005; Grossman, 2004; Karp, Goldstein, & Unger, 2007; Kay & Van Putten, 2007; Lawler III & Boudreau, 2006; Nussbaum, 2008; Reda, 2000), only recently has the importance of board human capital been a subject of empirical research. These empirical studies, nevertheless, are limited to examining expertise at board level (e.g. Kroll, Walters, & Wright, 2008b; Rashid, Fairuz, & Husein, 2010) or attributes of audit committee members (e.g. Defond, Hann, & Hu, 2005a; Dhaliwal, et al., 2010; Krishnain & Visvanathan, 2008). Furthermore, in contrast to research examining audit committee attributes, which concludes that accounting expertise is significant and positively related to financial reporting quality (Krishnain & Visvanathan, 2008), and firms achieve the most positive impact on accrual quality when they have a combination of both accounting- and finance-literate experts on their audit committee (Dhaliwal, et al., 2010), no similar examination has been conducted on compensation committee members. The extant literature concerning effective compensation committees over-emphasises the issue of committee independence in forming an effective compensation committee, but no conclusive results have been achieved (Anderson & Bizjak, 2003; Daily, Johnson, Ellstrand, & Dalton, 1998; Laksmana, 2008; Newman & Mozes, 1999; Vafeas, 2003a). It is, therefore, necessary to understand the human capital aspect of compensation committee members beyond the traditional economic perspective that mainly focuses on the issue of independence.

In the absence of regulated attributes for compensation committee members to perform their governance function, compensation consultants' expertise may, arguably, be

[2] In investigating the effect of compensation committee members' expertise on investment efficiency, following prior study that examines the expertise of audit committee members (Krishnan, Wen, & Zhao, 2011), this thesis does not only focus on the single expertise effect of compensation committees, when compensation committee member(s) hold(s) one type of expertise, on investment efficiency, but also explores the combined expertise effect of the committee members: the mixed expertise (when the committee has two members with a combination of two different single expertise held by each member) and the joint expertise (when one member of the committee hold two types of single expertise).

considered the types of expertise that are appropriate for committee members in order to arrange efficient contracts that induce investment efficiency. Due to their expertise on compensation-related issues and extensive knowledge on different forms of compensation, compensation consultants are frequently engaged to help the compensation committee design executive compensation contracts (Brancato, 2002; Cadman, Carter, & Hillegeist, 2010). Therefore, the expertise of the consultants will best represent the attributes that members of a compensation committee should have to enable them to structure efficient pay packages. This thesis maintains that, by holding similar expertise as compensation consultants, a compensation committee will design efficient compensation contracts that will be reflected in the efficiency of investment decisions made by the CEO.

In addition, although research has addressed the influence of financial reporting quality and accounting quality on investment efficiency (Biddle & Hilary, 2006; Biddle, et al., 2009), no study specifically investigates corporate investment efficiency in the context of a compensation committee's individual and the overall attributes: those mixed and joint attributes, where efficient contracts arranged by the committee mitigate agency conflict and thereby ultimately prevent CEOs from making value-destroying investment decisions. The lack of empirical evidence on corporate investment efficiency in the context of a compensation committee's attributes becomes another motivation of this thesis.

Based on these motivations, the first objective of this thesis is to investigate investment efficiency in the light of a compensation committee's expertise, i.e., to identify important attributes of a compensation committee that enhances a firm's investment efficiency. It is expected that, with proper compensation committee members' expertise, firms will be able to arrange efficient compensation contracts that provide motivation for executives to invest efficiently. This thesis also aims to examine the combined effect of individual expertise on investment efficiency, i.e., whether the mix of and the joint existence of identified attributes of the compensation committee enhance investment efficiency.

The research questions to be addressed in this study are:

RQ1: Does the expertise of compensation committee members enhance investment efficiency?

RQ2: Does the mixed expertises on a compensation committee enhance investment efficiency?

RQ3: Do the joint expertises on a compensation committee enhance investment efficiency?

1.3 Overview of the Main Findings

Using a total of 7,013 firm-year observations listed on the S&P 1500 from 2003 – 2010, this study employs Biddle et al.'s (2009) multivariate regression analysis based on the conditional model (Model 1) and multinomial logistic regression analysis based on the unconditional model (Model 2) in the main analysis. This study also undertakes additional analysis by using a multivariate regression analysis based on the residual model (Model 3) as specified by Chen et al. (2011).

The empirical analysis based on these three models does provide some evidence on the association between compensation committee expertise and investment efficiency. Of the three types of single expertise investigated in this thesis, it is found that business expertise, which is when a compensation committee member has CEO experience, and legal expertise, which is when a compensation committee member holds a law degree or has legal practical experience, are important attributes for compensation committee members if they are to design efficient executive pay packages that prevent executives from investing inefficiently (although, it is important to note that not all models are able to report similar significant estimations). Accounting/finance expertise, which is when a compensation committee member hold an accounting/finance degree or has accounting/finance practical experience, however, does not appear to play an important role in mitigating investment efficiency. In fact, the regression estimations indicate an unexpected outcome, as under- and over-investment is exacerbated in firms with accounting/finance experts on their compensation committee. This confounding effect of

the accounting/finance expertise on investment efficiency is possibly due such experts having overlapping commitments on both the audit and compensation committees. Prior studies indicate that overlapping membership in the audit and compensation committee can result in conflicting interests leading to sub-optimal decisions (Hoitash & Hoitash, 2009; Liao & Hsu, 2013), and thus, compensation committee members with accounting/finance expertise (who may also be members of the audit committee) may not perform their governance function in arranging more aligned CEO compensation contracts leading to sub-optimal investment by the executives.

Some of the adverse effect of accounting/finance expertise, however, is reversed when this expertise is mixed or joint with CEO or legal expertise, and thus underlining the important role of the mix of and joint expertise within compensation committees in encouraging investment efficiency. In fact, stronger results are documented for the role of mixed and joint expertise within the compensation committee in mitigating investment inefficiency compared to the presence of single expertise[3].

In terms of mixed expertise, the results show that firms with mixed CEO and legal experts and mixed CEO and accounting/finance experts on their compensation committees invest more efficiently than firms without such types of mixed expertise. The results are consistent across Model 2 and Model 3, while Model 1 produces insignificant results. In the case of joint expertise, while it is found that both joint CEO and legal expertise and joint legal and accounting/finance expertise significantly mitigate under- and over-investment, under-investment is, unexpectedly, exacerbated in firms with compensation committee members holding joint CEO and accounting/finance expertise. This unexpected outcome highlights that the adverse effect of accounting/finance expertise on investment efficiency may not necessarily be eliminated when the compensation committee members with accounting/finance expertise also hold CEO expertise, unlike when the accounting/finance expert members hold legal expertise. CEO directors may be sympathetic to their fellow CEO and intentionally

[3] As highlighted in the above paragraph, of the three single expertise, only CEO expertise is found to successfully mitigate under-investment (under Model 2 and 3).

inflate a CEO's pay to increase the average CEO compensation in the market for their own benefit, leading to inefficient compensation contracts (Faleye, 2011). This suggests that of the three types of expertise, legal expertise is the most essential expertise for compensation committee members in arranging more aligned compensation contracts that encourage investment efficiency. Litov, Sepe and Whitehead (2014) support this and contend that lawyer-directors help structure compensation that aligns CEO and shareholder interests beyond monitoring.

Despite not all regression models utilised in this study consistently predicting significant results, the findings highlighted above do provide some support to the theoretical argument, built upon resource dependency and group decision making theory (Bainbridge, 2002; Bettenhausen, 1991; Dorff, 2007; Johnson, Schnatterly, & Hill, 2013; Kor & Sundaramurthy, 2009; Murphy & McIntyre, 2007; Nicholson & Kiel, 2004; Pfeffer & Salancik, 1978; Wright, et al., 1994), of the importance of heterogeneity and different mixes of a pool of human capital for compensation committees in performing their governance function to arrange more aligned compensation contracts leading to investment efficiency.

A further investigation on the relationship between compensation committee expertise and the components of total investment, i.e., capital expenditure, acquisitions and research and development (R&D) expenditure, suggest that the inconsistent findings in the main analysis are possibly due to the different effects that compensation committee expertise has on each investment component. From the three types of investment, more pronounced results are generated for the R&D compared to the other two components of investment. The results of the additional analysis show that both CEO and legal expertise are associated with the reduction of under- and over investment in R&D, whereas no similar significant effect is found for capital expenditure or acquisition. Consistent with the main findings, the effect of CEO and legal expertise on R&D investment efficiency also remains significant when these two types of single expertise are mixed or joined together. Under-investment in R&D is mitigated for firms with mixed CEO and accounting/finance expertise and joint legal and accounting/finance expertise and over-investment is reduced for firms with mixed legal and accounting

expertise and joint legal and accounting/finance expertise on compensation committees. These significant findings may be attributable to the distinct features of R&D investment that makes agency conflicts and information asymmetry in this type of investment more severe than capital expenditure or acquisitions (Aboody & Lev, 2000; Lundstrum, 2002); and therefore the effect of the compensation committee in R&D investment is more significant than the other two types of investment.

1.4 Contribution

Building upon agency, resource dependency, and group decision making theories, this thesis complements the existing literature by presenting an alternative analysis of efficient compensation contracts through the identification of important single, mix and joint expertise of the compensation committee members, which allow them to arrange more aligned compensation contracts that induce investment efficiency. Through the investigation of compensation committee expertise that results in efficient compensation contracts, which ultimately induce efficient investment strategies, this thesis offers a contribution by examining efficient compensation contracts in the context of compensation committee expertise.

An extensive amount of executive compensation research has for decades investigated the issue of compensation contracts that optimally address the alignment of shareholders and management interests, but the results are inconclusive. While a number of studies recommend performance-based incentive contracts as efficient compensation contracts to ameliorate the adverse impact of agency conflicts on managerial investment decisions, and thus promote value-increasing investment (e.g. Armstrong, et al., 2010; Bergstresser & Philippon, 2006; Dechow & Sloan, 1991; Hall & Liebman, 1998; Sok-Hyon, et al., 2006), other studies indicate that such contracts are not consistent with optimal contracting and lead to opportunistic actions by management, such as earnings management or reductions in earnings persistence (Ashley & Simon, 2004; Cheng & Warfield, 2005; Yermack, 1995). Therefore, rather than attempting to resolve what an optimal compensation contract is, this study takes a different approach by investigating the efficiency of a compensation contract via the enhancement of investment efficiency

as a result of a more aligned compensation contract arranged by a compensation committee member with significant attributes. From a research design perspective, this thesis is the first study that attempts to proxy efficient compensation contracts with the enhancement of investment efficiency in the light of the expertise of the compensation committee members.

This thesis also contributes to the literature by identifying important attributes for a compensation committee to perform its governance function in designing a compensation contract that aligns the interests of shareholders and executives. Prior studies mainly utilise independence, the number of directorships held, tenure, or a combination of these variables as important attributes for a high quality compensation committee (Anderson & Bizjak, 2003; Daily, et al., 1998; Newman & Mozes, 1999; Sun & Cahan, 2012; Sun, Cahan, & Emanuel, 2009; Vafeas, 2000, 2003b), but fail to provide solid conclusion as to what attributes form an effective compensation committee. This thesis specifically concludes that two attributes of compensation committee, i.e., business, as proxied with CEO experiences, and legal expertise, equip the committee members with the ability to design efficient compensation contracts that align the interests of managers and shareholders, which in turn result in investment efficiency. Confirming the arguments on resource dependency, human capital and group decision making theories, the results of this thesis also complements the existing studies by underlining the significance for incorporating members with various types of expertise on compensation committees.

Furthermore, the results of this thesis provide market authorities with evidence for the potential value of more specific regulation governing compensation committee attributes. Although the importance of compensation committee attributes has been addressed by market authority outside US, with the Canadian Securities Administrators' amendments to its executive compensation disclosure rule by requiring firms to disclose skills and experience of their compensation committee members relevant to their executive compensation responsibilities, the rule does not specify what expertise significant for the committees in for performing their governance function effectively (O'Brien, 2007). In US itself, despite much legislation concerning executive

compensation and compensation committees, the regulation is currently lacking in establishing significant expertise for compensation committees. In fact, the presence of a compensation committee is mandatory only for firms listed on the New York Stock Exchange (NYSE), while other securities exchanges do not impose similar requirements. The existing rules on compensation committees are also limited to demanding independence as a significant attribute for the committee to be able to function effectively and they have overlooked other potential attributes of committee members that enable them to arrange efficient compensation contracts. Therefore, the findings in this thesis contribute to the knowledge of regulators by identifying important types of expertise for compensation committee members to perform their governance functions effectively.

1.5 Thesis Structure

The remaining chapters of this thesis are structured as follows: Chapter 2 presents the regulatory setting; Chapter 3 discusses the theoretical framework and related literature, which is then followed by hypothesis development in Chapter 4; the description of the methodology to test the hypotheses is detailed in Chapter 5; Chapter 6 discusses the results of this thesis; The sensitivity analysis to ensure the robustness of the results is presented in Chapter 7. Chapter 8 concludes the thesis.

Chapter 2
Regulatory Framework

In this chapter, several regulations governing the oversight functions of compensation committee is discussed. As the purpose of this thesis is to examine firms' investment efficiency in the context of a compensation committee members' attributes, the regulations concerning a compensation committee are explained, based on the expectation that the committee members' expertise lead to more aligned executive compensation programs that eventually induce investment efficiency. The first section of this chapter explains the SEC 1992 executive compensation rule. This is followed by a description of NYSE 2003 corporate governance listing standard and SEC 2006 executive compensation and related person disclosure rule in the second and third sections, respectively. In the fourth and fifth sections of this chapter, the SEC 2009 proxy disclosure enhancements, the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act and the SEC 2012 listing standard for compensation committees are detailed. The last section of this chapter summarises the regulations and presents some concluding remarks.

2.1 SEC 1992 Executive Compensation Disclosure Rule

In the midst of controversies and public outcry over sky-rocketing executive remuneration that reached exorbitant levels beginning in the 1990s[4], the SEC approved new executive compensation disclosure rule[5] on 15 October 1992 to improve executive compensation disclosure in proxy statements by making compensation disclosures

[4] In the early 1990s, CEO pay surged from120 to 150 times that of rank and file employees, in comparison to the 1980s ratio of 42 to 1(Stabile, 2002). Further, an annual survey indicated that in 1991 the average CEO earned US$1.8 million and the median for the top 100 executives surveyed was US$4.5 million (Forbes, 1992).

[5] The disclosure rule consists of five main parts: (1) a summary of the compensation table for the CEO and the other four highest-paid officers for the last three pre-proxy years; (2) a series of tables detailing and valuing specific compensation elements, such as stock options, stock appreciation rights (SAR) and long-term incentives; (3) a compensation committee report detailing the committee's compensation philosophy; (4) a performance graph comparing the firm's cumulative total shareholder return with a performance indicator of the overall stock market and either a published industry index or the firm's peer-group; and (5) compensation committee interlocking disclosure.

clearer and more concise and more useful to shareholders (Karmel, 2005; Perry & Zenner, 2000; Ragsdale, 1993; SEC, 1992). One part of the rule that enhances the compensation committee's role is to require that the committee[6] provides a report which sets out the basis for executive compensation decisions by the compensation committee, as well as the link between the compensation paid and the company's performance.

It is believed that the compensation committee report "bring[s] shareholders into the compensation committee or board meeting room and permit them to see and understand the specific decisions made through the eyes of the directors" (Mobley, 2005, p. 120). The SEC (1992) further asserts that the compensation committee report improves the ability of shareholders to assess how well the directors represent their interests, and the committee's rationale for its compensation actions, through the arrangement of efficient executive compensation contracts, which will in turn discourage executive opportunistic actions that jeopardise shareholders' long-term value. Lo (2003) argues that the SEC 1992 disclosure rule enhances corporate governance through the mitigation of contracting friction (e.g., agency costs and information asymmetry), and this results in efficient compensation contracts that eventually induce the adoption of efficient investment strategies by managers.

The SEC 1992 and other rules governing executive compensation[7] imposed during the 1990s strengthened the significance of the oversight role of compensation committees and were considered by the President of the United Shareholders Association to "pave the way for shareholders to take back their companies" (Johnson, 1995, p. 196) through the arrangement of an efficient CEO remuneration plan that eventually encourages executives to create value for shareholders. These rules were expected to substantively

[6] If firms do not have a compensation committee in place, the requirement applies to any other committee performing an equivalent function or to the entire board of directors (SEC, 1992).

[7] This includes the Internal Review Code (IRC) Section 162(m) enacted in August 1993, which denies a firm tax deductibility of non-performance-based compensation paid to the CEO and the other four highest-paid top executives to the extent that the compensation exceeds $1 million, and it categorises compensation as performance-based only if the performance goals are determined by a compensation committee that comprises solely of two or more outside directors, approved by shareholders, and the amount can be calculated objectively from a pre-determined formula (Graham & Wu, 2007; IRS, 1993; Perry & Zenner, 2000).

impact on the firm's behaviour with regards to compensation practices arranged by a compensation committee. This could induce investment efficiency, even if the establishment of compensation committee was to remain voluntary. In addition, the regulation did not govern what attributes were needed by compensation committee members to perform their functions effectively. Rather, the legislation in this period was limited to echoing director independence as an important attribute for committee effectiveness (Ragsdale, 1993).

2.2 NYSE 2003 Corporate Governance Listing Standards

In the late 1990s to the early 2000s, the US corporate world was shaken by financial scandals of high-profile firms due to failures in diligence, ethics and controls (NYSE, 2002), which caused multimillion dollar losses in firm. The scandals intensified public criticism over excessive executive pay, which was regarded by J. Richard Finlay, the chair of Canada's Centre for Corporate and Public Governance, as the "mad-cow disease of American boardrooms" (Brountas, 2004, p. 95). It shook shareholder confidence in board of director accountability in protecting shareholders' interests, including concerns over executive compensation practices by compensation committees, which purportedly awarded excessive CEO pay at the expense of shareholders (Bebchuk & Fried, 2005).

To restore shareholders' confidence in the integrity of the capital markets, the then-SEC Chairman Harvey Pitt requested the NYSE to update its corporate governance listing standards, including the governance of the compensation committee, with the principal aims of improving accountability, integrity and transparency of firms listed on the exchange (NYSE, 2002). The update of the NYSE governance listing standards was believed to enhance checks and balances, and to provide better tools that empowered diligent directors and encouraged excellence, as well as to "allow shareholders to more easily and efficiently monitor the performance of companies and directors in order to reduce instances of lax and unethical behaviour" (NYSE, 2002, p. 1). In its testimony, the Council of Institutional Investors suggests that "strengthening the governance

standards mandated by the NYSE is an important, and necessary, step toward repairing the failure of certain safety nets intended to protect investors" (NYSE, 2002, p. A51).

The NYSE new listing rule[8] regulated the establishment of compensation committees by mandating the formation of committees whose members are totally independent[9], among other requirements[10] (NYSE, 2003). Under this listing rule, the compensation committee's responsibility is to determine and oversee the corporation's executive compensation plans in light of corporate goals and objectives relevant to executive compensation. It is argued that well-structured compensation policies designed by a compensation committee "can foster the right incentives and prevent a short-term focus or a narrow emphasis on particular aspects of the corporation's business" and thus be in line with the overall goal of enhancing enduring shareholder value (The Business Roundtable in NYSE, 2002, p. A43). The Senior Vice President and General Council of Fidelity Management and Research Company, Eric D. Roiter, in his statement commenting on the NYSE governance listing review, indeed notes that the proper alignment of management and shareholders through an efficient compensation program designed by a compensation committee is one key objective of corporate governance (NYSE, 2002) .

Not only did it mandate the presence of an independent compensation committee in its listed firms, the NYSE 2003 rule also required the committee to possess a written

[8] Both NASDAQ and AMEX new listing rules did not mandate the presence of a compensation committee and a compensation committee written charter was also not mandatory. One non-independent compensation committee member is permitted under both rules if the compensation committee is comprised of at least three members, provided that the insider is not a current officer or employee (or family member of an officer or employee) of the company when the board (under exceptional and limited circumstances) determines that it is in the best interests of the compensating company and its shareholders, and the company discloses such a relationship and the reason for the determination in the next annual proxy statement subsequent to the determination (or, if the company does not file a proxy statement, in its Form 10-K or 20-F). Such a director may not serve on the compensation committee for more than two (2) years.

[9] NYSE defines an independent director as one where the director has no material relationship with the listed company directly or as a partner, shareholder or officer of an organization that has a relationship with the company (NYSE, 2003).

[10] These requirements relate to the independence of a majority of board members, separate meetings for board members, the establishment and independence of the nominating committee, audit committee composition, charter and responsibilities, internal audit function, adoption and disclosure of corporate governance guidelines, adoption and disclosure code of business conduct and ethics, CEO certification and Public Reprimand Letter (NYSE, 2003).

charter (NYSE, 2003). Section 303A.05 of the NYSE rule (NYSE, 2003) requires the charter to address the committee's purpose and responsibilities, including reviewing and approving the firm's goals and objectives in relation to CEO compensation. The charter should also detail: the committee members' qualifications; committee member appointment and removal; committee structure and operations (including authority to delegate to subcommittees); and committee reporting to the board.

The fact that NYSE listing rules require the compensation committee charter to detail its members' qualifications sends a clear signal about the significance of the individual expertise of the compensation committee members in relation to the effectiveness of the committee as a whole. Indeed, a diversity of professional backgrounds in compensation committee members has been considered a principle for effective functioning of the committee in structuring more aligned compensation contracts (The Business Roundtable, 2007).

2.3 SEC 2006 Executive Compensation and Related Person Disclosure Rule

Despite constant scrutiny from the Congress, regulators and the financial press, CEO compensation surged almost nine times as high as 1992 levels (Grant & Grant, 2008) and the CEO pay ratio to an average employee reached over 400 to 1 in 2004 compared with a ratio of 42 to 1 in 1982 (Campos, 2007). A major overhaul of legislation governing executive compensation was undertaken by the SEC in response to shareholder and public outrage on numerous controversies over the fiduciary role of directors, particularly compensation committee members, in determining executive compensation[11].

The new disclosure rule on executive compensation and related parties was proposed by the SEC on 26 January 2006 with the main goal of providing investors with a more detailed picture of issues relating to executive compensation and other related parties

[11] One example of this is the 2003 Disney shareholder lawsuit against the board of directors relating to the $140 million severance package rewarded to its former President, Michael Ovits, with the final decision in favour of the defendant, as the board members did not breach their fiduciary roles by hiring Ovits and then firing him (Brossman & Weiss, 2005).

(SEC, 2006a). After generating more than 20,000 comments [12] during a 6-month deliberation period, the rule was adopted on 26 July 2006 (SEC, 2006b). The SEC believes that the 2006 rule 'will clarify executive pay, demystify any financial dealings between executives and the related party transactions and shed new light on the degree of director independence and the quality of corporate governance at public companies' (Cox, 2006, para. 6). The SEC 2006 rule is deemed to provide the tool needed by shareholders to make informed decisions about whether the compensation committee is performing its duty in setting executive pay effectively and addressing the important issue of overcoming conflicts of interest between managers and shareholders in the design of executive compensation (Murphy, 2006).

The 436-page SEC 2006 rule was the first revision on executive compensation disclosure since 1992, with broader and more comprehensive disclosure obligations for US public companies (Dudley, 2007), given these obligations require all elements of executive compensation to be disclosed. As such the rule was deemed to improve disclosure of perquisites, retirement benefits, stock option compensation and future payment to executives in the event of termination or change in control (Cox, 2006). This SEC 2006 disclosure rule replaced the compensation committee report required under the previous SEC rule in 1992, which was considered to be boilerplate and uninformative (Beller, 2004), by the compensation discussion and analysis (CD&A) and a new compensation committee report [13].

[12] The SEC notes that the 2006 rule has generated the most interest during the 72 years of the Commission's history (Cox, 2006).

[13] The CD&A is a principle-based narrative disclosure that provides material information about the firm's objective and policies on executive compensation in plain English without resorting to boilerplate disclosure, and in particular answers the following questions: (1) what are the objectives of the firm's compensation program? (2) what is the compensation program designed to reward? (3) what is each element of compensation; (4) why does the firm chooses to pay each element? (5) how does the company determine the amount (and where applicable, the formula) for each element? (6) how is each compensation element determined and what is the company's decision regarding that element? The new compensation committee report is a brief compensation committee report that is similar to the one required for an audit committee; it requires the compensation committee to disclose whether it has reviewed and discussed the CD&A and, based on this review and discussion, the committee has recommended to the board of directors that the CD&A be included in the company's annual report and, if applicable, in the company's proxy statement, with the name of each committee member, appearing underneath the disclosure. While the CD&A is considered as soliciting material and thus is 'filed' with the SEC, the compensation committee report is deemed 'furnished' rather than 'filed' by the compensation committee (SEC, 2006).

Beller (2004) believes that a significant number of companies and compensation committees would benefit from the new compensation committee reports, since the new CD&A presents a clear perspective into the firm's compensation philosophy and a channel for shareholders to assess whether and how closely pay is linked to performance (Reda, Reifler, & Thatcher, 2008). Reda et al. (2008, p. 3) further remark that "a thoughtfully prepared CD&A is good evidence of a well-functioning compensation committee that takes its work seriously". It is important also to note that the way executive compensation is administered by the compensation committee determines management action in running of a firm (Yermack, 2006a), therefore, well-structured CEO pay will result in well-managed firms that do not over- or under-invest.

In relation to the role of the compensation committee, one significant modification in the 2006 rule concerns changes in corporate governance disclosure. The new rule consolidated the disclosure requirement concerning director independence and related corporate governance under a single disclosure item, which is item 407 of Regulation S-K (SEC, 2006b). Under the new rule, companies should disclose whether their compensation committee has a charter; and if the committee does have a compensation committee charter, the charter should be made available through the firm's website or proxy materials. The rule also seemingly covers matters regarding the description of the procedures and processes for determining executive compensation[14], including the scope and authority of the compensation committee (SEC, 2006b).

Furthermore, the amendment to corporate governance disclosure addresses the role of a compensation consultant in assisting the compensation committee to determine executive compensation. Specifically, the rule requires the company to identify the compensation consultant and disclose any role that the consultant plays in structuring or recommending the amount or form of executive compensation[15] (SEC, 2006). The fact

[14] This disclosure is made apart from the CD&A, with the focus on describing the corporate governance structure of the company in considering and determining executive and director compensation.

[15] The rule also requires a firm to state whether the consultants are engaged by the committee (or equivalent function) or any other persons and describes the nature and scope of the consultants' assignment and the material elements of the instructions or directions given to the consultants with respect to the performance of their duties under the engagement.

that the rule discloses the role of a compensation consultant in assisting the compensation committee to structure efficient executive pay acts as a potential indicator of the need for compensation committee members' to hold similar attributes possessed by the consultants, which will enable the committee to perform its agency function effectively.

The adoption of the SEC 2006 rule enables shareholders to have access to more extensive information in making informed judgments about whether the board, particularly the compensation committee, is fulfilling its fiduciary role in determining appropriate compensation on behalf of shareholders (Nazareth, 2006 in Kohn & Sykes, 2007). The complexity of the executive compensation disclosure requirements in the SEC 2006 rule signals the importance of skills and qualifications of committee members in order to assist them in adhering to rule requirements (Brancato, 2002; Hourihan, 1990; Reda, 2000), an area which has remained unexplored. Moreover, the disclosure requirement for identifying compensation consultants engaged by the committee to structure executive pay, and the more complex role of the compensation committee mandated in this rule, indicates the urgency for committee members to possess certain qualifications that enable them to satisfactorily perform their agency role in arranging an efficient executive compensation plan that prevents executives from distorting firm investment.

2.4 SEC 2009 Proxy Disclosure Enhancements

The SEC proxy disclosure enhancement proposal on 10 July 2009 highlighted the critical issue of directors' qualifications by proposing a disclosure of specific experience, qualifications or skills that qualify a person to serve as a director and committee member (SEC, 2009b). Examples of the types of information to be disclosed under the SEC 2009 rule include: information about a director's or nominee's risk assessment skills and any specific past experience that would be useful to the company; information about a director or nominee's particular area of expertise and why the director or nominee's service as a director would benefit the company at the time at which the relevant filing with the Commission is made; and details of any particular

experience, qualifications, attributes or skills that qualify an individual to be chosen to serve as a member of any committee (SEC, 2009b). The SEC believes that the new disclosure requirement about directors' qualifications, which amends Item 401 of Regulation S-K, assists shareholders to better understand and evaluate whether a particular director addss value to the company (Walter, 2009). This presents a clear view of the importance of directors' expertise for performing their governance role effectively. In regard to the compensation committee, it implies that directors, who serve as compensation committee members, with certain expertise help design executive pay packages that provide alignment between the interests of shareholders and management, which induces efficient investment choices by management.

The final rule of adopted on 16 December 2009[16] was limited to the qualification disclosure of qualifications at board level by requiring disclosure for director and any nominee of that director's particular experience, qualifications, attributes or skills that led the board to conclude that the person should serve as a director of the company. The rule does not require firms to disclose the specific experience, qualifications or skills that qualify a person to serve as a committee member due to the concern that the requirement may necessarily lead to the potential for greater liability, and will make it more difficult for companies to find qualified directors willing to serve in these roles (Phillips, 2009; Sullivan & Cromwell, 2009). Moreover, it will be difficult to put the proposed rule into practice because some companies have implemented term limits for committee memberships and have their members rotated between committees to allow them to gain a broader understanding of the company (Phillips, 2009)

In spite of the above limitation, the SEC 2009 rule initiates the need to discover the types of expertise significant for the compensation committee to satisfactorily play its role as an agency mechanism to design compensation that motivates companies' ethical conduct to act in the best interests of shareholders through undertaking investment

[16] Besides addressing the director qualification issue, the rule also adopted amendments in relation to: compensation policies and practices that present material risks to the company; stock and option awards of executives and directors, and board leadership structure; the board's role in risk oversight; and potential conflicts of interest of compensation consultants who advise companies and their boards of directors.

projects that maximise shareholder value. Indeed, Jensen et al. (2004, p. 22) have highlighted the importance of expertise for effective functioning of a compensation committee and suggest that compensation committee members, who "routinely lack the information, expertise and negotiating skills necessary for hard-nosed contract negotiations with incumbent and incoming executives" may lead to sub-optimal compensation contracts that exacerbate agency problems, thereby causing the executive to behave opportunistically by investing inefficiently, leading to the destruction of the value of the firm.

2.5 The 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act and SEC 2012 Listing Standard for Compensation Committees

The most recent legislation concerning compensation committees as a monitoring mechanism was the passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act, signed into law on 21 July 2010 (Alcock et al., 2010). The Act is the most comprehensive regulation reforming the financial industry since the Great Depression (Sepe, 2010). The objective of the Act is: to promote the financial stability of the United States by improving accountability and transparency in the financial system; to protect the American taxpayer by ending bailouts; to protect consumers from abusive financial services practices; and for other purposes (SEC, 2010).

Although the Act's provisions are mostly applicable to financial institutions, the Act includes significant executive compensation rules regulating the governance of the compensation committee. Under section 952 Subtitle E Title IX, the Act requires that the firm's compensation committee be independent; otherwise firms are prohibited from being listed on any securities exchanges and national securities associations (SEC, 2010)[17]. To satisfy the independence criteria of compensation committee members

[17] Besides regulating the independence of the compensation committee, the law also gives the committee authority to solely retain or obtain the compensation consultant. The compensation committee is obliged under the Act to only retain an independent compensation consultant based on the independence standard identified in the law and is directly responsible for the appointment of the consultant.

required by the Act[18], certain factors are taken into consideration, including: (1) the director's source of compensation (e.g., consulting, advisory or other compensatory fees paid by the company to the director); and (2) whether the director is affiliated with the company or any affiliate or subsidiary of the company (Alcock, et al., 2010).

As a follow-up to the Act, a new disclosure rule, which added Section 10C to the Securities Exchange Act of 1934 that requires the SEC to establish listing standards on the independence of the compensation committee, was proposed (SEC, 2012). After receiving 58 comment submissions that generally lent support to the implementation of the proposed rule, the SEC adopted final rules on the independence of compensation committees and their advisers on 20 June 2012 (Thatcher, 2012). The rules specifically direct the national securities exchanges to issue listing standards regarding the independence of the members of compensation committees and the rights of the compensation committees to hire independent compensation consultants, legal counsel and other advisors (Fields, 2012). The independence requirement for compensation committee members is similar to the independence requirements for audit committee members, but each exchange has flexibility and is permitted to adopt its own independence criteria for compensation committee members, provided that it satisfies factors relating to affiliate relationships and sources of compensation as promulgated in Section 10C(a)(3) of the Securities Exchange Act of 1934 (SEC, 2012; Thatcher, 2012).

The passage of the SEC 2012 rule promulgated under the Act aims at greater shareholder and regulatory oversight of executive compensation, and these are expected to enhance the governance role of the compensation committee in structuring an efficient compensation plan that aligns shareholder and executive interests. Furthermore, the new implemented regulations provide a compensation committee with the ability to fully carry out its functions independently from managers. Nevertheless, the Act and

[18] The independence requirements do not apply to: (1) foreign private issuers that disclose annually to shareholders why they do not have an independent compensation committee; or (2) listed companies of which more than 50 percent of the voting power for the election of directors is held by an individual, group or other company ('Controlled Companies').

SEC rule arguably have overlooked the significance of the compensation committee members' expertise in performing their oversight duty effectively.

In recognition of the importance of compensation committee expertise, following the enactment of the Dodd-Frank Act, the Canadian Securities Administrators (CSA) implemented the amendments for its Form 51-102F6 Statement of Executive Compensation in 2011, which requires the disclosure of the levels of relevant expertise and experience of the compensation committee that enable the committee to make decisions on the suitability of the company's compensation policies and practices that are consistent with a reasonable assessment of the company's risk profile (CSA, 2011). The requirement to include the relevant expertise and experience of the compensation committee is a response to the increasing importance of executive compensation as a societal issue and acknowledges the "complexity of the issues with which compensation committee must deal" (Hugessen Consulting, 2010, p. 4). The complex issue in setting up executive compensation signals the intention of requiring the committee to be composed of members who collectively have the required level of expertise and experience in compensation matters in order to function effectively. These amendments provide investors with enhancement on compensation governance matters that will allow investors to make better informed decisions and help them determine whether management's incentives are aligned with their interests (Rice, 2011). The executive compensation disclosure regarding compensation committee expertise in Canada clearly signals the importance of compensation committee members' competency, which facilitates efficient compensation arrangements that balance the divergent interest of shareholders and management, and ultimately encourage efficient investment decisions by executives. Similar regulation in the US is yet to come.

2.6 Summary and Remarks

Regulations governing compensation committees over the past two decades have significantly changed the oversight function of the committee. The enactment of the SEC 1992 executive compensation disclosure rule requiring a compensation committee to report the basis of its compensation decisions highlights the committee's crucial

responsibility in creating an efficient compensation plan, although the existence of a compensation committee in corporations was not mandated under the rule (SEC, 1992). At the beginning of 21st century, compensation committee establishment became mandatory with the passage of the NYSE 2003 listing rule update. The rule also requires the establishment of a compensation committee charter that outlines the qualifications of compensation committee members (NYSE, 2003). In 2006, the major update of the SEC executive compensation disclosure rule replaced the compensation committee report required under the 1992 rule with the CD&A and new compensation committee report, which further enhances the compensation committee governance role (SEC, 2006). Three years after the SEC 2006 executive compensation disclosure rule was enacted, in 2009 the SEC adopted the proxy statement disclosure enhancement rule. One requirement of this regulation particularly addresses the importance of directors' qualifications to contribute effectively to satisfying board oversight, including the role of the compensation committee in arranging effective compensation policy (SEC, 2009a). The recently enacted 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act and the passage of SEC 2012 rule (as a follow up to the enactment of the Act) strengthens the compensation committee oversight function by further tightening the requirement of directors' independence in serving on the compensation committee.

For over a decade after the enactment of the Sarbanes Oxley Act in 2002, and two decades subsequent to the SEC 1992 executive compensation disclosure rule, regulations governing the organisation of the compensation committee have made the committee more independent than it was 20 years ago (Walker, 2010b). Nevertheless, overemphasising the issue of director independence through various regulatory initiatives in the US may not be sufficient to ensure that the committee will perform its job effectively[19]. The complexity of the executive compensation issue presents a fundamental challenge to compensation committee members and they may need to be more just independent. This thesis attempts to investigate the efficiency of compensation

[19] Some empirical evidence shows little or no correlation, or, indeed, a negative correlation between independence and the performance of the board and firms (Deutsch, 2005; Hsueh-En, 2010; Sanjai & Bernard, 2002; Sanjai & Black, 1999).

contracts through the examination of compensation committee member expertise that enable the committee to arrange efficient compensation contracts that induce investment efficiency.

The disclosure rules governing a compensation committee will greatly improve the shareholders' ability to understand and evaluate how well directors perform their job and will potentially raise the profile of the compensation committee (Johnson & Thamotheram, 2006). Johnson and Thamotheram (2006) further note that, in an environment of continuous scrutiny, an efficient executive compensation will be a good way to establish a better relationship with shareholders. Therefore the key channel to achieve this is to form a strong and knowledgeable compensation committee. The next chapter discusses the theoretical framework and related literature that identifies the gap in the current research.

Chapter 3
Theoretical Framework and Related Literature

This chapter provides the theoretical foundation that identifies the research problems to be addressed in this study. The first section of this chapter provides a theoretical link to how an optimal investment decision is distorted by agency conflicts and information asymmetry. The theoretical concepts on the reconciliation of agency conflicts and information asymmetry through efficient executive compensation contracts, based on the rationale that more aligned contracts designed by the committees provide the motivation for executives to invest efficiently, are presented in the second section. In the third section, the conceptual argument on the importance of compensation committee members' attributes in designing an efficient executive compensation contract is established. The conclusion of this chapter is then presented fourth section.

3.1 Investment, Information Asymmetry, and Agency conflict

Investment is one major determinant of corporate value and therefore an investment decision represents one of the most critical types of decision made the firms (Butler, Davies, Pike, & Sharp, 1993). Total investment in the US in 2013 was 19.5% of annual GDP, accounting for more than $300 trillion, and it is estimated that this figure will rise to above $340 trillion by 2015 (IMF, 2012). This enormous sum indicates that investment is not only important to firms, but is also a significant factor influencing an economy. Chirinko (1993) claims that the pace and pattern of business investments considerably affect economic activity. Given this significant role of investment for both firms and the economy, corporate investment decisions have been an important part of the research agenda for decades.

Early research on investment concludes that firms invest to maximise their market value and will invest up to the point where marginal benefit is equal to marginal cost of capital (Crotty, 1996; Hubbard, 1994). The theory of investment, developed from the notion of perfect capital markets established by Modigliani and Miller (1958), maintains that in a frictionless capital market, the value of a firm depends only on its profit stream, and

therefore, its financing decisions and capital structure are irrelevant. Modigliani and Miller (1958) further suggest that the independence of the firms' investment decisions on its financing activities is based on the assumptions that internal and external funds are perfect substitutes and firms may easily obtain external funds to smooth their investments, implying that financial factors are considered unimportant to firms (Jorgenson, 1963; Jorgenson & Stephenson, 1967). Hence, the rule of an investment decision is simple and straightforward, i.e. firms should and will be able to undertake all investment projects with positive net present values to maximise shareholder wealth.

Nevertheless, in the real world firms do not operate in a perfect capital market. Stein (2003) suggests that there is a variety of distortionary forces that influence firms' investment behaviour. A large body of literature, beginning with a seminal article by Fazzari, Hubbard and Petersen (1988), examines the impact of financial constraints on investment behaviour of firms and suggests that financial factors, such as the availability of cash flow and leverage, indeed affect corporate investment (e.g. Almeida & Campello, 2007; Campbell, Dhaliwal, & Schwartz, 2012; Fazzari, et al., 1988; Gilchrist & Himmelberg, 1995; Lang, Ofek, & Stulz, 1996; Rauh, 2006), and, that financing investment through external funds (equity or debt) is more costly than internal funds (cash) (Campbell, et al., 2012).

Another strand of corporate investment research emphasises the significance of uncertainty and costly reversibility on investment (Dixit & Pindyck, 1994; Lensink & Sterken, 2000). Empirical evidence under this research branch exploits an analogy with the theory of options in financial markets and introduces the real options approach, which creates an alternative view of investment by examining the timing of investment and its effect on incentives to invest (Dixit & Pindyck, 1994; Stockhammer & Grafl, 2010). Specifically, it is suggested that firms may delay their investment decisions until more information about uncertainty in the future is resolved (Abel, 1983; Abel, Dixit, Eberly, & Pindyck, 1996; Gong, Van der Stede, & Mark Young, 2011).

However, among the variety of forces that distort optimal investment policies in capital markets, it can be argued that the most pervasive and significant factors are those that

result from agency problems and information asymmetry (Stein, 2003). Under the lens of agency theory, conflicting interests stem from the separation of ownership and control in corporations, which cause costly and imperfect contracting between executives and shareholders (Berle & Means, 1932; Jensen & Meckling, 1976). This condition motivates executives to act opportunistically in making their investment decisions by pursuing their own benefit as opposed to maximising shareholders' wealth (Fama, 1980; Jensen & Meckling, 1976). Furthermore, due to informational asymmetries, executives, as insiders, have more detailed information regarding corporate investment activities that is inaccessible to shareholders. Shareholders have little information about top managers' actual actions, and whether these executives act congruently with shareholders' interests or not. This is what Jensen and Murphy (1990) referred to as the moral hazard problem. Furthermore, adverse selection also exists, where managers possess more private information than shareholders about their own capabilities and better knowledge on the quality of investment projects (Grenadier & Wang, 2005; Hui & Fei, 2004).

Fama and Jensen (1985) argue that the efficiency of managerial investment decisions is primarily evaluated on the wealth created for the providers of capital, i.e., shareholders. In the presence of agency conflicts and information asymmetry, executives, who are supposed to adopt value maximizing investment projects, have an incentive to deviate from the optimal level of investment and are more likely to expropriate private benefits from their investment decisions (Fama & Jensen, 1983a, 1983b; Jensen, 1986; Jensen & Meckling, 1976; Lambert, 1986; Myers & Majluf, 1984; Pawlina & Renneboog, 2005). This makes it difficult for firms to efficiently allocate their resources to investment projects that maximise firm value and, hence, suffer two types of investment distortion, over-investment and under-investment, which ultimately destroy the value of businesses.

Executives may over-invest by engaging in all investment projects, including those with negative net present values, and grow their firms beyond optimal size (an empire-building tendency) to gain benefits from perks, and pursue power by controlling more assets (Aggarwal & Samwick, 2006; Blanchard, et al., 1994; Hart & Moore, 1995 ;

Jensen, 1986; Stulz, 1990; Yermack, 2006b). Jensen (1986) suggests that self-interested executives, on whom free cash flow is bestowed, will invest in negative net present value projects rather than pay it out to shareholders, leading to over-investment. It is documented that, among positive free cash flow firms, average firms over-invest 20% of their free cash flow (Richardson, 2006). Sheu and Lee (2012) provide evidence on how excess cash is significantly correlated with empire-building through capital expenditure, particularly for financially constrained firms and firms with highly entrenched executives. The authors suggest that, while excess cash is beneficial for financially constrained firms to fund necessary expenditures, it may expropriate shareholders' interest by facilitating empire-building over-investment when such firms also have severe managerial entrenchment. It is also documented that poorly governed firms dissipate their excess cash on capital expenditure and acquisition, resulting in lower operating performance, thus destroying firm value (Dittmar & Mahrt-Smith, 2007; Harford, Mansi, & Maxwell, 2008)

Jensen (1986) predicts that investment activities, in the form of takeovers, mergers and acquisitions, are some ways in which "managers spend cash instead of paying it out to shareholders". This prediction is confirmed by Lang, Stulz and Walkling (1991), who suggest that some tender-offer mergers and acquisitions are driven by the free cash flow of the bidder firm. Morck, Shleifer and Vishny (1990) also find that firms may extract private benefit through making value-destroying acquisition activities. Given merger and acquisition transactions that have taken place since 1992 are valued at over $7 trillion (Yim, 2013), and nearly a $160 billion value of mergers and acquisition transactions were recorded for a two month period in 2013 (Guerrera & Berman, 2013), the potential cost that may be borne by shareholders due to over-investment in mergers and acquisitions may be staggering. In fact, Moeller, Schlingemann and Stulz (2005) provide empirical evidence on how a bad acquisition severely destroys shareholder value, with acquiring-firm shareholders losing a total of $240 billion on those acquisitions examined.

Anecdotal evidence also indicates that firms that are listed as the top 20 R&D spenders do not necessarily make value-enhancing investments that increase firm value (Hartung,

2012). For instance, despite spending almost $88 billion on R&D during 2011, Nokia, ranked number seven on the list, and considered a likely bankruptcy candidate, was recently acquired by Microsoft (Hartung, 2012; Hillen, 2013; O'Brien, 2013). Another striking example is General Motors, which expended almost $40 billion in R&D activities during 1990s, yet experienced a $6.5 billion loss in the early 1990s and suffered an opportunity loss of over $100 billion (Jensen, 1993). Or more recently, a surge spending on its new-product development only led Amazon to its largest quarterly loss in 14 years, with a recorded net loss of $437 million in the third quarter of 2014 (Bensinger, 2014).

At the other extreme, managers may under-invest by opting out of optimal and profitable investment projects due to the high risks involved (Dey, 2008; Lambert, 1986; Myers & Majluf, 1984; Shavell, 1979). Literature on under-investment argues that risk-averse 'lazy' managers may shirk their task by rejecting projects that are profitable for shareholders or avoiding optimal risk investment projects, if they perceive that such projects will place their own personal welfare at risk (Dey, 2008; Lambert, 1986). Stulz (1990) explains that the problem of under-investment relates to executives under-investing in risky but positive net present value projects, because executives' personal costs are high in the case of project failures, while the personal benefits are low for successful outcomes. It is documented that executives who are concerned about bearing personal costs (e.g., possible employment risk) as a consequence of undertaking unsuccessful investment projects tend to choose less risky short-term projects rather than riskier long-term ones (Nagarajan, Sivaramakrishnan, & Sridhar, 1995). It is argued that this myopic project selection strategy by executives represents non-value-maximising use of a firm's capital, where managers forsake good investments to boost current earnings (Nagarajan, et al., 1995; Stein, 1989), thus imposing considerable costs on shareholders, and ultimately leading to market share loss and financial distress. Cohen, Dey and Lys (2013) further document that changes in CEOs' investments in risky projects are related to lower operating performance of firms.

Under-investment is inconsistent with a shareholder value maximising objective, because such sub-optimal behaviour may lead to bondholders increasing the cost of

borrowing, thereby forcing shareholders to ultimately pay a price for under-investment (Kanagaretnam & Sarkar, 2011). Investment in R&D, for example, is the type of investment that typically suffers from the problem of under-investment (Ghosh, et al., 2007). Using risk tolerance (inverse of risk aversion) as a different measure for firm risk preference, Abdel-Khalik (2014) finds that R&D investments are relatively higher in firms whose CEOs have higher degrees of risk tolerance. The R&D investments are costly discretionary activities and high-risk in nature, due to major uncertainty about the probability of future success (Abdel-Khalik, 2014; Chan, Lakonishok, & Sougiannis, 2001; Ghosh, et al., 2007; Shen & Zhang, 2013), and provide the opportunity for risk-averse executives to under-invest.

3.2 Investment Efficiency, Executive Compensation and Compensation Committee

Agency problems and their effects in distorting optimal investment allocation necessitate the provision of incentives to executives to remedy such problems. Prior literature has indicated that the conflicts of interest between managers and shareholders, and the agency costs involved as a consequence of their agency relationship, can be reconciled through compensation schemes that reward (punish) executives when they perform consistently (inconsistently) in the interest of shareholders (Berhold, 1971; Eisenhardt, 1989; Fama & Jensen, 1983b; Heckerman, 1975; Lewellen, et al., 1987; Tosi, Werner, Katz, & Gomez-Mejia, 2000). Lewellen et al., (1987) present evidence that executive compensation packages are designed to reduce agency costs. It has also been maintained that executive remuneration is one internal control mechanism that lowers agency costs (Walsh & Seward, 1990) and positively relates to accounting performance (Lambert & Larcker, 1987). A well-designed executive compensation plan is claimed to serve as a vital mechanism for corporate governance and provide an alignment of incentives between managerial and shareholders in making investment decisions (Faulkender, et al., 2010). It is documented that executives with less well-aligned pay packages are quicker to undertake large investment, and hence are more likely to over-invest (Billett, Garfinkel, & Jiang, 2011). In their theoretical model,

Kanagaretnam and Sarker (2011) show that a properly designed compensation contract may substantially mitigate under-investment problems[20] and the extent of this mitigation depends on the details of the contract, where with a certain level of managerial share ownership may even eliminate the problem in underinvestment.

Research examining the relationship between executive compensation and investment opportunities also suggests that firms often reward their executives with higher remuneration to motivate them to accept higher uncertainties, since managerial risk aversion is considered in the design of compensation contracts (Harvey & Shrieves, 2001; Smith Jr & Watts, 1992). Lord and Saito (2012) further show that personal risks faced by executives significantly affect the design of their compensation contracts. Therefore, it is suggested that executive compensation arrangements may be used to alleviate agency conflicts by encouraging risk-taking behaviour and providing incentives to optimise long-term performance (Gray & Cannella, 1997). Risk-averse executives, whose compensation is not a convex function of firm value, have incentives to reduce cash flow variability by rejecting positive net present value projects, so that increasing the convexity of executive compensation to firm value is one way to counter such behaviour (Smith & Stulz, 1985).

Since managerial efforts and ability in undertaking investment opportunities are difficult to observe due to agency conflicts and information asymmetry (Darrough & Melumad, 1995; Eisenhardt, 1989; Harris & Raviv, 1990; Holmstrom, 1979), firms with considerable investment opportunities are more likely to link their performance indicators to compensation (Bizjak, et al., 1993; Smith Jr & Watts, 1992), preventing their executive from overly invest in unprofitable projects. An extensive body of literature shows that financial performance measures, such as accounting and market measures, are used as a basis for rewarding top management (Burns & Kedia, 2006; Ittner, et al., 1997; Lambert & Larcker, 1987; Murphy, 1985; Sloan, 1993).

[20] Kanagaretnam and Sarker (2011) explicitly identified two components of an appropriate compensation contract: a fixed component (salary) and an incentive component (equity ownership). They argue that a fixed salary will provide the alignment of interests between the executives and bondholders, whereas equity ownership will align the executives' interests with shareholders.

Yim (2013) further emphasises the importance of devising proper compensation incentives to anticipate the impact of opportunistic behaviour in executives' investment policies. It is suggested that rewarding executives with incentive-based pay contracts, such as equity-based compensation, is one direct solution for mitigating conflicts of interest between executives and shareholders (Bergstresser & Philippon, 2006; O'Connor, et al., 2013; Ryan & Wiggins, 2002) because when CEOs also hold a portion of the firms ownership, they will act in line with shareholders (Morgan & Poulsen, 2001). When an executive is granted a large portion of equity-based pay, stock options in particular, the tendency for earnings management is reduced, hence resulting in improved efficiency of investment decision making (Xian, et al., 2011).

Besides being examined in the context of total investment, executive compensation also is often related with the executives' decision in making specific types of investment. O'Connor et al. (2013) suggest that an equity-based pay induces risk-taking behaviour for risk-averse CEOs to become more willing to make investments in R&D expenditure. Firms with high intensity of R&D activities are found to rely more on equity-based incentives (Kole, 1997). It is further documented that equity compensation is used to alleviate agency problems and encourage R&D outlays and sub-optimal reduction in R&D spending is mitigated by CEO stock ownership (Kanagaretnam & Sarkar, 2011; Ryan & Wiggins, 2002). In the case of acquisition decisions, it is suggested that CEO pay in the form of equity should have the effect of reducing the non-value maximising behaviour of acquiring managers (Shleifer & Vishny, 1988). Datta et al. (2001) further confirm this conjecture by examining how equity-based pay determines corporate acquisition decisions and found that managers in high equity-based compensation acquiring firms have better incentives to maximize shareholder wealth than their counterparts in low equity-based compensation firms. Ghosh et al. (2007) argue that problem of over-investment through capital expenditure are likely to be severe at low levels of stock ownership, because CEOs have incentives to undertake investments for empire-building purposes and, thus, increasing CEO stock ownership is likely to reduce the over-investment problem. High alignment of interests between shareholders and management resulting from incentive compensation reduces the tendency for executives

to dissipate internal free cash flow and, therefore, mitigates the over-investment problem by reducing the sensitivity of investment to available cash flows (Zhang, 2009). Broussard et al. (2004) further document that the pay-performance sensitivity (delta) of incentive compensation (i.e., stock and stock option holdings) has a strong effect on the reduction of over-investment of free cash flows and limited effect on the reduction of under-investment due to managerial shirking behaviour.

Different types of compensation may contribute to investment efficiency, but to design compensation contracts that maximise the expected utility of both shareholders and the management to encourage efficient investment is problematic, because "the optimal contract depends on the manager's risk aversion, the variance of firm performance, the productivity of investment, and the magnitude of the private benefits or costs associated with investment, as well as other potential agency problems" (Aggarwal & Samwick, 2006, p. 490). Lewellen et al. (1987, p. 287) further argue that "if managerial performance were easy to measure, devising an efficient compensation contract would merely involve finding an optimal allocation of risk-sharing between owners and managers". Many empirical facts on executive compensation contracts appear inconsistent with optimal contracting (Edmans & Gabaix, 2009). Crocker and Slemrod (2007) demonstrate that, in a hidden action model, in which shareholders could never observe management action of increasing profit, efficient managerial contracts will permit earnings manipulation.

Furthermore, the design of efficient compensation contracts is difficult and varies considerably across industries and firms (Morgan & Poulsen, 2001; Walker, 2010a; Williams, 1998). Efficient compensation contracts at any particular time are arguably a function of various transaction costs, and thus efficient contracts will vary over time, because the contracting arrangements evolve with changes in contracting mechanism (Core, et al., 2003). It is further suggested that "there is no cookbook solution for remuneration in all organisations" and a well-designed compensation contract for a particular firm, "must take account of the trade-offs that are inevitably involved to achieve balance and fit with their own organisation and people" (Jensen, et al., 2004, p. 3). Jensen et al. (2004) also contend that there are many factors, such as powerful

relations and interactions between the financial markets and the firm, the top-level executives and the board, should be considered in the design of optimal compensation contracts.

Executive compensation, on its own, is indeed insufficient to incentivise top management to act in the best interests of shareholders. The market regulator and the press have raised concerns about the insufficiency of current compensation contracts to incentive executive to maximise shareholder value (Donaldson, 2003). Faulkender et al. (2010) highlight that, despite firms experiencing poor performance and their stock prices plummeting, executive compensation of those firms increase dramatically. It is also noted that shareholders suffer not only because CEO's pay is higher than necessary, but also because compensation arrangements fail to motivate managers to maximize shareholder wealth (Bebchuk & Fried, 2003). Furthermore, Eisdorfer, Giaccotto and White (2013) conclude that executives who are rewarded with more debt-like compensation components tend to under-invest, while those with larger equity-based compensation engage more in over-investment, suggesting the failure of certain compensation terms to incentivise executives to maximise shareholder value.

Empirical evidence also documents a low sensitivity between pay and performance[21] and even an insignificant relationship between executive compensation and firm performance, indicating little incentive for CEOs to maximise shareholder wealth (Jensen & Murphy, 1990; Tosi, et al., 2000). This evidence arguably indicates that the standard performance-based compensation policy may not be able to induce an efficient investment outcome. Furthermore, incentive-based compensation and the use of specific performance measures to reward CEOs, which have been considered the most powerful tools to reward both management and shareholders (Jouber, 2013), allegedly fail to prevent self-interested executives from acting opportunistically at the expense of shareholders. Incentivising CEOs with compensation based on a firm's accounting measures, for example, often exacerbates the agency problem (Rehnert, 1985).

[21] Jensen and Murphy (1990) find that, in each $1,000 increase in shareholder wealth, CEO compensation increases by only $3.25.

To elaborate, empirical research on the effectiveness of performance measured on executives offers mixed conclusions, with some studies confirming the performance measures enhance firm value (e.g. Lambert & Larcker, 1987; Murphy, 1985; Sloan, 1993) and others agreeing that performance measures encourage opportunism (e.g. Bergstresser & Philippon, 2006; Burns & Kedia, 2006). Crocker and Slemrod (2007) draw attention to a darker side of performance-based compensation that encourages executives to misrepresent the company's true performance, which led to the accounting scandals of the early twenty-first century. Accounting-based performance evaluations also continue to be criticized for encouraging actions that sacrifice long-term profitability for short-term profit gain (Dechow & Sloan, 1991; Smith Jr & Watts, 1992). Smith Jr and Watts (1992) describe how a CEO bonus that is tied to annual profits provides incentives for executives to reject positive net present value investments with long pay-back periods, like R&D projects. CEOs may also downgrade all possible expenses to provide a short-term boost at the expense of long-term profitability of the firm (Fernando & Xu, 2012). Moreover, excessive focus on the current stock price as a basis for performance measurement provides an incentive for the executive to either over-invest or under-invest (Bizjak, et al., 1993).

Research also remains inconclusive on the value enhancing nature of incentive-based compensation contracts (Armstrong, et al., 2010; Laux & Laux, 2009; Morgan & Poulsen, 2001). It is found that utilising incentive-based compensation to encourage executives risk appetite has conflicting consequences (Abdel-Khalik, 2014). While it is argued that an incentive-based compensation mitigates the over-investment problem by linking manager wealth to firm value (Zhang, 2009), incentive-based compensation packages have also been found to be sub-optimal in preventing managerial opportunism (Ashley & Simon, 2004; Cheng & Warfield, 2005; Yermack, 1995) and have been blamed for promoting excessive risk taking (Walker, 2010a). It is maintained that equity compensation may have perverse effects, in which executives may seek to boost the short-term value of their shares and options (O'Connor, et al., 2013). It is also noted that granting options does not necessarily motivate managers to take on more risk; rather, in certain situations, stock option rewards may either lead to executives seeking less risk

(Carpenter, 2000). Executive option compensation is also found to induce information manipulation (Wu, 2011). Shen and Zang (2013) further conclude that rewarding CEOs with stock options may induce executives to over-invest in inefficient R&D projects.

Under the managerial power hypothesis (Bebchuk & Fried, 2003; Bebchuk & Fried, 2006), executive compensation, whether performance or incentive based, is seen as the product of rent-seeking by self-interested and opportunistic executives, and thus exhibits agency problem symptoms (Boyle & Roberts, 2013). Bebchuk and Fried (2005) argue that executive compensation is dysfunctional, as top managers 'capture' the pay-setting process and may camouflage the excessive size of their pay by using more complex compensation arrangements. Executive compensation is then viewed not only as a potential mechanism for addressing agency problems, but also as a part of the agency problem itself (Bebchuk & Fried, 2003).

In these circumstances, the compensation committee, working in the shareholders' interest, may provide the correct incentives to executives through executive compensation (Ozerturk, 2005). A compensation committee of the board of directors, as a firm's monitoring mechanism, appropriately influence CEO compensation contracts, ensuring that the contracts are arranged favourably to enhance the interests of shareholders (Wright, et al., 2002). Through this, as suggested in the early papers by Jensen and Meckling (1976) and others, the compensation committee serves as a monitoring mechanism as well as a bonding mechanism that enforces the achievement of optimal contracts that ultimately motivate optimal investment decisions by executives. Compensation committees play a role as an agency institution, by designing efficient compensation contracts (Healy & Palepu, 2001) that attract and retain executives, as well as, provide the right incentives for them to best represent the interests of shareholders (Anderson & Bizjak, 2003; Kumar & Sivaramakrishnan, 2008; Wallach, 1999).

The importance of compensation committees, who serve as agency mechanisms, has been reflected in the fact that most firms have established compensation committees and the compensation committee chair is commonly deemed the most difficult role on the

board (Reda, et al., 2008). Compensation committees have felt a profound tension between the demands of management and those of shareholders and have had to confront public concerns about the high levels of CEO pay, which has culminated in compensation committee members considering balance and fairness in compensation (Hermanson, Tompkins, Veliyath, & Ye, 2012). Reda (2001) claims that compensation committee decisions and actions may distinguish between mediocre and outstanding corporate performance, and, therefore, the committee has become a potential strategic asset of a firm. The compensation committee itself is regarded as one of the important committees on the board of directors and the committee's decisions are among the most critical decisions made by an organisation (Hermanson, et al., 2012; Wallach, 1999).

The crucial role of the compensation committee in structuring executive pay has also received politicians' and regulators' attention (Sun, et al., 2009), which enhances the importance of the agency role of the compensation committee. Since the inception of the compensation committee in early 1990s, regulatory changes around compensation committee functions and responsibilities have brought the compensation committee to prominence in firms (Reda, 2000). For instance, the SEC 1992 rule requires listed companies to provide compensation committee reports that describe the basis of executive compensation in their proxy statements, while the 2003 NYSE corporate governance listing rule mandates firms to establish a compensation committee comprised totally of independent members. Also, the newest SEC 2012 rule regulates listing standards of compensation committee independence, including the independence of compensation advisers. These requirements concerning the governance of a compensation committee shift the committee's role from merely serving as an administrative tool that sets executive compensation (Main, Jackson, Pymm, & Wright, 2008)to being a more vital corporate governance mechanism that influences the company's corporate governance quality (Brancato, 2002). Further, the compensation committee has been recognised as "a more advanced corporate governance structure and a current best practice" and its role has been cited as a critical element in the corporate governance structure of firms (Brancato, 2002, p. 14).

The critical role of a compensation committee in arranging effective executive pay packages has been documented by a large body of research, supporting the view that firms with a compensation committee in place have better aligned performance and executive pay (Conyon & Peck, 1998). Empirical evidence shows that compensation committees effectively prevent potential executive opportunism in investment (Cheng, 2004) and mitigate earnings management problems (Hsu & Liao, 2012). It is documented that compensation committees systematically adjust the provisions of incentive compensation plans and treat components of earnings differently to avoid providing CEOs with incentives to act opportunistically (Ashley & Simon, 2004; Dechow & Huson, 1994; Duru, et al., 2002; Huson, Yao, Wiedman, & Wier, 2012). Specifically, compensation committees adjust the relative weights placed on earnings components in the cash compensation to mitigate earnings manipulation incentives during CEOs' terminal years (Huson, et al., 2012). Compensation committees also discount strategic expenses, such as R&D expenditure, when computing the firms' profitability to determine CEOs compensation (Duru, et al., 2002; Fernando & Xu, 2012). Cheng (2004) argues that compensation committee is able to evaluate the efficiency of R&D activities undertaken by CEOs through ex-ante contracts or ex-post discretion. Ashley and Yang (2004) further find that, as the persistence of earnings declines, compensation committees seek to use cash flows from operations as an alternative performance measure to evaluate executive performance. Firms, through their compensation committee, are more likely to choose performance measures that are more informative of CEO actions (De Angelis & Grinstein, 2015)[22] to ensure that the pay package rewarded to the CEOs will optimally motivate them to adopt investment strategies that are efficient for shareholders.

Given this significant role, the compensation committee has become the forum to design the most effective remuneration packages that reduce the level of information

[22] In their study, De Angelis and Grinstein (2015) particularly argue that for growth firms, for example, end of year accounting performance measures are likely to be less informative of optimal CEO actions, and therefore stock price performance is a more informative measure, because it captures investors' perception regarding the firm's long-term growth opportunities. On the other hand, for mature firms, the end-of-year accounting performance measures are more informative of CEO actions, because this captures efficiency in allocation of capital to existing operations.

asymmetry in a firm (Anderson & Bizjak, 2003; Conyon & Peck, 1998; Main, 1993). Efficient compensation contracts allow shareholders to observe managerial behaviour and, therefore, managers are forced to adopt value-enhancing policies: investing in projects that enhance firm value. This signals the significant role a compensation committee has in designing compensation contracts that maximise the expected utility of both shareholders and management to induce investment efficiency. It is, therefore, plausible to argue that the efficiency of a compensation contract can be examined within the context of the efficiency of investment decisions by the firms. Instead of disentangling the complexity of executive compensation provisions that are considered efficient, the efficiency of a compensation contract can be measured through a properly functioned compensation committee that design an efficient compensation contract.

3.3 Investment Efficiency and Compensation Committee Expertise

The compensation committee, as an oversight mechanism, helps alleviate the agency problem between shareholders and management by designing efficient compensation contracts that address expectations and mitigate important personal risks of executives, so that efficient investment can be induced, and hence firm value can be maximised (Lord & Saito, 2012; Randolph-Williams, 2010; Yim, 2013). However, to design an efficient executive compensation contract is quite challenging due to the pressures put upon the committee from shareholders, executives and public opinion, which not only call for the committee to maximise shareholder value, but also to balance the interests of management and shareholders, as well as those of other stakeholders (Hermanson, et al., 2012; Reda, 2001). Compensation committee should consider a combination of compensation programs to reward different aspects of the company's performance that mitigate management's inappropriately risky behaviour (Fisher, Kohn, & Sykes, 2010).

A well-structured compensation committee may fulfil the oversight duties of the directors serving on the committee in the important area of executive pay (Reda, 2001), because bad governance can easily lead to value-destroying pay policies (Jensen, et al., 2004). The composition of compensation committees, then, becomes of major importance due to the difficulty and complexity in making executive compensation

decisions (Main, 1993; Newman, 2000), since the existence of a compensation committee itself has not been proven as a valid predictor of corporate performance and as an explanation of CEO pay (O'Reilly & Main, 2007). Sun et al. (2009) further document that greater incentive alignment in executive compensation contracts are achieved with higher compensation committee quality. Since the ability and strength of a compensation committee depends, to a great extent, on the attributes of its members, with the right attributes, compensation committee members will structure efficient compensation contracts that alleviate agency conflicts and information asymmetry, and thus ultimately provide less incentive for executives to act opportunistically, but rather to encourage them to invest efficiently.

Prior studies investigating compensation committee structure predominantly measure compensation committee quality through the committee independence (Newman & Mozes, 1999; Sun, et al., 2009; Vafeas, 2000). An independent compensation committee comprising outside directors has been empirically documented to maximise shareholder value (Brickley, et al., 1994; Laksmana, 2008; Vafeas, 2003a), because members "have incentives to carry out their tasks and do not collude with managers to expropriate residual claimants" (Fama & Jensen, 1983b, p. 315). However, while it is suggested that compensation committee insiders may favour firm CEOs in compensation design (Newman & Mozes, 1999; Vafeas, 2003a), it is documented that greater committee independence has little effect on executive pay (Anderson & Bizjak, 2003), and there is no evidence that non-independent directors set greater CEO compensation at the expense of shareholders (Daily, et al., 1998). In fact, compensation committee independence cause CEO pay to increase (Guthrie, Sokolowsky, & Wan, 2012). Furthermore, as the NYSE updated its listing rule in 2003 and required compensation committees to be composed only of independent directors (NYSE, 2003), independence as a measure of compensation committee quality may no longer be valid, since the variation in compensation committee independence across firms would approximate to zero (Sun & Cahan, 2012).

The overemphasis on independence as the sole attribute of compensation committee effectiveness is also reflected in the most recent rule on compensation committees, the

SEC 2012, which regulates the listing standards for compensation committee independence. While it is desirable that the committee operates independently, as mandated by the SEC 2012 rule, independence alone is an incomplete attribute on which to build a solid conclusion as to what significant attributes count in forming an optimal group of compensation committee members (Cunningham, 2010; Dorff, 2007). In fact, it has been documented that board independence has little or no correlation with the performance of the board and firms (Deutsch, 2005; Sanjai & Bernard, 2002; Sanjai & Black, 1999), perhaps due to the directors' lack of knowledge and skills needed to perform their duties (Lawler III & Finegold, 2006; Roberts, McNulty, & Stiles, 2005). Bhagat and Black (1999) confirm this and conclude that experiences and expertise of directors influence firm performance more than their independence.

Kroll, Walters and Wright (2008b) further maintain that director vigilance without relevant experience is unlikely to ensure board effectiveness and therefore boards containing vigilant directors, as well as directors with appropriate knowledge gained through experience, are useful advisers to senior managers. Jensen et al (2004, pp. 53-54) further argue that "the inherent biases in the pay-setting process are not easily solved by enhancing board independence…but rather require remuneration committees to invest in much greater information and negotiation expertise". Furthermore, it is argued that an independent board may lack of specific insider knowledge that would be needed to monitor the executives efficiently (Biondi & Rebérioux, 2012). Rashid et al. (2010) confirm the importance of human capital for board effectiveness and conclude that, by taking into account human capital, a higher proportion of outsiders on the board may reduce under-investment and agency problems in comparison with insider and affiliated director-dominated boards. This implies that a compensation committee with a specific expertise will be able to structure more aligned compensation contracts that prevent opportunistic behaviour in investment decisions.

In human decision making theory, it is commonly acknowledged that experts demonstrate outstanding and exceptional performance that is domain-specific and related to experience and practice (Bédard & Mock, 1992; Herbig & Glöckner, 2009). Experts also appear to have more knowledge and more appropriate decision making

skills than novices, thus enabling them to produce better processed decisions (Gilmour & Corner, 1998; Johnson et al., 1981; Phillips, Klein, & Sieck, 2008). Gilmour and Corner (1998) suggest that experts bring a well-developed set of decision making procedures, which they are highly skilled at implementing, and are seen as reliable and capable people who produced consistently good results and suitable decisions when required.

A recent work by Field and Mkrtchyan (2016), which examines the influence of directors' expertise on firm performance, indeed concludes that firms with higher levels of director expertise in acquisitions make better acquisition decisions.. The results of Field and Mkrtchyan (2016) demonstrate that directors' knowledge and prior experience is valuable for board effectiveness. In the same way, it is then plausible to expect that compensation committee members with high levels of expertise would be superior in making executive compensation decisions and, thus, have greater ability to design executive compensation contracts that encourage investment efficiency. The human decision making theory, which highlights the superiority of experts in decision-making, complements agency theory by emphasising that, while it is desirable to have an independent compensation committee, the expertise of the committee's members should not be overlooked in providing the motivation for the CEO to invest efficiently due to more interest-aligned compensation contracts..

Drawing on resource dependence theory (Pfeffer & Salancik, 1978), recent literature on board of directors governance also has examined how board human capital may enhance director effectiveness in performing its agency function (Hermalin & Weisbach, 2003; Hillman & Dalziel, 2003; Hillman, et al., 2008). This school of thought, which also complements agency theory[23], takes the view that directors, as resources, bring their own unique values in the form of expertise, experience, knowledge, reputation, and

[23] Hillman and Dalziel (2003) provide an integrative framework of agency theory and resource dependence theory and argue that, while agency theory suggests that board monitoring is a direct function of board incentives, the theory of resource dependency maintains that both board monitoring and resources provision are influenced by the board's capital (both human and social capital) and are moderated by board incentives. They further assert that the resource dependence view complements agency theory to provide deeper understanding on the effect of board capital on board functions as resource provision and a monitoring mechanism, which offers additional insight about boards and the performance of the firms.

skills, defined as human capital (Becker, 1964; Coleman, 1988), to the boardroom to help the board perform its monitoring function properly. This literature, which views the board members as resource providers and as a dynamic group, theoretically and empirically highlights how the provision of human capital embedded in its team members is an important determinant of board effectiveness and ultimately affects firm-level performance (Carpenter & Westphal, 2001; Dalton, Daily, Certo, & Roengpitya, 2003; Hillman, Cannella, & Paetzold, 2000; Hillman & Dalziel, 2003; Hillman, et al., 2008; McDonald, Westphal, & Graebner, 2008; McIntyre, Murphy, & Mitchell, 2007; Payne, Benson, & Finegold, 2009; Rashid, et al., 2010).

Newman (2000) concludes that the composition of a compensation committee influences the practices of executive compensation. Supporting this view, Whittlessey, in Yong-Yeon and Won-Yong (2014), also argues that the experiences of the compensation committee members with other organisations will influence their practices and policies at focal firms. It is, then, important to acknowledge that members of compensation committees need the right background and mindset to be able to perform compensation committee functions effectively in understanding executive compensation issues profoundly, including the fairness and balance of compensation decisions in the eyes of shareholders and executives (Hermanson, et al., 2012).

Ryan and Wiggins (2004) argue that the board's characteristics and, by extension, its compensation committee, are predetermined when they design compensation policy. Since each member of the compensation committee possesses different attributes, depending on various characteristics such as incentives, knowledge, background, and skills, the effectiveness of a compensation committee to design efficient compensation contracts is likely to be dependent on such characteristics (Adams, Hermalin, & Weisbach, 2010; Main & Johnston, 1993).

The proxy enhancement disclosure rule adopted by the SEC (2009a), which mandated listed firms to provide information on the qualifications, experience and skills of all their directors and nominees, further lends support to the significance of human capital in improving board quality. The SEC 2009 proposed rule (2009b), which proposed

disclosure on specific experiences, qualifications or skills that qualify a person for committee membership (including compensation committees) further signals the importance of human capital for board effectiveness.

While regulation has urged the importance of audit committee members to have finance expertise, current legislation governing compensation committees is silent on specific human capital that contributes to the effectiveness of a compensation committee (Gordon, 2005; Nussbaum, 2008). There are no such requirements for a member of compensation committee, despite the complex roles and enormous responsibilities assumed by a compensation committee necessitating its members having applicable skill sets, experience and knowledge (Reiter, 2004). In fact, Reiter (2004) suggests that one problem arising with compensation committees is because the wrong people are appointed to them. This creates the need to investigate the effect of compensation committee member expertise on effectiveness in meeting its governance function, which eventually encourages investment efficiency through the design of efficient executive pay package. With the proper expertise, it is believed that compensation committee members will be able to construct efficient executive compensation that, in turn, will motivate executives to invest efficiently.

3.4 Conclusion

This chapter presents the theoretical concepts that identify the research problems in this thesis and associate investment efficiency and compensation committee attributes. It particularly points out that due to agency conflicts and information asymmetry, CEOs may act opportunistically to maximise their own utility at the expense of shareholders by impeding optimal investment decision. In this case, the executives may undertake inefficient investment projects by investing in all projects, including negative net present value projects (i.e., overinvesting), or by rejecting positive net present value projects (i.e., under investing).

This chapter also highlights that the acknowledgement of sub-optimal investment decisions by executives necessitates the provision of incentives through managerial

compensation contracts to mitigate agency costs and discourage managerial opportunism. It particularly argues, through the alignment of interests between management and shareholders, more aligned compensation contracts encourage management to invest in projects that maximise shareholder value.

Given the competing theories and mixed empirical findings, what considers an efficient compensation contract, however, is still an open question. Literature on executive compensation argues that the design of an efficient compensation contract is difficult because the efficiency of such contract varies considerably across firms and industries. Hence, a compensation committee, charged with responsibility for designing efficient executive compensation contracts, serves as an oversight mechanism that provides alignment of the interests of shareholders and management, which ultimately resulting in investment efficiency.

It is, however, important to underscore that the ability and strength of a compensation committee depends, to a great extent, on the attributes of its members. Compensation committee members with the right attributes are then expected to enable the committee to structure efficient compensation contracts that alleviate agency conflicts and information asymmetry, and thus ultimately provide no incentive for managers to act opportunistically, but rather to invest efficiently. In this chapter, it is then argued that with the right attributes, compensation committee members will structure efficient compensation contracts that motivate CEOs to invest efficiently.

The following chapter identifies significant attributes for the committee members to arrange efficient compensation contracts. Anecdotal evidence and theoretical arguments on the importance of these significant attributes for compensation committee in structuring more aligned compensation contracts become the basis to formulate hypotheses of the association between investment efficiency and compensation committee attributes.

Chapter 4
Hypothesis Development

This chapter presents the development of hypotheses to be tested in this study. Since this study examines investment efficiency within the context of compensation committee members' expertise, the first section of this chapter provides a discussion on the identification of important attributes for compensation committee members if they are to design efficient compensation contracts that motivate executives to invest efficiently. Based on the identified attributes, the three sub-sections in Section 1 present the hypotheses about the implications of each type of member expertise (i.e., business – CEO expertise, legal expertise and accounting/finance expertise) on the effectiveness of the compensation committee to encourage investment efficiency. The second and the third section of this chapter develop the hypotheses about the mixed attributes and the joint attributes of compensation committee members. The last section concludes the chapter.

4.1 The identification of Significant Compensation Committee Expertise

Despite being under the scrutiny of the public and regulators, which constantly call for executive compensation contracts that align the divergent interests of management and shareholders, there are no pronouncements on the attributes compensation committee members should possess in order for them to perform effectively. Researchers and policy makers are currently put too much emphasis on the issue of balancing outside and inside directors serving on boards, i.e., their independence, at the expense of directors' expertise as a key characteristic of directors (Rindova, 1999). Unlike the audit committee, whose members are required by regulation to include those with finance literacy, no similar requirement applies to compensation committee members, although some anecdotal evidence and theoretical studies have indeed noted the importance of the expertise needed to effectively fulfil board governance in protecting shareholders' interests at both board and committee level (e.g. Cunningham, 2010; Grossman, 2004;

Karp, et al., 2007; Kay & Van Putten, 2007; Lawler III & Boudreau, 2006; Nussbaum, 2008; Reda, 2000).

Many empirical studies on compensation committee composition utilise variables, such as independence, number of directorships held, tenure, or a combination of these, as a proxy for high quality compensation committees (Anderson & Bizjak, 2003; Daily, et al., 1998; Newman & Mozes, 1999; Sun & Cahan, 2012; Sun, et al., 2009; Vafeas, 2000, 2003b). Yet there are no conclusive results on what attributes constitute the most effective compensation committee. Thus, determination of the significant types of expertise necessary for compensation committee to optimally structure executive pay packages remains an open question. To assists, this thesis refers to the common types of expertise held by executive compensation consultants.

It is common practice for firms to employ executive compensation consultants to assist the compensation committee with regard to executive compensation matters. In a study by Armstrong, Ittner and Larcker (2008), 87% of a total of 2,116 public firms in their sample hired compensation consultants. Compensation consultants are frequently engaged by compensation committees to provide expert advice and insight into structuring senior management compensation policies (Cadman, et al., 2010; Conyon, Peck, & Sadler, 2009b). Furthermore, the consultants provide advice on the tax, legal, and accounting implications of pay packages (Armstrong, et al., 2008). The consultants' expertise is based on their knowledge of relevant laws and their access to detailed proprietary compensation practices, such as compensation surveys and competitive-benchmarking information on the industry and the market (Cadman, et al., 2010; Murphy & Sandino, 2010). The knowledge and skills of the consultants are important inputs for a compensation committee in making prudent compensation policy to perform its oversight and governance role, as well as to maintain "competitive, compliant and responsible executive pay" (Burek, 2010, p. 14), as demanded by shareholders and regulators. Conyon et al. (2009b) further suggest that the consultants are hired for their speciality and expertise to design an efficient compensation contract. Ellig (2014) also maintains that from a knowledge point of view, the best candidate for a compensation committee is an executive compensation consultant. Therefore, the types of expertise

possessed by the consultants will be a credible benchmark to employ in defining compensation appropriate committee members' attributes.

Compensation consultants may help firms to "choose economically-appropriate compensation levels and structures that efficiently achieve labour market objectives and provide appropriate incentives to executives" (Armstrong, et al., 2008). This indicates that the consultants, as independent institutions, assume the capacity to influence and constrain the firm's senior management remuneration strategy (Conyon, Peck, & Sadler, 2009a) by helping the firm's compensation committee construct efficient compensation contracts. Nevertheless, it has been alleged that consultants may have economic dependence on firms that hire them (Waxman, 2007); thus, relying only on the consultants' executive pay package recommendation may not result in efficient compensation contracts. As such, compensation committee members with human capital that resembles expertise embedded in the consultants arguably represent the important attributes that will constitute a high-quality compensation committee.

A preliminary examination of 100 consultants' biographies that detail the consultants' education and professional experience from 12 consulting firms' websites indicates some distinct attributes[24]. Business expertise has the highest frequency (24.5 percent), followed by legal and accounting/finance expertise (16 percent and 15 percent, respectively). The next two consultant's attributes that frequently appear are human resource expertise, with a frequency of 8.5 percent, and economic expertise of 8 percent. This is followed by tax competency and psychology expertise, which both account for 4.5 percent. Industrial relations expertise and certified compensation professionals are in next place, both with 4 percent. The remaining six consultants' expertise are at the bottom in expertise distribution, with 2 percent for a certified benefit professional, 1.5 percent each for foreign-service, marketing, and mathematics expertise, 1 percent each for a certified equity professional, political science, and public administration policy expertise, and 0.5 percent each for biology, engineering and history expertise.

[24] See Appendix 1 for all compensation consultants' attributes and their frequencies resulting from the survey.

From these attributes, the top three attributes, i.e. business, legal, and accounting/finance, are chosen to represent crucial expertise that a compensation committee should have if it is to be constituted as a highly effective compensation committee. In order to confirm the importance of the consultants' expertise for a compensation committee, an initial survey of 103 compensation committee members in 20 randomly chosen firms is conducted. The survey of compensation committee member expertise reveals a similar pattern of frequency as the consultants, with business, accounting/finance and legal expertise as three most common levels of expertise of compensation committee members[25]. Therefore, these three attributes are arguably the most prominent attributes that will assist a compensation committee in structuring more aligned compensation contracts to induce efficient investment project selection by management, consistent with their high frequency amongst compensation consultants.

4.1.1 Investment Efficiency and Compensation Committee Business – CEO Expertise

A compensation committee that is charged with the task of designing an executive pay package that is "often simple in concept but detailed in design and administration" (Ellig, 2009, p. 7) requires members of the committee to have relevant knowledge about their company's business and the market in which the company operates. Kor and Sundaramurthy (2009) suggest that the current and past professional experience of directors as CEOs allow the directors to develop tactical knowledge about, and specific skills for, the operations of firms and industries. CEO-directors enhance their ability to contribute to corporate strategy because their experience as CEOs improve their task expertise (Kroll, Walters, & Wright, 2008a). The director experience as a CEO is also a significant source of business expertise (Tian, Haleblian, & Rajagopalan, 2011). Business knowledge is important, since the designed pay policy should have a holistic approach to suit the common practice of comparable firms, as well as be tailored to the uniqueness of each firm's business, culture and philosophy, in order to design efficient

[25] See Appendix 2 for the complete results of the initial survey of compensation committee expertise.

contracts and retain talented executives (Kay & Van Putten, 2007; Randolph-Williams, 2010).

Business expertise also equips a compensation committee with considerable competence in decision making (Agrawal & Knoeber, 2001; Rubin & Dierdorff, 2009; Sudsakorn & Swierczek, 2009), i.e., to make decisions on an optimal pay plan that provides a strong link between the performance of the executive and shareholder interests. The committee members' skills in decision making may accrue from their experiences as senior executives in other firms (Agrawal & Knoeber, 2001). Fich (2005) suggests that CEO-directors are considered as sources of superior managerial talent, unique expertise and business acumen and, therefore, are sought after to enhance firm performance. With experience working as a CEO at other firms, CEO-directors have developed expertise particular to the CEO's position (Tian & Twite, 2011) and thus have better judgement in making decisions on CEO pay packages that will optimally motivate executives to invest in efficient investment projects.

In addition, the business knowledge acquired through CEO experience assists compensation committee members to meet their responsibilities, as highlighted in the NYSE listing standard to evaluate executive performance based on the attainment the firm's goals and to compensate according to that evaluation (NYSE, 2003). The responsibilities of the compensation committee underlined by this listing standard imply that compensation programs that the committee administers should cohere with overall corporate strategies (Hellerman, 2010; Kay & Van Putten, 2007; Reda, 2000). The compensation programs should also exercise a significant influence on the firm's overall strategy (Brancato, 2002; Cyr, 2012). This strategic function of the compensation committee transforms the traditional administrative role of the committee into being a strategic asset for the firm (Reda, 2000), and this clearly demands strategic competency and business problem solving expertise of members that have developed from their business acumen as CEOs (Agrawal & Knoeber, 2001; Sturges, Simpson, & Altman, 2003).

Thus, members of a compensation committee with expertise in management or business administration are more knowledgeable and competent to calibrate executive pay packages that motivate executives to best deliver on the corporate goal of maximising shareholder value. This managerial competency earned through experience a CEO furnishes committee members with broad yet customised strategic business knowledge, good decision making, strategic competency and business problem solving expertise that enables them to effectively perform their governance duty to create more aligned compensation contracts that motivate management to undertake efficient investments.

The argument above leads to the following hypothesis:

H1a: Firms with compensation committee members, who possess business expertise, adopt more efficient investment strategies than firms with members without the attribute.

4.1.2 Investment Efficiency and Compensation Committee Legal Expertise

Recent trends in corporate board of directors composition indicate an increasing number of appointed directors with legal expertise, with the percentage of public corporations with lawyer-directors is almost double what it was in 2000 (Krishnan, et al., 2011; Litov, et al., 2014). Research shows that having lawyers on the board increases firm value and lawyer-directors assist companies in designing compensation to align the interests of executives and shareholders, as well as, managing litigation and regulation (Litov, et al., 2014). Tett (2013) further highlights that employing lawyers on board helps minimise external legal risks and improves internal governance. It is also argued that lawyers, as independent advocates for their clients, reduce agency costs by implicitly monitoring that their client's officers act on the clients' behalf (Schwarcz, 2007).

Incorporating lawyers to serve in compensation committees may also help firms to design efficient compensation contracts, because lawyers often serve as talent agents who typically negotiate contractual and compensation terms on behalf of candidate CEOs (Rajgopal, Taylor, & Venkatachalam, 2012). Evidence shows that the

involvement of talent agents in firms is positively associated to future performance (Rajgopal, et al., 2012), which signals the importance of a legal background for committee members. Moreover, firm value is increased by an average 9.5 percent when lawyers are included as directors in public corporations (Litov, et al., 2014). This implies that bringing legal experts onto compensation committees is consistent with the efficient contracting view, whereby the committee will be able to structure compensation packages that prevent executives from making value-destroying investment decisions.

Executive compensation as a product of contract negotiation between the committee and top-tier management calls for committee members with legal literacy because of their role as transaction cost engineers, which increase the effectiveness of the committee through skills in reducing costly transactions in drafting, negotiating and safeguarding contract agreements (Gilson, 1984; O'Kelley, 2000; Williamson, 1985). Schwarcz (2007) maintains that by drafting transaction documents and agreements to eliminate adverse actions due to changes in incentives, lawyers may reduce moral hazard. He further argues that lawyers also reduce transactions costs by reducing information asymmetry. This implies that compensation committee members who possess legal expertise are more likely to write better compensation contracts. In fact, the use of an attorney to draft or review agreements with an executive, such as employment, separation and change-in-control agreements, has been found to be useful for some compensation committees (Edwards, 2006; NACD, 2003), which implies the significance of legal expertise for committee members performing their roles optimally.

In an environment of criticism over excessive CEO pay, especially post-Enron and the enactment of the Sarbanes-Oxley Act, a compensation committee is currently challenged by increased scrutiny and alleged responsibility for sky-rocketing executive compensation. Legislation on executive pay and compensation committee responsibilities has undergone significant changes, including IRS code section 162(m), rules promulgated by the SEC, NYSE and NASDAQ, and the latest regulation, the Dodd-Frank Act, all of which bolster compensation committee controlling functions. Thus, it is critical for compensation committees to ensure that their executive

compensation packages comply with the rules to avoid legal consequences for neglecting these (Tormey, 1996). This signals the need to equip committee members with legal professionals such as lawyers, who possess adequate legal insight into and compliance with these rules (Karp, et al., 2007), because lawyers bring their special skills and provide particular expertise on legal or regulatory concerns (Litov, et al., 2014; Okamoto, 2012). The legal knowledge possessed by the committee's members will give them the ability to comprehend legislation administering executive compensation that provides guidelines in furnishing the CD&A (Nussbaum, 2008) to design more effective compensation plans. Proficiency in legal issues may also prevent the compensation committee from excessively compensating executives, which is regarded as a persistent problem in corporate law (Orts, 1998) and is subject to pressure due to prospects of litigation (Nussbaum, 2008).

Therefore, compensation committee members with legal literacy will design efficient executive compensation contracts that strike a balance in aligning the interests of shareholders and preventing dysfunctional investment behaviour of management. The discussion above leads to the following hypothesis:

H1b: Firms with compensation committee members, who possess legal expertise, adopt more efficient investment strategies than firms with members without the attribute.

4.1.3 Investment Efficiency and Compensation Committee Accounting/Finance Expertise

In performing its critical function as a monitoring mechanism in structuring executive rewards, a compensation committee must deal with the growing complexity of executive pay programs. Where the pay plan once only comprised base salary, bonus, stock options, limited perks and benefits, it now includes different kinds of financial instruments and devices, for instance, performance units and shares, restricted stock, supplemental retirements policy, severance payments, 'golden parachutes', and so on (Hourihan, 1990). Such complex remuneration plans call for compensation committee members with financial expertise who are familiar with different elements in

compensation packages. It is suggested that a compensation committee should comprise sufficient number of members with finance expertise in order to understand the role and the valuation of the instruments used in executive compensation and to interpret financial data for incentive plan purposes (England, 1987; Faulkender, et al., 2010). Furthermore, a compensation committee benefits from the assistance of financial executives for the necessary data and insight on internal budgeting to make informed decisions on goal-setting when designing compensation (Heim, 2011). Compensation committee members with finance literacy arguably contribute more value through their comprehensive understanding of financial concepts used in today's executive compensation (Faulkender, et al., 2010; Reda, 1999).

Shaw and Zang (2010) assert that compensation committees and executives negotiate the contracts that will be used to evaluate CEO performance. It is the responsibility of compensation committees to evaluate executives' performance and make recommendations in relation to executives' compensation (Jackson, Lopez, & Reitenga, 2008). Many performance measures used in executive compensation nowadays are financial in nature (Fisher, et al., 2010). Empirical evidence further indicates that both accounting and market measures are commonly used to evaluate and reward CEO performance (Burns & Kedia, 2006; Ittner, et al., 1997; Lambert & Larcker, 1987; Murphy, 1985; Sloan, 1993) and the majority of firms use accounting earnings as a key performance criterion in their executive compensation contracts (Ashley & Simon, 2004; Murphy, 1999; Rehnert, 1985; Shaw & Zhang, 2010). Moreover, research shows that a firm's persistent earnings stream provides useful information for compensation committees to adjust types of compensation and performance-based measures in compensation contracts (Ashley & Simon, 2004), and compensation committees allocate higher weights to persistent earnings in order to induce value-maximizing actions by managers (Baber, Kang, & Kumar, 1998). This signals the need for the firm to include members with an accounting background that enables compensation committees to better evaluate CEO performance by selecting the optimal accounting measures in their executive compensation contracts.

Hsu and Liao (2012) argue that compensation committees with accounting and financial backgrounds have better understanding on the implications of internal controls on reported financial performance and, ultimately, incorporate the quality of internal controls in compensation decisions. Specifically, they show that, when a firm's internal control becomes ineffective, the reduction in executive compensation as recommended by compensation committees, is more pronounced when those committees have higher levels of financial expertise (Hsu & Liao, 2012). A more recent study relates investment efficiency to the effectiveness of internal control and concludes that ineffective internal control over financial reporting has a significant adverse impact on investment efficiency (Cheng, Dhaliwal, & Zhang, 2013).This implicitly signals the importance of compensation committee members having financial and accounting expertise to comprehend the adverse effect of a weak internal control system, and incorporating it in the executive compensation plans to increase investment efficiency.

Familiarity with finance and accounting concepts is significant for a compensation committee, which is no longer assumed to be a management rubber-stamp, but rather plays more prominent role in determining executive compensation by thoroughly disclosing its rationale for rewarding executives with different pay elements (Doubleday & Wagner, 2009; Gordon, 2005; Reda, 1999), as mandated by the SEC disclosure rule (SEC, 2006). This implies that compensation committee members with accounting knowledge and insight will also provide assistance to help the committee arrange compensation programs more optimally. Without a working knowledge of corporate finance and accounting standards, the committee's job in reviewing, justifying and evaluating its compensation decisions will be difficult, and thus less effective in creating compensation programs that ameliorate agency conflict to incentivise CEOs to invest efficiently.

Based on the discussion above, the following is hypothesised:

H1c: *Firms with compensation committee members, who possess accounting/finance expertise, adopt more efficient investment strategies than firms with members without the attribute.*

4.2 Investment Efficiency and Compensation Committee Mixed Expertise

Under the resource dependence framework, a board of directors brings valuable resources through its members' human capital and thus the effectiveness of members will be evaluated based on how this expertise, derived from professional or personal qualifications, contributes to the achievement of sustainable competitive advantage (Huse, 2005).

Cohen et al. (2008) show that collaboration of accounting experts with other experts is important for audit committee effectiveness. Dhaliwal et al. (2010) also provide empirical evidence on the collaboration different types of expertise and find that there is a complementary effect between finance and accounting expertise. Extrapolating to compensation committees, these findings suggest that the collaboration of attributes on the compensation committee may lead to design of more aligned compensation contracts. This implies that a pool of compensation committee attributes can create similar competitive advantage, as the committee function more effectively in arranging efficient compensation contracts that provide encouragement for management to invest in projects that maximise shareholder value. Specifically, it is expected that the amalgam of business/managerial, legal, and accounting/finance attributes amongst compensation committee members supplies a knowledge superiority in the boardroom greater than each single attribute can offer (Dalton & Dalton, 2005). This enables the committee to make better decisions about highly complex issues in determining executive compensation packages that not only represent shareholder value maximisation, but also reflect the true quality of executive talent (Anderson & Bizjak, 2003).

This expectation is also consistent with group effectiveness literature, which acknowledges the importance of heterogeneity of team members and maintains that positive performance outcomes are generated from diverse attributes of members (Campion, Papper, & Medsker, 1996; Guzzo & Dickson, 1996; Holtzman & Anderberg, 2011; Milliken & Martins, 1996; Stevens & Campion, 1994). Compensation committees with well-diversified members are also less likely to be co-opted by CEOs and will have

more bargaining power to reduce CEO influence in compensation decisions (Conyon & Lerong, 2004), and thus will be able to structure more aligned compensation contract that incentivise CEOs to invest efficiently.

It is also argued that the board of directors is a group of individuals who perform certain functions in an organisational context and make superior decisions in a group rather than individually, due to heterogeneity in the attributes of its members (Bettenhausen, 1991; Forbes & Milliken, 1999; Murphy & McIntyre, 2007). A group with members possessing various attributes may inhibit the occurrence of groupthink, which distorts the optimality of decisions (Bainbridge, 2002). Therefore, the mix of expertise among compensation committee members is expected to form an ideal compensation committee that results in effective compensation contracts to induce investment efficiency.

Drawing on resource dependence and group decision making theories (Bainbridge, 2002; Bettenhausen, 1991; Dorff, 2007; Murphy & McIntyre, 2007; Nicholson & Kiel, 2004; Pfeffer & Salancik, 1978; Wright, et al., 1994), it is expected that a full integration of the identified attributes constitutes an effective compensation committee that satisfies its oversight function effectively in ensuring efficient compensation contracts that align shareholder and management interests and induce investment efficiency. Thus, the discussion above results in the following hypothesis:

H2: *Firms with compensation committee members with a mix of expertise adopt more efficient investment strategies than firms without such mixed expertise.*

4.3 Investment Efficiency and Compensation Committee Joint Expertise

Li and Ang (2000) maintain that directors, including those who serve on the compensation committee, are appointed for their expertise and this expertise is needed in making major decisions such as determining executive pay packages. Furthermore, directors' personal values have started to become the subject of research exploration as another aspect that affects the decisions of the board and its standing committees beyond issues of board independence (Adams, Licht, & Sagiv, 2011). Rindova (1999) suggests

that the directors' contribution in dealing with strategic decision complexity is due to the problem-solving expertise possessed by the directors, which they can apply to a variety of contexts, including arranging efficient compensation contracts. Since directors' experiences and proficiencies affect their cognition and decisions, the activities of the compensation committee in structuring efficient executive compensation to induce investment efficiency is affected by the members' human capital (Johnson, et al., 2013).

Johnson et al. (2013) further note the importance of looking at individual directors, since each of the directors is a bundle of interacting characteristics. The bundling effects of specific types of human capital can dramatically alter the individual effects (Kor & Sundaramurthy, 2009). Empirical evidence shows that, in the presence of directors with joint legal and accounting expertise in the firm's audit committee, the financial reporting quality is enhanced beyond the contribution of individual expertise (Cheng, et al., 2013).

Thus, the presence of compensation committee members with joint expertise may further contribute to arranging efficient executive compensation to encourage executives to invest efficiently.

This discussion above results in the following hypothesis:

H3: *Firms with compensation committee members with joint expertise adopt more efficient investment strategies than firms without such joint expertise.*

4.4 Conclusion

This chapter develops hypotheses to investigate the effect of compensation committee expertise on investment efficiency. In the absence of regulation and empirical evidence on exact characteristics that represent significant attributes for compensation committee members in performing their governance function effectively, this thesis examines 100 executive compensation consultants' profiles to identify important expertise of the committee members. Compensation consultant expertise would be a credible benchmark to employ in defining compensation committee members' attributes, because these consultants are frequently hired by compensation committees to provide expert advice and insight in structuring senior management compensation policies. Based on the

consultants' expertise, this chapter identifies three important attributes for compensation committee members to arrange more aligned compensation contracts that motivate investment efficiency, which becomes the basis for formulating the hypotheses in this thesis. It specifically predicts that business – CEO, legal and accounting/finance expertise of compensation committee members will enhance the ability of the committee in arranging more aligned executive compensation that induce the executives to invest efficiently. Building upon resource dependency, group effectiveness and human capital literature, this thesis also predicts that team members' heterogeneity and the interacting characteristics an individual director has, will significantly influence the net effect of the relationship between compensation committee expertise and investment efficiency. The next chapter, Chapter 5 discusses the research methodology to test the hypotheses.

Chapter 5
Research Method

This chapter details the research methodology that will be used to formally test investment efficiency within the context of single expertise of the compensation committee, the mix of expertise on the compensation committee and the joint expertise of compensation committee members. The first section describes the models used in this thesis. The second section provides the description on data, sampling and variable measurements.

5.1 Research Model

Multivariate regression models are used to examine, the effect on investment efficiency, of (1) single expertise of compensation committee members, (2) mix of expertise amongst compensation committee members, and (3) joint expertise of compensation committee members. Investment efficiency[26] is measured using two approaches in Biddle et al., (2009) and Cheng et al., (2013). Table 1 presents the definition of variables that are used to construct investment efficiency.

<<<< INSERT TABLE 1 ABOUT HERE >>>>

Furthermore, all models include industry fixed-effects, using the Fama and French (1997) 48-industry classification code to control industry-specific shocks to investment. Given that the study spans several years, the potential effect of time is also controlled. The models are discussed below.

[26] Refer to the following sections for details of how investment efficiency is measured using the two approaches.

5.1.1 Investment Efficiency and Single Expertise of Compensation Committee Members

- Model 1

The following model is employed to test how single expertise of compensation committee members in a firm contributes to investment efficiency:

$$TINVEST_{i,t+1} = \alpha + \beta_1 OVERI_{i,t+1} + \beta_2 BUS_{i,t} + \beta_3 LAW_{i,t} + \beta_4 AF_{i,t} + \beta_5 OVERI_{i,t+1} * BUS_{i,t} + \beta_6 OVERI_{i,t+1} * LAW_{i,t} + \beta_7 OVERI_{i,t+1} * AF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(1)}$$

Where:

$TINVEST_{i,t+1}$	=	Total investment in t+1 year, which is the sum of capital expenditure, R&D expenditure, and acquisition, minus sales of PPE, scaled by lagged total asset.
$OVERI_{i,t+1}$	=	A ranked variable capturing the likelihood of over-investment. The variable is derived from averaging the deciles of cash and inverse leverage.
$BUS_{i,t}$	=	Business – CEO expertise of compensation committee of firm *i* in each year *t* during the period of 2003–2010, measured by a dichotomous variable, which is coded 1 if the compensation committee has at least one member with business expertise, 0 otherwise.
$LAW_{i,t}$	=	Legal expertise of compensation committee of firm *i* in each year *t* during the period of 2003–2010, measured by a dichotomous variable, which is coded 1 if the compensation committee has at least one member with legal expertise, 0 otherwise.
$AF_{i,t}$	=	Accounting/finance expertise of compensation committee of firm *i* in each year *t* during the period of 2003–2010, measured by a dichotomous variable, which is coded 1 if the compensation committee has at least one member with accounting/finance expertise, 0 otherwise.
$OVERI_{i,t+1} * BUS_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $BUS_{i,t}$ that captures the effect of compensation committee members with business – CEO expertise on firms that are likely to over-invest.
$OVERI_{i,t+1} * LAW_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $LAW_{i,t}$ that captures the effect of compensation committee members with legal expertise on firms that are likely to over-invest.
$OVERI_{i,t+1} * AF_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $AF_{i,t}$ that captures the effect of compensation committee members with finance/accounting expertise on firms that are likely to over-invest.
$Control_{j,i,t}$	=	A set of control variables (detail is provided in the control variables section).
$FYEAR_{i,t}$	=	A dummy variable to control for the fixed effect of the time
$FFINDUSTRY_{i,t+1}$	=	A dummy variable to control for the industry-specific effects on investments using the Fama-French (Fama & French, 1997) 48-industry classification
ε	=	error term.

Following prior studies (Biddle, et al., 2009; Cheng, et al., 2013), Model 1 estimates investment efficiency based on a firm's likelihood of under- or over-investing by using a rank variable $OVERI_{i,t+1}$ that distinguishes whether a given firm is more likely to under-invest or over-invest in a particular year. With the inclusion of $OVERI_{i,t+1}$, the model indicates that an increase (decrease) in total investment in t +1, when a firm is likely to under- (over-invest) is an indication of investment efficiency.

From the model, the dependent variable, $TINVEST_{i,t+1}$, is the total level of investment in firms, which captures both the likelihood that a firm over- or under-invests. As the hypotheses in this study are conditional on the respective ex ante likelihoods of under-investment and over-investment (Biddle, et al., 2009; Cheng, et al., 2013), a variable $OVERI_{i,t+1}$ is used to distinguish between situations in which a given firm is more likely to under-invest or over-invest. To construct $OVERI_{i,t+1}$, this study focuses on cash and leverage, follows prior studies that suggest firms with high cash and/or low leverage are more likely to over-invest due to agency problems that result in inefficient use of the excessive cash, such as empire building and perquisites consumption (Biddle, et al., 2009; Blanchard, et al., 1994; Jensen, 1986) and firms with a low level of cash or high leverage are more likely to be financially constrained and suffer debt overhang problems, forcing them to under-invest (Biddle, et al., 2009; Jensen, 1986; Myers & Majluf, 1984; Stulz, 1990). $OVERI_{i,t+1}$ is then created by decile ranking the sample firms based on cash and leverage[27] (leverage is multiplied by minus one (-1) before ranking, so that leverage, as for cash, is consistently increasing in the likelihood of over-investment), and is computed as the average of the ranks of the two variables. For example, a firm with cash in decile 2 and inverse leverage in decile 8 will have a rank equal to 5 (this variable is then ranging from zero to one, so that its rank would be 0.5).

To test H1, this study focus on the expertise variable *BUS*, *LAW* and *AF* and its interaction with $OVERI_{i,t+1}$. If $OVERI_{i,t+1}$ equals zero, then the firms are in the lowest decile of cash and negative leverage, hence the firms are more likely to under-invest.

[27] Cash is defined as the ratio of cash to total assets and leverage is the ratio of long-term debt to the sum of long-term debt to the market value of equity. Both variables are rescaled to range between 0 and 1.

Under this scenario, if the compensation committee single expertise *BUS*, *LAW*, and *AF* mitigate under-investment, then each of the coefficients of *BUS*, *LAW*, and *AF* (β_2, β_3, and β_4) is expected to be positive, indicating that each *BUS*, *LAW*, and *AF* will increase the level of total investment towards its optimal level. On the other hand, if $OVERI_{i,t+1}$ equals one, then the firms are in the highest decile of cash and negative leverage, hence the firms are more likely to over-invest. Under this scenario, if the compensation committee single expertise *BUS*, *LAW*, and *AF* indeed mitigate over-investment, then the sum of the coefficients on (*BUS, LAW, AF*) and $OVERI_{i,t+1}$ * *BUS* (*LAW, AF*)$_{i,t}$, i.e. $\beta_2 + \beta_5$, $\beta_3 + \beta_6$, and $\beta_4 + \beta_7$ is expected to be negative, indicating that each *BUS*, *LAW*, and *AF* will reduce the level of total investment towards its optimal level.

Following previous literature, several sets of control variables that influence investment efficiency and compensation committee effectiveness are included in the models to control the effects that could confound the results. These variables will be further explained in variable measurement section.

- Model 2

Under the second model, following Biddle et al. (2009), the expected level of firm-specific investment of capital is directly modelled on the firm's growth opportunities as proxied by sales growth, and is depicted in the following model:

$$TINVEST_{i,t+1} = \beta_0 + \beta_1 SGrowth_{i,t} + \varepsilon_{i,t+1} \quad \textbf{(2)}$$

Where:

$SGrowth_{i,t}$ = The yearly percentage growth rate of sales, which is measured as the percentage change in sales from year t-1 to t.

Other variables are defined in equation 1.

Under the model in equation 2, it is assumed that firms invest efficiently when their investment is in proportion to their sales growth. When firms invest proceeds from their sales, the residuals in the equation approach 0 (zero), which indicates the optimal or normal level of investment. Higher positive and negative residuals capture a firm-specific deviation from optimal levels of investment, with larger positive and negative deviations representing less investment efficiency.

As specified by Biddle et al. (2009), the firms are sorted yearly and grouped into quartiles based on the magnitude of the residuals from equation 2. These groups of firms (that are grouped into quartiles based on their residuals) become the dependent variable in the model. Firm-year observations in quartile 1, representing the lowest (the most negative) residuals, are classified as under-investment group (*INVEFF* = 1), whereas observations in quartile 4, representing the highest (the most positive) residuals, are classified as the over-investment group (*INVEFF* = 2). Firm-year observations in quartiles 2 and 3, with the residuals close to zero (0), act as the reference group representing normal/efficient investments (*INVEFF* = 0). In order to examine the effect of the single expertise within compensation committee on investment efficiency, the following multinomial logit model in equation 3 is examined.

$$\Pr(INVEFF=1, INVEFF=2) = \alpha + \beta_1 BUS_{i,t} + \beta_1 LAW_{i,t} + \beta_1 AF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(3)}$$

Where:

INVEFF = The residuals from the investment model, which regresses investment at time t+1 against current sales growth. The residuals are then ranked into quartiles by each year and Fama-French (1997) industry classification to assign a code of 0, 1 or 2 to each of firm-year observation;
- *INVEFF* = 1, under-investment group, comprising firm-year observation in quartile 1 of *INVEFF* with the most negative residuals
- *INVEFF* = 2, under-investment group, comprising firm-year observation in quartile 4 of *INVEFF* with the most positive residuals.
- *INVEFF* = 0, benchmark group, comprising firm-year observations with residuals close to 0.

Other variables are defined in equation 1.

The multinomial logit model predicts whether a firm's likelihood of being in the lowest quartile (*INVEFF*= 1) or in the highest quartile (*INVEFF*= 2), as opposed to the two middle quartiles (*INVEFF*= 0), is associated with business – CEO (*BUS*), legal (*LAW*), or accounting/finance (*AF*) attributes held by compensation committee members as test variables in this study. The model in equation 3 specifies simultaneously, but separately, the likelihood of under- and over-investment as a function of the compensation committee single expertise. It is expected that the coefficients of the test variables (β_1, β_2, and β_3) are negative, showing that firms with compensation committee members holding

BUS, *LAW*, or *AF* are less likely to be in the most extreme quartile of residuals (the under-investment group and/or over-investment group).

5.1.2 Investment Efficiency and Mixed Expertise of Compensation Committee Members

To test Hypothesis 2, the investigation is extended to examine the effect of a mix of the three types of single expertise (i.e. *BUS*, *LAW*, and *AF*) of the compensation committee on investment efficiency. Models similar to those described earlier in this chapter are employed to examine the influence of the mix of expertise amongst compensation committee members on investment efficiency, except that the variable of interest in this model now becomes the mixed expertise. The mix of expertise amongst compensation committee members represents combinations of those single areas of expertise previously considered, i.e., the committee comprises of two types of expertise[28]. For instance, the mix of business – CEO and legal expertise means that the compensation committee will have at least one member with CEO expertise and at least one other member with legal expertise. Thus, there are in total three different mixes of compensation committee expertise variables examined in this study: a mix of business – CEO and law expertise (*MBUSLAW)*, a mix of business – CEO and accounting expertise (*MBUSAF)*, and a mix of legal and accounting expertise (*MLAWAF)*. The effect of mix of expertise on investment efficiency will be examined using the following two models in Equation 4 and 5

- Model 1

Like model 1 in the previous section, the focus of this model is on the mixed expertise variables, i.e. $MBUSLAW_{i,t}$, $MBUSAF_{i,t}$ and $MLAWAF_{i,t}$ and its interaction with $OVERI_{i,t+1}$. Under the scenario of highest likelihood of under-investment (i.e. $OVERI_{i,t+1}$ in the lowest decile of cash and negative leverage), if $MBUSLAW_{i,t}$, $MBUSAF_{i,t}$ and $MLAWAF_{i,t}$, indeed, mitigate under-investment, then each of the coefficients of $MBUSLAW_{i,t}$, $MBUSAF_{i,t}$ and $MLAWAF_{i,t}$ (β_2, β_3, and β_4) is expected to be positive. The

[28] This study omits to test the mix of all three types of expertise, given the limited sample available for firms with such a mix of expertise.

positive coefficients indicate that in the presence of these three types of mixed expertise, the level of total investment increases towards its optimal level, under a setting where under-investment is more likely. By contrast, under the scenario of higher likelihood of over-investment (i.e. $OVERI_{i,t+1}$ in the highest decile of cash and negative leverage), if the compensation committee mixed expertise mitigate over-investment, then the sum of the coefficients on *MBUSLAW* (*MBUSAF*, *MLAWAF*)$_{i,t}$ and $OVERI_{i,t+1}$ * *MBUSLAW* (*MBUSAF*, *MLAWAF*)$_{i,t}$, i.e. $\beta_2 + \beta_5$, $\beta_3 + \beta_6$, and $\beta_4 + \beta_7$ is expected to be negative, indicating that these three types of mixed expertise will reduce the level of total investment towards its optimal level.

$$TINVEST_{i,t+1} = \alpha + \beta_1 OVERI_{i,t+1} + \beta_2 MBUSLAW_{i,t} + \beta_3 MBUSAF_{i,t} + \beta_4 MLAWAF_{i,t} + \beta_5 OVERI_{i,t+1} * MBUSLAW_{i,t} + \beta_6 OVERI_{i,t+1} * MBUSAF_{i,t} + \beta_7 OVERI_{i,t+1} * MLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(4)}$$

Where:

$MBUSLAW_{i,t}$ = A dichotomous variable, which takes a value of 1 if a compensation committee of firm *i* in each year *t* during the period of 2003–2010 has at least a mix of 1 member with business – CEO expertise and another member with legal expertise, 0 otherwise.

$MBUSAF_{i,t}$ = A dichotomous variable, which takes a value of 1 if a compensation committee of firm *i* in each year *t* during the period of 2003–2010 has at least a mix of 1 member with business – CEO expertise and another member with accounting/finance expertise, 0 otherwise.

$MLAWAF_{i,t}$ = A dichotomous variable, which takes a value of 1 if a compensation committee of firm *i* in each year *t* during the period of 2003–2010 has at least a mix of 1 member with legal expertise and another member with accounting/finance expertise, 0 otherwise.

$OVERI_{i,t+1}$* $MBUSLAW_{i,t}$ = An interactive variable between $OVERI_{i,t+1}$and $MBUSLAW_{i,t}$ that captures the effect of compensation committee members with mix of business – CEO and legal expertise on firms that are likely to over-invest.

$OVERI_{i,t+1}$* $MBUSAF_{i,t}$ = An interactive variable between $OVERI_{i,t+1}$ and $MBUSAF_{i,t}$ that captures the effect of compensation committee members with mix of business – CEO and accounting/finance expertise on firms that are likely to over-invest.

$OVERI_{i,t+1}$* $MLAWAF_{i,t}$ = An interactive variable between $OVERI_{i,t+1}$ and $MLAWAF_{i,t}$ that captures the effect of compensation committee members with mix of legal and accounting/finance expertise on firms that are likely to over-invest.

Other variables are defined in equation 1.

- Model 2

The same procedure as discussed in the previous section is also used to develop the second model to examine the mix of expertise within the compensation committee on investment efficiency. The following model is proposed:

$$\Pr(INVEFF=1, INVEFF=2) = \alpha + \beta_1 MBUSLAW_{i,t} + \beta_2 MBUSAF_{i,t} + \beta_3 MLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(5)}$$

All variables are defined in equations 3 and 4.

An approach similar to that in the previous section is used to form the dependent variable, Pr(*INVEFF* =1, *INVEFF* =2*)*. The multinomial logit model will test the effect of a compensation committee's mix of expertise (*MBUSLAW*, *MBUSAF*, and *MLAWAF*) on the likelihood that firms will be in the under-investment group (*INVEFF* =1*)* or in the over-investment group (*INVEFF*=2) referenced against the benchmark group (*INVEFF*=0). The coefficients of *MBUSLAW*, *MBUSAF*, and *MLAWAF* are expected to be negative for both cases of under-investment and over-investment, suggesting that in the presence of the mixed expertise within the compensation committee, the firms will less likely to be in the most extreme residuals groups as opposed to the benchmark group.

5.1.3 Investment Efficiency and Joint Expertise of Compensation Committee

In section 5.11 and 5.1.2, the regression model considers the effect of single expertise and the mix of expertise within compensation committee on investment efficiency respectively. Further investigation is conducted to examine the joint effect of the expertise of the compensation committee on investment efficiency. Joint expertise within the compensation committee arises when one compensation committee member of a firm possesses two different areas of expertise from the three identified attributes.[29] For example, a compensation committee with joint business – CEO and legal expertise (*JBUSLAW*) suggests that the committee has at least one member, who is both a CEO

[29] This study is limited to test the joint effect of 2 kinds of expertise, given the limited sample available to test the 3-way joint expertise.

and a legal expert. In total, there are three different joint expertise variables tested in this study: joint business – CEO and legal expertise (*JBUSLAW*), joint business – CEO and accounting expertise (*JBUSAF*), and joint legal and accounting expertise (*JLAWAF*). Similar models (Model1 and Model 2) as in the single and mixed expertise are used to test the effect of joint expertise within the compensation committee on investment efficiency. The two models are presented in the Equation 6 and 7.

- Model 1

$$TINVEST_{i,t+1} = \alpha + \beta_1 OVERI_{i,t+1} + \beta_2 JBUSLAW_{i,t} + \beta_3 JBUSAF_{i,t} + \beta_4 JLAWAF_{i,t} + \beta_5 OVERI_{i,t+1} * JBUSLAW_{i,t} + \beta_6 OVERI_{i,t+1} * JBUSAF_{i,t} + \beta_7 OVERI_{i,t+1} * JLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(6)}$$

Where:

$JBUSLAW_{i,t}$	=	Joint business – CEO and legal expertise within the compensation committee of firm i in year t during the period of 2003–2010, measured by a dichotomous variable coded 1 if the compensation committee has at least one member with both business – CEO and legal expertise, 0 otherwise.
$JBUSAF_{i,t}$	=	Joint business – CEO and accounting/finance expertise within the compensation committee of firm i in year t during the period of 2003–2010, measured by a dichotomous variable coded 1 if the compensation committee has at least one member with both business – CEO and accounting/finance expertise, 0 otherwise.
$JLAWAF_{i,t}$	=	Joint legal and accounting/finance expertise within compensation committee of firm i in year t during the period of 2003–2010, measured by a dichotomous variable coded 1 if the compensation committee has at least one member with both legal and accounting/finance expertise, 0 otherwise.
$OVERI_{i,t+1}$* $JBUSLAW_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $JBUSLAW_{i,t}$ that captures the effect of compensation committee members with joint business – CEO and legal expertise on firms that are likely to over-invest.
$OVERI_{i,t+1}$* $JBUSAF_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $JBUSAF_{i,t}$ that captures the effect of compensation committee members with joint business – CEO and accounting/finance expertise on firms that are likely to over-invest.
$OVERI_{i,t+1}$* $JLAWAF_{i,t}$	=	An interactive variable between $OVERI_{i,t+1}$ and $JLAWAF_{i,t}$ that captures the effect of compensation committee members with of joint law and accounting/finance expertise on firms that are likely to over-invest.

Other variables are defined in equation 1.

Similar to previous models in this chapter, to test H3, this study focus on the joint expertise variable *JBUSLAW*, *JBUSAF*, and *JLAWAF* and its interaction with $OVERI_{i,t+1}$. As discussed before If $OVERI_{i,t+1}$ equals zero, then the firms are in the

lowest decile of cash and negative leverage, hence the firms are more likely to under-invest. Under this scenario, if under investment is mitigated by *JBUSLAW*, *JBUSAF*, and *JLAWAF*, then each coefficient of these variables (β_2, β_3, and β_4) is expected to be positive, indicating that each *JBUSLAW*, *JBUSAF*, and *JLAWAF* will increase the level of total investment towards its optimal level in a setting of under-investment is more likely. On the other hand, if $OVERI_{i,t+1}$ equals one, then the firms are in the highest decile of cash and negative leverage, hence the firms are more likely to over-invest. Under this scenario, if the compensation committee joint expertise *JBUSLAW*, *JBUSAF*, and *JLAWAF* mitigate over-investment, then the sum of the coefficients on *JBUSLAW* (*JBUSAF*, *JLAWAF*)$_{i,t}$ and $OVERI_{i,t+1}$ * *JBUSLAW* (*JBUSAF*,*JLAWAF*) i.e. $\beta_2 + \beta_5$ ($\beta_3+\beta_6$, $\beta_4+\beta_7$) is expected to be negative, indicating that in a setting of over-investment is more likely each *JBUSLAW*, *JBUSAF*, and *JLAWAF* will reduce the level of total investment towards its optimal level.

- Model 2

The following multinomial logit model in equation (7), similar to the previous two sections, is used to investigate the effect of joint expertise of compensation committee on investment efficiency (H3).

$$\Pr(INVEFF = 1, INVEFF = 2) = \alpha + \beta_1 JBUSLAW_{i,t} + \beta_2 JBUSAF_{i,t} + \beta_3 JLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(7)}$$

All variables are defined in equation 1, equation 3 and equation 6.

In Equation 7, as discussed earlier, the model tests the effect of joint expertise with the compensation committee on likelihood of firms of being in the lowest quartile of residuals (*INVEFF* = 1) or in the highest quartile of residuals (*INVEFF* = 2), relative to the two middle quartiles of residuals (*INVEFF* = 0). As in the Equation 3 and 5, the model in equation 7 specifies simultaneously, but separately, the likelihood of under- and over-investment as a function of the compensation committee joint expertise. It is expected that the coefficients of the *JBUSLAW*, *JBUSAF*, and *JLAWAF* (β_1, β_2, and β_3 respectively), for both cases of under-investment and over-investment, are negative,

showing that firms with joint expertise on their compensation committees are less likely to be in the most extreme quartile of residuals (the under-investment group and/or over-investment group) relative to the normal investment group.

5.2 Data Collection

5.2.1 Measuring Compensation Committee Expertise

In this section, the procedure used to measure compensation committee expertise as the variables of interest in this study is detailed. As described in Chapter 4, the compensation committee expertise variables used in the thesis are based on the expertise of compensation consultants. In the absence of current regulation and studies that specify what attributes of compensation committee members contribute to efficient compensation contract design, an examination of the profiles of executive compensation consultants is conducted to identify which types of expertise can be extrapolated to an effective compensation committee. Surveying 100 executive compensation consultants profiles to form the expertise of compensation committee members is based on the rationale that the consultants are frequently employed to provide expert advice and insights on executive compensation matters, based on their knowledge about relevant laws, compensation practices and their access to the detailed proprietary compensation practice (Cadman, et al., 2010; Murphy & Sandino, 2010), making these consultants' expertise relevant for compensation committees in making prudent compensation policy decisions as demanded by shareholders and regulators.

Following Krishnan et al. (2011), Dhaliwal et al. (2010) and DeFond et al. (2005b), expertise of each of the committee members is coded based on their educational background, academic qualification, professional certification and/or professional experience. Biographical information of the members obtained from the proxy statement was examined to assign the three types of expertise – business, legal and accounting/finance using a binary code of zero and one.

Profiles of the directors from proxy statements generally include current and past experience and education qualification. In the process of classifying the attributes of

compensation committee members, some judgement was necessarily involved because the information about the professional qualifications of committee members from proxy statements was sometimes unclear and brief. Furthermore, if the proxy statement does not provide sufficient information for coding the biographical data, proxy statements of the particular firm from different years were also used to complement missing information about compensation committee members attributes at the current year. Additionally, if the proxy statement of the firm did not provide sufficient information for coding the biographical data, the proxy statements of other firms and the Risk Metrics database were also used as supplemental information and confirmation of the attributes. Dhaliwal et al. (2010) adopt a similar approach to confirm the biographical information of proxy statements.

Some keywords were applied during the classification of attributes to ensure uniformity in the measurement of the attributes. For example, "CEO[30]" is used as a keyword to assign a member of the compensation committee as a business expert, "lawyer" as a keyword for legal expert or "accountant" as a keyword for accounting/finance experts. Table 2 describes the definition of the committees' attributes used as keywords in assigning the compensation committee members to the expertise.

As specified in Table 2, a compensation committee member is classified as a business – CEO expert (*BUS)* if the member had a working experience or presently works as a CEO. Following prior study (Krishnan, et al., 2011), a legal expert (*LAW*) is defined as a compensation committee member with a law school degree, such as J.D, LL.B, LL.D, or LL.M and/or past or current working experience as an attorney/partner in a law firm/general counsel/law executive of a firm. The classification of accounting/finance attributes of compensation committee members also follows similar approaches used in previous studies (e.g. Defond, et al., 2005a; Dhaliwal, et al., 2010). Accounting/finance attributes (*AF*) exist when compensation committee members hold a degree in

[30] Initially, a compensation committee member with a business attribute is defined as a member with a degree in business/management and/or has a current/past working experience as a company's executive that includes CEOs, and/or other top executives. However, this definition of business attributes leads to over 90% of the entire sample of compensation committee members are being classified as business experts. Thus, to allow more variation in the sample, this study restricts the business attributes to CEOs.

accounting/finance and/or have working experience in the accounting/finance area, such as finance/accounting executives (chief financial officers, chief accounting officers, chief investment officers, vice presidents of finance/accounting), accountants, financial controllers, investment bankers, financial analysts, partners/executives in investment/accounting firms or other financial management role.

<<<INSERT TABLE 2 ABOUT HERE>>>

Examples of compensation committee members classified as having *BUS* (Panel A), *LAW* (Panel B), and *AF* (Panel C), as disclosed in proxy statements are provided in Appendix 3. Since the focus of the study is at the committee level, a dichotomous measure (*DUMMY*) is constructed to convert each of the three types of expertise (*BUS*, *LAW*, and *AF*) from the director-level to the committee-level.

As the data about compensation committee expertise obtained from proxy statements is at the member level, the coding procedure of the expertise variables in this thesis involves two steps: at the member level (i.e. raw data from proxy statements) and at the committee level (i.e. the final data that will be used to test the hypotheses). At the member level, a value of one is assigned to a committee member with a particular type of expertise and zero otherwise. This is applied to all members of the compensation committee, drawing upon information in the firm's proxy statements. After all members have been coded either one or zero (for each type of expertise), following Krishnan et al. (2011)[31] the data at the member level is then converted to the committee level: a value of one is assigned to a firm if at least one member of the committee has that particular area of expertise and zero otherwise.

For example, in the case of a compensation committee comprising two members A and B, if "Member A" holds legal expertise (and does not hold the other two types of

[31] In their study, Krishnan et al. (2011) use three alternative measures of expertise (*DUMMY*, *PROPORTION*, and *NUMBER*). The main test of this thesis is limited to the *DUMMY* proxy. The test based on *PROPORTION* and *NUMBER* proxy is presented in Chapter 7 Sensitivity Analysis.

expertise) and “Member B” does not hold any of the three types of expertise, then at the member level “Member A” will be coded one for *LAW*, and coded zero for both *BUS* and *AF*, while “Member B” will be coded zero for all three types of expertise (*BUS*, *LAW*, and *AF*). At the committee level, the compensation committee will be coded one for *LAW* when testing H1b, due to “Member A’s” expertise, and coded zero for *BUS* and *AF*, when testing H1a and H1c. Similarly, if “Member A” holds legal expertise (and does not hold other types of expertise) and “Member B” also holds only legal expertise in the same compensation committee, while at the member level both members will be coded one for *LAW*, at the committee level the coding is the same as that described above, as the requirement is that at least one member has a particular type of expertise to be coded one for H1a, HI1b or H1c testing.

In another case, if “Member A” holds legal expertise (and does not hold the other two types of expertise) and “Member B” has business – CEO experience (and does not hold the other two types of expertise), “Member A” is coded one for *LAW* and “Member B” is coded one for *BUS*. For H1, at the committee level, the observation will be coded one for *BUS* (due to the presence of “Member B”, who holds business – CEO expertise only) to test H1a and be coded one for *LAW* (due to the presence of “Member A”, who holds legal expertise only) to test H1b; and zero for H1c. Furthermore, given the presence of both types of expertise, at the committee level the firm is considered to contain a mix of both *LAW* and *BUS* expertise and would be coded one for *MBUSLAW*, when testing H2, and zero for all other types of mixed expertise .

Finally, if “Member A” holds two types of expertise, i.e. CEO experience and legal expertise and “Member B” does not hold any type of expertise, at the member level “Member A” will be coded one for each *BUS* and *LAW* expertise, and “Member B” will be coded zero for all types of expertise. At the committee level, however, when testing H1a and H1b the observation will be coded zero because the primary purpose of Hypothesis 1 (whether it is H1a, H1b or H1c) is to isolate the effect of a single type of expertise on investment efficiency. In this example, as the effect of legal expertise is unable to be isolated from that of business – CEO expertise, and vice versa (due to “Member A” holding both types of expertise), the observation is coded zero for both

H1a and H1b. The fact "Member A" has two types of expertise (business – CEO and legal expertise) is captured at the committee level when testing H3, as the firm is considered to contain a member with joint expertise and would be coded one for *JBUSLAW*, and zero for all other types of joint expertise.

The coding procedure outlined above ensures that, for Hypothesis 1a (1b, 1c), the observed effect of business – CEO (legal, accounting/finance) expertise is due to the effect of the expertise itself and is not due to other types of expertise. In recognising that a compensation committee may comprise members with a mix of two types of expertise (mixed expertise effect) or have a member with two types of expertise (joint expertise effect), the thesis is then extended to test Hypothesis 2 and Hypothesis 3. Hypothesis 2 is intended to examine the effect of a compensation committee containing mixed expertise on investment efficiency, i.e. when a compensation committee comprises members with different types of single expertise and Hypothesis 3 is aimed to test the effect of a compensation committee containing joint expertise on investment efficiency, i.e. when at least one member in a committee holds two types of expertise. Hypothesis 2 and Hypothesis 3 test the combined effects of two varying types of expertise present in a compensation committee has on investment efficiency, whether it be mixed and joint expertise effects, which are not observable in Hypothesis 1. In particular, hypothesis 3 overcome the concerns of coding observations zero, when testing H1a, H1b and H1c, if a member has other types of expertise (note that in the case of mixed expertise, as explained above, the observation would still be coded one for hypothesis 1 purposes). Thus, Hypothesis 2 and Hypothesis 3 are providing evidence of incremental effects of combined expertise on investment efficiency.

- Control Variables

Several sets of control variables that influence investment efficiency and compensation committee effectiveness are used to control confounding effects of those variables on the results of this study. Following prior research (e.g. Biddle, et al., 2009; Cheng, et al., 2013), the first control group are based on the variables that may influence investment (Panel A of Table 3). For instance, it is argued firms with large cash balances and free

cash flows will provide more opportunity to their CEOs to engage in value destroying investment activities (e.g. Blanchard, et al., 1994; Jensen, 1986; Richardson, 2006). Thus, the firms' economic characteristics, such as firm size (*FSIZE)*, market to book ratio (*MKTBOOK*), bankruptcy risk (*ZSCORE*), tangibility (*TANGIBILITY*), leverage (*LEV*), industry leverage (*INDLEV*), dividend (*DIVIDEND*), slack (*SLACK*), firm age (*FAGE*), sales and cash flow volatility (*SDSALE* and *SDCFOP*)[32], the length of operating cycle (*OPCYCLE*), the frequency of losses (*LOSS*) and investment volatility (*SDINV*), are included as control variables in this study. These variables were obtained from the Compustat database. The analyst coverage (*ANALYST*), as a governance mechanism, is also included as a control variable, because prior research suggests that the analysts provide public information that reduces information asymmetries between firms and market participants (Roulstone, 2003). The number of analyst following was downloaded from the I/B/E/S database. As it has been found that financial reporting quality (*FRQ*) and disclosure of material weaknesses in internal control (*ICW*) also influence investment efficiency (Biddle, et al., 2009; Cheng, et al., 2013), these two variables are also included as control variables. The Compustat database is utilised to obtain the financial reporting quality variable, whereas the internal control weaknesses variable is obtained from the Audit Analytics variable.

<<<< INSERT TABLE 3 ABOUT HERE >>>>

Given this thesis is focused on how investment efficiency is influenced by the attributes of compensation committee members, the second group of the control variables capture the compensation committee governance, as identified in previous studies (e.g. Beasley, 1996; Brickley, et al., 1994; Conyon & Lerong, 2004; Core, Holthausen, & Larcker, 1999; Daily, et al., 1998; Graham & Wu, 2007; Kren & Kerr, 1997; Laksmana, 2008; Morck, Shleifer, & Vishny, 1988; Sun, et al., 2009; Vafeas, 2003a; Wade, O'Reilly, &

[32] Following Biddle et al. (2009) and Cheng et all. (2013), the cash flow used in *SDCFOP* and *CFOSALE* is the cash-flow from operating activities.

Chandratat, 1990). The variables to control compensation committee characteristics (Panel B of Table 3) include size (*CCSIZE*), number of meetings (*CCMEET*), age (*CCAGE*), tenure (*CCTNR*), the number of directorships held (*CCBRD*), shareholding (*CCSHR*), and independence (*CCINDP*). These control variables were hand collected from firms' proxy statement and the Risk Metrics database. The definition of these two groups of control variables are also presented in Table 3.

5.2.2 Sample

Following previous studies on investment efficiency and compensation committee governance (e.g., Biddle et al., 2009; Murphy and Sandino, 2010; Sun, Cahan, and Emanuel, 2009), this study examines sample firms from the S&P 1500. The data used for this study is sourced from a combination of databases, i.e. Compustat, I/B/E/S, CRSP, Risk Metrics, Audit Analytics and manually collected data. Data on compensation committee attributes are hand-collected from proxy statements filed with the SEC available from the SEC website. The study covers an eight-year period beginning in 2003 through to 2010. The main reason for choosing 2003 as the first year for data collection is due to the adoption of the 2003 stock exchange governance listing rules mandating the establishment of compensation committees[33].

The sample selection procedure and sample distribution are reported in Table 4. Panel A of Table 4 reports the sample selection procedure. The table shows that the initial sample of this study consists of a total of 14,904 firm-year observations representing firms on the S&P 1500 during the sample period. Consistent with prior research, sample firms from financial and utilities institutions (SIC codes 6000 - 6999, and 4900 - 4999) are excluded from the analysis, due to the ambiguity in differentiating between their operating, investing, and financing activities (Biddle, et al., 2009; Richardson, 2006), resulting in the exclusion of 3,534 firm-year observations. A further 1,752 firm-year observations are also excluded from the sample as a result of some firms' proxy statements not being available for download from the SEC website. After deducting 586

[33] See Chapter 2 Regulatory Framework for further detail on the rules

firm-year observations due to missing information on compensation committee expertise in the firms' proxy statements and Risk Metrics, 791 firm-year observations with missing data on analyst following from I/B/E/S, 448 firm-year observations with missing investment related variables data from Compustat, 297 firm-year observations with missing internal control weakness disclosures from Audit Analytics, and 483 firm-year observations of data outliers from Compustat, this study utilises a final sample of 7,013 firm-year observations.

<<<< INSERT TABLE 4 ABOUT HERE >>>>

Table 4 Panel B shows the yearly distribution of the firm-year observations. The lowest number of observations is in 2010 with a total of 828 firm-year observations, which is 11.81 percent of the final sample, whereas the largest observation number is in 2005, with a total of 907 firm-year observations or 12.93 percent of the sample. The annual distribution of the sample is fairly even with no apparent evidence of clustering in any year. Table 4 Panel C reports the distribution of the firm-year observations by industry, based on the Fama and French (1997) 48-industry classification code. The most highly represented industry is the Business Service industry, with 779 firm-year observations (11.11 %). It is also shown that the sample comprises 36 industries with less than three percent of the membership in each industry, which have been consolidated in the last line of Panel C and in total constitutes 2,490 firm-year observations (35.51%). Although there is no apparent evidence of either industry or year clustering in the sample as shown in Table 4, the regression models will control for industry and time effects.

5.3 Conclusion

This chapter describes the research method employed to empirically test the hypotheses. Following prior literature on investment efficiency, this thesis utilises two research models – the likelihood and the unconditional models. The conditional model tests the hypotheses based on the firms' likelihood of under- or over-investing. The focus of

Model 1 is on the compensation committee expertise and its interaction with $OVERI_{i,t+1}$. It is expected that the coefficient of compensation committee expertise is positive, indicating that the level of total investment increases towards its optimal level under a setting where under-investment is more likely. Under the scenario of higher likelihood of over-investment, the sum of the coefficients on the expertise and the interactive term between $OVERI_{i,t+1}$ and the expertise is expected to be negative, indicating that the expertise will reduce the level of investment towards its optimal level.

Model 2, on the other hand, test the effect of a compensation committee's expertise on the likelihood that firms will be in the under-investment group (*INVEFF* =1*)* or in the over-investment group (*INVEFF*=2) referenced against the benchmark group (*INVEFF*=0). This model specifies simultaneously, but separately, the likelihood of under- and over-investment as a function of the compensation committee expertise. It is expected that the coefficients of the test variables are negative, showing that firms with compensation committee members holding the specified areas of expertise are less likely to be in the most extreme quartile of residuals (the under-investment group and/or over-investment group). The next chapter, Chapter 6, discusses the summary statistics and results of the study.

Chapter 6
Results and Discussion

This chapter presents the results generated from the two models of investment efficiency described in the research methodology chapter. The first section reports the summary statistics of and the correlation between variables used in the model. In the second section, the analysis of the difference in mean values of the expertise variables across the under-investment, over-investment groups, and normal investment groups is presented. The empirical results from multivariate regression testing of the three hypotheses, and the discussion and summary of the main results, are presented in Section 3. The results of a further analysis of the effect of compensation committee expertise on the three components of total investment – capital expenditure (*CAPX*), acquisition (*ACQ*) and R&D investment (*RD*) – under both models are presented and discussed in the fourth section. The fifth section provides an alternative explanation of the effect of compensation committee expertise on investment efficiency. The final section provides the overall conclusion of the results in this chapter

6.1 Summary Statistics

Table 5 reports descriptive statistics on the investment variables and compensation committee expertise variables. Panel A of Table 5 shows that the mean (median) of $TINVEST_{t+1}$ (the total investment of the sample firms), as the dependent variable in Model 1, equals 10.27 percent (8.49 percent) of prior year total assets. This reported figure is quite similar to that reported in Biddle et al. (2009)[34], although it appears that the total investment distribution in this study is less skewed (with a mean value closer to the median) than in Biddle's et al. (2009).

Panel B of Table 5 reports the summary statistics of the dependent variables of Model 2, where the residuals are placed into quartiles and grouped into normal-investment (firm-year observations in quartiles 2 and 3, *INVEFF = 0)*, under investment (firm-year

[34] Biddle et al. (2009) report the mean (median) of the total investment across their sample equals 14.14% (9.28%).

observations residing in quartile 1, *INVEFF* = 1) and over-investment group (firm-year observations residing in quartile 4, *INVEFF* = 2). The figure shows that within 3,507 firm-year observations, the mean (median) value of the residuals in the normal investment group, *INVEFF* = 0, equals to -0.83 (-0.96) with an interquartile range between -2.43 (Quartile 1) and 0.60 (Quartile 3). The negative value of mean (median) of -0.83 (-0.96) for *INVEFF* = 0 suggests a more prevalent case of under-investment among firms in the normal investment group. Nonetheless, in terms of the magnitude of inefficiency of investment, a higher degree of over-investment than under-investment is reported, as the mean (median) value for *INVEFF* = 2 equals 8.16 (7.10), in comparison with the mean (median) value of the under-investment group, *INVEFF* = 1, equalling -6.50 (-5.88).

<<<< INSERT TABLE 5 ABOUT HERE >>>>

Table 5 Panels C to F details the summary statistics of compensation committee expertise variables [35]. Without controlling for whether or not the compensation committee members hold other types of expertise, it is reported in Panel C of Table 5 that 87.95 percent (n = 6,168), 24.48 percent (n = 1,717) and 69.36 percent (n = 4,864) of compensation committees contain members holding business – CEO expertise, legal expertise and accounting/finance expertise, respectively. The numbers reported in Panel C of Table 5 use a more general definition of business expertise beyond CEO expertise, and includes Chief Operating Officers, business consultants, and committee members with a degree in business/management [36]. A more specific definition of business

[35] The column percentage or number of the committee expertise do not add up to 100 percent or 7,013 respectively, because the compensation committees may have a member(s) holding more than one type of expertise. The final sample of 7,013 firm-year observations includes 5,429 firm-year observations with compensation committees that had no single business – CEO, legal and accounting type of expertise and 3,236 firm-year observations that had no expertise at all, i.e. observations that are coded zero across H1, H2, and H3.

[36] The observations reported in Panel C of this table are not used for testing purposes. These figures are used for descriptive statistics purposes only.

expertise, i.e. CEO working experience, is adopted for hypothesis testing purposes due to the large proportion of sample firms that would otherwise be coded one under the more expansive definition. Furthermore, the figures in Panel C include observations with a 'mix' of expertise that takes into account the top 5 (rather than top 3) areas of expertise (i.e. business, legal, accounting/finance expertise, economic and human resource expertise), which was derived from an examination of the primary types of expertise possessed by compensation consultants. These five areas of expertise were then reduced to the top 3 in frequency within the compensation committee to test the hypotheses[37].

It is important, however, to ensure that the committee members, who hold any of the three main types of expertise specified as test variables, do not hold other types of expertise[38], so that the results of the regression models will not be influenced by areas of expertise other than business, legal and accounting/finance. When restricted to compensation committee members holding one type of expertise only, Table 5 Panel D reports that approximately 13.08 percent of committees in the sample have at least one compensation committee member holding single business – CEO expertise (*BUS*), 4.28 percent holding single legal expertise (*LAW*) and 7.84 percent holding single accounting/finance expertise (*AF*). Turning to mixed expertise, Table 5 Panel E, where the committee has members with a mix of two types of single expertise (i.e. at least two members in the committee holding different types of single expertise)[39], there are 3.07 percent and 1.81 percent of sample committees who appoint members with mixed business – CEO and legal expertise (*MBUSLAW*) and mixed business – CEO and

[37] The thesis is limited to examine the top 3 areas of expertise as these are the most frequent types of expertise found amongst compensation committee members (see Appendix 1). There is a significant drop off in frequency from the third most common (accounting/finance expertise, with a frequency of 15 percent) and the fourth and fifth expertise types being economics and human resources, with respective frequencies of 8.5 percent and 8 percent.

[38] These areas of expertise included are the area the most frequent areas of expertise within compensation consultants' firms: business, law, accounting/finance, economics and human resources. See Appendix 1 for the full list of expertise.

[39] For example, to be classified in the mixed business – CEO and law expertise, the firm's compensation committee should have at least one member holding single business – CEO expertise and another member holding single legal expertise. These members of the committee also cannot hold any other type of expertise.

accounting expertise (*MBUSAF*), respectively, whereas there is as little as 0.2 percent of firm-years in the observations that employ compensation committee members with mixed accounting and legal expertise (*MLAWAF*).

Panel F of Table 5 reports the summary statistics of joint expertise held by compensation committees, where one member of the committee has dual types of expertise. Within the sample firms, the most common dual expertise held within compensation committees is joint business – CEO and accounting expertise (*JBUSAF*), with 31.94 percent of sample firms having at least one member with *JBUSAF* expertise. This is followed by 6.74 percent of observations with at least one joint business – CEO and legal (*JBUSLAW*) expert member and 3.54 percent of the observations with at least one member with joint legal and accounting/finance (*JLAWAF*) expertise serving on the committee.

Summary statistics on 25 control variables used for both Model 1 and Model 2 are described in Table 6[40]. Panel A reports the summary statistics for the full sample firms of 7,013 firm-year observations. It is reported that the sample of this study consist of large firms with, on average, 1.84[41] billion dollars of total asset (the mean of *FSIZE* = *7.52*) and market value of shares nearly two times more than the book value (the mean of *MKTBOOK* = 1.97). Mean values of *ZSCORE*, *TANGIBILITY*, *SLACK*, *LEV*, and *SDINV* of 1.66, 0.26, 1.86, 0.15, and 7.19 respectively. Furthermore, on overage, more than half of the sample firms pay dividends (the mean of *DIVIDEND* = 0.54*)* and 12 percent of the firms reporting loss in their financial statement (*LOSS*). On average sample firms have been listed for 24.71 years (*FAGE*), followed by, on average, 7.23 analysts (*ANALYST*) and 19 percent of firms disclose internal control weaknesses under Section 302 or Section 404 (*ICW)*. All other investment-related control variables are generally in line with prior studies (Biddle, et al., 2009; Cheng, et al., 2013).

[40] For Model 1, leverage and slack are omitted as control variables because those variables are used to compute *OVERI*, which is included in the model. Thus, there are only 23 control variables included in Model 1.

[41] The summary statistics of *FSIZE* reported in Table 6 Panel A are based on the natural log transformation of the total assets. Thus, when the mean value of total assets of 7.52 is transformed with the inverse of the natural log, it equals to 1.84 billion dollars.

In terms of the compensation committee attributes, it is evident that the average age (*CCAGE*) and tenure (*CCTNR*) of compensation committee directors is 61.66 years and 7.87 years, respectively. Furthermore, the compensation committees, on average, consist of 3.77 members (*CCSIZE*) and meets 5.56 times a year (*CCMEET*), while approximately 57 percent of compensation committee members serving on at least two external boards (*CCBRD*). In addition, compensation committee members in the sample firms are mostly independent with 97 percent of committees in the sample comprising of all independent members (*CCINDP*). Finally with 2 percent of the committees, on average, contain members owning at least a 1 percent share ownership (*CCSHR*).

<<<< INSERT TABLE 6 ABOUT HERE >>>>

Panel B of Table 6 presents the mean values of the control variables across the groups of quartile residuals, i.e. under-investment, normal investment and over-investment firms. The table suggests that there is not much different in the average value of the investment related control variables across the under-, normal and over-investment group. Table 6 Panel B suggests that there is a linear relation between *MKTBOOK* and the residual groups, where firms in the highest residual group (i.e. over-investment firms) have the highest *MKTBOOK* relative the normal- and under-investment group. It is also reported that, confirming past research (Biddle, et al., 2009), firms within the underinvestment group have the highest leverage (*LEV*). However, it is indicated that different from previous results by Verdi (2006), firms classified as underinvesting have higher slack than the normal-investment firms and even the over-investment firms. In terms of the compensation committee attributes, there is no considerable difference found across the group of residuals.

Table 7 shows the correlation matrix between the test and control variables. The lower (upper) diagonal of the Table shows the Pearson (Spearman) correlation. While there appears to be significant correlations between variables, the variance inflation factor of

those variables remains lower than 10 (un-tabulated), which is the threshold for multicollinearity causing a threat to the results (O'Brien, 2007)

<<<< INSERT TABLE 7 ABOUT HERE >>>>

In terms of the association between compensation committee expertise as the test variables and total investment as the dependent variable, Table 7 indicates that some of the compensation expertise variables are significantly correlated with *TINVEST* under both Pearson and Spearman correlation. For example, it is reported that both *BUS* and *LAW* have significant negative correlation with *TINVEST* at the 1 and the 5 percent level respectively and *AF* is positively correlated with *TINVEST* at the 5 percent level. Despite the significant association between total investment and compensation committee expertise relate to the level of investment, rather than the efficiency of investment. As elaborated on multivariate regression section of this chapter, the relationship between compensation committee expertise and investment efficiency is the focus of this thesis, which is conditional on firm likelihood to over- or under-invest and in the presence of control variables.[42]. Therefore, it is still too early to a make solid conclusion about the relationship between compensation committee expertise and investment efficiency.

6.2 Difference in Means of Compensation Committee Expertise Analysis: Normal Investment versus Under- or Over-investment

Before undertaking multivariate analysis, it is useful to examine the univariate relationahip between the measures of investment efficiency and compensation committee expertise. This includes an analysis of any difference in mean values of compensation committee expertise within the normal-investment group against the

[42] In terms of the linear relationship between the test variables (compensation committee expertise) and investment related control variables (e.g. *FSIZE*, *MKTBOOK*, *ZSCORE*, etc.), significant correlation are reported in Table 7. It is also interesting to note from the correlation figures in the table, some of the compensation committee attributes (i.e. the members' age (*CCAGE*), committee's size (*CCSIZE*), number of directorships (*CCBRD*) and shareholdings (*CCSHR*)) also have significant correlation with total investment.

under- or over-investment group. Results are presented in Table 8. The first three columns in Table 8 describe the mean of each type of expertise within quartile 1 (representing under-investment), quartile 2 and quartile 3 (representing normal investment) and quartile 4 (representing over-investment). The last two columns in the Table present the *t-test* results of the normal investment group *versus* the under-investment group and the normal investment group *versus* the over-investment group, respectively. The mean of each type of expertise in the normal investment group should be significantly higher than the mean of each type of expertise in the extreme investment groups (the under- and over-investment groups), and thus the *t-test* between the normal and extreme investment groups is expected to be positively significant.

<<<< INSERT TABLE 8 ABOUT HERE >>>>

The *t-test* results between the normal investment and under-investment groups reveal that the means of *BUS* and *MBUSAF* are 0.145 and 0.023 in the normal investment group, compared with 0.127 and 0.010 in the under-investment group, each positively significant at the 10 percent and the 1 percent levels, respectively. When the normal investment group is compared against the over-investment group, significantly higher levels of *BUS*, *LAW*, and *MBUSLAW* (at the 1 percent level) and of *JBUSLAW* (at the 5 percent level) in the normal investment group than in the over-investment group are reported. Interestingly, an opposite result is generated with *AF*, where the mean of *AF* in quartile 4, (0.098), representing the over-investment group, is significantly higher at the 1 percent level than the mean of *AF* (0.073) in the benchmark group.

These results taken together show initial evidence of the relationship between the investment efficiency and compensation committee expertise. Apart from the insignificant and unexpected results generated for *AF*, as discussed above, some results appear to provide early confirmation of the prediction that sub-optimal investment is lower when some members with the identified area of expertise serve on the compensation committee. Nevertheless, the results presented in this section are based on

univariate analysis, and therefore require deeper examination through a multivariate regression model, which is presented in the following section.

6.3 Empirical Results and Discussion

The results from estimations of Model 1 and Model 2, which focus on the association between investment efficiency and (1) single expertise (*BUS*, *LAW*, and *AF*), (2) mix of expertise (*MBUSLAW*, *MBUSAF*, and *MLAWAF*), and (3) joint expertise (*JBUSLAW*, *JBUSAF*, and *JLAWAF*) of the compensation committee are reported in Tables 9 to 14. Recall that Model 1 (the conditional model) measures investment efficiency based on the likelihood of firms over- and under-investing with total investment ($TINVEST_{t+1}$) as the dependent variable, whereas Model 2 (the unconditional Model) is a multinomial logistic regression model that tests the likelihood that a firm is in the extreme investment residuals quartiles (*INVEFF* = 1 and/or *INVEFF* = 2) against the benchmark group (*INVEFF* = 0) as a function of compensation committee expertise. The results of both models have been corrected for heteroscedasticity and include industry fixed-effects, using the Fama and French (1997) 48-industry classification codes to control for industry-specific shocks to investment, and year fixed-effects, given that the sample in the study spans several years.

6.3.1 Model 1: Multivariate Regression of Analysis of the Effect of Compensation Committee Expertise on Investment Efficiency based on the Likelihood Model

Table 9 reports the results of the multivariate regression model of the effect of compensation committee single expertise on investment efficiency based on Model 1. Note that Model 1 estimates investment efficiency on the respective ex-ante likelihoods of under-investment and over-investment with the inclusion of a rank variable $OVERI_{i,t+1}$ (Biddle, et al., 2009; Cheng, et al., 2013). Thus, to test Hypothesis 1, the focus is on the expertise variables (*BUS*, *LAW*, and *AF*) and the sum of these expertise variables and their interaction with *OVERI* (*BUS + OVERI*BUS*, *LAW + OVERI*LAW*, *AF + OVERI*AF*). Therefore, despite the dependent variable in Model 1 being *TINVEST*, as explained in Chapter 5, the model is designed to examine investment

efficiency based on the likelihood of under- and over-investing and not aimed to investigate the relationship between compensation committee member expertise and the level of investment.

In general, contrary to the theoretical expectation, the results presented in Table 9 are unable to provide support for Hypothesis 1. The coefficients of the test variables (*BUS*, *LAW*, and *AF*), which indicate the effect of single expertise on firms that are likely to under-invest, are generally insignificant. Insignificant results are also found for the sum of the coefficients of the expertise variables and the interactive terms (*BUS* + *OVERI*BUS* and *LAW* + *OVERI*LAW*), which tests the association between investment efficiency and compensation committee expertise on firms that are likely to over-invest. The estimation for the effect of *AF* on investment efficiency, however, is surprisingly inconsistent with Hypothesis 1c. In contrast to expectations, the sum of the coefficients of *AF* + *OVERI*AF* is positive and significant at the 5 percent level, indicating that with a higher likelihood of over-investment, the total investment levels increase, when firms employ at least one compensation committee member with accounting/finance expertise.

One plausible explanation for the adverse effect of accounting/finance expertise on investment efficiency is the presence of directors with an overlapping commitment on audit and compensation committees [43]. Prior literature suggests that overlapping membership in the audit and compensation committee can result in conflicting interests leading to sub-optimal decisions, and thus limiting members appointment to both committees might contribute to the effectiveness of board decisions (Hoitash & Hoitash, 2009; Liao & Hsu, 2013). Laux and Laux (2009) argue that, when a compensation committee member has dual membership on the compensation and audit committees, he/she will be concerned about the monitoring tasks resulting, as an audit committee member, from compensation design and, thus, will reduce the use of incentive compensation, as a compensation committee member. This reduction may possibly be sub-optimal, since incentive-based compensation is considered a powerful tool to

[43] It has been a common practice in firms that a member of the board serves on multiple committees. In their study, Liao and Hsu (2013) show that more than half of S&P 1500 firms had a director serving on multiple committees.

alleviate agency problems and provide the incentives that align CEO interests with those of shareholders (Armstrong, et al., 2010).

<<<< INSERT TABLE 9 ABOUT HERE >>>>

Table 9 also reports the regression results between total investment, as the dependent variable, and the set of control variables that may influence the effect of compensation committee expertise on investment efficiency. Following prior studies (Biddle, et al., 2009; Cheng, et al., 2013), there is no prior expectation regarding the sign of these control variables. The reported coefficients of 23 control variables indicate that, of the investment determinants and compensation committee attributes variables, *TINVEST* level have a positive association with *TANGIBILITY*, *MKTBOOK*, *SDINV*, *CFOSALE*, *ANALYST*, *FRQ*, *CCMEET*, and *CCINDP*, and have a negative association with *FSIZE*, *DIVIDEND*, *INDLEV*, *LOSS*, *CCAGE* and *CCSIZE*. As such, firms with higher asset tangibility (*TANGIBILITY*), market to book value (*MKTBOOK*), investment volatility (*SDINV*), cash flow from operation to sales ratio (*CFOSALE*), analyst following (*ANALYST*), financial reporting quality (*FRQ*), more frequent compensation committee meetings (*CCMEET*), and a more independent compensation committee (*CCINDP*) are associated with higher levels of total investment. Conversely, larger firms (*FSIZE*), dividend paying firms (*DIVIDEND*), firms that operate in higher leveraged industries (*INDLEV*) loss-making firms (*LOSS*), firms with older compensation committee members (*CCAGE*) and firms with larger compensation committees (*CCSIZE*) have lower total investment levels.The regression results of these known determinants of firm investment levels (i.e. *TANGIBILITY*, *MKTBOOK*, *SDINV*, *CFOSALE*, *ANALYST*, *FSIZE*, *DIVIDEND*, *INDLEV*, and *LOSS*) are consistent with those reported in prior studies (Biddle et al., 2009; Cheng et al., 2013). It is also interesting to note the results relating to the association between firm investment levels compensation committee characteristics (i.e. *CCMEET*, *CCINDP*, *CCAGE* and *CCSIZE*) also affect the level of

investment (*TINVEST*) suggest the role of the compensation committee in influencing firm investment decisions.

In terms of compensation committee mixed expertise, Table 10 also reports a non-significant effect of the mix of expertise on investment efficiency. All coefficients of the three different compensation committee mixed expertises (*MBUSLAW, MBUSAF,* and *MLAWAF*) and the sum of the expertise and the interaction coefficients (*MBUSLAW* + *OVERI*MBUSLAW*, *MBUSAF* + *OVERI*MBUSAF*, and *MLAWAF* + *OVERI*MLAWAF*) are not significant, suggesting a non-significant effect of the committee's mixed expertise on under- and over-investment; hence, the regression estimation is unable to lend support to H2. As also reported from Table 10, the relationship between total investment and the control variables remains consistent with those figures reported in the single expertise regression explained earlier.

<<<< INSERT TABLE 10 ABOUT HERE >>>>

Turning to the joint expertise regressions, unlike the results reported in Tables 9 and 10, results on the association between compensation committee joint expertise and investment efficiency reported in Table 11 do provide some support for H3. In Table 11, the coefficients of *JBUSLAW* and *JLAWAF* are 2.146 and 3.463. Both coefficients, *JBUSLAW* and *JLAWAF*, are positively significant at the 5 percent (*t-statistics* = 2.30, *p-value* = 0.021) and 1 percent (*t-statistics* = 3.07, *p-value* = 0.002) levels, respectively. This suggest that in an environment of higher likelihood of under-investment, the total investment of firms with compensation committee members holding joint business – CEO and legal expertise or joint legal and accounting/finance expertise is significantly increased. In terms of the economic significance of the results, with a coefficient for *JBUSLAW* (*JLAWAF)* of 2.146 (3.463), it indicates that in a setting where the *ex-ante* likelihood of under-investment is high, there is an increase in total investment levels of firms that appoint at least one member with joint business – CEO and legal expertise (joint legal and accounting/finance expertise by approximately $39.49 million ($63.72

million)[44] in firms that appoint at least one member with joint business – CEO and legal attributes. This represents about 21 (34) percent increase in the average total investment level for the entire sample of firms.[45]

<<<< INSERT TABLE 11 ABOUT HERE >>>>

Consistent also with the study's prediction, the sum of the coefficients of the expertise and interactive variables, *JBUSLAW* + *OVERI*JBUSLAW* (-1.438) and *JLAWAF* + *OVERI*JLAWAF* (-3.267), which capture the effect of expertise on over-investment, are negative and significant at the 5 percent (joint significance p-value = 0.039) and the 1 percent levels (p-value = 0.003), suggesting a significant reduction in total investment for firms with a high likelihood of over-investment when having *JBUSLAW* or *JLAWAF* on their compensation committee. In regards to the economic significance, the total investment level in firms that appoint at least one member with joint business – CEO and legal (joint legal and accounting/finance) expertise is significantly reduced by about over 26 million (over 59 million), which represents 14 (31) percent reduction in the average total investment level for the entire sample of firms[46].

Despite this statistically and economically significant result of *JBUSLAW* and *JLAWAF*, an inconsistent result for H3 is documented for joint business – CEO and accounting/finance expertise (*JBUSAF*). It is reported that, inconsistent to H3, the coefficient of *JBUSAF* is significantly negative at the 5 percent level, indicating that

[44] Recall that the average total asset of the sample firms is $1.84 billion dollar. With a coefficient for *JBUSLAW* (*JLAWAF*) of 2.146 (3.463) percent of total asset means that 2.146 (3.463) * 1.84 billion = $39.49 ($63.72) million.

[45] The average total investment is 10.27%. Thus, an increase by 2.15 (3.46) percent of the investment level in the presence of committee members with joint CEO and legal (legal and accounting/finance) expertise means: 2.15/10.27 x 100% = 20.93 ≈ 21% (3.46/10.27 x 100% = 33.68 ≈ 34%) increase in average total investment levels for the sample firm.

[46] Similar to the under investment case, a reduction by 1.44 (3.23) percent of the investment level in the presence of committee members with joint CEO and legal (legal and accounting/finance) expertise means: 1.44% (3.23%)*1.84 billion = 26.50 (59.43) million.

under-investment is encouraged when a firm, which has a higher likelihood of under-investment, has joint business – CEO and accounting expertise on its compensation committee. A negative coefficient of -0.935 of *JBUSAF* suggests that the total investment is lower for these firms by a magnitude of approximately -0.94 percent of the total assets, representing a reduction of $17.25 million in the average total investment level for the entire sample of firms [47].

The contrasting effect of *JBUSAF* on investment efficiency is potentially influenced by the negative effect of the single *AF* expertise on investment efficiency, as reported in Table 9, indicating that the adverse effect of accounting/finance expertise on investment efficiency may not be fully eliminated when the compensation committee members with accounting/finance expertise also hold business – CEO expertise (*JBUSAF*), unlike when accounting/finance expert members hold legal expertise (*JLAWAF*). This may indicate that of the three types of expertise, legal expertise is the most essential expertise for compensation committee members in arranging more aligned compensation contracts that encourage investment efficiency. This is supported by Litov et al. (2014),who argue that lawyer-directors design CEO compensation that provides the alignment of interests between CEO and shareholder beyond monitoring.

In terms of the control variables, Table 11 indicates that the direction and significance levels of the control variables coefficients are unchanged and remain consistent with the findings from Table 9 and 10. The results in Table 11, in general, lend support to this thesis's expectation that joint expertise of the members of the compensation committee, particularly business – CEO and legal joint expertise (*JBUSLAW*) and legal and accounting/finance joint expertise (*JLAWAF*), efficiently design compensation contracts that discourage CEOs to under- and/or over-invest.

[47] 0.94/10.27 x 100% = 9.15 ≈ 9% decrease in average total investment levels for the sample firm.

6.3.2 Model 2: Multinomial Logistic Regression Analysis of the Effect of Compensation Committee on Investment Efficiency based on Unconditional Model

In this section, to investigate the effect of compensation committee expertise on investment efficiency, the hypotheses in this study are tested using a multinomial logistic regression that considers simultaneously, but separately, the likelihood that a firm might be in the lowest quartile of residuals (the under-investment group) and/or in the highest quartile of residuals (the over-investment group), against the two middle quartile of residuals (the normal investment group), where the residuals represent "unexplained" or "inefficient" investment by firms[48]. The results in relation to H1 are reported in Table 12.

In Table 12, the coefficient of *BUS* (-0.211) is negatively significant at the 5 percent level (Wald-Chi Square = 4.71) for the under-investment group (under *INVEFF* = 1 heading), indicating that firms with at least one business – CEO expert on their compensation committee will be 19 percent[49] less likely to under-invest than firms without such expertise on their compensation committee. No similar effects as of *BUS* on under-investment group are found for either *LAW* or *AF*.

For the over-investment group (under the heading of *INVEFF* = 2 in Table 12), although the *BUS* and *LAW* coefficients have the predicted sign, these coefficients are insignificant. Furthermore, similar to the result in Model 1, *AF* is found to be positively significant at the 1 percent level, which again shows an adverse effect of *AF* expertise on over-investment. With a coefficient of 0.331, the result indicates that, in comparison

[48] Prior studies (Hubbard, 1998; Verdi, 2006) commonly utilise Tobin's Q to measure growth opportunity. Following Biddle et al (2009), who argue that marginal Q is notoriously hard to measure, to determine the residuals in Model 2, the expected level of firm-specific investment of capital is directly modelled on the sales growth. In un-tabulated results, the use of Tobin's Q to proxy for growth opportunity generates similar findings.

[49] The odds of firms with *BUS* in their compensation committee to be in the under-investment group = exponential (-0.211) = 0.81, suggesting that firms with *BUS* will be 19 percent (0.81 – 1.00) less likely to under-invest than firms without such expertise

to firms without accounting/finance experts, firms with such experts on their compensation committee will be 39 percent[50] more likely to over-invest.

<<<< INSERT TABLE 12 ABOUT HERE >>>>

In regards to the investment determinants, the reported figures in Table 12 suggest that firms with higher (lower) tangibility (*TANGIBILITY*) and cash flow to sale ratio (*CFOSALE*) are more likely to over-invest (under-invest), whereas firms that are more (less) levered (*LEVERAGE*) have higher (lower) likelihood to be placed in the under-invest (over-invest) group. These findings are consistent with prior studies suggesting that firms with high cash and/or low leverage are more likely to over-invest, while firms with a low level of cash or high leverage have higher likelihood to under-invest (Biddle, et al., 2009; Blanchard, et al., 1994; Jensen, 1986; Myers & Majluf, 1984; Stulz, 1990).

In line with Biddle et al. (2009), the table also suggests that analyst following (*ANALYST*) has a positive (negative) association with the likelihood to over-invest (under-invest). For other investment related control variables, the table reports a negative (positive) association between dividend payout ratio (*DIVIDEND*) and the likelihood of over-investment (under-investment). Moreover, *MKTBOOK*, investment *SDINV*, *FAGE*, and *OPCYCLE* (*SDSALE* and internal control weaknesses *ICW*) are negatively (positively) related to the likelihood of firms to under-invest, while negative (positive) association is documented between the likelihood of firms to over-invest and *ZSCORE* and *DIVIDEND* (*SDSALE*).

In terms of the attributes of the compensation committee, the results in Table 12 report that firms with less frequent meetings (*CCMEET*) and more members in their compensation committees (*CCSIZE*) are more likely to under-invest. By contrast, firms with more frequent meeting (*CCMEET*) have higher likelihood of over-investing

[50] Similar to the explanation above, since the odds ratio = exponential (0.331) = 1.39, firms with *AF* experts on their compensation committee will be 39 percent (1.39 – 1.00) more likely to over-invest.

(indicated by the higher positive residual). These results, interestingly, indicate that more frequent number of compensation committee meeting has an adverse effect on over-investment, and thus an indicator of over-investment efficiency, For under-investment, more meetings are associated with the reduction of absolute negative residuals, representing lower under-investment.

The findings in Table 12, overall, provide some support about the effect of compensation committee members' CEO expertise on investment efficiency, particularly in mitigating under-investment. Hence, H1a is partially supported. By contrast, no similar significant findings are generated for legal and accounting/finance expertise to support H1b and H1c. In fact, consistent to the findings in Model 1, the presence of accounting/finance experts on compensation committees exacerbates over-investment.

The effects of mixed expertise within the compensation committee on investment efficiency are presented in Table 13. Results from the estimation indicate that *MBUSAF* is significant in reducing the likelihood of firms being placed in the under-investment quartile (*INVEFF* = 1) with a coefficient of -0.295 being significant at the 5 percent level (Wald-Chi Square = 3.94). *MBUSLAW* is also found to be significant in reducing the likelihood of firms being in the over-investment quartiles (*INVEFF* = 2) with a coefficient of -0.587, being significant at the 1 percent level (Wald-Chi Square = 7.27). Apart from those two variables, the other expertise variables are reported to be insignificant. The results of control variables remain consistent with those reported in the regression of single expertise.

<<< INSERT TABLE 13 ABOUT HERE >>>>

In terms of economic significance, the results suggest that firms with compensation committee members holding a mix of business – CEO and accounting/finance expertise

are 47 percent[51] less likely to under-invest. Furthermore, there is 40 percent[52] less likelihood of firms when having a mix of CEO and legal expertise.

Overall, despite not all types of mixed expertise being significant to mitigate inefficiency in investment, some support for H2 is still documented. The findings highlight the importance of incorporating members with the mixed of CEO and legal expertise (*MBUSLAW*) and mixed of CEO and accounting expertise (*MBUSAF*) to motivate investment efficiency through their ability in designing more aligned CEO compensation contracts.

Table 14 details the results from the effects of compensation committee joint expertise on investment efficiency. The table shows that the coefficients of all of the combinations of joint expertise (*JBUSLAW*, *JBUSAF*, and *JLAWAF*) are insignificant. Unlike Model 1, the results generated from Model 2 are unable to support H3. Despite most of the coefficients of the three different types of joint expertise within compensation committees (*JBUSLAW*, *JBUSAF*, and *JLAWAF*) having the predicted sign to support H3 in the context of both under- and over-investment, the null hypothesis is unable to be rejected. The control variables reported in the table are unaffected and remain consistent with the results in the single and mixed expertise regression.

<<<< INSERT TABLE 14 ABOUT HERE >>>>

6.3.3 Discussion: Compensation Committee Expertise and Investment Efficiency Model 1 versus Model 2

In general, the results generated from Model 1 and Model 2 in the previous sections do provide some evidence of the importance of single expertise, mixed expertise and joint

[51]With a coefficient of -0.642, the odd ratio estimate = exponential (-0.642) = 0.526 and thus firms with *MBUSAF* will be 47 percent (0.526 – 1.00) less likely to under-invest than firms without such expertise.

[52] Similarly, the coefficient -0.587 represents the estimate of odd ratio = exponential (-0.587) = 0.603 suggesting 40% (0.603 – 1) less likelihood of over-investing form firms with *MBUSLAW*.

expertise of the compensation committee in mitigating investment inefficiency, although both models do not generate statistically consistent results. In terms of single expertise, the results from both Model 1 and Model 2 are unable to fully support H1. Only Model 2 is able to document the effect of CEO expertise in mitigating investment inefficiency, but the significant effect is limited in mitigating under-investment. Furthermore, against expectation, results from both Model 1 and Model 2 indicate that accounting/finance expertise on a compensation committee exacerbates over-investment. This suggest that distinct from the documented important role of accounting/finance expertise on the effectiveness of audit committees (e.g., Defond, et al., 2005a; Dhaliwal, et al., 2010; Krishnain & Visvanathan, 2008), accounting/finance experts on a compensation committee do not appear to play a similar role. Accounting/finance experts on compensation committee are unable to prevent sub-optimal investment by the CEO through their inability to design efficient compensation contracts.

As outlined earlier, one plausible explanation for the adverse effect of accounting/finance expertise on investment efficiency is the presence of directors with overlapping commitments on the audit and compensation committee[53]. Overlapping membership is considered to be an ineffective governance scheme because it can dilute the director's time and effort devoted to each committee (Liao & Hsu, 2013). It is also suggested that overlapping membership in the audit and compensation committee can result in conflicting interests leading to sub-optimal decisions, and thus separating the members within these committees contributes to more effective board decisions (Hoitash & Hoitash, 2009; Liao & Hsu, 2013). Laux and Laux (2009) argue that, when a compensation committee member has dual membership on the compensation and audit committees, he/she will be more concerned about the monitoring role of the compensation committee when designing compensation and, thus, will reduce the use of incentive compensation. This reduction may be sub-optimal, since incentive-based compensation is considered a powerful tool to alleviate agency problems and provide

[53] It has been a common practice in firms that a member of the board serves on multiple committees. In their study, Liao and Hsu (2013) show that more than half of S&P 1500 firms had a director serving on multiple committees.

the incentives that align a CEO's interests with those of the shareholders (Armstrong, et al., 2010). Liao and Hsu (2013) further document that pay-performance sensitivity is lower for firms that have common membership on the compensation and audit committees, and thus dampens the quality of the compensation committee function.

Relative to the results reported in the single expertise regressions, mixed and joint expertise amongst compensation committee members are documented to have stronger effects on investment efficiency, although both models do not appear to consistently present significant results. While Model 2 documents significant effects of *MBUSLAW* (*MBUSAF*) on over- (under-) investment, Model 1 is unable to provide similar significant findings to support H2. By contrast, the effects of *JBUSLAW* and *JLAWAF* in mitigating both under-investment and over-investment are strongly supported under Model 1, whereas Model 2 is unable to lend the same strong support in testing H3[54].

With significant findings for some mixed and joint types of expertise amongst compensation committee members, results also show that some of the adverse effect of *AF* is reversed, when accounting/finance expertise is mixed or joint with either CEO or legal expertise. As discussed earlier, with *MBUSAF* and *JLAWAF* expertise on the compensation committee, the committee arranges more optimal contracts in alleviating under-investment, supporting the positive effect of group heterogeneity.

[54] The differences in the results between Model and Model 2 may possibly due to the differences in the design and investment efficiency proxy of the two models. Model 1 measures investment efficiency conditionally to the likelihood of under- and over-investing, through the construction of *OVERI*, a ranked variable based on the firm's cash and leverage, whereas investment efficiency in Model 2 is proxied with the residuals from the model of expected investment as a function of sales growth. In un-tabulated results, when the sample is differentiated between the likelihood of under-/over-investment (Model 1) and the quartile of residuals (Model 2), the summary statistics shows that firms in the lowest quartile of residuals (under-investment group) exhibit the same amount of average cash holdings (i.e. the average ratio of cash to total asset and cash flow from operation to sales) as firms in the normal investment group. Moreover, the average slack ratio of the under-investment group (2.10) is higher than both the over-investment (2.09) and normal-investment group (1.63). By contrast, since Model 1 is constructed under the assumption of firms with high cash holdings are more likely to over-invest, the statistics show that the cash holdings of firms with greater likelihood of over-investing is significantly higher (the average of cash to total asset ratio = 0.26, average cash flow from operation to sale = 0.14, slack = 3.18) than those with the likelihood of under-investing (the average cash to total asset ratio = 0.06, cash flow from operation to sale = 0.12; slack = 0.58). Since prior research suggests that the likelihood of firms to under- and over-investment is influenced by the amount of cash holding, where higher cash holdings increase the likelihood of over-investing (Biddle, et al., 2009; Jensen, 1986; Richardson, 2006), the difference cash holdings specified under Model 1 causes the results from Model 1 and Model 2 to be inconsistent, with Model 1 generates more consistent results to support the hypotheses.

However, it should also be noted that the adverse effect of the committee's accounting/finance expertise on investment efficiency could not be fully eliminated by *JBUSAF*. As reported in Model 1, *JBUSAF* is statistically significant in exacerbating inefficiency in investment, suggesting an inability of compensation committee, with CEO and accounting/finance joint expertise amongst its member to arrange efficient compensation contracts that motivate investment efficiency. This may indicate that the presence of CEO expertise amongst compensation committee members is unable to reverse the adverse effect of accounting/finance expertise (who presumably have overlapping commitments with the audit committees) on investment efficiency. As such, legal expertise within the compensation committee may be considered to be the most essential expertise for compensation committee members in arranging more aligned compensation contracts that encourage investment efficiency. This is supported by Litov et al (2014), who argue that lawyers-directors help structure compensation contracts that provide the alignment of interests between a CEO and shareholders. In addition, the contradictory effect of *JBUSAF* on investment efficiency may also be attributed to the ineffectiveness of CEO expertise to arrange efficient compensation contracts. Faleye (2011) argues that CEO directors can be sympathetic in evaluating and rewarding their fellow CEOs performance and intentionally inflate a CEO's pay to increase average CEO compensation in the market for their own benefit, leading to inefficient compensation contracts. The lack of willingness of CEO experts to design efficient compensation contracts to encourage investment efficiency may then influence the effectiveness of the committee members with joint CEO and accounting/finance expertise to perform their governance function effectively, causing higher likelihood of over-investment and under-investment. However, since the regression results also report a favourable effect of *JBUSLAW* on investment efficiency, it is still unclear whether the adverse effect of *JBUSAF* can be isolated to the presence of CEO experts on a compensation committee.

One potential reason for the positive effect of *JBUSLAW* on investment efficiency may be due the fact that a joint CEO and legal expert-director is the same person holding two different types of expertise (i.e. CEO and legal expertise). Therefore, this positive effect

is possibly driven by the innate ability of legal experts to structure more aligned compensation contracts[55]. As discussed earlier, it appears that legal expertise represents the most significant expertise needed by compensation committee members to arrange efficient compensation contracts that motivate CEOs to invest efficiently.

Overall, partial support for H1a, H2 and H3, which predict an association between compensation committee member expertise (single, joint and mixed expertise) and investment efficiency, is established in this study. Despite results from both models not seeming to generate statistically consistent estimations, some results do signal the importance of compensation committee expertise in arranging optimal compensation contracts that motivate CEOs to invest efficiently, especially those compensation committee members with joint expertise (H3). The results appear to provide confirmation for the significance of the compensation committee members having multiple skill-sets and positive outcomes possible from having heterogeneous teams as per resource dependence, human capital and group effectiveness literature. However, given the results presented in the main analysis do not fully support all hypotheses in this study, further investigation is warranted.

6.4 Further Analysis: Components of Total Investment and Compensation Committee Expertise

Due to the fact that not all hypotheses are supported by the main findings of this study, further examination is needed to explore alternative explanations for the adverse effects and non-significant results found on the relationship between investment efficiency and compensation committee expertise. Recall that, as specified by Biddle et al. (2009), the measurement of investment efficiency considers three components of total investment: capital expenditure (*CAPX*), acquisition (*ACQ*), and R&D investment (*RD*). Each of these three components of investment, however, may be different in nature, which will

[55] Although in the mixed expertise regression results from Model 1 and Model 2 *MLAWAF* suggest insignificant results, the coefficients of *MLAWAF* do have the predicted sign. Furthermore, due to the fact that, of the three types of mixed expertise, M*LAWAF* has the least number of observations in sample firms, where there are only 14 out of the total 7,013 firm-year observations having compensation committee members with *MLAWAF* expertise, this small observations number of *MLAWAF* may then drive the effect of *MLAWAF* to be insignificant.

influence the association between compensation committee expertise and investment efficiency.

Compared to capital expenditure, acquisition and R&D investments are more risky types of investments due to the uncertainty involved in these two types of investment decisions (Aboody & Lev, 2000; Boulton, Braga-Alves, & Schlingemann, 2014). Furthermore, while acquisition activities are externally observable, R&D expenditure generate intangible benefit that are very specialised to a particular firm and relate to projects that are difficult for outsiders to observe, causing R&D to have even higher information asymmetry levels between shareholders and top management than all other types of investment (Aboody & Lev, 2000; Chan, et al., 2001; Chen, Ho, & Ho, 2013; Gu & Wang, 2005; Kothari, Laguerre, & Leone, 2002). Due to the different properties that each of the three components of total investment possesses, the effect of compensation committee expertise on the efficiency of capital expenditure, acquisition, and R&D investment may not be uniform and, thus, will influence the net effect of the committee expertise on total investment.

Table 15 presents the mean values of total investment and its components (i.e. capital expenditure, acquisition and R&D investments) across the groups of residual quartiles (i.e. under-, normal- and over-investment groups). It is reported from the table that the over-investment firms have the highest average of total investment (16.80) relative to the normal investment and under-investment firms (10.58 and 9.09 respectively). This finding is consistent to Biddle et al. (2009), who found a positive association between total investment and the likelihood of firms to over –invest. Thus, if the results in the main analysis are not driven by certain types of investment, the amount of each component of total investment will also exhibit similar association.

It is indicated in Table 15, of the three components of total investment, only the average level of *RD* shows patterns consistent with total investment, with the highest mean value of *RD* being 5.32 in the over-investment group, relative to the value of 2.43 in the normal-investment group and 1.57 in the under-investment group. By contrast, although the mean values of *CAPX* (31.81) and *ACQ* (3.58) in the over-investment group are

significantly higher than the normal-investment group (i.e. 24.48 for *CAPX* and 2.91 for *ACQ*), the mean value comparison for *CAPX* (*ACQ*) between normal-investment and under-investment is not significant (in the opposite direction, i.e. i.e. the mean of *ACQ* in the normal investment firm is significantly lower relative to the under-investment firm). This finding is inconsistent with the findings in Verdi (2006), who found that the firms classification based on under- and over-investment is not driven by certain industries and the amount of each component of total investment will increase as the firms are moving from the lowest to the highest residuals.. It is, thus, plausible that the inconsistency effect of compensation committee expertise on investment efficiency in the main analysis is driven by the inconsistency of the level of each component of total investment (*CAPX*, *ACQ* and *RD*) within the firms' classification of under- and over-investing.

<<<< INSERT TABLE 15 ABOUT HERE >>>>

Due to the above findings, the effect of compensation committee single expertise, mixed expertise and joint expertise is to be re-examined on each of the components of total investment for both Model 1 and Model 2. This is undertaken through repeating equations (1) to (7) (in Chapter 5) and replacing the total investment variable in the model with each component of investment, i.e., *CAPX*, *ACQ*, and *RD* at *Year t+1* and running the regression for Model 1 and Model 2 separately for each of *CAPX, ACQ* and *RD* as detailed below.

6.4.1 Research Models

Similar to the main analysis, in investigating the relationship between compensation committee single, mixed and joint expertise and investment efficiency for each investment component, the following equations are used, to test Model 1:

$$CAPX(ACQ,RD)_{i,t+1} = \alpha + \beta_1 OVERI_{i,t+1} + \beta_2 CCSINGLE(CCMIXED,CCJOINT)_{i,t} + \beta_3 OVERI_{i,t+1} * CCSINGLE(CCMIXED,CCJOINT)_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(8)}$$

Where:

CAPX = The capital expenditures, scaled by property, plant, and equipment.

ACQ = Acquisitions, scaled by lagged total asset.

RD = R&D expenditures, scaled by lagged total asset.

CCSINGLE = Compensation Committee single expertise: *BUS*, *LAW*, and *AF*

CCMIXED = Compensation committee mixed expertise: *MBUSLAW*, *MBUSAF*, and *MLAWAF*

CCJOINT = Compensation committee joint expertise: *JBUSLAW*, *JBUSAF*, and *JLAWAF*

Other variables are defined in equation 1, equation 3 and equation 6.

Using Equation 8, the effect of compensation committee expertise on investment efficiency is tested by separately running the regression for each component of total investment, i.e. *CAPX*, *ACQ*, and *RD* as the dependent variables, and single expertise (*BUS*, *LAW*, and *AF*), mixed expertise (*MBUSLAW*, *MBUSAF*, and *MLAWAF*) and joint expertise (*JBUSLAW*, *JBUSAF*, and *JLAWAF*) as the test variables.

Similar to the main analysis, variable *OVERI*, which is constructed based on the decile of cash and leverage, is used to identify firms that are more likely to under-invest or over-invest. When *OVERI* is in the bottom decile (i.e. firms with lowest cash and highest leverage[56]), firms are most likely to under-invest. Under this scenario, if compensation committee expertise mitigates under-investment, then the coefficients of the expertise variables (β_2) are expected to be positive, indicating that the expertise increases the level of *CAPX*, *ACQ*, and *RD* (as the dependent variable in the model) for firms with a likelihood of under-investment. On the other hand, when *OVERI* is in the top decile (i.e. firms with highest cash level and lowest leverage), firms are most likely to over-invest. Under this scenario, if over-investment can be mitigated by compensation committee members expertise, then the sum of the coefficients on the expertise variables and the interaction terms between *OVERI* and the expertise variables is expected to be

[56] In constructing *OVERI*, as explained in Chapter 5, the leverage is multiplied by negative one, so that, as for cash, it is increasing with the likelihood of over-investment

negative, indicating that with the specified expertise the level of *CAPX*, *ACQ*, and *RD* (as the dependent variable in the model) is reduced for firms with a likelihood of under-investment.

Under Model 2, consistent with the procedure used in the main analysis, the residual values, which represent investment inefficiency, of *CAPX*, *ACQ*, and *RD* are estimated by using the following investment model in Equation 9:

$$CAPX\,(ACQ, RD)_{i,t+1} = \beta_0 + \beta_1 SGrowth_{i,t} + \varepsilon_{i,t+1} \quad \textbf{(9)}$$

All variables are defined in Equation 2 and 8.

Equation 9 is run separately for each component of total investment. The residuals from each of the *CAPX*, *ACQ* and *RD* from investment models are used as proxies for investment efficiency. Similar to the main model, higher or lower levels of residuals capture a firm-specific deviation from optimal levels of the components of total investment, with larger positive and negative deviations representing less investment efficiency. The following equation is used to examine the effect of single, mixed and joint expertise on *CAPX*, *ACQ* and *RD* investment efficiency:

$$\begin{aligned}\Pr(INVEFF\,(CAPX, ACQ, RD=1), INVEFF\,(CAPX, ACQ, RD=2)) = {} & \alpha + \beta_1 CCSINGLE\,(CCMIXED, CCJOINT)_{i,t} \\ & + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{,i,t} \\ & + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}\end{aligned} \quad \textbf{(10)}$$

Where:

INVEFF (CAPX, ACQ, RD) = The residuals from the investment model in Equation 9 for each of *CAPX*, *ACQ* and *RD*. The residuals are ranked into quartiles by each year and Fama-French (1997) industry classification to assign a code of 0, 1 or 2 to each of firm-year observation;

All variables are defined in Equation 2 and 8.

Equation 10 predicts whether a firm's likelihood to be in the lowest quartile (*INVEFF* (*CAPX*, *ACQ*, *RD)* = 1) or in the highest quartile (*INVEFF* (*CAPX*, *ACQ*, *RD)* = 2), as opposed to the two middle quartiles (*INVEFF* (*CAPX*, *ACQ*, *RD)* = 0), is associated with single, mixed or joint expertise of compensation committee for each of *CAPX*, *ACQ*, and *RD*. It is expected that the coefficients of the expertise variables are negative,

indicating that firms with compensation committee members holding single, mixed or joint expertise are less likely to be in the most extreme quartile of residuals (under-investment group and/or over-investment group).

6.4.2 Model 1 Multivariate Regression Analysis of the Effect of Compensation Committee Expertise on the Efficiency of CAPX, ACQ and RD as the Components of Total Investment

The multivariate regression analysis of the effect of compensation committee single expertise depicted in Table 16 suggests that, of the three components of total investment, only R&D investment efficiency is found to be significantly related with compensation committee single expertise. With *RD* as the dependent variable, a considerably stronger adjusted R^2 of an 64.11 percent is also documented for *RD* relative to adjusted $R^2$of 37.02 percent for *CAPX* and 7.94 percent for *ACQ*, suggesting that a greater proportion of variance is accounted for by the *RD* rather than the *CAPX* and *ACQ* model.

<<<< INSERT TABLE 16 ABOUT HERE >>>>

By using *RD* as the dependent variable, the coefficients of *BUS* (*LAW)* are both positive 0.448 (0.463), with *t-statistics* of 2.54 (1.66) and p-values of 0.011 (0.098), suggesting that firms with at least one *BUS* (*LAW)* expert serving on their compensation committee are more likely to increase their investment level by 0.45 (0.46) percent of total asset in a setting where under-investment is more likely. These results indicate that CEO and legal expertise are important attributes of compensation committee members that will assist the committee in designing an efficient compensation contract that reduces under-investment in R&D.

In the case of over-investment, the sum of the expertise variable and its interactive variables (*BUS* + *OVERI*BUS*) is negative, with a coefficient of -0.455[57] that is significant at the 5 percent level, suggesting that, in a setting of high propensity for over-

[57] This represents a reduction of: 0.455/2.858 x100 = 15.92% of the average R&D investment

investment, firms' R&D investment level is significantly reduced when at least one of the compensation committee members holds CEO expertise. For legal expertise, although the sum of the coefficients of *LAW* and its interactive variable (*LAW + OVERI*LAW)* is negative, and consistent with the predicted sign, its significance level does not allow the author to reject the null hypothesis. For the other components of total investment, i.e., *CAPX* and *ACQ*, no significant effect of compensation committee expertise is found.

The regression results on the effects of mixed expertise on the components of total investment are consistent with H2, when *RD* is the dependent variable. In Table 17, with *RD* as the dependent variable the coefficients of *MBUSLAW* (*MLAWAF*) are 0.797 (1.339), with *t-statistics* of 3.06 (1.86). These results indicate that for firms in a situation, where under-investment is more likely, firms with *MBUSLAW* (*MLAWAF*) expertise on the compensation committee increase their R&D investment levels by $14.701 million (24.698 million), representing an increase by 28 (47)[58] percent of the average R&D investment level of the sample firms.

<<<< INSERT TABLE 17 ABOUT HERE >>>>

In the case of over-investment, only mixed legal and accounting expertise is significant (with p-values = 0.054), with a summed negative coefficient of *MLAWAF + OVERI*MLAWAF* of -1.568, suggesting in a setting of high likelihood of over-investment, firms with the mixed of legal and accounting expertise on their compensation committees experience a significant reduction in their R&D investment. Although the summed coefficient of *MBUSLAW + OVERI*MBUSLAW* is also negative, the p-value of the joint significance test is not statistically sufficient to reject the null hypothesis.

[58] 0.80/2.858 x 100 (1.339/2.858 x 100) = 27.89 ≈ 28 (46.85 ≈ 47) reduction of the average R&D investment

For the other components of total investment, non-significant effects of compensation committee mixed expertise on *CAPX* and *ACQ* are primarily found, except for *MBUSLAW*, where an adverse effect of the mixed of CEO and legal expertise on efficiency of *ACQ* is reported, with significantly negative (positive) coefficients of *MBUSLAW* (*MBUSLAW* + *OVERI*MBUSLAW*) at the 1 (5) percent level. These conflicting findings seem to confirm the argument that CEO experts arrange inefficient compensation contracts that induce sub-optimal investment. CEO experts may use their compensation committee membership to extract rents and intentionally inflate the CEO's pay to increase the average CEO compensation in the market, leading to the use of sub-optimal pay arrangements (Bebchuk, Fried, & Walker, 2002; Boyle & Roberts, 2013; Faleye, 2011).

In terms of joint expertise of the compensation committee, Table 18 presents results consistent with H3, but once again only when *RD* is used as the dependent variable. The coefficients of *CAPX* and *ACQ* are insignificant. In the case of under-investment, Table 17 shows that only *JLAWAF* significantly (at the 1 percent level) increases the level of R&D investment in a setting of higher likelihood of under-investment, given a coefficient of 1.308 and *t-statistics* of 4.21. Although the coefficient of *JBUSLAW* is also positive, it is not statistically significant to confirm the author's prediction.

<<<< INSERT TABLE 18 ABOUT HERE >>>>

In the case of over-investment, both *JBUSLAW* and *JLAWAF* are found to significantly reduce R&D investment levels in a setting of over-investment is more likely. The coefficients of *JBUSLAW* + *OVERI*JBUSLAW* (-0.910) and *JLAWAF* + *OVERI*JLAWAF* (-1.943) are both negative and significant at the 1 percent level, suggesting that when the *ex-ante* likelihood of over-investment is high, firms with *JBUSLAW* or *JLAWAF* expertise on their compensation committee invest more efficiently than firms without such joint expertise.

The results from Table 16 to 18 show that the effect of compensation committee members' expertise on efficiency of the three components of total investment is consistent only for R&D investment. The results on R&D confirm the main findings that CEO and legal expertise are important types of expertise for compensation committee members in arranging efficient compensation contracts that induce investment efficiency. The results also document the significance of mixed and joint expertise amongst compensation committee members on R&D investment efficiency, particularly for mixed and joined between CEO and legal expertise and legal and accounting/finance expertise. This result suggests that, consistent with the main findings, legal expertise remains to be the most significant type of expertise for compensation committee members in structuring compensation that aligns the interests of CEOs and shareholders to motivate investment efficiency. On the other hand, the insignificant findings relating to *CAPX* and *ACQ* may potentially explain the inconsistent results in the main analysis. It shows the different nature of each type of investment may, indeed, significantly drive the association between investment efficiency and compensation committee expertise.

When it comes to the effect of control variables on the components of total investment, their associations with each investment component, generally confirms the result in the main analysis. More significant associations are, in fact, found between *RD* and the control variables than between the other two components or even the total investment and the control variables. Consistent with the main findings, *CAPX, ACQ,* and *RD* are positively related with the volatility of the respective investment component (*SDCAPX*, *SDACQ*, and *SDRD*). Both *CAPX* and *RD* have positive (negative) association with *MKTBOOKK*, *SDCFOP*, and *ANALYST* (*FAGE* and *DIVIDEND*) and both *ACQ* and *RD* are negatively related with *SDSALE*. Furthermore, *RD* is positively (negatively) associated with *FRQ* (*FAGE* and *ZSCORE*).

In terms of the compensation committee attributes, Table 16 – 18 suggest that *RD* is negatively (positively) related with *CCAGE* and *CCSIZE* (*CCMEET*, *CCBRD*, and *CCSHARE*). By contrast, both *CAPX* and *ACQ* have a negative association *CCSIZE* only, while *CAPX* (*ACQ*) is also positively (negatively) associated with *CCINDP* (*CCAGE*).

6.4.3 Model 2: Multinomial Logistic Regression Analysis of the Effect of Compensation Committee Expertise on the Efficiency of CAPX, ACQ and RD as the Components of Total Investment

Table 19 reports the effect of single types of expertise (*BUS*, *LAW*, and *AF*) on *CAPX*, *ACQ* and *RD* investment efficiency under Model 2. In Table 19, Panel A, only *LAW* (with a coefficient of -0.446 respectively) is found to significantly reduce the likelihood of firms being in the *RD* under-investment group (*RDINVEFF* = 1) at the 10 percent level (Wald Chi-Square = 3.13; p-value = 0.077), suggesting that firms with at least one CEO (legal) expert on their compensation committee are 18 (36)[59] percent less like to under-invest relative to the firms without legal expertise. By contrast, in Panel B of Table 19, no significant associations are found between single types of expertise and any components of total investment in the case of over-investment.

<<<< INSERT TABLE 19 ABOUT HERE >>>>

Panel A of Table 20 examines the relationship between the mix of expertise within a compensation committee and investment efficiency in the context of the components of total investment for the under-investment group. In particular, it depicts negative and significant coefficients for *MBUSLAW* (-1.424) and *MBUSAF* (-0.901) with Wald Chi-Square of 7.35 and 3.14 respectively for *RDINVEFF* = 1. This result indicates that firms with *MBUSLAW* (*MBUSAF*) expertise are 76 (41)[60] percent less likely to be in the R&D under-investment group relative to firms without such expertise. Panel B of Table 20 reveals that no significant expertise variable is estimated under *RDINVEFF* = 2. For

[59] With a coefficient of -0.446, the odd ratio estimate = exponential (-0.446) = 0.64 and thus firms with *LAW* on their compensation committee will be 36 percent (0.64 – 1.00) less likely to under-invest than firms without such expertise.

[60] The odds of firms with *MBUSLAW* in their compensation committee to be in the under-investment group = exponential (-1.424) = 0.24, suggesting that firms with *MBUSLAW* will be 76 percent (0.24 – 1.00) less likely to under-invest than firms without such expertise. Similarly, the odds of firms with *MBUSAF* = exponential (-0.901) = 0.41, thus the firms will be 59 percent (0.41 – 1.00) less likely to under-invest relative to firms without such mixed expertise.

ACQ, however, the coefficient of *MBUSAF* is positive (0.477) and marginally significant at the 10 percent level for the over-investment group, suggesting an adverse effect from the mix of CEO and accounting expertise on acquisitions.

<<<< INSERT TABLE 20 ABOUT HERE >>>>

In terms of joint expertise, Panel A of Table 21 reports non-significant effects for all types of compensation committee joint expertise in mitigating investment inefficiency for each component of total investment for the under-investment group. In Panel B, the results for the effect of joint expertise on over-investment for *CAPX*, *ACQ* and *RD* are also primarily insignificant, with the exception of *JBUSLAW* on *RD* and *JBUSAF* on *ACQ*. The table reports that *JBUSLAW* significantly reduces the likelihood of firms being placed in the R&D over-investment group (*RDINVEFF* = 2), with a negative and significant coefficient of *JBUSLAW* (-0.354) at the 5 percent level (Wald Chi-Square = 4.65; p-value = 0.031). *JBUSAF* is also reported to be significantly associated (at the 1 percent level) with a reduction in firms' likelihood of being placed in the acquisition over-investment group (*ACQINVEFF = 2*), with a negative and significant coefficient of -0.196 at the 1 percent level (Wald Chi-Square = 7.80; p-value = 0.005).

<<<< INSERT TABLE 21 ABOUT HERE >>>>

When it comes to the association between the likelihood of under-/over-investment of the three components of total investment and the control variables, the results are generally consistent with the main empirical results. More consistent results are found under *RD* relative to the association between the control variables and *CAPX* or *ACQ*.

Overall, unlike Model 1, which predominantly reports significant results for the effect of compensation committee expertise on *RD*, Model 2 yields weaker results. Under Model 2, only legal expertise (*LAW*) is found to be significant in enabling compensation

committee to structure a compensation contract that aligns interests of CEOs and shareholders. The significant effect, however, is limited to mitigating under-investment in R&D. The effect of mixed and joint expertise on the efficiency of the three components of total investment reports similar results, where findings consistent with the main results are reported for *RD*. The results find that firms with *MBUSLAW* and *MBUSAF* (*JBUSLAW*) within their compensation committees are less likely to under-invest (over-invest) in *RD*. On the other hand, the effect of mixed and joint expertise within compensation committees for *CAPX* and *ACQ* are mainly insignificant. In the case of *ACQ,* it is reported that *MBUSAF* increases the likelihood of over-investment. This adverse effect may be due to the ineffectiveness of accounting/finance experts, who potentially hold overlapping commitments in both the compensation and the audit committee, as discussed in relation to the main results.

6.4.4 Discussion of Compensation Committee Expertise and Investment Efficiency of CAPX, ACQ and RD: Model 1 versus Model 2

The previous two sections detailed estimations from regressing compensation committee expertise on the components of total investment using Model 1 and Model 2. In general, the results are consistent with the reported results using total investment as the dependent variable, where *BUS* and *LAW* are being the two types of expertise significant in facilitating compensation committees in designing efficient compensation contracts that result in efficiency in investment. The results, however, suggest that of the three components of total investment, the effects of committee expertise (i.e., single expertise, mixed expertise and joint expertise) are more pronounced for *RD* than for *CAPX* and *ACQ*. Under-investment and over-investment in R&D are mitigated when the firms' compensation committee members hold single CEO or legal expertise, whereas accounting/finance experts on compensation committees have no significant effect on R&D investment efficiency.

Although both mixed and joint expertise affect the efficiency of R&D investments, the results are not generalizable for both cases of over- and under-investment. Only *MBUSLAW* and *JLAWAF* are found to significantly mitigate both under- and over-

investment in R&D, once again suggesting the importance of legal expertise to compensation design. By contrast, *MLAWAF* and *JBUSLAW* are reported to significantly reduce R&D investment levels in settings with a high likelihood of over-investment, while non-significant effects of these two types of expertise are reported in for R&D under-investment case. This may suggest that compensation committee expertise is more significant in mitigating over-investment relative to under-investment in R&D. This finding is interesting since prior studies commonly relate sub-optimality in R&D investments to under-investment (Ghosh, et al., 2007; Lu & Wang, 2015). Therefore, if compensation committee expertise is significant in mitigating inefficiency in R&D investments, the effect of expertise on over-investment should also be significant. However, Saad and Zantout (2014) document that large-size firms appear to significantly over-invest in R&D. As such, it is plausible that compensation committee expertise has a more significant effect on R&D over-investment relative to under-investment in this thesis is due to the fact that sample firms predominantly comprise of large firms with an average of total assets of $1.84 billion.

The results from regressing compensation committee expertise on the other two components of total investment generate mixed findings. Predominantly insignificant effects of compensation committee expertise on *CAPX* and *ACQ* are obtained. If the results are indeed significant, they are inconsistent and against predictions, especially when *ACQ* is the dependent variable. For example, while *MBUSAF* is found to significantly mitigate R&D under-investment, in the case of *ACQ*, *MBUSAF* is found to exacerbate over-investment. This finding apparently confirms the argument in the main analysis on the ineffectiveness of accounting/finance expertise within the compensation committee due to potential overlapping commitments the committee member(s) have on both the compensation and audit committee. However, since *MBUSAF* is found to significantly mitigate *RD* under investment, it is unclear whether the adverse effect of *MBUSAF* on over-investment is really due to the adverse effect of accounting/finance expertise.

One potential explanation for the adverse effect of compensation committee expertise on over-investment in *ACQ* is that the agency theory alone may not be sufficient in

explaining the importance of the expertise for enhancing the ability of compensation committees to arrange efficient compensation contracts that encourage efficiency acquisition investments. Prior study argues that, beside agency conflicts, CEO overconfidence, as a result of self-attribution, affects managerial compensation, with over-confidence leading to increased risk-taking in acquisitions (Billett & Qian, 2008; Gervais, Heaton, & Odean, 2011). It is also documented that even without agency conflicts, overconfident CEOs are significantly more acquisitive than the non-overconfident CEOs (Boulton, et al., 2014; Malmendier & Tate, 2008). Therefore, without considering the level of CEO over-confidence, the expertise of compensation committee members may be insufficient to enable the committee to arrange more aligned compensation contracts to mitigate over-investment in acquisitions.

The overall reported results of the effect of compensation committee expertise on each of the components of total investment do confirm the main findings, particularly R&D investment. It is found that CEO and legal expertise, as well as the mix and joining of these two types of expertise, are significant in mitigating inefficiency in R&D investments. Consistent with the main results, the adverse effect of accounting/finance expertise on R&D investment efficiency is also eliminated when this expertise is mixed or joined with either CEO or legal expertise. By contrast, the analysis of the compensation committee expertise effects on *CAPX* and *ACQ* could not produce similar significant findings.

6.5 Investment Efficiency and Compensation Committee Expertise: An Alternative Explanation

As discussed previously, while some results confirm the hypothesised association between compensation committee expertise and investment efficiency, insignificant results and conflicting inferences between Model 1 and Model 2 are also generated. A further analysis that disaggregates the total investment into *CAPX*, *ACQ* and *RD* was carried out to find a possible explanation for the inconclusive results regarding firms' total investment regressions.

The regression results of compensation committee expertise on *CAPX*, *ACQ* and *RD*, as components of total investment, do offer some insights on the insignificance and conflicting results reported in the main findings. It appears that both insignificant results and the adverse effect of compensation committee expertise on investment efficiency in the main findings are driven by the results for *CAPX* and *ACQ*. The results also show that the effect of expertise on investment efficiency is more prominent for *RD*, as shown with the consistent findings that single, mix of and joint expertise enhance *RD* investment efficiency under Model 1 and 2. It is, therefore, important to provide an explanation about the characteristics of R&D investments that make them different from the other two components of total investment.

Previous literature suggests that, despite the fact that the CEO may invest inefficiently in any type of investment, R&D investment inefficiency resulting from agency conflicts and information asymmetry is arguably more severe than the other types of investment due to the special features of R&D investment (Aboody & Lev, 2000; Lundstrum, 2002). It is documented that the future benefit of R&D investment is more uncertain than that of investment in property, plant and equipment (Kothari, et al., 2002). It is also asserted that, in the context of obtaining new technology, firms' engagement in R&D activities is inherently more risky that firms' acquisition of external technology, because acquired technology is commonly more fully developed (Xue, 2007).

Investment in R&D activities is also associated with greater information asymmetry between shareholders and top management than other tangible investments (Aboody & Lev, 2000). It is also argued that information about the productivity and value of a given R&D investment is more difficult to obtain, because R&D projects are often exclusive to the firms initiating the investment, whereas returns or productivity of financial or tangible investments are not unobservable (Aboody & Lev, 2000; Bebchuk & Stole, 1993; Hall & Lerner, 2010; Lundstrum, 2002). Unlike capital expenditures and mergers/acquisition, R&D expenditures convey not only tangible information, but also reflect intangible information regarding the future cash flows of the firm (Chen, et al., 2013). Kothari et al. (2002) and Gu and Wang (2005) further suggest that the intangible

benefits embedded in R&D investments makes it difficult for shareholders to assess the quality of such projects.

Moreover, accounting treatment of R&D projects makes R&D more subject to distortions arising from agency conflicts than do the other types of investments[61] (Chen, Chen, & Wei, 2009). The trade-off between current and future earnings from firms' R&D investments may result in a preference for short-term results (managerial myopia) and thus a decrease in R&D (managerial myopia) (David, Hitt, & Gimeno, 2001). For instance, myopic executives are more likely to cut R&D expenditure than other types of investment in order to boost current earnings, with each amount of money saved on R&D translating into artificially inflated pre-tax current income (Chen, et al., 2009; Nagarajan, et al., 1995; Osma, 2008; Stein, 1989). These unique characteristics of R&D activities, which differ significantly from other types of investments make agency cost and information asymmetry in R&D investment particularly severe (Aboody & Lev, 2000; Holmstrom, 1989; Lundstrum, 2002).

It is then plausible to assume that the significant results of compensation committee expertise in motivating efficient investments in R&D are due to the need for compensation design experts, given the severe agency cost and information asymmetry embedded in the unique characteristics of R&D investment. In the presence of severe agency costs and information asymmetry, compensation design is important in resolving these problems. Furthermore, since high agency costs and information asymmetry exacerbate the complexity in structuring efficient compensation contracts, to alleviate these problems, it is essential that compensation committee members have the skills to design executive compensation contracts that encourage CEOs to act in the best interests of shareholders. As such, due to the complexity of executive compensation design to encourage R&D investment efficiency, it is imperative that compensation committee

[61] The US accounting standards treat R&D investments as expenses that should be incurred immediately in the current period, while future revenues may only be recognized when they are actually realized. This accounting rule applied to R&D investments is different from the rule applied to capital expenditure and acquisition costs, which are allowed to be capitalised (Chan, et al., 2001; Dechow & Sloan, 1991; Lundstrum, 2002; Xue, 2007). By capitalising capital expenditure and acquisition, the recognition of the expense of these two types of investment is incurred over multiple years (e.g., through depreciation and amortisation), and thus has a smaller impact on firms' current earnings (Lundstrum, 2002).

members are appropriately skilled. Only in the presence of such skilled committee members will efficient R&D investment result.

6.6 Conclusion

This chapter presents the empirical findings for testing the hypotheses pursuant to the effect of single, mixed and joint expertise within the compensation committee on investment efficiency. Overall, the results suggest that compensation committee expertise is important for the committee to arrange efficient compensation contracts that provide alignment of interests between the executives and shareholders that ultimately encourage the executives to invest efficiently. Although the main findings in this study are unable to document a significant effect of single expertise within the compensation committee on investment efficiency (H1)[62], some types of mixed and joint expertises (i.e. *MBUSLAW*, *MBUSAF*, *JBUSLAW*, and *JLAWAF*) within the committee do significantly affect the efficiency of firm investments, supporting the resource dependence, group effectiveness and human capital theories (H2 and H3).

Of the three types of expertise examined in this study, business expertise, particularly proxied by CEO experience, and legal expertise are important for compensation committee members if they are to design efficient compensation contracts that motivate investment efficiency. Against expectation, accounting/finance expertise is found to exacerbate sub-optimal investment. The adverse effect of accounting/finance expertise on investment efficiency is potentially due to the overlapping commitment an accounting/finance expert-director may have in the compensation and audit committee. Prior studies document that compensation committee members with overlapping commitment in the audit committee may have a conflict of interest leading to sub-optimal decisions and causing the compensation committees to be unable to perform their governance function of arranging interest aligning CEO compensation contracts (Hoitash & Hoitash, 2009; Liao & Hsu, 2013). When business or legal expertise is being mixed or joint with accounting/finance expertise, some of the adverse effects of

[62] Under Model 2, *BUS* is reported to be significant in mitigating investment efficiency, but the significant effect applies only on under-investment case.

accounting/finance expertise on investment efficiency are reversed, confirming the significance of team heterogeneity and bundling individual expertise in enhancing the effectiveness of the compensation committee in arranging efficient compensation contracts. However, since results also suggests that joint business – CEO and accounting/finance expertise on the compensation committee is unable to fully eliminate the adverse effect single accounting/finance expertise has on investment efficiency, it may indicate that legal expertise generally has a more prominent effect in preventing under- and over-investment.

Due to the inconsistencies within the main findings, following Biddle et al. (2009), further analysis that disaggregates the total investment into three components, i.e. capital expenditure, acquisition and R&D investment. The results indicate that compensation committee expertise has more profound effects on R&D investments relative to the other two components of investment. In terms of single expertise, consistent with the findings in the main analysis, firms with CEO (*BUS*) and legal (*LAW*) experts serving on their compensation committee invest more efficiently in R&D than firms without such expertise. In an examination of the effect of the mixed and joint expertise on the components of total investment, R&D investment remains to be the type of investment that is more profoundly affected. Sub-optimal in R&D are mitigated when firms with appoint member(s) with mix of business – CEO and legal expertise (*MBUSLAW*), mix of legal and accounting/finance expertise (*MLAWAF*), joint business – CEO and legal expertise (*JBUSLAW*) and joint legal and accounting/finance expertise (*JLAWAF*) within their compensation committees. By contrast, the effect of compensation committee expertise on capital expenditure and acquisition are predominantly insignificant and even some of the mixed expertise (*MBUSLAW* and *MBUSAF*) appear to worsen under- and over-investment in acquisition.

Given the inconsistent findings from this chapter, Chapter 7 presents sensitivity analysis to ensure the robustness of the results generated in this chapter and further explore the association between the compensation committee expertise and investment efficiency.

Chapter 7
Sensitivity Analysis

This chapter presents the sensitivity tests to establish the robustness of the results found in the Chapter 6. The first section presents the first sensitivity test, which applies a different model of investment efficiency based on Chen et al. (2011). In the second section, alternative measures of compensation committee expertise are employed. Following Krishnan et al. (2011), two different proxies of committee expertise are developed: percentage measure (*PROP*), which is measured by the ratio of the members of compensation committee with the corresponding expertise relative to the total number of compensation committee members, and the number measure (*NUMBER*), which is measured by the number of compensation committee members with the corresponding expertise. In the last section of this chapter a sensitivity test that divides the sample into financially distressed and non-financially distressed firms is presented. For the sake of brevity, the results reported in the second and third sections of this chapter are limited to Model 1.

7.1 Investment Efficiency and Compensation Committee Expertise: Multivariate Regression based on the Alternative Unconditional Model (Model 3)

Recall that under Model 2, the firms are grouped in quartiles based on the magnitude of their residuals to form a dependent variable *INVEFF* = 1 for firms in the lowest residual quartile (under-investment group), *INVEFF* = 2 for firms in the highest residual quartile (over-investment group) and *INVEFF* = 0 for firms in the two middle quartiles (normal investment group). The multinomial logistics regression is then performed to predict the likelihood that a firm will be in the one of the extreme quartiles, as opposed to the middle quartiles.

To check the robustness of the main findings of this thesis, a different multivariate regression model, as specified by Chen et al. (2011), is employed to test the association between compensation committee expertise and investment efficiency. Similar to the

approach specified by Biddle et al. (2009), firms' residuals are measured through a regression of the expected level of firm investment on growth opportunities as proxied by sales growth (Equation 2). However, under Chen et al. (2011), Equation 2 is re-estimated by including *NEG*, an indicator variable that takes a value of 1 for negative sales growth, which controls for differential predictability for sales growth increases and sales growth decreases, and is depicted in the following model:

$$TINVEST_{i,t+1} = \beta_0 + \beta_1 SGrowth_{i,t} + \beta_2 NEG_{i,t} + \beta_3 NEG * SGrowth_{i,t} + \varepsilon_{i,t+1} \quad \textbf{(11)}$$

Where:

$NEG_{i,t}$ = An indicator variable that takes a value of 1 for negative sales growth, and 0 otherwise.

Other variables are defined in equation 1 and equation 2.

Based on the magnitude of the residuals computed from Equation 8, firms are sorted yearly and classified into two groups, which forms the dependent variable *INVEFF*. Firms with residuals < 0 are classified as under-investing (*INVEFFU*) and residuals > 0 are classified as over-investing (*INVEFFO*). To estimate the effect of compensation committee expertise (single expertise, mixed expertise and joint expertise) on investment efficiency the following model is examined

$$INVEFF(U,O)_{i,t+1} = \alpha + \beta_1 CCSINGLE(CCMIXED, CCJOINT)_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010} \gamma_t FYEAR_{,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(12)}$$

Where:

$INVEFF(U,O)_{i,t+1}$ = The residuals of the investment model, measuring over-investment and under-investment.
INVEFFO = residuals > 0, depicting over-investment
INVEFFU = residuals < 0, depicting under-investment
The model will be run separately, for each of under-investment (*INVEFFU*) and over-investment (I*NVEFFO*). For under-investment, the absolute value of residuals is used, so a higher value suggests a more severe under-investment.

Other variables are defined in equation 1 and equation 8.

The equation is run separately, for under-investing firms (*INVEFFU*) and over-investing firms (*INVEFFO*). To simplify the exposition, the under-investment residuals are multiplied by -1, so that a higher value indicates a more severe under-investment.

The regression results that test Hypothesis 1, Hypothesis 2 and Hypothesis 3 under this Model are reported in Tables 22, 23 and 24 respectively. The estimations of the effect of single expertise on investment efficiency in Table 21 are similar to those of Model 2. *BUS* is found to significantly reduce under-investment at the 5 percent level (p-value = 0.0438) with a coefficient of -0.245. *LAW* remains insignificant for both under- and over-investment. *AF* is positive with a coefficient of 0.509 and significant at a 1 percent level (*t-statistics* = 2.95) in the under-investment regression (*INVEFFU*), suggesting that with accounting/finance expertise on compensation committee, under-investment is exacerbated.

Regarding the control variables, the results reported in Table 22 generally confirm what were found in the main analysis. However, it should be noted that although under-investment (over-investment) is found to be positively (negatively) related to the firm's leverage level as established by prior research (e.g. Biddle, et al., 2009), the level of under- and over-investment of this study's sample firms apparently is insensitive to the firm's level of cash, since the coefficients of both the slack and the cash from operation to sales ratio are insignificant under both cases of *INVEFFU* and *INVEFFO* (except for the under-investment case, the coefficient of the cash flow from operation to sales is negatively related to under-investment). This finding is potentially due to the different sensitivity that each component of total investment has on cash, as Sheu and Lee (2012) document that while capital expenditure is significantly correlated with excess cash, R&D investment is found to be insensitive to excess cash.

<<<< INSERT TABLE 22 ABOUT HERE >>>>

Overall the findings from Model 3 are consistent with the ones generated from Model 1 and Model 2. Notably, Model 3 remains insignificant in documenting the effect of compensation committee single expertise on investment efficiency. Similar what found in Model 1 and 2, the insignificant findings may be driven by the effect of each component of total investment, which influences the net effect of expertise on total investment efficiency.

Turning to the mixed expertise regression, relative to Model 1 and 2, Model 3 generates more significant effects of the mixed expertise of compensation committee on investment efficiency [63]. In Table 23, under Model 3, *MBUSLAW* and *MBUSAF* are found to significantly mitigate under-and over-investment. For *INVEFFU*, the coefficient on *MBUSLAW* and *MBUSAF* are -0.590 and -0.894 respectively and both are significant at the 5 percent level with *t-statistics* of -2.38 and -2.46 respectively. The coefficients of both *MBUSLAW* (-1.114) and *MBUSAF* (-1.206) for *INVEFFO* are also negative and significant at the 5 and 10 percent level, respectively. Although the coefficients on *MLAWAF* under both *INVEFFU* and *INVEFFO* have the predicted sign, similar to the main findings under Model 1 and Model 2, the coefficients are not statistically significant to reject the null hypothesis.

<<<< INSERT TABLE 23 ABOUT HERE >>>>

The results of the compensation committee mixed expertise regression on investment efficiency, overall, lend strong support to H2. *MBUSLAW* and *MBUSAF* are significant mixed expertises that help compensation committee to design more align compensation contracts that motivate the CEOs to investment efficiently. Furthermore, results for the control variables under the mix of expertise regression are generally consistent with previous empirical results on single expertise.

Table 24 shows that the variable estimations generated in Model 3 for the effect of compensation committee joint expertise on investment efficiency are not as strong as Model 1 that reports significant effect of *JBUSLAW* and *JLAWAF* in mitigating efficiency in investment. Under Model 3, most of the joint expertise variables are insignificant. However, unlike Model 2 that reports insignificant effect of all types of joint expertise, Model 3 does indicate that one particular joint expertise, *JBUSAF*, significantly reduces

[63] Recall that under Model 1, there is no type of mixed expertise is significant to mitigate sub-optimal investment and under Model 2, *MBUSAF* is found significant to reduce the firms' likelihood to over invest

under-investment with negative coefficient (-0.196) and *t-statistics* = -2.16 (p-value = 0.031). Interestingly, the significant effect of *JBUSAF* in mitigating under-investment under Model 3 is not consistent with the result found under Model 1, which documents that *JBUSAF* exacerbates over-investment. As explained in the main analysis, overlapping compensation committee on the compensation and audit committee or the ineffectiveness of CEO experts in arranging more aligned compensation contracts may explain the adverse effect of *JBUSAF*. However, given *JBUSAF* is found to significantly mitigate under-investment, it remains unclear, whether the adverse effect of *JBUSAF* can be isolated to the presence of CEO or accounting/finance experts on compensation committee.

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As in the main analysis, the regressions on each component of total investment, i.e., *CAPX*, *ACQ*, and *RD* are also being under Model 3. The residuals from each component of total investment are obtained by replicating Equation 11 with each *CAPX*, *ACQ*, and *RD* as the dependent variable. To examine the effect of compensation committee on investment efficiency, the residuals are regressed against the compensation committee expertise, using the following equation:

$$INVEFF(U,O)(CAPX,ACQ,RD_{i,t+1}) = \alpha + \beta_1 CCSINGLE(CCMIXED,CCJOINT)_{i,t} + \sum_{j=1}^{25}\gamma_j Contr_{j,i,t} + \sum_{t=2003}^{2010}\gamma_t FYEAR_{,i,t} + \sum_{j=1}^{48}\gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1} \quad \textbf{(13)}$$

Where:

$INVEFF(CAPX, ACQ, RD)_{i,t+1}$ = The residuals of the investment model of the components of total investment, measuring over-investment and under-investment in *CAPX*, *ACQ* and *RD*.

Other variables are defined in Equation 1, Equation 8 and Equation 11.

Table 25 reports the results of the effect of compensation committee single expertise on *CAPX*, *ACQ*, and *RD*. In Panel A, *BUS* coefficient in *INVEFFUCAPX* regression is found to be negative (-0.263) and significant at the 5 percent level (*t-statistics* = -2.44). A similar significant finding for *INVEFFURD* is also reported. The coefficient of *LAW* is negative

(-0.179) and significant at the 1 percent level with *t-statistics* = -2.63 (p-value = 0.007), confirming the significance of legal expertise in arranging efficient compensation contracts that discourage the CEOs to under-invest in R&D as. Across the three models legal expertise has been consistently found to mitigate under-investment in R&D.

Against expectation, *LAW* in *INVEFFUACQ* is found to be statistically positive at the 5 percent level with a coefficient of 0.198. This finding is puzzling, since legal expertise has been quite consistent to significantly mitigate sub-optimal investments across the regression models. One possible explanation is that because acquisitions represent major corporate investments with CEOs receiving, very often, lucrative compensation packages (Grinstein & Hribar, 2004)[64], legal experts on compensation committee are being too conservative by providing very little incentive compensation plan, which makes the CEOs less motivated to invest in acquisition.

<<<< INSERT TABLE 25 ABOUT HERE >>>>

In Panel B of Table 25, a highly significant reduction in R&D over-investment at the 1 percent is found in *BUS* with a negative coefficient of -0.537. No other single expertise variables in in both panels of Table 25 significantly affects the components of total investment, despite a negative coefficient of *BUS* (*LAW*) in the regression of *INVEFFURD* (*INVEFFORD*) are generated, the *t-statistics* is not high enough to reject the null hypothesis.

The results from re-estimating the effect of mixed expertise of the compensation committee on *CAPX*, *ACQ*, and *RD* in Table 26 Panel A indicate that, in the case of under investment, only *MBUSLAW* (*MLAWAF)* is significant to mitigate *INVEFFURD* (*INVEFFUCAPX*) The coefficients of *MBUSLAW* (*MLAWAF*) are both negative, -0.220 (-0.638) and significant at the 5 percent level with a *p-value* of 0.034 (0.013). By contrast, marginal

[64] Empirical evidence document that acquiring CEOs are rewarded for merger and acquisition activities, even if the transactions are not successful (Grinstein & Hribar, 2004; Harford & Li, 2007)

adverse effect of *MBUSAF* on *INVEFFUCAPX* at the 10 percent level is reported, with positive coefficient of 1.300 and *t-statistics* equal to 1.70.

Of the three types of the compensation committee mix of expertise, the effect of *MBUSLAW* on R&D investment efficiency is consistently significant in mitigating R&D under-investment across the three models. However, no similar significant effect of *MBUSLAW* is obtained to mitigate over-investment in R&D. This finding is plausible since R&D investment is the type of investment that typically suffers from under-investment problems[65] (Ghosh et al., 2007). And thus, expertise of compensation committee will be more likely to have more profound effect in mitigating under-investment than over-investment. Overall, similar to the results from Model 1 and 2, the effect of mix of expertise of compensation committee on *RD* remains most prominent and is more consistent relative to *CAPX* and *ACQ*.

<<<< INSERT TABLE 26 ABOUT HERE >>>>

Table 27 reports the results from estimating Model 3 for joint expertise. Only results from the regression with R&D investment as the dependent variable are significant, whereas the regression of the other two components of total investment generate insignificant results. In Panel A of Table 27, it particularly suggests that the coefficient of *JBUSLAW* in *INVEFFURD* is -0.142 and significant at the 5 percent level with *t-statistics* of -2.00. It is also reported that, contrary to the prediction, *JBUSAF* is found to worsen under-investment in R&D, with a positive, but relatively small, coefficient of 0.069, at the marginal level of 10 percent. This adverse finding of *JBUSAF* may be influenced by the overlapping commitment of the accounting/finance expertise of the committee members with *JBUSA*F, as explained earlier in the main analyses. In the *INVEFFORD* regression, only *JLAWAF* is significant to mitigate R&D over-investment, with a negative coefficient of -0.932 and *t*-

[65] Sheu and Lee (2012) conclude that R&D expenditure is insensitive to excess cash. They further document that when holding excess cash, financially constraint firms do invest in large R&D expenditure.

statistics of -2.81 (*p-value* = 0.005). In *INVEFFURD*, on the other hand, the coefficient of *JBUSLAW* is -0.142 and significant at the 5 percent level.

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The overall findings from Model 3 do provide confirmation to the results generated by Model 1 and Model 2 in the main analysis. Consistent with Model 1 and 2, CEO and legal remain to be important areas of expertise needed by compensation committee to arrange efficient compensation contracts. Accounting/finance expertise, on the other hand, still exacerbates sub-optimal investment, and only in the presence of business, as proxied with CEO experience, or legal expertise, some of the adverse effect of accounting/finance expertise can be reversed. Model 3 also confirms the importance of having compensation committee members with mixed and joint expertise. In the further analysis that partitions the total investment into three components, i.e. capital expenditure, acquisition and R&D investment, similar to the results generated from Model 1 and Model 2, the effect of compensation committee expertise still largely affect R&D investment relative to the other two components of total investment.

7.2 Investment Efficiency and Alternative Measures of Compensation Committee Expertise: Proportion and Number Proxies

In this section, the model is re-examined using alternative measures of compensation committee expertise[66]. In particular, compensation committee expertise will be measured using proportion and number proxies. The proportion proxy is computed as the ratio of the number of compensation committee members with the corresponding expertise relative to the total number of compensation committee members, while the number proxy is merely the number of compensation committee members with that expertise. Results from testing H1 (single expertise), H2 (mixed expertise) and H3 (joint expertise) for the association

[66] Recall that in the previous chapter, the results are reported based on *DUMMY* as the proxy for the compensation committee expertise.

between committee expertise and total investment, as well as the components of investment, based on the two expertise proxies (*PROP* and *NUMBER*), are presented in Tables 28 to 31. With regards to the regression of mix of expertise as the test variable, the alternative measure of *PROP* proxy could not be presented, given the nature of the expertise data availability and the difficulty of applying the alternative proxy on the mixed variable during the coding process[67]. To avoid repetition, only the regression results of Model 1 is presented. Furthermore, for the sake of brevity, the results of control variables are not reported, since they are generally consistent with prior findings.

<<<< INSERT TABLE 28 ABOUT HERE >>>>

Table 28 presents the empirical results of the regression model that test the association between compensation committee single expertise and investment efficiency (H1). Similar to the results based on *DUMMY*, the table reports negative (positive) coefficients of *AF* (*AF* + *OVERI*AF*) of -4.131(8.491) with *t-statistics* = -1.78 (2.00) significant at the 10 (5) percent level, when *PROP* is used as the proxy. When the *NUMBER* proxy is used, the coefficient of *AF* (*AF* + *OVERI*AF*) is -1.377 (2.762), which is also found to significantly increase inefficiency of the firms' investment decisions, both at the 5 percent level, confirming the adverse effect of *AF* on investment efficiency. The other types of single

[67] In converting the expertise at the member level to the committee level for the committee mixed expertise, all members of the compensation committee are multiplied against one and another. For example, in a given firm with four members, i.e. A, B, C and D; Member A has CEO expertise (thus, the member is coded 1 for *BUS*), Member B has also CEO expertise (the member is also is coded 1 for *BUS*), Member C has none expertise (the member is then coded 0 in all expertise *BUS*, *LAW* and *AF*), and Member D has legal expertise (the member is coded 1 for *LAW*). Thus, under *DUMMY* proxy, at the member level, this firm has *BUS* = 1, *LAW* = 1, and *AF* = 0. The mix of CEO and legal expertise based on *DUMMY* will be the *BUS*LAW* = 1 x 1 = 1 at the committee level, which simply indicates the presence of mix of CEO and legal expertise on the firm's compensation committee. In the *NUMBER* and *PROP* proxy, on the other hand, this procedure will be impractical and complicated to interpret. For example, under *NUMBER* proxy, at the member level, *BUS* = 2 (because there are two members with CEO expertise), *LAW* = 1 and *AF* = 0. Thus, *MBUSLAW* at the committee level = 2 x 1 = 2. The value 2 of *MBUSLAW* could not be easily to be interpreted. It could be interpreted as there are two members of the committee with *MBUSLAW*, although it essentially represents that there are 2 members with *BUS* and 1 member with *LAW*. By contrast, the 1 and 0 in the *DUMMY* proxy simply suggests, whether or not, *MBUSLAW* is present in the compensation committee of a given firm.

expertise are in significant. Overall, the results using *PROP* and *NUMBER* confirm those generated in the main findings.

The results from the empirical model that tests the association between compensation committee joint expertise and investment efficiency (H3) are presented in Table 29. The results suggest that using *PROP* and *NUMBER* to measure committee expertise does not affect the statistical inferences drawn when the *DUMMY* proxy is used in the model. The coefficients of the joint expertise variables (*JBUSLAW* and *JLAWAF*) and the sum of expertise and interactive variables (*JBUSLAW + OVERI*JBUSLAW* and *JLAWAF = OVERI** *JLAWAF*) remain consistent with the hypothesis and significant at the 5 percent level or less. For instance, the coefficient of *JBUSLAW* (*JBUSLAW + OVERI*JBUSLAW*) under *PROP* is 7.761 (-5.994) and both are significant at the 1 percent level.

<<<< INSERT TABLE 29 ABOUT HERE >>>>

A similar adverse effect of *AF* on investment efficiency that influences the effect of *JBUSAF* on investment efficiency, as in the dummy regression, is also reported under *PROP* and *NUMBER*. It is reported from Table 29, under *PROP* (*NUMBER*) proxy, the coefficient of *JBUSAF* is -3.036 (-0.750) and significant at the 1 (5) percent level, suggesting the total investment level is further reduced in the setting of higher likelihood of under-investment.

Turning to the components of total investment regression, Table 30 presents the empirical results for the association between single expertise and the components of total investment (*CAPX* in Panel A, *ACQ* in Panel B and *RD* in Panel C), based on *PROP* and *NUMBER* measure. Again, the results reported in Table 30 confirm the main findings based on the *DUMMY* measure. When *PROP* and *NUMBER* are used to proxy for the expertise, the committee's CEO and legal expertise similarly have more pronounced effects on R&D investment (Panel C) regression than on *CAPX* (Panel A) and *ACQ* (Panel B) regression,

confirming the regression results based on the *DUMMY* proxy reported in the previous chapter.

While the effect of *AF* on *ACQ* in the main finding based on the *DUMMY* and *PROP* proxies in a setting of higher likelihood of over-investing is not significant (although the coefficients of *AF + OVERI*AF* under the two proxies have the predicted sign), under the *NUMBER* proxy, the coefficient of *AF + OVERI*AF* is positive and significant, suggesting that *AF* increases the level of acquisition in firms with higher likelihood of over-investment. This may then suggest that the adverse effect of *AF* on over-investment generated in the main analysis is driven by the adverse effect of *AF* on acquisition. Beside *AF*, under the *PROP* and *NUMBER*, no other single expertise is significantly associated with the likelihood of firms to under- or over-invest in *CAPX* and *ACQ*.

<<<< INSERT TABLE 30 ABOUT HERE >>>>

Table 30 Panel C suggests that under the two alternative proxies (*PROP* and *NUMBER*), the coefficients *BUS* (*BUS + OVERI*BUS*) and *LAW* (*LAW + OVERI*LAW*) are consistently positive (negative), indicating the enhancement of R&D investment efficiency as the level of CEO and legal expertise increases. Stronger results for legal expertise, however, are generated under *PROP*, with *LAW* (*LAW + OVERI*LAW*) coefficients of 2.326 (-3.410) and *p-value* equals 0.011 (<0.001), compared to the coefficients of 0.442 (-0.609) and *p-value* of 0.104 (0.077) under *NUMBER*. As in the main analysis, the coefficients *AF* and *AF + OVERI*AF* remain statistically insignificant.

Results similar to the main findings are yielded under the two alternative proxies, *PROP* and *NUMBER* as in the regression based on *DUMMY*, when the effect of joint expertise on efficiency in *CAPX*, *ACQ*, and *RD* investments is examined. As reported in Table 31, while *CAPX* and *ACQ* regressions result show insignificant effects, more pronounced effects of compensation committee joint expertise are experienced by R&D, except for the effect of *JBUSLAW* on *CAPX* and *JLAWAF* on *ACQ* based on *PROP* measure.

Table 31 Panel A reports that under *PROP*, *JBUSLAW* is found to significantly increase the level of *CAPX* in firms with higher likelihood of under-investing, while under the *DUMMY* and *NUMBER* the coefficient of *JBUSLAW* is not significant. Under *PROP*, it is reported that coefficient of *JBUSLAW* is 13.812 and significant at the 5 percent level, suggesting that in the setting of higher propensity of under-investment in *CAPX*, firms with higher proportion of *JBUSLAW* the level of *CAPX* is increased. Panel B of Table 31, confirms the finding under *DUMMY* measure that with a significant coefficient of *JLAWAF* under *PROP* and *NUMBER* (5.150 and 1.706 respectively) both at the 5 percent level, suggesting that with a higher proportion (number) of *JBUSAF,* firms in a setting of higher propensity of under-investment in *ACQ* experience higher level of *ACQ*. Not only that, *JLAWAF* is also significant to mitigate over-investment in *ACQ* under *PROP (NUMBER*) with a negative coefficient of -3.432 (-1.143) and both significant at the 10 percent level. Again, in Table 31 Panel C, under *PROP* (*NUMBER*), *JLAWAF* and *JLAWAF + OVERI*JLAWAF* are significant to mitigate sub-optimal investment in *RD*, with coefficients of 3.162 and -5.684 (-1.300 and -1.971) respectively and all coefficients are significant at the 1 percent level for both *PROP* and *NUMBER* measure.

<<<< INSERT TABLE 31 ABOUT HERE >>>>

The overall regression results based on the alternative measures of *PROP* and *NUMBER* do confirm the results in the main findings under the *DUMMY* measure. *BUS* and *LAW* remain to be two important areas of expertise of compensation committee that enable them to arrange more aligned compensation contracts that motivate investment efficiency. Similar to the main findings, *AF*, as a single expertise of compensation committee, is seen to have adverse effect on investment efficiency, yet when the expertise is mixed or joint with the other two types of expertise (*BUS* or *LAW*), some of the adverse effect can be reversed and thus enable the compensation committee to design efficient compensation contracts that encourage efficient investment decisions.

When the total investment is classified into three components, i.e. *CAPX*, *ACQ* and *RD*, similar results to the main findings are also yielded under the alternative proxies (the *PROP* and *NUMBER* measure) as to under the *DUMMY* measure. The effect of the expertise on *RD* remains the most prominent, relative to the other two components of total investment *CAPX* and *ACQ*.

7.3 Investment Efficiency and Compensation Committee Expertise: Financially Distressed versus Non-Financially Distressed Firms

Prior literature analysing the influence of the financial distress on investment behaviour of firms argues that distressed firms may present different investment behaviour and the problems of over- and under-investment can be exacerbated in distressed firms (Bhagat, Moyen, & Suh, 2005; López-Gutiérrez, Sanfilippo-Azofra, & Torre-Olmo, 2014; Pindado, Rodrigues, & de la Torre, 2008; White, 1996). There might be a concern that the effect of compensation committee expertise on investment efficiency is clouded by the distress riskiness of a firm[68], since the findings considering financially distressed firms may not be applicable to non-financially distressed firms. Due to the propensity for distressed firms to invest inefficiently, expertise within the compensation committee is fundamental to restoring efficient investment levels. This may suggest that there should be more discernible effect of expertise on investment efficiency for the distressed firms than in non-distressed firms, which may explain the inconsistency found in some results in the main analysis.

In order to further explore this, sensitivity analysis is then conducted that partitions the full sample into distressed and non-distressed firms. The initial 7,013 observations in the full sample are ranked in quartiles based on *ZSCORE*. Firms in the lowest quartile (Q1), being the group of firms with the lowest *ZSCORE*, are assigned as being financially distressed (FD), whereas those in the highest quartile (Q4), being firms with the highest *ZSCORE*, are

[68] Although in the main model, a variable *ZSCORE*, which controls for the firm's bankruptcy risk, has also been included, and the fact that the variable is found to be significant with investment efficiency in some of the regression results suggest that the risk of bankruptcy might influence the effect of compensation committee expertise on investment efficiency. For instance, higher *ZSCORE* (lower bankruptcy risk) is found to reduce the likelihood of firms being placed in the over-investment group of firms in total investment and R&D expenditure.

assigned as being non-financially distressed firms (NFD). In total, there are an equal number of 1,753 firm-year observations for each FD and NFD sample. For the sake of brevity and given that quite similar results are generated from single, mixed and joint expertise, the results presented in this section are limited to the single expertise of compensation committee.

Before running the multivariate regression model, univariate analysis between the two sub-samples (FD *vs* NFD firms) is conducted to examine any differences in the level of investment (Panel A), investment inefficiency (Panel B)[69], and the level of expertise between those two sub-samples (Panel C). The results of the univariate analysis between FD and NFD are reported in Table 32.

<<<< INSERT TABLE 32 ABOUT HERE >>>>

In terms of the level of investment, Panel A of Table 32 shows FD sample firms have a significantly higher *TINVEST* (with the mean value of 10.941 percent of total asset) than NFD firms (with the mean value of 9.141), at the 1 percent level (*t-statistics* = 7.01). When the total investment is disaggregated into its component, it is found that a significantly greater portion *RD* is made by FD firms with mean value of 3.726 percent of total asset for FD firms relative to the mean value of NFD of 1.095 percent of total asset (*t-statistics* = 18.64*)*. This finding confirms a study by Zhang (2015) that documents that firms with higher R&D expenditures are more likely to enter financial distress. In contrast, it is also reported that more *CAPX* is being made by NFD firms with the mean value of 29.089 relative to the average *CAPX* of 23.279 percent of total asset for FD firms. This is consistent to with the evidence shown in prior studies that firms with large cash access tend to spend their excess cash on capital expenditure (Harford, et al., 2008; Sheu & Lee, 2012;

[69] To ease the interpretation of the univariate analysis between FD and NFD groups, investment efficiency level reported in Table 32 are measured in accordance with Chen et al. (2011). The positive value of residuals represents over-investment, and under-investment is represented by the absolute value of the negative residuals (so higher values of residuals consistently indicate more severe cases of over- and under-investment).

Stulz, 1990). The result further shows that there is no significant difference in the average *ACQ* level between FD and NFD firms.

When it comes to the level of investment efficiency (Table 32, Panel B), FD firms are more likely to over- and under-invest in total investment and R&D investment than NFD firms with the mean values of under-investment (*INVEFFURD*) of 5.486 *vs* 4.338 respectively and the mean values of over-investment (*INVEFFORD*) of 3.811 vs 3.445 for FD and NFD respectively. This higher level of inefficiency is potentially attributed to the lower expertise level held by compensation committee members of FD firms in comparison to the expertise of NFD firms' compensation committee members. Panel C of Table 32 reports that NFD firms comprise of more *BUS* (*LAW*) with the average of 15 (11) percent of NFD firms having at least one member with CEO (legal) expertise relative to FD firms.

Based on this univariate analysis, initial evidence on the relationship between compensation committee expertise and investment efficiency in the light of firms' distress riskiness is found. The univariate analysis reveals that firms that are financially distressed have higher level of investment inefficiency (both under- and over-investment) and lower levels of expertise compared to non-distressed firms. Before a solid conclusion can be drawn, further analysis in the form of regression analysis is required.

Tables 33 report the results of multivariate regression analysis of the effect of compensation committee's single expertise on the efficiency of investment (*TINVEST*) and its components (*CAPX*, *ACQ*, and *RD*), based on the conditional model (Model 1) for financially distress firms and non-financially distress firms[70]. In Table 33, the regression models that examine the investment efficiency (and the components of total investment: *CAPX*, *ACQ* and *R&D*) as in the main analysis are re-estimated for each sub-sample of financially distressed and non-financially distressed firms. The results from Table 33 are

[70] Model 2 is also re-estimated by partitioning the sample into financial distress *versus* non-financial distress firms (untabulated). The result of the logistic regression analysis in Model 2 are similar to those in Model 1 and thus consistent with the results in the main analysis. In general, the effect of the compensation committee expertise on investment efficiency is apparently not influenced by the financial distress status of the firms.

generally consistent with those generated in the main analysis. Some inconsistencies are still found, even after the pool sample is partitioned into FD and NFD sub-samples.

As in the main analysis, when the full sample is partitioned into FD and NFD sub-samples, the regression results for both sub-samples are generally insignificant and inconsistent with the expected outcome. Table 33 Panel A suggests that, consistent to the main findings, *BUS* expertise within the compensation committee is found to be insignificant in stimulating investment efficiency for both FD and NFD firms. Similar to the results reported in the main analysis, *AF* is also found to exacerbate inefficiency in total investment for both FD and NFD, although for the FD sub-sample, the significant result is limited to the case of over-investment. It is reported that in FD firms the coefficient of *AF + OVERI*AF* is 2.589 and significant at the 10 percent level, whereas in NFD firms the coefficient of *AF* (*AF + OVERI*AF*) is -3.051(2.929) both significant at the 5 percent level. *LAW*, on the other hand, is only significant for preventing under-investment in FD firms, with a coefficient of 2.080 and significant at the 10 percent level.

<<<< INSERT TABLE 33 ABOUT HERE >>>>

When it comes to the effect of the committee expertise on *CAPX* in FD and NFD, Panel B of Table 33 reports predominantly insignificant effects of the three types of single expertise on *CAPX* in both FD and NFD firms. Only *LAW* is found to exacerbate both *INVEFFUCAPX* and *INVEFFOCAPX* in FD firms, whereas it is also reported that *AF* appears to worsen *INVEFFOCAPX*. Panel C of Table 33, similarly indicate insignificant effects of almost all types of expertise on *ACQ* in both FD and NFD firms. Only CEO expertise is found to be significant for mitigating both *INVEFFUACQ* and *INVEFFOACQ* in FD firms with a coefficient of *BUS* and *BUS + OVERI*BUS* of 1.857 and 0.044 respectively, which both are significant at the 5 percent level.

With regards to *RD*, Table 33 Panel D suggests that legal expertise (*LAW*) appears to have consistent effect in mitigating inefficiency of *RD* in both FD and NFD firms. The results

suggest that *LAW* significantly mitigates *INVEFFURD* and *INVEFFORD* for both sub-samples. In FD (NFD) firms, the coefficient of *LAW* is 1.117 (1.390) and significant at the 5 (1) percent level, and the coefficient of *LAW + OVERI*LAW* is -3.178 (-0.714) and significant at the 1 (10) percent level. Furthermore, in the NFD sub-sample, the coefficient of *AF + OVERI*AF* is, interestingly, negative (-0.454) and significant at the 10 percent level, suggesting that different from what found in the main results, with the presence of accounting/finance expertise on compensation committee, over-investment in *RD* is mitigated.

7.4 Conclusion

This chapter presents the sensitivity analyses undertaken to ensure the robustness of the results generated from the main tests. These sensitivity analyses include the application of a different investment efficiency model as specified by Chen et al. (2011), the use of two different proxies for compensation committee expertise, i.e. the percentage and the number measure, and the sample firms' partition based on the firms' financial distress status. The results from these three sensitivity tests, generally, confirm the findings outlined in the main analyses. Business, as measured by CEO expertise, and legal expertise remain important types of expertise for compensation committee in structuring efficient compensation contracts that motivate investment efficiency, whereas accounting/finance expertise are only significant when the expertise is being mixed or joint with the business – CEO or legal expertise. The results also consistently predict stronger effects of the mix of and joint expertise within compensation committee members. Furthermore, of the three components of total investment, more profound effects of compensation committee expertise are found on R&D investment relative to capital expenditure and acquisitions. The results also indicate that the effects of committee expertise on investment efficiency, apparently, are not influenced by whether or not the firms are in financial distress state.

The next chapter, Chapter 8, presents the conclusion of the thesis results drawn from the main, additional and sensitivity analyses, the limitation of this thesis and suggest future avenues for research.

Chapter 8
Conclusion

8.1 Review of the Study

In the presence of agency conflict and information asymmetry, the interest between shareholders and executives will not be fully aligned, where both parties attempt to maximise their own expected utility (Berle & Means, 1932; Fama & Jensen, 1983a, 1983b; Jensen & Meckling, 1976; Lambert, 1986). As a result of this, both the shareholders and the executives will not necessarily be unanimous in deciding which investment project is the best, causing the adoption of suboptimal investment policy in the form of under- and over-investment by the executives (e.g. Berle and Means, 1932; Fama and Jensen, 1983a, b; Jensen and Meckling, 1976; Lambert, 1986). This opportunistic behaviour by executives urges the necessity for the provision of incentives and controlling mechanism through the arrangement of managerial compensation contract to reduce agency costs and discourage managerial opportunism (Berhold, 1971; Fama & Jensen, 1983b ; Grenadier & Wang, 2005; Heckerman, 1975; Lewellen, et al., 1987; Ross, 1973; Watts, 1977). Prior studies conclude that efficient compensation contract provides the incentive for the top executives to extend their effort and disclose private information to the shareholders, thereby reducing agency problems and information asymmetry.

Although a large body of executive compensation research have investigated the issue of compensation contract that optimally addresses the alignment of shareholders and management interest for decades, what considers an efficient compensation contract is still an open question. Executive compensation, on its own, is arguably not sufficient to provide the executives incentives to act in the best interests of shareholders, because executive compensation exhibits agency problem symptoms and is perceived as a product of rent seeking by opportunistic executives (Bebchuk & Fried, 2003; Bebchuk & Fried, 2006; Boyle & Roberts, 2013). Bebchuck and Fried (2003) view executive compensation not only as the instrument to address agency problems, but also as part of the agency problems itself.

The market regulator and the press have raised concerns about the insufficiency of current compensation contracts to incentivise executive to maximise shareholder value (Donaldson, 2003). The literature on executive compensation also presents evidence on the ineffectiveness of performance-based compensation policies and that managerial opportunism still exists under equity-based compensation contracts (Ashley & Simon, 2004; Bebchuk & Fried, 2005; Bergstresser & Philippon, 2006; Cheng & Warfield, 2005; Dechow & Sloan, 1991; Jensen & Murphy, 1990; Ryan & Wiggins, 2002; Shen & Zhang, 2013; Yermack, 1995; Yim, 2013).

This creates the need for establishing a compensation committee that is responsible for protecting shareholder interests by setting an efficient management remuneration plan that provides incentives for executives to act congruently with shareholders' interests. Compensation committees, arguably serves as an agency mechanism that enforces efficient compensation contract and play a crucial role in motivating CEOs to invest efficiently.

Nevertheless, it is important to be noted that each of compensation committee members is dynamic depending on various characteristics such as incentives, knowledge, personalities, background, skills and connections (Adams, et al., 2010; Main & Johnston, 1993), which influence their ability to structure compensation contracts. Sun et al (2009) document that greater incentive alignment in executive compensation contracts are achieved with higher compensation committee quality. As different firms have different incentives in composing their compensation committees, a one-size fits all solution for compensation committee quality might not be optimal (Sun & Cahan, 2012). Kroll, Walters and Writh (2008b) further maintain that director vigilance without relevant experience is unlikely to ensure board effectiveness and therefore boards containing vigilant directors, as well as directors with appropriate knowledge gained through experience, are useful advisers to senior managers. This implies that a compensation committee with specific expertise will be able to structure more optimal compensation contracts that prevent opportunistic behaviour in investment decisions. Rashid et al. (2010) confirm the importance of human capital to board effectiveness and conclude that, by taking into account human capital, a higher

proportion of outsiders on the board may reduce underinvestment and agency problems in comparison with insider and affiliated director-dominated boards.

Drawing from resource dependency theory (Pfeffer & Salancik, 1978), this study extends the examination of investment efficiency within the framework of agency role of compensation committee to investigate compensation committee member expertise on investment efficiency and expect that members of the committee with proper expertise results in a more optimal pay contract, further enhances the investment efficiency. Although, some anecdotal evidence and theoretical studies have indeed noted the importance of the expertise needed to effectively fulfil board governance in protecting shareholders' interests at both board and committee level (e.g. Cunningham, 2010; Grossman, 2004; Karp, et al., 2007; Kay & Van Putten, 2007; Lawler III & Boudreau, 2006; Macintosh, Shearer, Thornton, & Welker, 2000; Nussbaum, 2008; Reda, 2000), no similar regulatory requirement of certain expertise as in audit committee has been imposed on compensation committee. Regulatory requirements imposed on the compensation committee, including the most current listing standard, are pre-occupied with the issue of its member independence (Rindova, 1999; SEC, 2012).

Although recent research has examined the influence of financial reporting quality and accounting quality on investment efficiency (Biddle and Hilary, 2006; Biddle et al., 2009, empirical studies that particularly investigate corporate investment efficiency in the context of a compensation committee's individual attribute and the overall attributes (the mixed and joint attributes) are yet to be done. Furthermore, in contrast to research examining audit committee attributes that concludes that accounting expertise is significant and positively related to financial reporting quality (Krishnain & Visvanathan, 2008), and firms achieve the most positive impact on accrual quality when they have a combination of both accounting- and finance-literate experts on their audit committee (Dhaliwal, et al., 2010), no similar examination has been conducted on compensation committee members. The extensive literature concerning effective compensation committees over-emphasises the issue of committee independence in forming effective compensation committee, but with

no conclusive results (Anderson & Bizjak, 2003; Daily, et al., 1998; Laksmana, 2008; Newman & Mozes, 1999; Vafeas, 2003a).

This thesis attempts to fill a gap in the literature through an examination of investment efficiency in light of compensation committee expertise by identifying important areas of expertise that assist the committee to structure efficient compensation contracts, which prevent the executives from making sub-optimal investments. It has been established that appropriately designed compensation contracts will provide an alignment of interests between executives and shareholders, which motivates the executives to take actions that maximise the value of shareholders. However, the design of optimal compensation contracts is difficult and generally unobservable, since the optimality of a compensation contract varies quite drastically across firms, industries and over time (Core, et al., 2003; De Angelis & Grinstein, 2015; Morgan & Poulsen, 2001; Walker, 2010a; Williams, 1998). Furthermore, the arrangements of an optimal compensation contract evolve with changes in contracting mechanisms, such as improvements in board governance, and may result in different patterns of compensation contracts that are desirable for one company but not for another (Conyon, 2006).

As compensation committee of the board of directors, as a vital corporate governance mechanism, determines the optimal terms of executive compensation (Brancato, 2002; O'Reilly & Main, 2007), it is plausible to argue the efficiency of a compensation contract will then be reflected by the efficiency of CEOs' investment decisions. A compensation committee, charged with responsibility for designing efficient executive compensation contracts, serves as an oversight mechanism that provides alignment of the interests of shareholders and management, and this ultimately results in investment efficiency (Anderson & Bizjak, 2003). Thus, this thesis takes a different approach by measuring the optimality of a compensation contract through a firm's investment efficiency and argues that, with the right attributes, compensation committee members will structure efficient compensation contracts that motivate CEOs to invest efficiently.

8.2 Findings and Contribution to Extant Literature and Practice

From the results of three alternative models used in prior literature (Biddle, et al., 2009; Chen, et al., 2011; Cheng, et al., 2013) (two main models and one model in sensitivity analysis), this thesis documents important effects of compensation committee attributes in arranging better compensation contracts to prevent sub-optimal investment decision making by executives. Table 34 presents the summary of findings of the effect of compensation committee single, mixed and joint expertise on investment efficiency. The table indicates that partial support for H1a, H2 and H3, which predict an association between compensation committee member expertise (single, joint and mixed expertise) and investment efficiency, is established in this study. Despite results from these three models not seeming to generate statistically consistent estimations, some results do signal the importance of compensation committee expertise in arranging optimal compensation contracts that motivate CEOs to invest efficiently, especially those compensation committee members with joint expertise (H3). The results appear to provide confirmation for the significance of the compensation committee members having multiple skill-sets and positive outcomes possible from having heterogeneous teams as per resource dependence, human capital and group effectiveness literature.

<<<< INSERT TABLE 34 ABOUT HERE >>>>

A further analysis is undertaken by partitioning the total investment into its components, i.e. capital expenditure, acquisitions and R&D investment. This comprehensive look at firm investment is important in order to ensure that insignificant and inconsistent results in total investment are not driven by a particular type of investment, given that different types of investment are different nature and, thus, compensation committee expertise possibly has offsetting effects on investment efficiency.

Table 35 summarises the findings of the effects of compensation committee expertise on each component of total investment. In Table 35, it is indicated that the effect of

compensation committee single, mixed and joint expertise on each of the components of total investment documents a strong association between committee expertise and R&D investment efficiency. By employing R&D investment as the dependent variable in the research models, more pronounced and consistent results are generated in comparison with the results where capital expenditure and acquisition are the dependent variables in the models. This may be due to the unique characteristics of R&D investment that differ significantly from other types of investment. These unique features of R&D activities (i.e., risky, lengthy, intangible and idiosyncratic) make agency costs and information asymmetry in R&D investment particularly severe (Aboody & Lev, 2000; Holmstrom, 1989; Lundstrum, 2002), which exacerbates the complexity in structuring efficient compensation contracts by compensation committees; and thus the effect of the compensation committee expertise on inducing investment efficiency on R&D investments is more apparent than the other total investment components.

<<<< INSERT TABLE 35 ABOUT HERE >>>>

Consistent with the reported results using total investment as the dependent variable, it is found that CEO and legal expertise, as well as the mix and joining of these two types of expertise, are significant in mitigating inefficiency in R&D investments. Consistent with the main results, the adverse effect of accounting/finance expertise on R&D investment efficiency is also eliminated when this expertise is mixed or joined with either CEO or legal expertise. By contrast, the analysis of the compensation committee expertise effects on *CAPX* and *ACQ* could not produce similar significant findings.

Viewed as a whole, this thesis presents evidence on two important attributes that enable a compensation committee to perform its governance function by designing efficient pay packages that encourage firms to invest efficiently. Business expertise, as measured by the director's CEO experience, equips the committee with strategic competency and detailed knowledge of the nature of the firms' business operation, allowing the committee to design

a pay policy with a holistic approach to suit the common practices of firms, as well as being tailored to the uniqueness of each firm's business, culture and philosophy (Kay & Van Putten, 2007; Randolph-Williams, 2010). Legal experts are important for the compensation committee to design efficient compensation contracts, as documented by Litov et al. (2014), who found that lawyer directors on the compensation committee are associated with interest-aligning compensation.

The effect of accounting/finance expertise in enhancing investment efficiency, on the other hand, is only significant in the presence of CEO or legal attributes, either when the expertise is mixed or joint with the other two attributes[71]. Without mixing or joining *AF* with the other two types of expertise, accounting/finance expertise is, in contrast to the hypothesis, found to exacerbate inefficient investment. This unexpected outcome is potentially attributed to the presence of the directors with dual membership on the compensation and audit committees, which hinders compensation committee members properly performing their governance function in designing efficient compensation contracts. Prior studies document that the presence of a director with common membership on the compensation and audit committees may result in conflicting interests, leading to decisions that are sub-optimal, and thus may put the effectiveness of both committees at risk (Hoitash & Hoitash, 2009; Liao & Hsu, 2013).

This thesis also confirms the significance of collaboration and bundling effects of attributes of the compensation committee in mitigating sub-optimal investment, although the results are not consistently significant across the three different models. Within the resource dependence framework and group effectiveness literatures, a combination of skills from a pool of human capital creates competitive advantage (Nicholson & Kiel, 2004; Wright, et al., 1994) and teams with heterogeneous members generate positive performance outcomes (Campion, et al., 1996; Guzzo & Dickson, 1996; Holtzman & Anderberg, 2011; Milliken & Martins, 1996; Stevens & Campion, 1994).

[71] As reported in the previous chapters, some insignificant results are also still reported, although the coefficients of the mixed/joint expertise variables have the predicted sign.

Building upon agency, resource dependency, and group decision making theories, this thesis contributes to the extant literature on efficient compensation contract by investigating the efficiency of a compensation contract via the enhancement of investment efficiency as a result of an efficient compensation contract arranged by a compensation committee member with relevant attributes. This thesis also provides a contribution to the literature by identifying important attributes for a compensation committee to perform its governance function in designing a compensation contract that aligns the interests of shareholders and executives. Prior studies mainly utilise independence, the number of directorships held, tenure, or a combination of these variables as important attributes for a high quality compensation committee (Anderson and Bizjak, 2003; Daily et al., 1998; Newman and Mozes, 1999; Sun and Cahan, 2012; Sun et al., 2009; Vafeas, 2000, 2003b). Furthermore, this study provides confirmation for the significance of the compensation committee members having multiple skill-sets and positive outcomes possible from having heterogeneous teams as per resource dependence, human capital and group effectiveness literature.

The results of this thesis also provide market authorities evidence for the potential value of more specific regulation governing compensation committee attributes. This thesis specifically concludes that two attributes of compensation committee, i.e., business as proxied with CEO experiences and legal expertise, which enable committee members to design efficient compensation contracts that align the interests of managers and shareholders, which in turn result in investment efficiency.

8.3 Limitation and Future Research

As with any studies, the findings in this thesis should be considered in light of several potential limitations. The first limitation of this study is that this thesis is built upon agency conflicts and attempts to proxy efficient compensation contracts through the firms' investment efficiency. However, recent literature suggests that there are factors other than agency conflicts that may affect firms' investment decisions, such as personal characteristics of CEOs (Gervais, et al., 2011; Malmendier & Tate, 2005; Stein, 2003). This

line of research suggests that the overconfidence level of CEOs affects firms investment, which results in sub-optimal investment decision the CEOs (Ahmed & Duellman, 2013; Malmendier & Tate, 2005). It is argued that an executive, who does not face any informational asymmetries, and whose incentives are perfectly aligned may still invest inefficiently if he or she is overconfident (Malmendier & Tate, 2005). Therefore, to fully comprehend the effect of compensation committee expertise (that enables the committee to arrange efficient compensation contracts) on investment efficiency, future research may extend the investigation and examine this issue within the context of CEO personal characteristics.

Another potential caveat of this thesis is on the inability to directly measure investment efficiency. Following prior research (Biddle, et al., 2009; Chen, et al., 2011; Cheng, et al., 2013; Verdi, 2006), the concept of investment efficiency adopted in this thesis is based on the assumption that the expected level of investment predicted by sales growth is optimal. Although all models have been well-specified in accordance with prior research (Biddle, et al., 2009; Chen, et al., 2011; Cheng, et al., 2013), the fact that there are still results suggesting inconsistent significant estimations of the expertise effect on investment efficiency calls a further examination. A re-estimation using different specifications of the investment model could be undertaken to provide more support for the beneficial effect of compensation committee expertise on investment efficiency.

Another limitation of this thesis is pertained to the compensation committee expertise data availability. This thesis generates data on compensation committee members' expertise from the proxy statements, which are publicly available in the SEC website. Supplemental information from the Risk Metrics database is also used in coding procedures of committee expertise to increase the accuracy of the expertise data. However, in subsequent research, different sources of information about committee members, such as Corporate Library

database[72] or Google search, could be considered to increase the number of observations with the identified expertise.

Furthermore, the main analysis of this thesis is focused on the relationship between compensation committee expertise and total investment efficiency, and thus the theoretical justification for the effect of expertise on each component of the total investment, i.e., capital expenditure, acquisition and R&D investment, is less explored. Subsequent study may consider investigating the relationship between committee expertise and the components of total investment separately in order to provide more thorough theoretical argument on why certain types of investment is differently affected by compensation committee expertise

The results of this thesis show that CEO and legal expertise of the compensation committee encourage investment efficiency by providing more efficient compensation contracts. Future research may also extend the analysis of investment efficiency by exploring the association of investment efficiency and the types of compensation contracts designed by compensation committees with CEO and legal experts. Since the results also consistently indicate adverse effects of accounting/finance expertise on investment efficiency, which potentially is caused by the presence of directors with audit and compensation committee common membership, overlapping membership effects on investment efficiency warrant further investigation.

Finally, the sample firms used in this study are limited to US-based public companies. Thus, the results may not be generalised to the compensation committees in private or non-US firms, due to different regulatory requirements that are imposed on compensation committees in those types of firms. Therefore, future study may also test the effect of compensation committee expertise on investment efficiency in a different regulatory setting.

[72] Prior study investigating the issue of human capital of board of directors (Khanna & Thomas, 2009) obtains the data about the directors from Information on director attributes the Corporate Library. However, this database is unavailable at the educational institution where the author studies

Table 1
Investment Efficiency Measurement

Variable		Definition
Model 1		
$TINVEST_{t+1}$	=	Total investment in t+1 year, which is the sum of capital expenditure, R&D expenditure, and acquisition, minus sales of PPE, scaled by lagged total asset.
$OVERI_{t+1}$	=	Ranked variable capturing the likelihood of over-investment. The variable is derived from averaging the deciles of cash and inverse leverage.
Model 2		
SALES GROWTH	=	The percentage change in sales from year t-1 to t.
RESIDUALS	=	The deviation of investment from its expected optimal level, representing investment efficiency measures (over- or under- investment measure)
INVEFF	=	The residuals of the investment, which are derived from regressing investment at time t+1 against current sales growth. The residuals are then ranked into quartiles by each year and Fama-French (1997) industry classification to assign a code of 0, 1 or 2 to each of the firm-year observation
INVEFF = 0	=	Firm-year observation (in quartile 2 and/or quartile 3 of *INVEFF*) with residuals close to 0
INVEFF = 1	=	Firm-year observation (in quartile 1 of *INVEFF*) with the most negative residuals, classified as under-investment
INVEFF = 2	=	Firm-year observation (in quartile 2 and/or quartile 3 of *INVEFF*) with the most positive residuals

Table 1 presents the measurement of the investment efficiency based on two models as explained earlier. In Model 1, investment efficiency is measured based on the firms' likelihood to over-invest. In Model 2, investment efficiency is measured as deviation from expected level of investment (residuals) based on a model that predicts investment as a function of sales growth. Based on the magnitude of the residuals, firms are sorted yearly and grouped into quartiles. A multinomial logit model will be run to estimate the firms' likelihood to be in the lowest quartile (*INVEFF*= 1) or in the highest quartile (*INVEFF*= 2), as opposed in the two middle quartile (*INVEFF*= 0).

Table 2
Compensation Committee Expertise Measurement

Attributes	Definition
Business Expertise (*BUS*)	A member of compensation committee with current/past working experience as a company's executive officer (CEO)
Legal Expertise (*LAW*)	A member of compensation committee with current/past working experience as an attorneys or partner in law firms or general counsel or law executive of firms or has law degree, such as J.D, LL.M, LL.B or LL.D
Accounting/Finance Expertise (*AF*)	A member of compensation committee with working experience as a finance/accounting executive (e.g., chief of financial/accounting/investment officer, vice president of finance/accounting), an accountant, financial controller, investment banker, financial analyst, partner in investment/accounting firms or other financial management role or has a degree in accounting/finance

Table 2 specifies the keywords and definition that are used to assign each compensation member to business expertise, legal expertise and accounting expertise as the variables of interests in this thesis.

Table 3
Control Variables Measurement

Panel A : Variables that Control Investment

Variable		Definition
(1) FSIZE	=	The natural logarithm of total assets
(2) MKTBOOK	=	The ratio of market value of total assets to book value of total assets
(3) ZSCORE	=	A measure of bankruptcy risk, which is computed by: 3.3 (net income before taxes) + Sales + 0.25(retained earnings) + 0.5((current assets – current liabilities)/total assets)
(4) TANGIBILITY	=	A measure of bankruptcy costs, which is computed by: PPE (net property, plant, & equipment) / total assets
(5) DIVIDEND	=	A dummy variable, which takes the value of 1 if the firms paid dividend, 0 otherwise
(6) SLACK (model 2)	=	The ratio of cash to PPE
(7) LEV model 2)	=	Firm leverage, measured by the long-term debt to the sum of long-term debt to the market value of equity.
(8) INDLEV	=	Mean of the ratio of long-term debt to the sum of long-term debt to the market value of equity for firms in the same SIC 3-digit industry
(9) SDINV	=	Investment volatility, measured by standard deviation of total investment
(10) FAGE	=	The firms' age, measured by the difference between the first year when the firm appears in CRSP and the current year
(11) CFOSALE	=	The ratio of CFO to sale
(12) SDCFOP	=	The standard deviation of cash flow from operating activities from years t-5 to t-1
(13) SDSALE	=	The standard deviation of sales from year t-5 to t-1
(14) OPCYLE	=	The log of receivables to sales plus inventory to COGS multiplied by 360
(15) LOSS	=	an indicator variable that takes the value of one if net income before extraordinary items (item18) is negative, and zero otherwise
(16) ANALYST	=	The number of analysts following the firm
(17) FRQ	=	The standard deviation of the firm-level residuals from Dechow and Dichev (2002) model during the years t-5 to t-1 multiplied by negative one.
(18) ICW	=	An indicator variable that takes the value of one if firms disclose internal control weaknesses under Section 302 or Section 404, and zero otherwise

Panel B : Variables that Control Compensation Committee

Variable		Definition
(19) CCAGE	=	The average age of each directors serving on the committee
(20) CCTNR	=	The average number of years of each director serving on the committee
(21) CCSIZE	=	The number of directors serving in compensation committee
(22) CCMEET	=	The number of meetings held by compensation committee during the fiscal year
(23) CCBRD	=	The number of compensation committee member serving at least two boards as a proportion of compensation committee size
(24) CCINDP	=	The number of independent directors serving in compensation committee as a proportion of compensation committee size
(25) CCSHR	=	The number of compensation committee members with more than 1 % shareholding as a proportion of compensation committee size

Table 3 describes the definition of control variables included in the model. Panel A presents the definition for investment related control variables, whereas Panel B presents variables that control for the attributes of the compensation committee.

Table 4
Sample Selection and Distributions

Panel A: Sample Selection Procedure	**N** ***(in firm-year)***
All firm-year from S&P 1500 firms	14,904
Less:	
- Firms in regulated industries (utilities, banks, and financial services with SIC codes 4910-4999 and 6000-6999)	(3,534)
- Missing proxy statements from the SEC website	(1,752)
- Missing compensation committee attributes information from proxy statements and Risk Metric	(586)
- Missing information from I/B/E/S	(791)
- Missing information from Compustat	(448)
- Missing information from Audit Analytics	(297)
- Observations with extreme value	(483)
Final sample	**7,013**

Panel B: Sample Distribution by Year

Year	**Obs**	**%**
2003	842	12.01%
2004	868	12.38%
2005	907	12.93%
2006	905	12.90%
2007	888	12.66%
2008	887	12.65%
2009	888	12.66%
2010	828	11.81%
Total	**7,013**	**100.0%**

Panel C: Sample Distribution by Industry

Fama and French Industry Classification	**Obs**	**%**
Business Services	779	11.11%
Retail	677	9.65%
Electronic Equipment	565	8.05%
Machinery	398	5.67%
Petroleum and Natural Gas	344	4.91%
Wholesale Trade	305	4.35%
Computers	268	3.82%
Transportation	256	3.65%
Medical Equipment	244	3.48%
Chemicals	236	3.37%
Pharmaceutical Products	234	3.34%
Measuring and Control Equipment	217	3.09%
Other (36 Industries with less than 3% membership)	2,490	35.51%
Total	**7,013**	**100.00%**

Panel A of Table 4 presents the procedure for generating the sample for testing the models. After deducting observations from financial and utilities industries, missing observations and observations with extreme value, there is a total sample of 7,013 firm-years. Panel B presents the yearly distribution of sample and Panel C presents the distribution of the sample based on the Fama and French industrial classification code.

Table 5
Summary Statistics for Total Investment and Residuals as the Dependent Variables in Model 1 and Model 2 and Compensation Committee Overall, Single, Mixed and Joint Expertise

Variables	N	Mean	Median	Q1	Q3	Std.Dev.
Panel A: Dependent Variable –Model 1						
$TINVEST_{t+1}$	7,013	10.27	8.49	4.76	14.12	7.36
Panel B: Dependent Variables - Model 2						
INVEFF =0	3,507	-0.83	-0.96	-2.43	0.60	1.87
INVEFF=1	1,753	-6.50	-5.88	-7.73	-4.77	2.25
INVEFF =2	1,753	8.16	7.10	4.71	10.53	4.27

	Percentage	Number *(in firm-year)*
Panel C: Compensation Committee Total Expertise[73]		
Business All	87.95	6,168
Legal All	24.48	1,717
Accounting/Finance All	69.36	4,864
Panel D: Test Variables - Single Expertise		
Business – CEO (BUS)	13.08	917
Legal (LAW)	4.28	300
Accounting/Finance (AF)	7.84	550
Panel E: Test Variables - Mixed Expertise		
Mixed Business – CEO and Law (MBUSLAW)	3.07	215
Mixed Business – CEO and Accounting/Finance (MBUSAF)	1.81	127
Mixed Law and Accounting/Finance (MLAWAF)	0.20	14
Panel F: Test Variables - Joint Expertise		
Joint Business – CEO and Legal (JBUSLAW)	6.74	473
Joint Business – CEO and Accounting/Finance (JBUSAF)	31.94	2,240
Joint Legal and Accounting/Finance (JLAWAF)	3.54	248

Table 5 presents the summary statistics of the dependent variables and the main test variables of this study. Panels A and B of this table report the summary statistics of the dependent variable (investment efficiency) based on Model 1 and Model 2. In Panel A, total investment ($TINVEST_{t+1}$) serves as the dependent variable, whereas in Panel B the residuals within the normal investment group (*INVEFF = 0*), under-investment group (*INVEFF = 1*), and the over-investment sample firms (*INVEFF = 2*) serve as the dependent variables. Table 5 Panels C to F detail the summary statistics of compensation committee expertise variables. Panel C reports the statistics of compensation committee expertise without eliminating the presence of other types of expertise within the top 5 types of expertise amongst compensation consultants (specified in Appendix 1). Total expertise reported in Panel C is used for descriptive statistics purposes only and is not used for hypotheses testing. Panels D, E and F detail the summary statistics of compensation committee expertise as the test variables for H1, H2, and H3, respectively. Panel D reports the statistics of compensation committee single expertise, which include members of the committee with business – CEO or legal or accounting/finance expertise only. Panel E reports the summary statistics of compensation committee mixed expertise (i.e. the committee has a mix of two members, with each member holding one single type of expertise). Panel F reports the descriptive statistics of compensation committee joint expertise (i.e. the committee that has one member of the compensation committee that holds more than one expertise).

[73] The statistics of specified expertise reported under this section include and do not control for the other top five of areas of expertise (business, law, accounting/finance, economics and human resource), as presented in Appendix 1.

Table 6
Summary Statistics of Control Variables

Panel A: Full Sample (N=7,013)

Variables	Mean	Median	Q1	Q3	Std.Dev.
(1)FSIZE	7.52	7.37	6.45	8.47	1.51
(2)MKTBOOK	1.97	1.64	1.27	2.29	1.11
(3)ZSCORE	1.66	1.54	1.05	2.12	0.90
(4)TANGIBILITY	0.26	0.20	0.10	0.37	0.21
(5)DIVIDEND	0.54	1.00	0.00	1.00	0.50
(6)SLACK	1.86	0.51	0.14	1.71	3.89
(7)LEV	0.15	0.11	0.01	0.23	0.15
(8)INDLEV	0.16	0.15	0.10	0.20	0.08
(9)SDINV	7.19	5.18	2.76	9.70	6.25
(10)FAGE	24.71	18.00	11.00	35.00	19.31
(11)CFOSALE	0.13	0.11	0.06	0.18	0.12
(12)SDCFOP	0.05	0.04	0.02	0.06	0.03
(13)SDSALE	0.15	0.11	0.07	0.19	0.13
(14)LOGOPCYLE	3.58	4.09	2.94	4.58	1.52
(15)LOSS	0.12	0.00	0.00	0.00	0.32
(16)ANALYST	7.23	6.00	3.00	10.00	5.20
(17)FRQ	-0.03	-0.02	-0.04	-0.01	0.03
(19)ICW	0.19	0.00	0.00	0.00	0.39
(19)CCAGE	61.66	61.83	58.50	65.00	5.18
(20)CCTNR	7.87	7.00	5.00	10.00	4.30
(21)CCSIZE	3.77	4.00	3.00	4.00	1.07
(22)CCMEET	5.56	5.00	4.00	7.00	2.78
(23)CCBRD	0.57	0.60	0.33	0.75	0.29
(24)CCINDP	0.97	1.00	1.00	1.00	0.10
(25)CCSHR	0.02	0.00	0.00	0.00	0.09

Panel B: Mean of the Control Variables within the Group of Under-, Normal- and Over-Investment

Variables	Under - Invest. (Q1) (N = 1,753)	Normal - Invest. (Q2 & Q3) (N=3,507)	Over - Invest. (Q4) (N = 1,753)
(1)FSIZE	7.59	7.65	7.17
(2)MKTBOOK	1.84	1.91	2.23
(3)ZSCORE	1.59	1.72	1.60
(4)TANGIBILITY	0.23	0.27	0.29
(5)DIVIDEND	0.57	0.58	0.42
(6)SLACK	2.10	1.63	2.09
(7)LEV	0.17	0.16	0.10
(8)INDLEV	0.14	0.17	0.15
(9)SDINV	7.07	6.87	7.95
(10)FAGE	25.48	20.43	21.01
(11)CFOSALE	0.12	0.12	0.17
(12)SDCFOP	0.04	0.03	0.05

Table 6 (Continued)

Variables	Under - Invest. (Q1) (N = 1,753)	Normal - Invest. (Q2 & Q3) (N=3,507)	Over - Invest. (Q4) (N = 1,753)
(13)SDSALE	0.16	0.12	0.15
(14)OPCYLE	63.67	75.9	69.22
(15)LOSS	0.13	0.12	0.11
(16)ANALYST	6.66	5.08	7.90
(17)FRQ	-0.03	-0.03	-0.03
(19)ICW	0.20	0.18	0.19
(19)CCAGE	62.00	61.80	61.04
(20)CCTNR	7.90	7.94	7.70
(21)CCSIZE	3.82	3.83	3.60
(22)CCMEET	5.47	5.59	5.61
(23)CCBRD	0.56	0.58	0.56
(24)CCINDP	0.97	0.97	0.97
(25)CCSHR	0.02	0.02	0.03

This table presents the summary statistics of the control variables for investment and compensation committee characteristics. Panel A of the table reports the statistic based on the full sample of 7,013 firm-year observations. In Panel B, the mean values of the control variables in the under-investment, normal-investment, and over-investment firms based on the quartiles of the residuals are presented. The definition and measurement of these control variables are detailed in Table 4.

Table 7
Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	*TINVEST$_{t+1}$*		**-0.04**	**-0.03**	0.02	-0.01	-0.02	0.00	0.01	-0.02	0.01	**-0.14**	**0.32**	**-0.07**	**0.18**	**-0.17**	**0.04**	**-0.27**	**-0.24**	**0.19**	**-0.10**
2	*BUS*	**-0.04**		0.01	**0.09**	**0.46**	**0.35**	0.00	**0.05**	-0.02	-0.01	**0.09**	**-0.04**	**0.05**	**0.04**	**0.10**	**-0.08**	**0.06**	**0.04**	0.01	**0.08**
3	*LAW*	**-0.02**	0.01		-0.02	**0.14**	-0.02	**0.21**	0.01	**-0.05**	**0.02**	-0.01	0.00	**0.04**	**0.02**	0.00	**-0.04**	0.01	0.00	-0.02	0.00
4	*AF*	**0.02**	**0.09**	**-0.02**		0.02	**0.47**	**0.15**	-0.01	-0.04	**0.03**	**-0.05**	**-0.05**	-0.01	**0.05**	**-0.01**	**-0.04**	0.01	0.00	**0.04**	-0.01
5	*MBUSLAW*	-0.01	**0.46**	**0.14**	0.02		**0.12**	**0.03**	**0.26**	-0.01	**0.10**	**0.06**	-0.02	0.01	**0.05**	**0.06**	**-0.07**	**0.04**	**0.03**	0.01	**0.06**
6	*MBUSAF*	-0.02	**0.35**	-0.02	**0.47**	**0.12**		**0.04**	-0.01	0.01	**-0.03**	0.02	-0.01	**0.07**	**0.03**	0.03	**-0.05**	0.01	0.01	0.00	**0.04**
7	*MLAWAF*	0.00	0.00	**0.21**	**0.15**	**0.03**	**0.04**		-0.01	0.00	0.01	0.00	-0.01	-0.01	0.02	0.00	-0.01	0.01	0.01	0.02	0.00
8	*JBUSLAW*	0.00	**0.05**	0.01	-0.01	**0.26**	-0.01	-0.01		-0.02	-0.02	**0.10**	0.02	-0.03	**0.05**	**0.07**	**-0.05**	**0.03**	0.01	-0.02	**0.08**
9	*JBUSAF*	**-0.02**	-0.02	**-0.05**	**-0.04**	-0.01	0.01	0.00	-0.02		**-0.04**	**0.11**	0.00	**-0.04**	0.00	**0.04**	-0.01	**0.06**	-0.01	**-0.03**	**0.06**
10	*JLAWAF*	0.02	-0.01	**0.02**	**0.03**	**0.10**	**-0.03**	0.01	-0.02	**-0.04**		**-0.07**	0.02	0.01	0.04	0.00	-0.03	-0.01	0.01	0.03	**-0.03**
11	*FSIZE*	**-0.13**	**0.09**	-0.02	**-0.05**	**0.07**	0.02	0.00	**0.12**	**0.11**	**-0.07**		**-0.17**	**-0.18**	**0.13**	**0.35**	**-0.24**	**0.42**	**0.21**	**-0.13**	**0.38**
12	*MKTBOOK*	**0.23**	**-0.03**	0.00	**-0.06**	-0.02	-0.02	0.00	0.00	0.00	**0.03**	**-0.21**		**0.32**	**-0.11**	**-0.04**	**0.29**	**-0.59**	**-0.34**	**-0.04**	**-0.15**
13	*ZSCORE*	**-0.11**	**0.05**	**0.04**	-0.01	0.00	**0.07**	-0.01	**-0.03**	**-0.04**	0.00	**-0.15**	**0.29**		**0.03**	**0.11**	**0.01**	**-0.34**	**-0.02**	**-0.22**	**-0.02**
14	*TANGIBILITY*	**0.24**	**0.03**	**0.03**	**0.06**	**0.05**	**0.03**	**0.03**	**0.04**	0.00	**0.04**	**0.14**	**-0.15**	**-0.07**		**0.20**	**-0.76**	**0.24**	**0.36**	0.02	**0.11**
15	*DIVIDEND*	**-0.17**	**0.10**	0.00	**-0.01**	**0.06**	**0.03**	0.00	**0.07**	**0.04**	0.00	**0.36**	**-0.07**	**0.10**	**0.14**		**-0.27**	**0.17**	**0.21**	**-0.19**	**0.44**
16	*SLACK*	0.02	**-0.08**	**-0.04**	**-0.03**	**-0.05**	**-0.04**	-0.01	**-0.04**	-0.02	0.00	**-0.19**	**0.20**	**-0.07**	**-0.40**	**-0.22**		**-0.48**	**-0.43**	**-0.06**	**-0.15**
17	*LEV*	**-0.24**	**0.05**	0.01	0.00	**0.03**	0.01	0.02	**0.02**	**0.04**	**-0.01**	**0.31**	**-0.47**	**-0.33**	**0.25**	**0.10**	**-0.21**		**0.39**	**0.05**	**0.21**
18	*INDLEV*	**-0.18**	**0.03**	0.00	-0.01	0.02	0.00	0.01	0.01	-0.01	0.01	**0.20**	**-0.28**	**-0.06**	**0.35**	**0.19**	**-0.19**	**0.42**		**-0.08**	**0.14**
19	*SDINVEST*	**0.16**	0.02	-0.01	**0.03**	0.01	0.01	0.02	0.00	-0.02	**0.03**	**-0.09**	**-0.05**	**-0.23**	**0.06**	**-0.16**	-0.01	**0.10**	**-0.06**		**-0.15**
20	*FAGE*	**-0.11**	**0.08**	-0.02	**-0.03**	**0.08**	**0.04**	-0.01	**0.13**	**0.07**	**-0.05**	**0.45**	**-0.15**	**-0.04**	**0.05**	**0.43**	**-0.17**	**0.16**	**0.10**	**-0.14**	
21	*CFOSALE*	**0.35**	-0.02	**-0.03**	**0.03**	0.02	-0.01	0.02	**0.05**	0.01	**0.04**	**0.14**	**0.25**	**-0.29**	**0.27**	-0.02	**0.10**	**-0.08**	0.01	**0.18**	**-0.07**
22	*SDCFOP*	**0.09**	**-0.04**	-0.01	0.01	-0.01	0.01	0.00	**-0.03**	**-0.04**	**0.03**	**-0.34**	**0.23**	**0.12**	**-0.15**	**-0.21**	**0.24**	**-0.18**	**-0.14**	**0.05**	**-0.17**
23	*SDSALE*	**-0.07**	**0.05**	0.00	0.02	0.02	**0.06**	0.01	-0.03	**-0.04**	**0.02**	**-0.17**	**0.05**	**0.38**	**-0.13**	**-0.12**	**0.09**	**-0.06**	**-0.04**	**0.11**	**-0.11**
24	*OPCYCLE*	0.01	**0.03**	0.02	**0.04**	0.00	0.02	-0.01	0.00	0.00	**-0.03**	**-0.06**	**-0.03**	-0.02	**-0.15**	**0.08**	-0.02	-0.02	**-0.11**	**-0.05**	**0.15**
25	*LOSS*	**-0.05**	-0.02	-0.02	0.02	**-0.03**	-0.01	0.01	**-0.04**	0.00	0.00	**-0.09**	**-0.20**	**-0.33**	-0.01	**-0.13**	**0.03**	**0.22**	**0.06**	**0.06**	**-0.04**
26	*ANALYST*	**0.16**	0.01	0.01	**-0.05**	**0.02**	**-0.01**	**-0.01**	**0.06**	**0.04**	**-0.03**	**0.51**	**0.15**	**-0.08**	**0.12**	0.02	**0.04**	**-0.06**	0.00	0.01	**0.06**
27	*FRQ*	-0.01	**0.03**	-0.02	-0.02	0.00	0.00	0.00	**0.03**	0.00	-0.02	**0.29**	**-0.14**	**-0.10**	**0.20**	**0.19**	**-0.21**	**0.15**	**0.14**	-0.01	**0.14**
28	*ICW*	0.02	0.01	0.01	0.00	0.01	-0.01	0.00	0.02	**0.04**	0.00	**0.06**	-0.01	**-0.07**	**-0.05**	**-0.03**	**0.03**	-0.02	**-0.03**	**0.03**	0.01
29	*CCAGE*	**-0.04**	**0.04**	**0.08**	**0.03**	**0.05**	**0.03**	0.02	**0.07**	0.00	-0.01	**0.09**	**-0.11**	**-0.03**	**0.06**	**0.13**	**-0.08**	**0.04**	**0.06**	-0.02	**0.17**
30	*CCTNR*	-0.02	**0.03**	**0.10**	**0.06**	0.01	**0.04**	**0.03**	0.02	0.01	-0.01	0.00	-0.01	**0.04**	0.01	**0.16**	-0.01	**-0.03**	-0.01	**-0.03**	**0.18**
31	*CCSIZE*	**-0.13**	**0.15**	0.02	**0.06**	**0.13**	**0.10**	**0.04**	**0.09**	0.12	**0.01**	**0.29**	**-0.11**	**0.02**	**0.09**	**0.25**	**-0.17**	**0.15**	**0.15**	**-0.09**	**0.31**
32	*CCMEET*	-0.01	-0.01	**-0.03**	0.01	-0.01	0.01	-0.01	-0.02	0.02	-0.01	**0.17**	**-0.11**	**-0.10**	**-0.06**	**-0.06**	**0.05**	**0.07**	0.02	0.01	**0.03**
33	*CCBRD*	**-0.04**	0.02	0.01	-0.01	**0.03**	0.01	0.00	**0.06**	**0.03**	0.00	**0.14**	**-0.05**	**-0.03**	0.01	**0.07**	**-0.02**	0.02	**0.06**	**-0.03**	**0.12**
34	*CCINDP*	0.00	-0.01	**-0.07**	0.01	0.00	-0.01	0.00	**-0.04**	0.01	0.01	**0.06**	-0.01	0.02	-0.01	-0.01	0.00	0.02	0.01	-0.02	**0.05**
35	*CCSHR*	**0.04**	**0.03**	**0.03**	**0.07**	**0.01**	**0.06**	0.01	**-0.04**	0.00	0.00	**-0.15**	**0.04**	-0.02	**0.04**	**-0.07**	0.01	**-0.04**	0.00	0.00	**-0.07**

Table 7 (Continued)

		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	*TINVEST$_{t+1}$*	**0.33**	**0.08**	**-0.07**	**0.05**	**-0.07**	**0.16**	**-0.02**	**0.01**	**-0.04**	**-0.02**	**-0.15**	**-0.03**	**-0.03**	0.01	**0.03**
2	*BUS*	**-0.04**	-0.02	0.04	0.00	-0.02	0.01	**0.03**	0.01	**0.04**	**0.04**	**0.14**	0.01	0.02	-0.02	**0.04**
3	*LAW*	**-0.03**	-0.01	0.01	**0.03**	-0.02	0.00	-0.01	0.01	**0.08**	**0.06**	0.02	**-0.03**	0.01	**-0.08**	**0.05**
4	*AF*	0.01	0.02	0.01	0.02	0.02	**-0.06**	-0.01	0.00	**0.04**	**0.05**	**0.05**	0.01	-0.02	0.00	**0.09**
5	*MBUSLAW*	0.00	0.00	0.01	0.00	**-0.03**	**0.03**	0.00	0.01	**0.05**	0.02	**0.12**	-0.02	**0.03**	-0.02	0.02
6	*MBUSAF*	**-0.04**	0.02	**0.04**	0.00	-0.01	-0.01	0.00	-0.01	**0.04**	0.04	**0.09**	0.02	0.01	-0.01	**0.09**
7	*MLAWAF*	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.02	**0.03**	-0.01	0.00	-0.01	0.01
8	*JBUSLAW*	**0.05**	**-0.02**	**-0.04**	-0.01	-0.04	**0.05**	**0.03**	0.02	**0.09**	**0.03**	**0.09**	-0.01	**0.06**	**-0.04**	**-0.03**
9	*JBUSAF*	0.01	**-0.03**	**-0.03**	-0.02	0.00	**0.05**	0.01	**0.04**	0.00	**0.03**	**0.13**	0.03	0.02	0.00	0.01
10	*JLAWAF*	0.01	0.02	0.02	**-0.03**	0.00	**-0.03**	-0.02	0.00	-0.01	-0.01	0.00	-0.02	0.00	0.01	0.01
11	*FSIZE*	**0.12**	**-0.36**	**-0.21**	**-0.09**	**-0.09**	**0.52**	**0.34**	**0.05**	**0.10**	**0.03**	**0.31**	**0.22**	**0.13**	**0.06**	**-0.15**
12	*MKTBOOK*	**0.34**	**0.11**	0.02	**0.03**	**-0.28**	**0.18**	**-0.10**	-0.02	**-0.09**	0.00	**-0.12**	**-0.12**	**-0.03**	0.00	**0.05**
13	*ZSCORE*	**-0.31**	**0.13**	0.35	**-0.04**	**-0.35**	**-0.08**	**-0.17**	-0.08	**-0.02**	0.05	**0.02**	**-0.12**	**-0.02**	0.02	**0.00**
14	*TANGIBILITY*	**0.10**	**-0.14**	**-0.13**	**-0.12**	-0.01	**0.07**	**0.23**	**-0.05**	**0.07**	**0.04**	**0.13**	**-0.08**	0.01	-0.01	**0.06**
15	*DIVIDEND*	-0.02	**-0.23**	**-0.14**	0.01	**-0.13**	0.02	**0.21**	**-0.03**	**0.12**	**0.18**	**0.26**	**-0.03**	**0.07**	-0.02	**-0.05**
16	*SLACK*	**0.08**	**0.28**	**0.14**	**0.11**	**0.04**	**0.02**	**-0.32**	**0.05**	**-0.07**	**-0.04**	**-0.18**	**0.08**	-0.01	0.00	**-0.03**
17	*LEV*	**-0.16**	**-0.24**	**-0.11**	**-0.07**	**0.14**	-0.02	**0.23**	-0.01	**0.07**	0.00	**0.20**	**0.10**	**0.03**	0.02	**-0.05**
18	*INDLEV*	**-0.07**	**-0.17**	**-0.05**	**-0.19**	**0.04**	0.00	**0.21**	**-0.04**	**0.09**	**0.03**	**0.18**	**0.04**	**0.07**	0.02	0.00
19	*SDINVEST*	**0.15**	**0.10**	**0.11**	**-0.03**	**0.05**	0.01	**-0.02**	0.01	-0.02	**-0.03**	**-0.12**	**-0.02**	**-0.04**	-0.02	**0.03**
20	*FAGE*	**-0.05**	**-0.19**	**-0.14**	**0.12**	-0.01	**0.02**	**0.16**	0.00	**0.20**	**0.31**	**0.29**	**0.06**	**0.12**	**0.03**	**-0.05**
21	*CFOSALE*		**-0.08**	**-0.34**	**-0.11**	**-0.21**	**0.28**	**0.19**	**0.04**	**-0.04**	-0.01	**-0.07**	0.01	0.02	0.01	-0.01
22	*SDCFOP*	-0.01		**0.46**	**0.04**	**0.13**	**-0.06**	**-0.63**	**-0.04**	**-0.06**	**-0.10**	**-0.13**	-0.02	**-0.05**	**-0.03**	**0.05**
23	*SDSALE*	**-0.24**	**0.40**		**-0.03**	**0.07**	**-0.06**	**-0.41**	**-0.05**	**-0.04**	**-0.07**	**-0.04**	**-0.02**	**-0.04**	-0.01	**0.05**
24	*OPCYCLE*	**-0.18**	0.01	**-0.06**		**0.08**	**-0.09**	**-0.15**	0.00	**0.05**	**0.10**	-0.02	**-0.06**	**0.03**	-0.02	0.00
25	*LOSS*	**-0.17**	**0.11**	**0.04**	**0.07**		**-0.07**	**-0.10**	**0.03**	0.00	**-0.03**	**-0.01**	**0.10**	0.01	-0.02	0.01
26	*ANALYST*	**0.32**	**-0.03**	**-0.05**	**-0.09**	**-0.06**		**0.12**	0.01	**-0.05**	**-0.06**	**0.05**	**0.17**	**0.09**	**0.04**	**-0.11**
27	*FRQ*	**0.11**	**-0.64**	**-0.32**	**-0.07**	**-0.08**	**0.08**		0.00	**0.05**	**0.07**	**0.10**	**0.02**	**0.03**	**0.04**	**-0.05**
28	*ICW*	**0.04**	**-0.03**	**-0.05**	0.00	**0.03**	0.01	0.00		0.03	-0.01	**0.07**	**0.09**	-0.02	0.01	-0.02
29	*CCAGE*	-0.02	**-0.08**	**-0.06**	**0.06**	0.00	**-0.04**	**0.06**	0.02		**0.39**	**0.09**	**-0.05**	**0.09**	0.01	**-0.05**
30	*CCTNR*	-0.01	**-0.09**	**-0.09**	**0.11**	**-0.04**	**-0.06**	**0.06**	-0.02	**0.42**		**0.03**	**-0.14**	**0.09**	**-0.06**	**0.10**
31	*CCSIZE*	**-0.05**	**-0.11**	**-0.03**	**0.03**	-0.01	**0.03**	**0.08**	**0.07**	**0.08**	**-0.03**		**0.10**	0.01	-0.01	0.00
32	*CCMEET*	0.02	0.00	0.00	**-0.05**	**0.10**	**0.16**	0.02	**0.09**	**-0.04**	**-0.16**	**0.04**		0.02	**0.07**	**-0.08**
33	*CCBRD*	0.00	**-0.08**	**-0.06**	**0.03**	0.01	**0.09**	**0.07**	-0.02	**0.09**	**0.08**	0.01	0.01		**-0.04**	**-0.05**
34	*CCINDP*	0.01	**-0.02**	-0.01	-0.02	-0.01	**0.03**	0.02	0.02	0.02	**-0.10**	**0.05**	**0.07**	**-0.04**		**-0.11**
35	*CCSHR*	-0.01	**0.05**	**0.03**	0.00	0.01	**-0.09**	**-0.05**	**-0.02**	**-0.07**	**0.13**	**-0.04**	**-0.08**	**-0.05**	**-0.13**	

This table presents Pearson (Spearman) correlations at the lower (upper) diagonal for the variables employed in the main regression analyses. Correlations significant at the 0.05 or lower levels are in bold. See Tables 2 - 4 for variable definitions.

Table 8
The Analysis of Difference in Means of Compensation Committee Expertise among Quartiles of Residuals: the Under-Investment Group (Q1), Normal Investment Group (Q2 And Q3) and Over-Investment Group (Q4)

Variables	Under-investment *INVEFF* = 1 (Q1)	Normal Investment INVEFF = 0 (Q2 & Q3)	Over-investment *INVEFF* = 2 (Q4)	T-test	
				Normal vs Under	Normal vs Over
BUS	0.127	0.145	0.106	1.78*	4.10***
LAW	0.042	0.048	0.034	1.05	2.54***
AF	0.070	0.073	0.098	0.37	-2.94***
MBUSLAW	0.031	0.037	0.018	0.98	4.05***
MBUSAF	0.010	0.023	0.017	3.53***	1.36
MLAWAF	0.001	0.002	0.002	1.00	-0.00
JBUSLAW	0.064	0.074	0.058	1.36	2.20**
JBUSAF	0.323	0.326	0.303	0.22	1.69*
JLAWAF	0.038	0.032	0.039	-1.10	-1.20

The table presents univariate analysis of the difference in means of compensation committee expertise between the normal- and the under-investment and between the normal- and over-investment groups. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 9

Multivariate Regression Analysis of the Effect of Compensation Committee Single Expertise on Investment Efficiency based on the Conditional Model (Model 1)

$$TINVEST_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 BUS_{i,t} + \beta_3 LAW_{i,t} + \beta_4 AF_{i,t} + \beta_7 OverI_{i,t+1} * BUS_{i,t} + \beta_8 OverI_{i,t+1} * LAW_{i,t} + \beta_9 OverI_{i,t+1} * AF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Under-investment: Expertise Variables	***BUS***	***LAW***	***AF***
Coefficient	-0.499	-0.408	-1.242
T-Statistics	-0.85	-0.48	-1.60
P-value	0.396	0.633	0.109
Over-investment: Interactive Variables	***OVERI*BUS***	***OVERI*LAW***	***OVERI*AF***
Coefficient	0.899	-0.067	2.734
T-Statistics	0.88	-0.04	1.99
P-value	0.38	0.966	0.047
Joint significance	*0.434*	*0.566*	*0.034***
Control Variables	**Coefficient**	**T-stat**	**P-value**
OVERI	3.982	7.80***	<.0001
FSIZE	-0.934	-12.37***	<.0001
MKTBOOK	0.744	7.28****	<.0001
ZSCORE	-0.161	-1.18	0.237
TANGIBILITY	10.67	18.66***	<.0001
DIVIDEND	-1.438	-8.28***	<.0001
INDLEV	-20.15	-6.88***	<.0001
SDTINVEST	0.067	5.08***	<.0001
FAGE	0.002	0.58	0.559
CFOSALE	6.012	5.89***	<.0001
SDCFOP	4.787	1.52	0.129
SDSALE	-1.022	-1.44	0.149
OPCYLE	0.138	1.59	0.111
LOSS	-0.899	-3.70***	<.0001
ANALYST	0.142	7.04***	<.0001
FRQ	10.561	2.86***	0.004
ICW	0.154	0.81	0.418
CCAGE	-0.063	-3.79***	0.000
CCTNR	0.012	0.60	0.549
CCSIZE	-0.266	-3.68***	0.000
CCMEET	0.088	3.03***	0.003
CCBRD	0.221	0.82	0.410
CCINDP	1.779	2.42**	0.016
CCSHR	0.326	0.39	0.699
Industry FE		*Included*	
Firm/Year cluster		*Included*	
F-Value		52.67***	
R^2		37.51%	
Adj R^2		36.79%	
N		7,013	

This table presents the results of the multivariate regression analysis of the effect of compensation committee single expertise on investment efficiency based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. The definition of each variable can be found in Tables 2 – 4.

Table 10
Multivariate Regression Analysis of the Effect of Compensation Committee Mixed Expertise on Investment Efficiency based on the Conditional Model (Model 1)

$$TINVEST_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 MBUSLAW_{i,t} + \beta_3 MBUSAF_{i,t} + \beta_4 MLAWAF_{i,t} + \beta_5 OverI_{i,t+1} * MBUSLAW_{i,t} + \beta_6 OverI_{i,t+1} * MBUSAF_{i,t} + \beta_7 OverI_{i,t+1} * MLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Under-investment: Expertise Variables	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Coefficient	-1.103	0.853	0.035
T-Statistics	-0.56	0.60	0.01
P-value	0.480	0.549	0.992
Over-investment: Interactive Variables	***OVERI* MBUSLAW***	***OVERI* MBUSAF***	***OVERI* MLAWAF***
Coefficient	-1.877	-1.316	-1.379
T-Statistics	-0.52	-0.54	-0.22
P-value	0.606	0.586	0.826
Joint significance	*0.632*	*0.717*	*0.701*
Control Variables	**Coefficient**	**T-stat**	**P-value**
OVERI	4.245	8.85***	<.0001
FSIZE	-0.937	-12.41***	<.0001
MKTBOOK	0.737	7.19***	<.0001
ZSCORE	-0.161	-1.18	0.237
TANGIBILITY	10.699	18.71***	<.0001
DIVIDEND	-1.429	-8.25***	<.0001
INDLEV	-20.084	-6.86***	<.0001
SDTINVEST	0.066	5.00***	<.0001
FAGE	0.002	0.52	0.602
CFOSALE	6.024	5.90***	<.0001
SDCFOP	4.449	1.41	0.158
SDSALE	-1.036	-1.46	0.145
OPCYLE	0.141	1.63	0.102
LOSS	-0.893	-3.67***	0.000
ANALYST	0.142	7.01***	<.0001
FRQ	10.033	2.71***	0.007
ICW	0.149	0.79	0.432
CCAGE	-0.061	-3.68***	0.000
CCTNR	0.009	0.46	0.645
CCSIZE	-0.274	-3.77***	0.000
CCMEET	0.09	3.08***	0.002
CCBRD	0.2	0.74	0.457
CCINDP	1.777	2.41**	0.016
CCSHR	0.364	0.43	0.667
Industry FE		*Included*	
Firm/Year cluster		*Included*	
F-Value		50.67***	
R^2		37.48%	
Adj R^2		36.74%	
N		7,013	

This table reports results from multivariate regression analysis of the effect of compensation committee mixed expertise on investment efficiency based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. Definition of each variable can be found in Tables 2 –4.

Table 11
Multivariate Regression Analysis of the Effect of the Compensation Committee Joint Expertise on Investment Efficiency Based on the Conditional Model (Model 1)

$$TINVEST_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 JBUSLAW_{i,t} + \beta_3 JBUSAF_{i,t} + \beta_4 JLAWAF_{i,t} + \beta_5 OverI_{i,t+1} * JBUSLAW_{i,t} + \beta_6 OverI_{i,t+1} * JBUSAF_{i,t} + \beta_7 OverI_{i,t+1} * JLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Under-investment: Expertise Variables	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	2.146	-0.935	3.463
T-Statistics	2.30**	-2.06**	3.07***
P-value	0.021	0.039	0.002
Over-investment: Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-3.584	1.285	-6.730
T-Statistics	-2.34**	1.68	-3.24***
P-value	0.020	0.093	0.001
Joint significance	*0.039***	*0.339*	*0.003****
Control Variables	**Coefficient**	**T-stat**	**P-value**
OVERI	4.355	8.16***	<.0001
FSIZE	-0.941	-12.41***	<.0001
MKTBOOK	0.743	7.26***	<.0001
ZSCORE	-0.172	-1.27	0.204
TANGIBILITY	10.700	18.73***	<.0001
DIVIDEND	-1.435	-8.30***	<.0001
INDLEV	-20.302	-6.93***	<.0001
SDTINVEST	0.065	4.98***	<.0001
FAGE	0.003	0.70	0.483
CFOSALE	5.919	5.81***	<.0001
SDCFOP	4.740	1.51	0.132
SDSALE	-1.049	-1.48	0.138
OPCYLE	0.156	1.81*	0.071
LOSS	-0.908	-3.75***	0.000
ANALYST	0.141	7.00***	<.0001
FRQ	10.755	2.92***	0.004
ICW	0.147	0.77	0.439
CCAGE	-0.062	-3.73***	0.000
CCTNR	0.011	0.53	0.594
CCSIZE	-0.266	-3.70***	0.000
CCMEET	0.088	3.05***	0.002
CCBRD	0.232	0.87	0.386
CCINDP	1.751	2.38**	0.017
CCSHR	0.393	0.46	0.645
Industry FE		*Included*	
Firm/Year cluster		*Included*	
F-Value		51.03***	
R^2		37.65%	
Adj R^2		36.91%	
N		7,013	

This table reports results from multivariate regression analysis of the effect of compensation committee joint expertise on investment efficiency based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. Definition of each variable can be found in Tables 2 –4.

Table 12

Multinomial Logistic Regression Analysis of the Effect of Compensation Committee Single Expertise on Investment Efficiency based on the Unconditional Model (Model 2)

$$\Pr(INVEFF = 1, INVEFF = 2) = \alpha + \beta_1 BUS_{i,t} + \beta_2 LAW_{i,t} + \beta_3 AF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	*INVEFF* = 1			*INVEFF* = 2		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-0.211	-0.118	-0.009	-0.145	-0.252	0.331
Wald-Chi Square	4.71**	0.54	0.01	2.09	2.29	8.30***
P-value	0.030	0.462	0.943	0.148	0.130	0.004
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	0.007	0.04	0.848	-0.227	38.88***	<.0001
MKTBOOK	-0.125	8.54***	0.004	0.065	3.13*	0.077
ZSCORE	0.003	0.00	0.963	-0.212	12.20***	0.001
TANGIBILITY	-2.863	113.52***	<.0001	1.986	60.05***	<.0001
DIVIDEND	0.338	18.74***	<.0001	-0.347	19.72***	<.0001
SLACK	0.011	1.23	0.267	-0.004	0.14	0.709
LEVERAGE	2.145	61.83***	<.0001	-2.526	65.61***	<.0001
INDLEV	-7.055	25.20***	<.0001	-3.099	5.49**	0.019
SDTINVEST	-0.023	16.06***	<.0001	0.007	1.67	0.196
FAGE	-0.005	4.91**	0.027	-0.001	0.13	0.724
CFOSALE	-0.918	4.72**	0.030	0.959	5.72**	0.017
SDCFOP	-2.118	2.40	0.121	0.690	0.31	0.576
SDSALE	0.907	8.15***	0.004	0.638	3.84*	0.050
OPCYLE	-0.112	10.12***	0.002	0.012	0.12	0.735
LOSS	0.012	0.01	0.915	-0.129	1.17	0.279
ANALYST	-0.034	13.76***	0.000	0.040	23.35***	<.0001
FRQ	0.748	0.19	0.662	3.717	5.49***	0.019
ICW	0.146	3.10*	0.079	0.020	0.06	0.814
CCAGE	0.003	0.16	0.686	-0.026	13.42***	0.000
CCTNR	0.002	0.03	0.854	0.010	1.41	0.236
CCSIZE	0.066	4.13**	0.042	-0.046	1.83	0.176
CCMEET	-0.033	6.49**	0.011	0.020	2.74*	0.098
CCBRD	0.063	0.30	0.586	0.166	2.16	0.142
CCINDP	-0.136	0.18	0.675	0.426	1.66	0.198
CCSHR	-0.012	0.00	0.973	-0.178	0.29	0.593
Industry FE			*Included*			
Firm/Year cluster			*Included*			
Pseudo R^2			22.64%			
N			7,013			

This table presents estimations from multinomial logistic regression of the effect of compensation committee single expertise on investment efficiency based on the unconditional model (Model 2). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. The definition of each variable can be found in Tables 2 –4.

Table 13

Multinomial Logit Regression Analysis of the Effect of Mixed Expertise of Compensation Committee on Investment Efficiency based on the Unconditional Model (Model 2)

$$\Pr(INVEFF = 1, INVEFF = 2) = \alpha + \beta_1 MBUSLAW_{i,t} + \beta_2 MBUSAF_{i,t} + \beta_3 MLAWAF_{i,t} + + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***INVEFF* = 1**			***INVEFF* = 2**		
	MBUSLAW	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Coefficient	-0.295	-0.642	-0.679	-0.587	0.134	0.182
Wald-Chi Square	2.00	3.94**	0.62	7.27***	0.32	0.08
P-value	0.157	0.047	0.429	0.007	0.574	0.78

Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	0.007	0.04	0.846	-0.227	38.83***	<.0001
MKTBOOK	-0.123	8.26***	0.004	0.066	3.14*	0.077
ZSCORE	0.003	0.00	0.966	-0.213	12.23***	0.001
TANGIBILITY	-2.857	112.88***	<.0001	1.988	60.13***	<.0001
DIVIDEND	0.331	18.00***	<.0001	-0.349	19.99***	<.0001
SLACK	0.011	1.26	0.262	-0.004	0.13	0.719
LEVERAGE	2.147	61.93***	<.0001	-2.536	65.97***	<.0001
INDLEV	-7.048	25.13***	<.0001	-3.097	5.48**	0.019
SDTINVEST	-0.023	16.23***	<.0001	0.007	1.69	0.194
FAGE	-0.004	4.44**	0.035	-0.001	0.07	0.787
CFOSALE	-0.910	4.63**	0.031	0.954	5.66**	0.017
SDCFOP	-2.090	2.34	0.127	0.698	0.32	0.572
SDSALE	0.919	8.33***	0.004	0.652	4.00**	0.045
OPCYLE	-0.116	10.70***	0.001	0.013	0.12	0.724
LOSS	0.012	0.01	0.915	-0.134	1.26	0.262
ANALYST	-0.034	13.71***	0.000	0.040	23.25***	<.0001
FRQ	0.674	0.16	0.693	3.677	5.36**	0.021
ICW	0.145	3.05*	0.081	0.018	0.04	0.834
CCAGE	0.003	0.19	0.663	-0.025	13.27***	0.000
CCTNR	0.001	0.02	0.892	0.010	1.35	0.246
CCSIZE	0.072	4.78**	0.029	-0.041	1.42	0.233
CCMEET	-0.033	6.54**	0.011	0.020	2.77*	0.096
CCBRD	0.069	0.35	0.555	0.172	2.32*	0.128
CCINDP	-0.133	0.17	0.682	0.419	1.61	0.205
CCSHR	-0.022	0.00	0.952	-0.178	0.29	0.593
Industry FE			*Included*			
Firm/Year cluster			*Included*			
Pseudo R^2			22.75%			
N			7,013			

This table presents estimations from multinomial logistic regression of the effect of compensation committee mixed expertise on investment efficiency based on the unconditional model (Model 2). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. The definition of each variable can be found in Tables 2 –4.

Table 14

Multinomial Logistic Regression Analysis of the Effect of Joint Expertise of Compensation Committee on Investment Efficiency based on the Unconditional Model (Model 2)

$$\Pr(INVEFF = 1, INVEFF = 2) = \alpha + \beta_1 JBUSLAW_{i,t} + \beta_2 JBUSAF_{i,t} + \beta_3 JLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***INVEFF* = 1**			***INVEFF* = 2**		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	-0.194	-0.083	-0.154	-0.209	-0.038	-0.001
Wald-Chi Square	2.16	1.41	0.80	2.47	0.30	0.00
P-value	0.142	0.235	0.372	0.116	0.584	0.997
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	0.012	0.10	0.746	-0.225	37.98	<.0001
MKTBOOK	-0.122	8.07***	0.005	0.068	3.34	0.068
ZSCORE	0.000	0.00	0.996	-0.214	12.36	0.000
TANGIBILITY	-2.847	111.96***	<.0001	2.002	60.94	<.0001
DIVIDEND	0.336	18.51***	<.0001	-0.347	19.73	<.0001
SLACK	0.011	1.16	0.282	-0.004	0.16	0.690
LEVERAGE	2.160	62.68***	<.0001	-2.528	65.62	<.0001
INDLEV	-7.045	25.12***	<.0001	-3.088	5.45	0.020
SDTINVEST	-0.023	16.14***	<.0001	0.007	1.75	0.186
FAGE	-0.004	4.30**	0.038	-0.001	0.07	0.788
CFOSALE	-0.935	4.88**	0.027	0.959	5.71	0.017
SDCFOP	-2.123	2.41	0.121	0.677	0.30	0.584
SDSALE	0.894	7.90***	0.005	0.646	3.94	0.047
OPCYLE	-0.113	10.21***	0.001	0.012	0.11	0.745
LOSS	0.005	0.00	0.968	-0.135	1.28	0.258
ANALYST	-0.034	13.78***	0.000	0.040	23.52	<.0001
FRQ	0.644	0.14	0.707	3.682	5.39	0.020
ICW	0.147	3.15*	0.076	0.022	0.07	0.795
CCAGE	0.003	0.21	0.646	-0.025	12.74	0.00
CCTNR	0.001	0.02	0.876	0.010	1.38	0.240
CCSIZE	0.071	4.69**	0.030	-0.042	1.49	0.223
CCMEET	-0.034	6.91***	0.009	0.019	2.56	0.110
CCBRD	0.072	0.38	0.537	0.174	2.38	0.123
CCINDP	-0.158	0.24	0.627	0.403	1.48	0.223
CCSHR	-0.012	0.00	0.973	-0.186	0.31	0.578
Industry FE			*Included*			
Firm/Year cluster			*Included*			
Pseudo R^2			22.70%			
N			7,013			

This table presents estimations from multinomial logistic regression of the effect of compensation committee joint expertise on investment efficiency based on the unconditional model (Model 2). The ***, **, and * denote statistical significance at 1%, 5%, and 10% levels. Definition of each variable can be found in Tables 2 –4.

Table 15
The Comparison of the Mean values of *TINVEST, CAPX, ACQ,* and *RD* within the Group of Residuals Quartile: Under-Investment, Normal-Investment and Over-Investment Group

Types of Investment (%)	Under – Invest. (Q1)	Normal – Invest. (Q2 & Q3)	Over – Invest. (Q4)	T-Test	
				Normal vs Under-invest.	Over vs Normal-invest.
TINVEST	9.08	10.54	16.80	4.85***	19.74***
CAPX	23.67	24.48	31.81	1.33	11.10***
ACQ	3.60	2.91	3.58	-2.73***	3.01***
RD	1.57	2.43	5.32	9.35***	17.09***

This table presents the comparison of the mean values of *TINVEST, CAPX, ACQ* and *RD* within the three groups of residuals quartiles ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 16

Multivariate Regression Analysis of the Effect of Compensation Committee Single Expertise the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* based on the Conditional Model (Model 1)

$$CAPX\,(ACQ, RD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 BUS_{i,t} + \beta_3 LAW_{i,t} + \beta_4 AF_{i,t} + \beta_5 OverI_{i,t+1} * BUS_{i,t} + \beta_6 OverI_{i,t+1} * LAW_{i,t} + \beta_7 OverI_{i,t+1} * AF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

	CAPX			***ACQ***			***RD***		
Expertise Variables	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	0.755	-0.601	-1.171	-0.342	-0.399	-0.351	0.448	0.463	0.079
T-Statistics	0.65	-0.31	-0.84	-0.84	-0.64	-0.66	2.55**	1.67*	0.27
P-value	0.515	0.754	0.400	0.401	0.525	0.510	0.011	0.096	0.790
Interactive Variables	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-1.555	1.468	3.213	0.771	0.092	1.137	-0.903	-1.037	-0.375
T-Statistics	-0.75	0.45	1.22	1.11	0.08	1.19	-2.58	-1.69	-0.59
P-value	0.454	0.653	0.221	0.268	0.935	0.232	0.010	0.091	0.558
Joint significance	*0.546*	*0.697*	*0.182*	*0.238*	*0.627*	*0.103*	*0.024***	*0.094**	*0.432*
Control Variables	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
OVERI	4.189	3.36***	0.001	-0.773	-2.32**	0.020	2.780	12.27***	<.0001
FSIZE	-1.526	-7.82***	<.0001	-0.017	-0.3	0.721	-0.326	-8.80***	<.0001
MKTBOOK	3.185	11.21****	<.0001	-0.181	-3.27***	0.001	0.270	4.68***	<.0001
ZSCORE	0.109	0.31	0.756	0.255	3.45***	0.001	-0.234	-3.65***	<.0001
TANGIBILITY	-22.652	-18.47***	<.0001	-2.967	-9.29***	<.0001	-0.825	-4.14***	<.0001
DIVIDEND	-3.785	-9.02***	<.0001	-0.019	-0.17	0.863	-0.318	-4.17***	<.0001
INDLEV	-21.704	-3.89***	<.0001	-3.858	-2.27**	0.023	-0.319	-0.33	0.742
SD(CAPX,ACQ,RD)	0.102	4.79***	<.0001	0.069	7.35***	<.0001	1.102	20.58***	<.0001
FAGE	-0.013	-1.50	0.135	0.001	0.29	0.773	0.004	2.55**	0.011
CFOSALE	11.228	4.17***	<.0001	1.626	2.87***	0.004	-0.379	-0.77	0.441
SDCFOP	20.668	2.23**	0.026	-5.739	-2.99***	0.003	3.383	1.78*	0.075
SDSALE	2.718	1.36	0.172	-0.821	-1.77*	0.076	-1.386	-4.35***	<.0001
OPCYLE	-0.624	-3.16***	0.002	-0.143	-2.88***	0.004	0.346	7.95***	<.0001
LOSS	-4.117	-6.71***	<.0001	-0.877	-6.66***	<.0001	0.535	4.27***	<.0001
ANALYST	0.200	4.08***	<.0001	-0.001	-0.10	0.918	0.065	6.34***	<.0001
FRQ	15.693	1.55	0.122	0.452	0.18	0.855	4.238	2.08**	0.037

Table 16 (Continued)

	Coeff	T-stat	P-value	Coeff	T-stat	P-value	Coeff	T-stat	P-value
ICW	-0.039	-0.09	0.929	0.016	0.13	0.895	-0.012	-0.13	0.898
CCAGE	-0.063	-1.49	0.138	-0.025	-2.49**	0.013	-0.014	-1.80*	0.072
CCTNR	-0.051	-1.09	0.278	0.007	0.53	0.597	0.011	1.16	0.245
CCSIZE	-0.418	-2.47**	0.013	-0.145	-3.12***	0.002	-0.090	-3.03***	0.003
CCMEET	0.054	0.76	0.447	-0.002	-0.12	0.903	0.065	4.39***	<.0001
CCBRD	-0.867	-1.33	0.184	0.090	0.51	0.608	0.202	1.68*	0.094
CCINDP	3.636	2.02**	0.044	0.475	1.04	0.299	0.098	0.26	0.797
CCSHR	1.064	0.43	0.667	-0.614	-1.25	0.212	0.999	2.23**	0.026
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		54.52***			8.85***			159.55***	
R^2		37.71%			8.95%			64.51%	
Adj R^2		37.02%			7.94%			64.11%	
N		7,013			7,013			7,013	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX*, *ACQ*, and *RD*) based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 17

Multivariate Regression Analysis of the Effect of Compensation Committee Mixed Expertise on the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* based on the Conditional Model (Model 1)

$$CAPX\,(ACQ, RD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 MBUSLAW_{i,t} + \beta_3 MBUSAF_{i,t} + \beta_4 MLAWAF_{i,t} + \beta_5 OverI_{i,t+1} * MBUSLAW_{i,t} + \beta_6 OverI_{i,t+1} * MBUSAF_{i,t} + \beta_7 OverI_{i,t+1} * MLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

	CAPX			***ACQ***			***RD***		
Expertise Variables	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Coefficient	2.311	-2.853	0.946	-1.755	0.692	0.742	0.797	0.429	1.339
T-Statistics	1.05	-1.08	0.14	-2.60***	0.62	0.62	3.07***	1.25	1.87*
P-value	0.29	0.28	0.89	0.009	0.536	0.538	0.002	0.213	0.061
Interactive Variables	***OVERI* MBUSLAW***	***OVERI* MBUSAF***	***OVERI* MLAWAF***	***OVERI* MBUSLAW***	***OVERI* MBUSAF***	***OVERI* MLAWAF***	***OVERI* MBUSLAW***	***OVERI* MBUSAF***	***OVERI* MLAWAF***
Coefficient	-2.317	6.185	5.819	3.249	-0.473	-1.926	-0.909	-0.607	-2.907
T-Statistics	-0.59	1.37	0.46	2.46	-0.24	-0.86	-1.85	-0.97	-2.22
P-value	0.55	0.17	0.64	0.014	0.810	0.391	0.064	0.332	0.027
Joint significance	*0.912*	*0.197*	*0.320*	*0.039***	*0.836*	*0.457*	*0.696*	*0.651*	*0.054***
Control Variables	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
OVERI	4.252	3.62***	0.000	-0.664	-2.12**	0.034	2.636	12.27***	<.0001
FSIZE	-1.543	-7.93***	<.0001	-0.019	-0.39	0.696	-0.326	-8.82***	<.0001
MKTBOOK	3.177	11.19***	<.0001	-0.184	-3.33***	0.001	0.271	4.70***	<.0001
ZSCORE	0.107	0.30	0.761	0.253	3.40***	0.001	-0.238	-3.72***	<.0001
TANGIBILITY	-22.663	-18.47***	<.0001	-2.962	-9.26***	<.0001	-0.827	-4.15***	<.0001
DIVIDEND	-3.786	-9.05***	<.0001	-0.013	-0.12	0.907	-0.309	-4.04***	<.0001
INDLEV	-21.846	-3.91***	<.0001	-3.822	-2.26**	0.024	-0.286	-0.29	0.768
SD(CAPX,ACQ,RD)	0.101	4.73***	<.0001	0.068	7.30***	<.0001	1.103	20.61***	<.0001
FAGE	-0.013	-1.51	0.131	0.001	0.18	0.857	0.004	2.44**	0.015
CFOSALE	11.186	4.15***	<.001	1.639	2.89***	0.004	-0.409	-0.83	0.407
SDCFOP	20.653	2.22**	0.026	-5.992	-3.14***	0.002	3.476	1.83*	0.068
SDSALE	2.673	1.34	0.172	-0.823	-1.78*	0.075	-1.390	-4.36***	<.0001
OPCYLE	-0.621	-3.15***	0.002	-0.139	-2.80***	0.005	0.344	7.90***	<.0001
LOSS	-4.120	-6.71***	<.0001	-0.877	-6.64***	<.0001	0.533	4.25***	<.0001
ANALYST	0.202	4.13***	<.0001	-0.001	-0.11	0.912	0.065	6.31***	<.0001
FRQ	15.788	1.55	0.121	0.035	0.01	0.989	4.356	2.13**	0.033

Table 17 (Continued)

	Coeff	T-stat	P-value	Coeff	T-stat	P-value	Coeff	T-stat	P-value
ICW	-0.024	-0.05	0.957	0.016	0.13	0.895	-0.010	-0.11	0.912
CCAGE	-0.063	-1.48	0.140	-0.025	-2.41**	0.016	-0.015	-1.90*	0.058
CCTNR	-0.052	-1.13	0.260	0.006	0.45	0.655	0.011	1.18	0.240
CCSIZE	-0.437	-2.57**	0.010	-0.147	-3.17***	0.002	-0.094	-3.16***	0.002
CCMEET	0.056	0.80	0.425	-0.002	-0.10	0.923	0.065	4.43***	<.0001
CCBRD	-0.880	-1.34	0.179	0.086	0.50	0.620	0.200	1.65*	0.098
CCINDP	3.623	2.01**	0.044	0.485	1.06	0.288	0.117	0.31	0.760
CCSHR	1.100	0.44	0.657	-0.604	-1.22	0.221	1.006	2.24**	0.025
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		52.49***			8.56***			153.59***	
R^2		37.72%			8.99%			64.51%	
Adj R^2		37.00%			7.94%			64.09%	
N		7,013			7,013			7,013	

This table presents estimations from multivariate regression analysis of the effect of compensation committee mixed expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX*, *ACQ*, and *RD*) based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 18

Multivariate Regression Analysis of the Effect of Compensation Committee Joint Expertise on the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* based on the Conditional Model (Model 1)

$$CAPX\,(ACQ, RD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 JBUSLAW_{i,t} + \beta_3 JBUSAF_{i,t} + \beta_4 JLAWAF_{i,t} + \beta_5 OverI_{i,t+1} * JBUSLAW_{i,t} + \beta_6 OverI_{i,t+1} * JBUSAF_{i,t} + \beta_7 OverI_{i,t+1} * JLAWAF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

	CAPX			***ACQ***			***RD***		
Expertise Variables	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	3.185	-0.466	1.836	0.223	-0.204	1.762	0.160	-0.051	1.308
T-Statistics	1.58	-0.49	0.73	0.36	-0.68	2.33**	0.52	-0.31	4.21***
P-value	0.115	0.622	0.468	0.721	0.495	0.020	0.600	0.760	<.0001
Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-4.082	1.150	-2.926	-0.272	0.208	-2.908	-1.070	-0.159	-3.251
T-Statistics	-1.16	0.67	-0.56	-0.28	0.42	-2.20	-1.85	-0.47	-5.08
P-value	0.247	0.504	0.575	0.783	0.677	0.028	0.064	0.640	<.0001
Joint significance	*0.625*	*0.422*	*0.651*	*0.874*	*0.992*	*0.104*	*0.003***	*0.272*	*<.0001****
Control Variables	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
OVERI	4.350	3.42***	0.001	-0.527	-1.50	0.133	2.789	11.82***	<.0001
FSIZE	-1.553	-7.91***	<.0001	-0.016	-0.33	0.738	-0.323	-8.65***	<.0001
MKTBOOK	3.169	11.16***	<.0001	-0.184	-3.32***	0.001	0.279	4.85***	<.0001
ZSCORE	0.109	0.31	0.756	0.256	3.45***	0.001	-0.249	-3.88***	<.0001
TANGIBILITY	-22.684	-18.46***	<.0001	-2.958	-9.24***	<.001	-0.804	-4.02***	<.0001
DIVIDEND	-3.791	-9.06***	<.0001	-0.023	-0.21	0.837	-0.318	-4.16***	<.0001
INDLEV	-21.720	-3.90***	<.0001	-3.928	-2.32**	0.020	-0.331	-0.34	0.733
SD(CAPX,ACQ,RD)	0.101	4.75***	<.0001	0.068	7.33***	<.001	1.098	20.42***	<.0001
FAGE	-0.013	-1.49	0.136	0.001	0.28	0.777	0.005	2.78***	0.005
CFOSALE	11.158	4.14***	<.0001	1.585	2.80***	0.005	-0.416	-0.85	0.397
SDCFOP	20.742	2.23***	0.026	-5.842	-3.05***	0.002	3.545	1.87*	0.062
SDSALE	2.676	1.34	0.179	-0.828	-1.79*	0.074	-1.350	-4.23***	<.0001
OPCYLE	-0.616	-3.11***	0.002	-0.132	-2.68***	0.007	0.346	7.98***	<.0001
LOSS	-4.093	-6.69***	<.0001	-0.879	-6.67***	<.001	0.511	4.07***	<.0001
ANALYST	0.200	4.10***	<.0001	-0.002	-0.16	0.873	0.065	6.32***	<.0001
FRQ	16.025	1.58	0.114	0.457	0.19	0.853	4.288	2.10**	0.036

Table 18 (Continued)

	Coeff	T-stat	P-value	Coeff	T-stat	P-value	Coeff	T-stat	P-value
ICW	-0.041	-0.09	0.925	0.009	0.08	0.938	-0.001	-0.01	0.912
CCAGE	-0.064	-1.50	0.134	-0.025	-2.45**	0.014	-0.014	-1.77*	0.078
CCTNR	-0.051	-1.10	0.273	0.006	0.47	0.637	0.011	1.12	0.262
CCSIZE	-0.444	-2.61***	0.009	-0.145	-3.12***	0.002	-0.079	-2.69***	0.007
CCMEET	0.059	0.84	0.399	-0.003	-0.16	0.871	0.063	4.29***	<.0001
CCBRD	-0.899	-1.38	0.169	0.090	0.52	0.602	0.241	2.00**	0.046
CCINDP	3.773	2.09**	0.037	0.453	0.99	0.322	0.087	0.23	0.820
CCSHR	1.155	0.47	0.641	-0.581	-1.18	0.240	0.967	2.15**	0.031
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		52.50***			8.57***			154.60***	
R^2		37.73%			9.00%			64.66%	
Adj R^2		37.01%			7.95%			64.24%	
N		7,013			7,013			7,013	

This table presents estimations from multivariate regression analysis of the effect of compensation committee mixed expertise on the components of total investment: capital expenditure, acquisition, and R&D expenditure (*CAPX*, *ACQ*, and *RD*) based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 19

Multinomial Logistic Regression Analysis of the Effect of Compensation Committee Single Expertise on the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* based on the Unconditional Model (Model 2)

$$\Pr(INVEFF(CAPX, ACQ, RD=1),\ INVEFF(CAPX, ACQ, RD=2)) = \alpha + \beta_1 BUS_{i,t} + \beta_2 LAW_{i,t} + \beta_3 AF_{i,t} + \sum_{j=1}^{25}\gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010}\gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48}\gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***CAPX***			***ACQ***			***RD***		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Panel A: *INVEFF*(*CAPX, ACQ, RD*)= 1									
Coefficient	-0.194	-0.008	0.076	0.019	0.092	0.158	-0.157	-0.446	-0.208
Wald Chi-Square	3.88**	0.00	0.42	0.03	0.29	0.02	1.16	3.13***	1.23
P-value	0.049	0.961	0.519	0.858	0.591	0.892	0.282	0.077	0.267
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	-0.020	0.31	0.577	-0.084	4.69**	0.030	0.075	1.88	0.170
MKTBOOK	-0.021	0.21	0.643	0.085	4.44**	0.035	-0.132	4.22**	0.040
ZSCORE	-0.097	2.62	0.106	-0.045	0.51	0.474	0.057	0.30	0.582
TANGIBILITY	1.760	43.53***	<.0001	0.124	0.19	0.664	-0.529	1.46	0.227
DIVIDEND	0.243	9.66***	0.002	0.118	2.05	0.152	0.411	12.21***	0.001
SLACK	-0.033	5.52**	0.019	0.018	3.04*	0.081	-0.036	5.14**	0.023
LEVERAGE	1.274	21.33***	<.0001	0.142	0.22	0.640	1.344	9.13***	0.003
INDLEV	-7.162	21.56***	<.0001	-2.373	2.53	0.112	-1.873	0.86	0.355
SD(CAPX,ACQ,RD)	0.003	0.81	0.368	-0.015	5.77**	0.016	-0.356	32.40***	<.0001
FAGE	-0.001	0.37	0.545	-0.004	2.58	0.108	-0.007	4.85**	0.028
CFOSALE	-1.763	17.85***	<.0001	0.176	0.18	0.668	-0.384	0.30	0.583
SDCFOP	1.015	0.53	0.465	0.363	0.08	0.780	-4.112	3.57*	0.059
SDSALE	0.245	0.58	0.448	0.675	4.06**	0.044	2.109	14.11	<.001
OPCYLE	0.050	2.03	0.154	-0.021	0.33	0.567	-0.132	3.96**	0.047
LOSS	-0.182	2.54	0.111	-0.017	0.02	0.890	-0.042	0.06	0.810
ANALYST	-0.013	2.16	0.142	-0.011	1.52	0.218	-0.067	22.21***	<.0001
FRQ	-1.264	0.53	0.468	-2.531	2.41	0.121	-5.392	3.84*	0.050
ICW	-0.135	2.52	0.112	-0.130	2.18	0.139	-0.105	0.76	0.383
CCAGE	0.011	2.45	0.117	-0.001	0.01	0.904	-0.008	0.54	0.461

Table 19 (Continued)

	CAPX			*ACQ*			*RD*		
	Coeff	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
CCTNR	0.021	5.71**	0.017	-0.005	0.31	0.576	0.046	12.49***	0.000
CCSIZE	-0.003	0.01	0.933	0.033	0.93	0.334	-0.032	0.45	0.504
CCMEET	-0.027	4.60**	0.032	-0.009	0.41	0.520	-0.013	0.49	0.486
CCBRD	-0.121	1.07	0.301	0.008	0.00	0.949	-0.212	1.57	0.210
CCINDP	-0.091	0.08	0.784	-0.079	0.05	0.818	-0.230	0.19	0.659
CCSHR	0.584	2.52	0.113	-0.453	1.49	0.222	-0.308	0.31	0.580

Panel B: *INVEFF*(*CAPX, ACQ, RD*) = 2

Expertise Variables	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-0.083	0.245	0.036	0.139	-0.166	0.158	-0.169	-0.225	-0.176
Wald Chi-Square	0.70	2.32	0.09	2.19	0.98	1.78	1.40	1.16	1.22
P-value	0.404	0.128	0.769	0.139	0.321	0.182	0.236	0.282	0.270
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	-0.235	39.52***	<.0001	-0.038	1.12	0.291	-0.003	0.00	0.946
MKTBOOK	0.208	29.38***	<.0001	-0.130	9.34***	0.002	0.167	9.98***	0.002
ZSCORE	-0.166	7.95**	0.005	0.127	4.40**	0.036	-0.014	0.03	0.858
TANGIBILITY	-2.606	82.25***	<.0001	-1.811	45.47***	<.0001	-2.610	49.57***	<.0001
DIVIDEND	-0.363	21.24***	<.0001	-0.008	0.01	0.915	-0.231	5.02**	0.025
SLACK	0.046	19.47***	<.0001	-0.011	0.99	0.319	-0.011	0.61	0.435
LEVERAGE	-0.618	4.19**	0.041	-1.044	12.87***	<.0001	-2.133	28.82***	<.001
INDLEV	-4.098	8.88***	0.003	0.247	0.04	0.846	0.274	0.03	0.861
SD(CAPX,ACQ,RD)	0.005	3.22*	0.073	0.040	51.92***	<.0001	0.540	103.85***	<.001
FAGE	-0.002	0.54	0.464	-0.001	0.09	0.765	0.007	7.89***	0.005
CFOSALE	1.040	6.59**	0.010	1.183	7.59	0.006	-0.541	0.91	0.341
SDCFOP	-0.940	0.53	0.468	-4.631	10.70***	0.001	-0.377	0.04	0.834
SDSALE	0.785	6.28**	0.012	-0.188	0.33	0.566	-0.986	4.78	0.029
OPCYLE	0.019	0.30	0.585	-0.092	6.96***	0.008	0.165	8.61***	0.003
LOSS	-0.264	4.69**	0.030	-0.419	11.49***	0.001	0.439	8.35***	0.004
ANALYST	0.019	4.84**	0.028	-0.006	0.55	0.458	0.017	1.97	0.161
FRQ	-0.275	0.03	0.870	-1.216	0.47	0.495	-5.117	4.94**	0.026

Table 19 (Continued)

	CAPX			***ACQ***			***RD***		
	Coeff	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
ICW	-0.127	2.17	0.141	-0.073	0.77	0.379	0.021	0.04	0.842
CCAGE	0.002	0.12	0.732	-0.011	2.59	0.107	-0.025	7.08***	0.008
CCTNR	-0.010	1.25	0.264	0.001	0.01	0.920	0.030	6.78***	0.009
CCSIZE	-0.060	3.10*	0.078	-0.054	2.63	0.105	-0.088	4.58**	0.032
CCMEET	-0.001	0.01	0.924	-0.009	0.49	0.482	0.041	6.19**	0.013
CCBRD	-0.207	3.17*	0.075	-0.032	0.08	0.780	0.161	1.14	0.285
CCINDP	0.288	0.71	0.399	0.371	1.23	0.268	-0.682	2.65	0.104
CCSHR	0.513	2.02	0.156	-0.959	6.17**	0.013	0.665	2.37	0.124
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
Pseudo R^2		26.53%			26.02%			62.65%	
N		7,013			7,013			7,013	

This table presents estimations from multinomial logistic regression analysis of the effect of compensation committee single expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX, ACQ, and RD*) based on the unconditional model (Model 2). Panel A presents the results for under-investment (*INVEFF* = 1), while Panel B reports the results for over-investment (*INVEFF* = 2). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 20

Multinomial Logistic Regression Analysis of the Effect Compensation Committee Mixed Expertise on the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* on the Unconditional Model (Model 2)

$$\Pr(INVEFF(CAPX, ACQ, RD=1),\ INVEFF(CAPX, ACQ, RD=2)) = \alpha + \beta_1 MBUSLAW_{i,t} + \beta_2 MBUSAF_{i,t} + \beta_3 MLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	*CAPX*			*ACQ*			*RD*		
	MBUSLAW	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Panel A: *INVEFF*(*CAPX, ACQ, RD*)= 1									
Coefficient	0.147	0.106	-1.036	-0.135	-0.193	-0.306	-1.424	-0.901	-0.094
Wald Chi-Square	0.50	0.14	1.40	0.35	0.37	0.15	17.35***	3.14*	0.01
P-value	0.480	0.711	0.236	0.554	0.546	0.699	<.0001	0.076	0.939
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	-0.020	0.30	0.585	-0.084	4.66**	0.031	0.076	1.90	0.168
MKTBOOK	-0.019	0.19	0.666	0.085	4.45**	0.035	-0.124	3.65*	0.056
ZSCORE	-0.099	2.71*	0.100	-0.044	0.51	0.477	0.058	0.31	0.577
TANGIBILITY	1.761	43.47***	<.0001	0.127	0.20	0.654	-0.527	1.43	0.231
DIVIDEND	0.244	9.69**	0.002	0.116	1.98	0.159	0.402	11.58***	0.001
SLACK	-0.033	5.49**	0.019	0.018	3.06*	0.080	-0.036	5.06**	0.024
LEVERAGE	1.274	21.35***	<.0001	0.145	0.23	0.632	1.425	10.22***	0.001
INDLEV	-7.169	21.60***	<.0001	-2.384	2.55	0.110	-1.861	0.84	0.359
SD(CAPX,ACQ,RD)	0.002	0.71	0.400	-0.015	5.66**	0.017	-0.353	31.84***	<.0001
FAGE	-0.001	0.40	0.525	-0.004	2.45	0.118	-0.006	4.22**	0.040
CFOSALE	-1.765	17.86***	<..0001	0.180	0.19	0.660	-0.362	0.27	0.606
SDCFOP	1.028	0.55	0.460	0.400	0.09	0.758	-4.157	3.62*	0.057
SDSALE	0.255	0.62	0.431	0.673	4.04**	0.045	2.125	14.28***	<.0001
OPCYLE	0.049	1.95	0.163	-0.022	0.35	0.554	-0.137	4.31**	0.038
LOSS	-0.182	2.52	0.113	-0.017	0.02	0.889	-0.047	0.07	0.788
ANALYST	-0.013	2.16	0.142	-0.012	1.54	0.215	-0.067	22.34***	<.0001
FRQ	-1.217	0.49	0.484	-2.546	2.43	0.119	-5.580	4.08**	0.043

Table 20 (Continued)

Control Variables	*CAPX* Coeff	*CAPX* Wald Chi-Square	*CAPX* P-value	*ACQ* Coeff	*ACQ* Wald Chi-Square	*ACQ* P-value	*RD* Coeff	*RD* Wald Chi-Square	*RD* P-value
ICW	-0.137	2.58	0.108	-0.131	2.23	0.135	-0.111	0.85	0.356
CCAGE	0.011	2.38	0.123	-0.001	0.02	0.902	-0.007	0.35	0.553
CCTNR	0.021	5.85**	0.016	-0.005	0.31	0.575	0.044	10.98***	0.001
CCSIZE	-0.004	0.01	0.909	0.035	1.06	0.302	-0.019	0.15	0.702
CCMEET	-0.027	4.65**	0.031	-0.009	0.43	0.512	-0.014	0.54	0.462
CCBRD	-0.122	1.09	0.297	0.011	0.01	0.926	-0.171	1.01	0.315
CCINDP	-0.087	0.07	0.792	-0.075	0.05	0.827	-0.179	0.12	0.733
CCSHR	0.590	2.57	0.109	-0.453	1.49	0.223	-0.344	0.38	0.539

Panel B: *INVEFF*(*CAPX, ACQ, RD*) = 2

Expertise Variables	*MBUSLAW*	*MBUSAF*	*MLAWAF*	*MBUSLAW*	*MBUSAF*	*MLAWAF*	*MBUSLAW*	*MBUSAF*	*MLAWAF*
Coefficient	-0.157	0.172	0.116	-0.012	0.477	-0.134	-0.378	-0.128	-16.061
Wald Chi-Square	0.49	0.34	0.03	0.00	3.04*	0.03	2.34	0.13	0.00
P-value	0.485	0.563	0.866	0.954	0.082	0.861	0.126	0.718	0.992

Control Variables	Coeff	Wald Chi-Square	P-value	Coeff	Wald Chi-Square	P-value	Coeff	Wald Chi-Square	P-value
FSIZE	-0.157	0.49	0.485	-0.038	1.11	0.293	0.001	0.00	0.985
MKTBOOK	0.172	0.34	0.563	-0.130	9.33***	0.002	0.174	10.75***	0.001
ZSCORE	0.116	0.03	0.866	0.123	4.08**	0.044	-0.018	0.05	0.820
TANGIBILITY	-0.235	39.59***	<.0001	-1.821	45.92***	<.0001	-2.625	50.06***	<.0001
DIVIDEND	0.208	29.29***	<.0001	-0.006	0.01	0.941	-0.235	5.20**	0.023
SLACK	-0.168	8.10***	0.004	-0.011	1.04	0.309	-0.011	0.60	0.439
LEVERAGE	-2.603	82.09***	<.0001	-1.045	12.89***	<.0001	-2.105	27.97***	<.0001
INDLEV	-0.362	21.08***	<.0001	0.256	0.04	0.840	0.267	0.03	0.865
SD(CAPX,ACQ,RD)	0.046	19.48***	<.0001	0.040	52.32***	<.0001	0.541	103.79***	<.0001
FAGE	-0.623	4.26**	0.039	-0.001	0.13	0.723	0.007	8.06***	0.005
CFOSALE	-4.090	8.84***	0.003	1.184	7.60***	0.006	-0.532	0.87	0.350
SDCFOP	-0.962	0.55	0.458	-4.661	10.82***	0.001	-0.356	0.04	0.843
SDSALE	0.787	6.29**	0.012	-0.196	0.36	0.550	-0.977	4.68**	0.031
OPCYLE	0.020	0.31	0.578	-0.090	6.68***	0.010	0.164	8.46***	0.004
LOSS	-0.267	4.80**	0.028	-0.422	11.61***	0.001	0.436	8.21***	0.004

Table 20 (Continued)

	CAPX			*ACQ*			*RD*		
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
ANALYST	0.019	4.77**	0.029	-0.007	0.59	0.443	0.016	1.91	0.167
FRQ	-0.316	0.04	0.851	-1.211	0.46	0.497	-5.199	5.09**	0.024
ICW	-0.127	2.18	0.140	-0.072	0.76	0.382	0.023	0.05	0.830
CCAGE	0.002	0.12	0.727	-0.012	2.68	0.102	-0.025	6.97***	0.008
CCTNR	-0.011	1.33	0.249	0.001	0.01	0.908	0.030	6.83***	0.009
CCSIZE	-0.059	2.98*	0.084	-0.055	2.73*	0.099	-0.083	3.96**	0.047
CCMEET	-0.001	0.01	0.924	-0.009	0.52	0.471	0.041	6.10**	0.014
CCBRD	-0.206	3.15*	0.076	-0.033	0.08	0.772	0.176	1.36	0.244
CCINDP	0.290	0.72	0.396	0.379	1.28	0.258	-0.660	2.46	0.117
CCSHR	0.512	2.01	0.157	-0.975	6.33**	0.012	0.682	2.49	0.115
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
Pseudo R^2		26.57%			26.06%			62.78%	
N		7,013			7,013			7,013	

This table presents estimations from multinomial logistic regression analysis of the effect of compensation committee mixed expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX*, *ACQ*, and *RD*) based on the unconditional model (Model 2). Panel A presents the results for under-investment (*INVEFF* = 1), while Panel B reports the results for over-investment (*INVEFF* = 2). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 21

Multinomial Logistic Regression Analysis of the Effect of Joint Expertise of Compensation Committee on the Components of Total Investment Efficiency: *CAPX, ACQ* and *RD* based on the Unconditional Model (Model 2)

$$\Pr(INVEFF(CAPX, ACQ, RD=1),\ INVEFF(CAPX, ACQ, RD=2)) = \alpha + \beta_1 JBUSLAW_{i,t} + \beta_2 JBUSAF_{i,t} + \beta_3 JLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	*CAPX*			*ACQ*			*RD*		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Panel A: *INVEFF*(*CAPX, ACQ, RD*) = 1									
Coefficient	0.008	-0.112	0.109	-0.034	-0.075	-0.167	-0.171	-0.050	0.112
Wald Chi-Square	0.00	2.47	0.38	0.06	1.04	0.78	0.93	0.23	0.17
P-value	0.950	0.116	0.537	0.800	0.308	0.376	0.335	0.629	0.682
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	-0.017	0.21	0.644	-0.083	4.61**	0.032	0.080	2.09	0.148
MKTBOOK	-0.018	0.17	0.684	0.087	4.69**	0.030	-0.130	4.05**	0.044
ZSCORE	-0.100	2.78*	0.096	-0.046	0.55	0.458	0.054	0.26	0.608
TANGIBILITY	1.763	43.60***	<.0001	0.128	0.20	0.653	-0.532	1.48	0.224
DIVIDEND	0.244	9.67***	0.002	0.120	2.12	0.146	0.409	12.04***	0.001
SLACK	-0.033	5.60**	0.018	0.018	3.05*	0.081	-0.036	5.14**	0.023
LEVERAGE	1.288	21.75***	<.0001	0.153	0.25	0.614	1.340	9.03***	0.003
INDLEV	-7.147	21.45***	<.0001	-2.378	2.54	0.111	-1.856	0.84	0.359
SD(CAPX,ACQ,RD)	0.002	0.64	0.424	-0.015	5.60**	0.018	-0.355	32.37***	<.0001
FAGE	-0.001	0.36	0.547	-0.004	2.58	0.108	-0.006	4.57**	0.033
CFOSALE	-1.795	18.43***	<.0001	0.170	0.17	0.678	-0.391	0.31	0.577
SDCFOP	1.003	0.52	0.471	0.316	0.06	0.808	-4.141	3.62*	0.057
SDSALE	0.234	0.52	0.471	0.676	4.06**	0.044	2.113	14.22***	<.0001
OPCYLE	0.050	2.04	0.153	-0.021	0.31	0.576	-0.131	3.94**	0.047
LOSS	-0.188	2.68	0.102	-0.020	0.03	0.865	-0.045	0.07	0.796
ANALYST	-0.013	2.18	0.140	-0.012	1.55	0.213	-0.066	21.80***	<.0001
FRQ	-1.375	0.62	0.431	-2.643	2.61	0.106	-5.459	3.90**	0.048

Table 21 (Continued)

	CAPX			*ACQ*			*RD*		
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
ICW	-0.134	2.47	0.116	-0.129	2.17	0.141	-0.102	0.72	0.397
CCAGE	0.011	2.39	0.123	-0.001	0.02	0.889	-0.007	0.44	0.508
CCTNR	0.021	5.77**	0.016	-0.005	0.29	0.593	0.046	12.12***	0.001
CCSIZE	0.001	0.00	0.973	0.038	1.24	0.265	-0.026	0.30	0.583
CCMEET	-0.028	4.89**	0.027	-0.009	0.44	0.505	-0.014	0.55	0.459
CCBRD	-0.118	1.02	0.313	0.015	0.02	0.898	-0.210	1.53	0.216
CCINDP	-0.085	0.07	0.798	-0.081	0.06	0.815	-0.260	0.25	0.619
CCSHR	0.588	2.54	0.111	-0.461	1.54	0.215	-0.286	0.26	0.608

Panel B: *INVEFF*(*CAPX, ACQ, RD*) = 2

Expertise Variables	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	0.183	0.060	-0.040	-0.053	-0.196	0.077	-0.354	-0.047	-0.110
Wald Chi-Square	2.41	0.70	0.05	0.17	7.80***	0.21	4.65**	0.27	0.23
P-value	0.121	0.404	0.819	0.682	0.005	0.648	0.031	0.603	0.634

Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
FSIZE	-0.239	40.71***	<.0001	-0.033	0.83	0.364	0.001	0.00	0.980
MKTBOOK	0.206	28.53***	<.0001	-0.125	8.65***	0.003	0.172	10.53***	0.001
ZSCORE	-0.164	7.67***	0.006	0.124	4.15**	0.042	-0.017	0.04	0.833
TANGIBILITY	-2.649	84.16***	<.0001	-1.793	44.49***	<.0001	-2.572	48.02***	<.0001
DIVIDEND	-0.362	21.15***	<.0001	-0.009	0.01	0.910	-0.234	5.15**	0.023
SLACK	0.046	19.42***	<.0001	-0.011	1.09	0.297	-0.011	0.59	0.444
LEVERAGE	-0.630	4.35**	0.037	-1.026	12.40***	<.0001	-2.132	28.76***	<.0001
INDLEV	-4.093	8.85***	0.003	0.272	0.05	0.831	0.232	0.02	0.882
SD(CAPX,ACQ,RD)	0.004	2.97*	0.085	0.040	52.17***	<.0001	0.542	104.65***	<.0001
FAGE	-0.002	0.68	0.410	-0.001	0.07	0.798	0.008	8.74***	0.003
CFOSALE	1.048	6.69	0.010	1.151	7.17	0.007	-0.540	0.90	0.343
SDCFOP	-0.907	0.49	0.484	-4.671	10.89***	0.001	-0.380	0.04	0.833
SDSALE	0.781	6.20**	0.013	-0.217	0.44	0.508	-0.987	4.76**	0.029
OPCYLE	0.020	0.30	0.581	-0.091	6.88***	0.009	0.162	8.28***	0.004
LOSS	-0.258	4.50**	0.034	-0.425	11.78***	0.001	0.431	8.06***	0.005

Table 21 (Continued)

	CAPX			*ACQ*			*RD*		
Control Variables	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**	**Coeff**	**Wald Chi-Square**	**P-value**
ANALYST	0.019	4.83**	0.028	-0.007	0.59	0.442	0.017	1.97	0.160
FRQ	-0.220	0.02	0.896	-1.465	0.67	0.412	-5.190	5.05**	0.025
ICW	-0.130	2.28	0.131	-0.069	0.69	0.406	0.028	0.07	0.794
CCAGE	0.002	0.06	0.807	-0.012	2.64	0.104	-0.024	6.46**	0.011
CCTNR	-0.010	1.13	0.288	0.001	0.02	0.885	0.029	6.54**	0.011
CCSIZE	-0.066	3.67**	0.056	-0.045	1.78	0.183	-0.080	3.69*	0.055
CCMEET	0.000	0.00	0.983	-0.010	0.61	0.436	0.040	5.75**	0.017
CCBRD	-0.214	3.39**	0.066	-0.027	0.06	0.813	0.175	1.34	0.246
CCINDP	0.323	0.89	0.346	0.367	1.20	0.274	-0.732	3.04*	0.081
CCSHR	0.525	2.10	0.147	-0.956	6.10***	0.014	0.658	2.30	0.129
Industry FE		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
Pseudo R^2		26.61%			26.12%			62.68%	
N		7,013			7,013			7,013	

This table presents estimations from multinomial logistic regression analysis of the effect of compensation committee joint expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX, ACQ, and RD*) based on the unconditional model (Model 2). Panel A presents the results for under-investment (*INVEFF* = 1), while Panel B reports the results for over-investment (*INVEFF* = 2). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 22

Multivariate Regression Analysis of the Effect of Compensation Committee Single Expertise on Investment Efficiency based on the Alternative Unconditional Model (Model 3)

$$INVEFF(U,O)_{i,t+1} = \alpha + \beta_1 BUS_{i,t} + \beta_2 LAW_{i,t} + \beta_3 AF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***INVEFFU***			***INVEFFO***		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-0.245	0.157	0.509	-0.130	0.051	-0.193
T-Statistics	-2.02**	0.27	2.95***	-0.50	0.12	-0.70
P-value	0.0438	0.790	0.003	0.616	0.906	0.482
Control Variables:	**Coeff**	**T-Stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
FSIZE	0.074	1.57	0.116	-0.341	-3.74***	0.000
MKTBOOK	-0.106	-1.80*	0.073	0.25	2.44**	0.015
ZSCORE	0.014	0.18	0.859	-0.407	-2.62***	0.009
TANGIBILITY	-2.882	-8.38***	<.0001	3.055	4.47***	<.0001
DIVIDEND	0.381	3.94***	<.0001	-0.312	-1.55	0.122
SLACK	0.018	1.21	0.228	-0.033	-1.24	0.215
LEV	1.891	5.77***	<.0001	-2.012	-2.55**	0.011
INDLEV	-7.37	-4.36***	<.0001	-7.528	-2.44**	0.015
SDTINVEST	-0.015	-2.10**	0.036	0.023	1.43	0.153
FAGE	-0.004	-1.53	0.127	-0.002	-0.33	0.739
CFOSALE	-1.362	-2.15**	0.032	1.158	1.07	0.284
SDCFOP	-1.055	-0.56	0.575	0.102	0.03	0.976
SDSALE	0.466	1.06	0.29	0.968	1.13	0.257
OPCYLE	-0.102	-2.09**	0.036	-0.128	-1.38	0.167
LOSS	-0.468	-3.36***	0.001	-0.471	-1.58	0.113
ANALYST	-0.046	-3.60***	0.000	0.029	1.34	0.182
FRQ	-0.62	-0.25	0.801	11.84	3.17***	0.002
ICW	0.05	0.45	0.652	0.128	0.6	0.551
CCAGE	0.009	0.95	0.341	-0.043	-2.29**	0.022
CCTNR	-0.001	-0.05	0.962	0.038	1.67*	0.095
CCSIZE	0.077	1.82*	0.07	-0.132	-1.52	0.128
CCMEET	-0.024	-1.53	0.125	0.037	1.20	0.231
CCBRD	-0.158	-1.04	0.301	0.001	0.00	0.996
CCINDP	-1.403	-2.86***	0.004	0.781	1.00	0.318
CCSHR	0.259	0.47	0.637	-0.458	-0.52	0.606
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		13.83***			6.41***	
R^2		21.33%			14.30%	
Adj R^2		19.78%			12.07%	
N		3,953			2,999	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise on investment efficiency based on the alternative unconditional model (Model 3). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 23

Multivariate Regression Analysis of the Effect of Compensation Committee Mixed Expertise on Investment Efficiency based on the Alternative Unconditional Model (Model 3)

$$INVEFF(O,U)_{i,t+1} = \alpha + \beta_1 MBUSLAW_{i,t} + \beta_2 MBUSAF_{i,t} + \beta_3 MLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***INVEFFU***			***INVEFFO***		
	MBUSLAW	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Coefficient	-0.590	-0.894	-1.123	-1.114	-1.206	2.567
T-Statistics	-2.38**	-2.46**	-1.49	-2.09**	-1.85*	0.99
P-value	0.017	0.014	0.136	0.037	0.065	0.324
Control Variables:	**Coeff**	**T-Stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
FSIZE	0.077	1.64*	0.101	-0.347	-3.79***	0.000
MKTBOOK	-0.104	-1.77*	0.077	0.248	2.42**	0.015
ZSCORE	0.011	0.15	0.885	-0.396	-2.55**	0.011
TANGIBILITY	-2.851	-8.29***	<.0001	3.004	4.41***	<.0001
DIVIDEND	0.376	3.89***	0.000	-0.320	-1.59	0.112
SLACK	0.019	1.25	0.211	-0.034	-1.25	0.212
LEV	1.879	5.74***	<.0001	-2.021	-2.54**	0.011
INDLEV	-7.342	-4.34***	<.0001	-7.924	-2.57**	0.010
SDTINVEST	-0.015	-2.09**	0.037	0.023	1.44	0.151
FAGE	-0.003	-1.36	0.175	-0.001	-0.18	0.854
CFOSALE	-1.400	-2.21**	0.027	1.195	1.10	0.270
SDCFOP	-0.805	-0.43	0.669	-0.060	-0.02	0.986
SDSALE	0.467	1.06	0.288	1.036	1.22	0.224
OPCYLE	-0.108	-2.22**	0.027	-0.126	-1.36	0.174
LOSS	-0.465	-3.33***	0.001	-0.494	-1.66*	0.097
ANALYST	-0.046	-3.59***	0.000	0.031	1.42	0.155
FRQ	-0.612	-0.25	0.804	11.713	3.13***	0.002
ICW	0.046	0.41	0.682	0.116	0.54	0.591
CCAGE	0.010	1.03	0.303	-0.043	-2.27**	0.024
CCTNR	-0.001	-0.09	0.929	0.038	1.68*	0.093
CCSIZE	0.083	1.96*	0.050	-0.121	-1.39	0.164
CCMEET	-0.024	-1.55	0.122	0.038	1.23	0.220
CCBRD	-0.147	-0.96	0.336	0.030	0.1	0.921
CCINDP	-1.382	-2.82***	0.005	0.786	1.01	0.313
CCSHR	0.255	0.47	0.642	-0.362	-0.41	0.684
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		13.48***			6.29***	
R^2		21.57%			14.54%	
Adj R^2		19.97%			12.23%	
N		3,953			2,999	

This table presents estimations from multivariate regression analysis of the effect of compensation committee mixed expertise on investment efficiency based on the alternative unconditional model (Model 3). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 24

Multivariate Regression Analysis of the Effect of Compensation Committee Joint Expertise on Investment Efficiency based on the Alternative Unconditional Model (Model 3)

$$INVEFF(O,U)_{i,t+1} = \alpha + \beta_1 JBUSLAW_{i,t} + \beta_2 JBUSAF_{i,t} + \beta_3 JLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***INVEFFU***			***INVEFFO***		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	-0.198	0.196	0.082	-0.454	-0.049	-0.244
T-Statistics	-1.25	2.16**	0.34	-1.35	-0.28	-0.6
P-value	0.210	0.031	0.731	0.176	0.780	0.547
Control Variables:	**Coeff**	**T-Stat**	**P-value**	**Coeff**	**T-stat**	**P-value**
FSIZE	0.080	1.69*	0.090	-0.341	-3.71***	0.000
MKTBOOK	-0.103	-1.75*	0.080	0.258	2.51**	0.012
ZSCORE	0.006	0.08	0.938	-0.407	-2.62***	0.009
TANGIBILITY	-2.845	-8.27***	<.0001	3.079	4.51***	<.0001
DIVIDEND	0.380	3.92***	<.0001	-0.310	-1.54	0.123
SLACK	0.017	1.15	0.250	-0.033	-1.22	0.222
LEV	1.913	5.84***	<.0001	-2.012	-2.54**	0.011
INDLEV	-7.345	-4.35***	<.0001	-7.596	-2.46**	0.014
SDTINVEST	-0.015	-2.14**	0.032	0.023	1.48	0.138
FAGE	-0.004	-1.39	0.165	-0.001	-0.23	0.819
CFOSALE	-1.380	-2.18**	0.029	1.182	1.10	0.273
SDCFOP	-1.084	-0.58	0.564	0.051	0.02	0.988
SDSALE	0.459	1.04	0.297	0.983	1.16	0.248
OPCYLE	-0.101	-2.06**	0.040	-0.130	-1.39	0.164
LOSS	-0.483	-3.46***	0.001	-0.470	-1.58	0.113
ANALYST	-0.046	-3.62***	0.000	0.030	1.37	0.171
FRQ	-0.701	-0.29	0.774	11.714	3.14***	0.002
ICW	0.060	0.54	0.590	0.127	0.59	0.554
CCAGE	0.009	0.93	0.355	-0.041	-2.15**	0.031
CCTNR	0.001	0.05	0.959	0.037	1.63	0.103
CCSIZE	0.085	2.02**	0.044	-0.121	-1.38	0.167
CCMEET	-0.025	-1.61	0.108	0.035	1.14	0.252
CCBRD	-0.146	-0.96	0.339	0.016	0.05	0.958
CCINDP	-1.430	-2.93***	0.003	0.742	0.95	0.343
CCSHR	0.244	0.45	0.654	-0.469	-0.53	0.598
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		13.39***			6.19***	
R^2		21.45%			14.40%	
Adj R^2		19.85%			12.04%	
N		3,953			2,999	

This table presents estimations from multivariate regression analysis of the effect of compensation committee joint expertise on investment efficiency based on the alternative conditional model (Model 3). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 25

Multivariate Regression Analysis of the Effect of Compensation Committee Single Expertise on the Components of Total Investment Efficiency: *CAPX*, *ACQ* and *RD* based on the Alternative Conditional Model (Model 3)

$$INVEFF(U,O)(CAPX,ACQ,RD)_{i,t+1} = \alpha + \beta_1 BUS_{i,t} + \beta_2 LAW_{i,t} + \beta_3 AF_{i,t} + \sum_{j=1}^{25}\gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010}\gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48}\gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	*CAPX*			*ACQ*			*RD*		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
PANEL A: Dependent Variable = *INVEFFU*(*CAPX, ACQ, RD)*									
Coefficient	-0.623	0.352	-0.236	-0.022	0.198	0.049	-0.048	-0.179	0.054
T-Statistics	-2.44**	0.65	-0.70	-0.46	2.47**	0.78	-1.06	-2.68***	0.91
P-value	0.015	0.515	0.485	0.646	0.014	0.437	0.291	0.007	0.364
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		17.02			19.85***			97.55***	
R^2		24.69%			24.08%			63.36%	
Adj R^2		23.24%			22.90%			62.71%	
N		*4,023*			*4,831*			*4,249*	
PANEL B: Dependent Variable = *INVEFFO*(*CAPX, ACQ, RD)*									
Expertise Variables	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-0.611	1.013	-0.302	-0.040	0.250	0.261	-0.537	-0.395	0.139
T-Statistics	-1.05	0.90	-0.38	-0.14	0.48	0.75	-3.91***	-1.65*	0.62
P-value	0.295	0.367	0.705	0.887	0.633	0.455	<.0001	0.098	0.535
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		13.84***			4.09***			23.07***	
R^2		27.06%			13.31%			44.16%	
Adj R^2		25.11%			10.10%			42.24%	
N		*2,912*			*2,101*			*2,234*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX*, *ACQ*, and *RD*) based on the alternative unconditional model (Model 3). Panel A presents the regression results for under-investment (*INVEFFU*), while Panel B reports the results for over-investment (*INVEFFO*). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 26

Multivariate Regression Analysis of the Effect of Compensation Committee Mixed Expertise on the Components of Total Investment Efficiency: *CAPX, ACQ* and *RD* based on the Alternative Unconditional Model (Model 3)

$$INVEFF(U,O)(CAPX, ACQ, RD)_{i,t+1} = \alpha + \beta_1 MBUSLAW_{i,t} + \beta_2 MBUSAF_{i,t} + \beta_3 MLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***CAPX***			***ACQ***			***RD***		
	MBUSLAW	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
PANEL A: Dependent Variable = *INVEFFU*(*CAPX, ACQ, RD*)									
Coefficient	0.112	1.300	-3.151	0.003	-0.106	-0.638	-0.220	-0.186	-0.203
T-Statistics	0.20	1.70*	-0.99	0.03	-0.75	-2.49**	-2.12**	-1.56	-1.16
P-value	0.843	0.088	0.320	0.974	0.452	0.013	0.034	0.120	0.245
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		16.42***			19.13***			93.87***	
R^2		24.76%			24.14%			63.41%	
Adj R^2		23.25%			22.88%			62.73%	
N		*4,023*			*4,831*			*4,249*	
PANEL B: Dependent Variable = *INVEFFO*(*CAPX, ACQ, RD*)									
Expertise Variables	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***	***MBUSLAW***	***MBUSAF***	***MLAWAF***
Coefficient	1.517	0.412	2.533	-0.548	-0.778	0.797	0.078	-0.044	N/A
T-Statistics	1.23	0.25	0.67	-0.97	-1.02	0.50	0.34	-0.12	
P-value	0.217	0.802	0.505	0.331	0.307	0.615	0.734	0.905	
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		13.32***			3.950***			22.44***	
R^2		27.09%			13.39%			44.16%	
Adj R^2		25.06%			10.00%			42.19%	
N		*2,912*			*2,101*			*2,234*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee mixed expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (*CAPX*, *ACQ*, and *RD*) based on the alternative unconditional model (Model 3). Panel A presents the regression results for under-investment (*INVEFFU*), while Panel B reports the results for over-investment (*INVEFFO*). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 27

Multivariate Regression Analysis of the Effect of Compensation Committee Joint Expertise on the Components of Total Investment Efficiency: *CAPX, ACQ* and *RD* based on the Alternative Unconditional Model

$$INVEFF\_CAPX, ACQ, RD(U, O)_{i,t+1} = \alpha + \beta_1 JBUSLAW_{i,t} + \beta_2 JBUSAF_{i,t} + \beta_3 JLAWAF_{i,t} + \sum_{j=1}^{25} \gamma_j Contr_{j,i,t} + + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	***CAPX***			***ACQ***			***RD***		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
PANEL A: Dependent Variable = *INVEFFU*(*CAPX, ACQ, RD*)									
Coefficient	0.478	-0.163	0.666	-0.097	-0.002	0.054	-0.142	0.069	0.070
T-Statistics	1.20	-0.80	1.18	-1.58	-0.07	0.54	-2.00**	1.78*	0.73
P-value	0.231	0.423	0.240	0.114	0.946	0.592	0.045	0.076	0.468
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		16.42***			19.12***			94.00***	
R^2		24.76%			24.12%			63.44%	
Adj R^2		23.25%			22.86%			62.77%	
N		*4,023*			*4,831*			*4,249*	
PANEL B: Dependent Variable = *INVEFFO*(*CAPX, ACQ, RD*)									
Expertise Variables	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	1.104	-0.003	0.910	-0.002	0.185	-0.448	-0.163	-0.083	-0.932
T-Statistics	1.39	-0.01	0.64	-0.01	0.86	-1.04	-0.67	-0.67	-2.81***
P-value	0.165	0.995	0.522	0.995	0.392	0.297	0.501	0.500	0.005
Control Variables		*Included*			*Included*			*Included*	
Industry Effect		*Included*			*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*			*Included*	
F-Value		13.34***			3.950***			22.33***	
R^2		27.12%			13.38%			44.37%	
Adj R^2		25.08%			10.00%			42.38%	
N		*2,912*			*2,101*			*2,234*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee joint expertise on the components of total investment: capital expenditure, acquisition, and R&D investment (CAPX, ACQ, and RD) based on the alternative unconditional model (Model 3). Panel A presents the regression results for under-investment (*INVEFFU*), while Panel B reports the results for over-investment (*INVEFFO*). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 28

Multivariate Regression Analysis of the Effect of Compensation Committee Single Expertise on Investment Efficiency based on the Conditional Model (Model 1) using Alternative Expertise Measurements: Proportion and Number

$$TINVEST_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 BUS(P,N)_{i,t} + \beta_3 LAW(P,N)_{i,t} + \beta_4 AF(P,N)_{i,t} + \beta_5 OverI_{i,t+1} * BUS(P,N)_{i,t} + \beta_6 OverI_{i,t+1} * LAW(P,N)_{i,t} + \beta_7 OverI_{i,t+1} * AF(P,N)_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	**Proportion Measure**			**Number Measure**		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-2.653	0.730	-4.131	-0.437	-0.348	-1.337
T-Statistics	-1.38	0.26	-1.78*	-1.10	-0.42	-2.10**
P-value	0.167	0.797	0.075	0.272	0.677	0.036
Interactive Variables:	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	4.573	-4.786	8.491	-4.786	-0.222	2.762
T-Statistics	1.39	-0.98	2.00	-0.98	-0.15	2.35
P-value	0.166	0.329	0.046	0.329	0.882	0.019
Joint significance	*0.152*	*0.104*	*0.055**	*0.391*	*0.457*	*0.029***
Control Var 1 - 23		*Included*			*Included*	
IndustryFE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		52.72***			52.69***	
R^2		37.53%			37.51%	
Adj R^2		36.82%			36.80%	
N		*7,013*			*7,013*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise using two different proxies, *PROP* and *NUMBER*, on investment efficiency based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 29

Multivariate Regression Analysis of Compensation Committee Joint Expertise Effect on Investment Efficiency based on the Conditional Model (Model 1) using Alternative Expertise Measurements: Proportion and Number

$$TINVEST_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 JBUSLAW(P,N)_{i,t} + \beta_3 JBUSAF(P,N)_{i,t} + \beta_4 JLAWAF(P,N)_{i,t} + \beta_5 OverI_{i,t+1} * JBUSLAW(P,N)_{i,t} + \beta_6 OverI_{i,t+1} * JBUSAF(P,N)_{i,t} + \beta_7 OverI_{i,t+1} * JLAWAF(P,N)_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	**Proportion Measure**			**Number Measure**		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	7.761	-3.036	8.794	1.760	-0.750	3.454
T-Statistics	2.91***	-2.71***	2.29**	2.13**	-2.29**	3.07***
P-value	0.004	0.007	0.022	0.034	0.022	0.002
Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-13.755	4.478	-18.073	-3.028	1.173	-6.705
T-Statistics	-3.26	2.31	-2.72	-2.32	2.09	-3.26
P-value	0.001	0.021	0.007	0.021	0.036	0.001
Joint significance	*0.001***	*0.135*	*0.005***	*0.024***	*0.123*	*0.002****
Control Var 1 - 23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		52.72***			52.69***	
R^2		37.53%			37.51%	
Adj R^2		36.82%			36.80%	
N		*7,013*			*7,013*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee joint expertise using two different proxies, *PROP* and *NUMBER*, on investment efficiency based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 30

Multivariate Regression Analysis of Compensation Committee Single Expertise (*BUS, LAW, AF*) Effect on Components of Total Investment: Capital Expenditure, Acquisition, And R&D Investment Efficiency based on the Conditional Model (Model 1) using Alternative Expertise Measurements: Proportion and Number

$$CAPX\,(ACQ, RD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 BUS(P,N)_{i,t} + \beta_3 LAW(P,N)_{i,t} + \beta_4 AF(P,N)_{i,t} + \beta_5 OverI_{i,t+1} * BUS(P,N)_{i,t} + \beta_6 OverI_{i,t+1} * LAW(P,N)_{i,t} + \beta_7 OverI_{i,t+1} * AF(P,N)_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Panel A: ***CAPX (N=7,013)***

	Proportion Measure			**Number Measure**		
Expertise Variables	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	0.756	-3.963	-5.401	0.661	-0.467	-1.149
T-Statistics	0.22	-0.67	-1.30	0.76	-0.25	-1.04
P-value	0.829	0.506	0.192	0.445	0.806	0.300
Interactive Variables	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-1.040	7.266	12.371	-0.892	1.540	2.916
T-Statistics	-0.17	0.73	1.45	-0.56	0.48	1.31
P-value	0.867	0.468	0.146	0.572	0.632	0.190
Joint significance	*0.842*	*0.614*	*0.191*	*0.983*	*0.590*	*0.207*
Control Var 1 - 23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		54.52***			54.52***	
Adj R^2		37.01%			37.02%	

Panel B: ***ACQ (N=7,013)***

	Proportion Measure			**Number Measure**		
Expertise Var	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	-1.742	-0.952	-1.321	-0.319	-0.380	-0.449
T-Statistics	-1.51	-0.45	-0.85	-1.15	-0.62	-1.07
P-value	0.131	0.655	0.397	0.249	0.535	0.285
Interactive Variables	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	3.242	-0.421	3.696	0.646	0.003	1.159
T-Statistics	1.65	-0.11	1.27	1.36	0.00	1.47
P-value	0.098	0.910	0.205	0.175	0.998	0.142
Joint significance	*0.156*	*0.504*	*0.131*	*0.231*	*0.5093*	*0.097**
Control Var 1 – 23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		8.85***			8.85***	
Adj R^2		7.93%			7.93%	

Table 30 (Continued)

Panel C: *RD (N=7,013)*

	Proportion Measure			Number Measure		
Expertise Variables	***BUS***	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	1.404	2.326	0.841	0.405	0.442	0.213
T-Statistics	2.72***	2.54**	0.78	3.48***	1.62	0.79
P-value	0.007	0.011	0.436	0.001	0.104	0.431
Interactive Variables	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-2.677	-5.736	-2.104	-0.765	-1.051	-0.566
T-Statistics	-2.68	-3.18	-0.95	-3.35	-1.82	-0.98
P-value	0.007	0.002	0.343	0.001	0.069	0.327
Joint significance	*0.023***	*0.001****	*0.322*	*0.005****	*0.077**	*0.301*
Control Var 1 - 23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		159.73***			159.60***	
Adj R^2		64.14%			64.12%	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise using two different proxies, *PROP* and *NUMBER*, on the component of investments, capital expenditure (*CAPX*) (Panel A), acquisition (*ACQ*) (Panel B) and R&D investment (*RD*) (Panel C), based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 31

Multivariate Regression Analysis of Compensation Committee Joint Expertise Effect on Components of Total Investment: Capital Expenditure, Acquisition, and R&D Investment Efficiency based on the Conditional Model (Model 1) using Alternative Expertise Measurements (Proportion and Number)

$$CAPX\,(ACQ, RD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 JBUSLAW(P,N)_{i,t} + \beta_3 JBUSAF(P,N)_{i,t} + \beta_4 JLAWAF(P,N)_{i,t} + \beta_5 OverI_{i,t+1} * JBUSLAW(P,N)_{i,t}\,\beta_6 OverI_{i,t+1} * JBUSAF(P.N)_{i,t} + \beta_7 OverI_{i,t+1} * JLAWAF(P,N)_{i,t} + + \sum_{j=1}^{23}\gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010}\gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48}\gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Panel A: *CAPX*

Expertise Variables	**Proportion Measure**			**Number Measure**		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	13.812	-1.246	5.894	2.747	-0.253	2.285
T-Statistics	2.26**	-0.51	0.71	1.51	-0.36	0.89
P-value	0.024	0.611	0.475	0.132	0.716	0.376
Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-18.658	4.227	-7.615	-3.304	0.916	-3.790
T-Statistics	-1.80*	0.93	-0.47	-1.08	0.71	-0.73
P-value	0.072	0.355	0.640	0.279	0.478	0.465
Joint significance	*0.352*	*0.218*	*0.792*	*0.724*	*0.309*	*0.549*
Control Var 1-23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		54.57***			54.52***	
Adj R^2		37.04%			37.02%	

Panel B: *ACQ*

Expertise Variables	**Proportion Measure**			**Number Measure**		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	0.657	-1.333	5.150	0.038	-0.255	1.706
T-Statistics	0.34	-1.61	2.04**	0.07	-1.18	2.26**
P-value	0.731	0.108	0.041	0.947	0.240	0.024
Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-1.393	1.592	-8.582	-0.055	0.269	-2.849
T-Statistics	-0.49	1.08	-2.06	-0.06	0.71	-2.17
P-value	0.625	0.281	0.039	0.950	0.476	0.030
Joint significance	*0.479*	*0.731*	*0.089**	*0.914*	*0.953*	*0.098**
Control Var 1-23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		8.59***			8.57***	
Adj R^2		7.97%			7.95%	

Table 31 (Continued)

Panel C: *RD*

Expertise Variables	**Proportion Measure**			**Number Measure**		
	JBUSLAW	***JBUSAF***	***JLAWAF***	***JBUSLAW***	***JBUSAF***	***JLAWAF***
Coefficient	0.745	-0.174	3.162	0.152	-0.001	1.300
T-Statistics	0.83	-0.41	3.16***	0.56	-0.01	4.20***
P-value	0.404	0.685	0.002	0.577	0.990	<.0001
Interactive Variables	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***	***OVERI* JBUSLAW***	***OVERI* JBUSAF***	***OVERI* JLAWAF***
Coefficient	-3.549	-0.146	-8.846	-0.935	-0.097	-3.271
T-Statistics	-2.20	-0.16	-4.67	-1.87	-0.40	-5.18
P-value	0.028	0.871	<.0001	0.061	0.688	<.0001
Joint significance	*0.001***	*0.537*	*<.0001****	*0.002****	*0.486*	*<.0001****
Control Var 1-23		*Included*			*Included*	
Industry FE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		154.67***			154.56***	
Adj R^2		64.25%			64.23%	
N		*7,013*			*7,013*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee joint expertise using two different proxies, *PROP* and *NUMBER*, on the component of investments, capital expenditure (*CAPX*) (Panel A), acquisition (*ACQ*) (Panel B) and R&D investment (*RD*) (Panel C), based on the conditional model (Model 1). ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 32
Univariate Analysis of Level of Investment, Investment Efficiency and Expertise Variables of Financially Distressed *versus* Non-Financially Distressed Firms

Variables	Mean		Difference	T-test	P-Value
	Financial Distress	Non-Financial Distress			
Panel A: Investment Variables					
$TINVEST_{t+1}$	10.941	9.141	1.800	7.01***	<.0001
$CAPX_{t+1}$	23.279	29.089	-5.811	-9.63***	<.0001
ACQ_{t+1}	1.641	1.784	-0.143	-1.17	0.243
RD_{t+1}	3.726	1.095	2.631	18.64***	<.0001
Panel B: Investment Efficiency Variables (based on Model 2 Chen et al)					
INVEFFU	5.486	4.338	1.148	4.78***	<.0001
INVEFFO	3.911	3.445	0.467	3.73***	<.0001
INVEFFU_CAPX	8.042	8.425	-0.383	-1.24	0.215
INVEFFO_CAPX	11.529	11.775	-0.246	-0.35	0.728
INVEFFU_ACQ	2.019	2.068	-0.048	-0.58	0.564
INVEFFO_ACQ	2.999	3.363	-0.364	-1.48	0.139
INVEFFU_RD	1.429	0.832	0.597	8.96***	<.0001
INVEFFO_RD	2.769	1.414	1.355	7.53***	<.0001
Panel C: Expertise Variables					
BUS	0.112	0.150	-0.037	-3.26***	0.001
LAW	0.035	0.052	-0.017	-2.40**	0.017
AF	0.085	0.082	0.003	0.31	0.760

The table presents compares means of the firms' investment level (Panel A), the level of investment efficiency (Panel B), and the compensation committee expertise level (Panel C) between financially distressed (FD) and non-financially distressed (NFD) firms.

Table 33

Multivariate Regression Analysis of Compensation Committee Single Expertise (*BUS, LAW, AF*) Effect on Total Investment, Capital Expenditure, Acquisition and R&D Investment Efficiency based on the Conditional Model (Model 1) for Financially Distressed *versus* Non-Financially Distressed Firms

$$TINVEST(CAPX, ACQ, RD)(FD, NFD)_{i,t+1} = \alpha + \beta_1 OverI_{i,t+1} + \beta_2 BUS_{i,t} + \beta_3 LAW_{i,t} + \beta_4 AF_{i,t} + \beta_5 OverI_{i,t+1} * BUS_{i,t} + \beta_6 OverI_{i,t+1} * LAW_{i,t} + \beta_7 OverI_{i,t+1} * AF_{i,t} + \sum_{j=1}^{23} \gamma_j Contr_{j,i,t} + \sum_{j=2003}^{2010} \gamma_j FYEAR_{j,i,t} + \sum_{j=1}^{48} \gamma_j FFINDUSTRY_{j,i,t} + \varepsilon_{i,t+1}$$

Expertise Variables	**FD**			**NFD**		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Panel A: Total Investment						
Coefficient	0.871	-1.302	-0.530	0.758	2.080	-3.051
T-Statistics	0.76	-0.86	-0.37	0.58	1.85*	-2.00**
P-value	0.449	0.388	0.708	0.562	0.065	0.046
Interactive Variables:	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-1.377	0.161	3.119	-0.343	-3.137	5.980
T-Statistics	-0.65	0.05	1.21	-0.16	-1.85	2.32
P-value	0.514	0.329	0.228	0.872	0.064	0.021
Joint significance	*0.658*	*0.525*	*0.065**	*0.664*	*0.196*	*0.020***
*Control Var 1-23**		*Included*			*Included*	
IndustryFE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		22.28***			14.91***	
R^2		50.93%			38.29%	
Adj R^2		48.64%			35.72%	
N		*1,753*			*1,753*	

Panel B: Capital Expenditure

Expertise Variables	**FD**			**NFD**		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	0.733	-8.871	1.257	0.099	5.574	-4.383
T-Statistics	0.41	-3.36***	0.53	0.03	1.13	-1.12
P-value	0.683	0.001	0.597	0.976	0.258	0.265
Interactive Variables:	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-1.695	16.932	-4.182	-0.727	-7.975	10.821
T-Statistics	-0.45	2.79	-0.82	-0.14	-1.12	1.57
P-value	0.655	0.005	0.413	0.891	0.264	0.116
Joint significance	*0.670*	*0.041***	*0.352*	*0.796*	*0.425*	*0.071**
*Control Var 1-23**		*Included*			*Included*	
IndustryFE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		14.00***			14.68***	
R^2		39.48%			37.92%	
Adj R^2		36.66%			35.34%	
N		*1,753*			*1,753*	

Table 33 (Continued)

Panel C: Acquisition

Expertise Variables	**FD**			**NFD**		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	1.857	-0.723	-0.814	0.570	-0.168	-1.177
T-Statistics	2.43**	-0.65	-1.08	0.60	-0.19	-1.27
P-value	0.015	0.515	0.282	0.653	0.548	0.851
Interactive Variables:	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-3.223	2.267	2.047	-0.811	-0.049	2.132
T-Statistics	-2.40	0.94	1.39	-0.54	-0.04	1.22
P-value	0.017	0.347	0.163	0.590	0.969	0.221
Joint significance	*0.044***	*0.290*	*0.134*	*0.711*	*0.700*	*0.303*
*Control Var 1-23**		*Included*			*Included*	
IndustryFE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		3.02***			4.03***	
R^2		12.34%			14.35%	
Adj R^2		8.25%			10.79%	
N		*1,753*			*1,753*	

Panel D: R&D Investment

Expertise Variables	**FD**			**NFD**		
	BUS	***LAW***	***AF***	***BUS***	***LAW***	***AF***
Coefficient	0.437	1.117	0.671	-0.440	1.390	0.356
T-Statistics	1.22	2.30**	1.07	-1.33	2.83***	1.47
P-value	0.222	0.022	0.285	0.185	0.005	0.143
Interactive Variables:	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***	***OVERI* BUS***	***OVERI* LAW***	***OVERI* AF***
Coefficient	-1.051	-4.295	-0.133	0.980	-2.104	-0.812
T-Statistics	-1.29	-3.66	-0.10	1.61	-2.20	-1.87
P-value	0.196	0.000	0.922	0.107	0.028	0.062
Joint significance	*0.232*	*<.0001****	*0.512*	*0.099**	*0.096**	*0.054**
*Control Var 1-23**		*Included*			*Included*	
IndustryFE		*Included*			*Included*	
Firm/Year cluster		*Included*			*Included*	
F-Value		48.89***			46.56***	
R^2		69.49%			65.96%	
Adj R^2		68.07%			64.54%	
N		*1,753*			*1,753*	

This table presents estimations from multivariate regression analysis of the effect of compensation committee single expertise on total investment (Panel A), capital expenditure (Panel B), acquisition (Panel C) and R&D (Panel D) investment efficiency based on the conditional model (Model 1) for financially distressed firms (FD) *vs* non-financially distressed (NFD) firms. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels.

Table 34
Summary of the Main Findings

Hypotheses	Findings					
	Model 1		Model 2		Model 3	
	Under-Invest.	Over-Invest.	Under-Invest.	Over-Invest.	Under-Invest.	Over-Invest.
H1a: Firms with compensation committee members who possess business expertise (*BUS*) adopt more efficient investment strategies than firms with members without the expertise.	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is supported	Hypothesis not supported	Hypothesis is supported	Hypothesis is not supported
H1b: Firms with compensation committee members who possess legal expertise (*LAW*) adopt more efficient investment strategies than firms with members without the expertise.	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is not supported
H1c: Firms with compensation committee members who possess accounting/finance (*AF*) expertise adopt more efficient investment strategies than firms with members without the expertise.	Hypothesis not supported	Accounting/ finance expertise exacerbates over-investment	Hypothesis is not supported	Accounting/ finance expertise exacerbates over-investment	Accounting/ finance expertise exacerbates under-investment	Hypothesis is not supported
H2: Firms with compensation committee members with a mix of expertise adopt more efficient investment strategies than firms without such mixed expertise: - Mix of business – CEO and legal expertise (*MBUSLAW*) - Mix of business – CEO and accounting expertise (*MBUSAF*) - Mix of law and accounting expertise (*MLAWAF*)	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is supported only for *MBUSAF*	Hypothesis is supported only for *MBUSLAW*	Hypothesis is supported for *MBUSLAW* and *MBUSAF*	Hypothesis is supported for *MBUSLAW* and *MBUSAF*
H3: Firms with compensation committee members with joint expertise adopt more efficient investment strategies than firms without such joint expertise: - Joint business – CEO and legal expertise (*JBUSLAW*) - Joint business – CEO and accounting expertise (*JBUSAF*) - Joint law and accounting expertise (*JLAWAF*)	Hypothesis is supported for *JBUSLAW* and *JLAWAF*. *JBUSAF* exacerbates under investment	Hypothesis is supported for *JBUSLAW* and *JLAWAF*.	Hypothesis is not supported	Hypothesis is not supported	Hypothesis is supported for *JBUSAF*	Hypothesis is not supported

The table presents the summary of findings of the effect of compensation committee single, mixed and joint expertise on investment efficiency based on three models of investment efficiency.

Table 35
Summary of the Additional Analysis Findings

Hypothesis	Findings					
	Model 1		Model 2		Model 3	
	Under-Invest.	Over-Invest.	Under-Invest.	Over-Invest.	Under-Invest.	Over-Invest.
Panel A: *CAPX*						
H1a	H1a is not supported	H1a is not supported	H1a is supported	H1a is not supported	H1a is supported	H1a is not supported
H1b	H1b is not supported	H1b is not supported	H1b is not supported	H1b is not supported	H1b is not supported	H1b is not supported
H1c	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported
H2	H2 is not supported	H2 is not supported	H2 is not supported	H2 is not supported	*MBUSAF* exacerbates under-investment	H2 is not supported
H3	H3 is not supported	H3 is not supported	H3 is not supported	H3 is not supported	H3 is not supported	H3 is not supported
Panel B: *ACQ*						
H1a	H1a is not supported	H1a is not supported	H1a is supported	H1a is not supported	H1a is supported	H1a is not supported
H1b	H1b is not supported	H1b is not supported	H1b is not supported	H1b is not supported	*LAW* exacerbates under-investment	H1b is not supported
H1c	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported
H2	*MBUSLAW* exacerbates under-investment	*MBUSLAW* exacerbates over-investment	H2 is not supported	*MBUSLAW* exacerbates over-investment	*MLAWAF* exacerbates under-investment	H2 is not supported
H3	H3 is supported for *JLAWAF*	H3 is not supported	H3 is not supported	H3 is supported for *JBUSAF*	H3 is not supported	H3 is not supported
Panel C: *RD*						
H1a	H1a is supported	H1a is supported	H1a is supported	H1a is not supported	H1a is supported	H1a is supported
H1b	H1b is supported	H1b is not supported	H1b is supported	H1b is not supported	H1b is supported	H1b is not supported
H1c	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported	H1c is not supported
H2	H2 is supported for *MBUSLAW*	H2 is supported for *MBUSLAW*& *MLAWAF*	H2 is supported for *MBUSLAW* and *MBUSAF*	H2 is not supported	H2 is supported for *MBUSLAW*	H2 is not supported
H3	H3 is supported for *JLAWAF*	H3 is supported for *JBUSLAW* & *JLAWAF*	H3 is not supported	H3 is supported for *JBUSLAW*	H3 is supported for *JBUSLAW*. *JBUSAF* exacerbates under-investment	H3 is supported for *JLAWAF*

The table presents the summary of findings of the effects of compensation committee expertise on investment efficiency for each component of total investment, i.e. capital expenditure (*CAPX*) in Panel A, acquisitions (*ACQ*) in Panel B and R&D investment in (*RD*) Panel C based on three models of investment efficiency

APPENDIX 1: COMPENSATION CONSULTANTS' ATTRIBUTES

NO	CONSULTANT ATTRIBUTES	TOTAL	%
1	Business	49	24.5
2	Legal	32	16
3	Accounting/Finance	30	15
4	Human Resources	17	8.5
5	Economics	16	8
6	Psychology	9	4.5
7	Tax	9	4.5
8	Certified Compensation Professional	8	4
9	Industrial and Labour Relations	8	4
10	Certified Benefit Professional/Specialists	4	2
11	Foreign Service	3	1.5
12	Marketing	3	1.5
13	Mathematics	3	1.5
14	Certified Equity Professional	2	1
15	Political Science	2	1
16	Public Administration/Policy	2	1
17	Biology	1	0.5
18	Engineering	1	0.5
19	History	1	0.5
	TOTAL	200	100

The table shows the attributes of 100 executive compensation consultants from 12 consulting firms

APPENDIX 2: INITIAL SURVEY OF THE EXPERTISE OF THE COMPENSATION COMMITTEE

No	COMPENSATION COMMITTEE ATTRIBUTES	TOTAL	%
1	Business	56	32.4
2	Accounting/Finance	40	23.2
3	Legal	18	10.4
4	Economics	12	6.9
5	Engineering	10	5.8
6	Marketing/Public Relation/Communication	7	4.1
7	Natural Science/Physics/Aeronautics/Astronautics/Chemistry	6	3.5
8	Political Science	4	2.3
9	Human Resources	3	1.7
10	Education/History/English	3	1.7
11	Mathematics	3	1.7
12	Public Administration/Policy	3	1.7
13	System Management/Computer	3	1.7
14	Foreign Service/International Relation	2	1.2
15	Medical/Hospital Administration	2	1.2
16	Psychology	1	1
	TOTAL	173	100

The table shows the attributes of 103 Compensation Committee Members in 20 randomly chosen firms

APPENDIX 3 EXAMPLES OF DATA SOURCE FOR THE DIRECTOR-LEVEL DATA

Panel A: CEO expertise

Disclosure from PSS World Medical Inc. (PSSI)

Alvin R. Carpenter, Director

Age: 68

ALVIN R. "PETE" CARPENTER has been a member of the Board since March 2005. Mr. Carpenter currently serves on the Board of Directors of the following entities: Regency Centers Corporation (NYSE:REG); Stein Mart, Inc. (NasdaqGS: SMRT); and Lender Processing Services, Inc. (NYSE:LPS).Mr. Carpenter previously served as Vice Chairman of CSX Corporation (NYSE:CSX) from July 1999 until his retirement in February 2001. He previously served as President and Chief Executive Officer of CSX Transportation from 1992 to July 1999 and was Executive Vice President-Sales and Marketing of CSX Transportation. Earlier in his career he held a wide variety of operating, planning, and sales and marketing positions, including trainmaster, superintendent of terminals, superintendent of operations, and division and regional manager. Mr. Carpenter also previously served on the Board of Directors of the following entities: Florida Rock Industries; Nations Bank; Barnett Bank, Inc.; American Heritage Life Insurance Company; Blue Cross & Blue Shield of Florida; and One Valley Bancorp of West Virginia. Mr. Carpenter served as Chairman of the Florida Council of 100 and is a member of various business and fraternal organizations. He chaired Governor Jeb Bush's Commission on Workers' Compensation Reform, served on Governor Bush's Advisory Council on Base Realignment and Closure, and served as Chairman of the Board of the Jacksonville Symphony Orchestra during 2002 and 2003. Mr. Carpenter is a native of Mt. Vernon, Kentucky and a graduate of the University of Cincinnati where he earned a bachelor's degree in political science.

Mr. Carpenter brings significant strategic and management experience from running large business units at a Fortune 500 company. In addition, having served on numerous public company boards, he brings valuable insight into how public companies should be managed. The Board believes this experience qualifies him to serve as a director.

Panel B: LEGAL expertise

Disclosure from Bio-Rad Laboratories Inc (BIO)

Albert J. Hilman, Director

Age: 79

Mr. Hillman retired from active practice as an attorney in 1996. He was Of Counsel to the law firm of Townsend and Townsend and Crew from 1995 through 2005 and a partner in the firm from 1965 to 1995, which firm serves as our patent counsel. We believe that Mr. Hillman's financial and business expertise gained through his law practice and over 30 years as a director of our Company give him the qualifications and skills to serve as a director.

Panel C: ACCOUNTING/FINANCE expertise

Disclosure from Bio-Rad Laboratories Inc (BIO)

Elizabeth R. Varet, Director

Age: 67

Ms. Varet is a Managing Director of American Securities Management L.P. and chairman of the corporate general partner of several affiliated entities. Ms. Varet brings to the Board expertise in finance and investment through her extensive management and investment experience at private equity and other investment firms.

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