Managerial Compensation, Investment and Financial Leverage: An Empirical Analysis of UK Firms

By

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Abstract

This thesis examines the causal effects of the different components of managerial compensation on the value-critical risk-taking activities, particularly those linked to investment, and financial leverage. Employing a three-stage least squares (3SLS) technique in a system of equations, the study makes interesting contributions to the growing strand of literature using datasets from the UK (FTSE 350) companies for the period 2006 – 2015. Specifically, this scholarly study contributes to the extant literature in three ways.

First, the study finds that higher long-term incentive plans (LTIPs) and stock options incentive cause more investment in capital expenditure and fixed intangible but less in research and development activity, whilst greater cash bonus induces more intangibles (research and development and fixed intangible) investment but less capital expenditure activity. Largely, the presented evidence is contrary to the view that the risk-motivated incentives (stock options and LTIPs) encourage more riskier activity like R&D. Rather, shareholders use risk-avoiding incentive (cash bonus) to reduce managerial risk-related agency problems. Further, the result suggests that higher LTIPs and stock options lead to lower spending on other fixed asset activities, which is inconsistent with the risk-related argument.

Second, the study further contributes to the optimal contracting theory by suggesting that the level and the effectiveness of managerial compensation induces capital expenditure investment distortions. Specifically, the research finds that extremely over-compensated (under-compensated) managers are more (less) likely to commit over-investment in capital expenditure. In contrast, extremely over-compensated (under-compensated) managers have a decreased (increased) probability of over-investing in research and development.

Finally, the finding shows that LTIPs (stock options) has a positive (negative) impact on leverage, which is consistent (inconsistent) with the alignment (risk-motivated incentive) hypothesis, whilst the cash bonus finding shows support for the risk-reduction assumption. The study also observes that shareholders use more debt-like incentive (deferred stock) to reduce the risk-shifting incentive problem and lower agency cost of debt. The evidence further reveals that the effectiveness of the stock options (risk-motivated) incentive to induce managerial risk-taking decisions via borrowings is limited to high-growth opportunity firms. Additionally, consistent with the alignment hypothesis, the study finds that highly monitored (governed) firms use the LTIPs incentive to influence managers to contract more debt; however, the stock options incentive discourages more borrowing in such governing state. This tends to support the view that the firm's remuneration committee applies LTIPs in lieu of stock options to minimise managerial excessive risk-taking.

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Chapter 1

1.0 Introduction

1.1 Background of the study

In a modern business form, ownership is separated from the management, leading to conflicts of interest amongst the principal(s) and the agent(s). The divergent interests of managers and shareholders can lead managers to pursue egocentric policies, which can negatively impact the owner's value-maximisation aspiration. As suggested in the literature, a risk-averse manager with undiversified human and economic wealth is more likely to forgo risky but positive net present value (NPV) activities (Fama, 1980; Amihud and Lev, 1981; Smith and Stulz, 1985) at the detriment of risk-neutral shareholders. Shareholders want corporate managers to embark on all positive risky activities to enhance the firm's value (Jensen and Meckling, 1976).

Modern scholarly studies in the area of accounting, management and finance have offered many suggestions on how to minimise the divergence of owner(s) – agent(s) interests. Significant among them include effective corporate governance practices (Carter et al., 2003; Ozkan, 2007), and efficient design of managerial compensation (e.g. Core et al., 1999; Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012; Nguyen, 2018). The literature argues that, through an efficient compensation contract designed by shareholders, the incentive conflict over risk is reduced, thereby causing managers to make value-critical investment and financing decisions (e.g. Core et al., 1999; Coles et al. 2006; Kini and Williams, 2012). However, the widespread usage of different components of managerial compensation – cash-based, stock options and long-term incentive plans (LTIPs) (Conyon and Murphy, 2000; Conyon et al. 2011) – has coincided with some catastrophic economic events. Some of these unfortunate events include the dot.com bubble in the late 1990s, the 2001 – 2002 corporate scandals and the more recent 2007 – 2009 financial crisis, which are often precipitated by excessive risk-taking by corporate officers. This raises legitimate concerns regarding the economic impacts of managerial compensation on value-critical risk-taking decisions.

In the United Kingdom, for instance, the guidelines for best practices in the form of the Greenbury Report (1995) and the Association of British Insurers (ABI) reports (1995, 1996) made recommendations to the board of directors (BODs) and remuneration committees on the form of executive remuneration schemes. In particular, the Greenbury Report (1995) recommends substituting the executive stock options incentive with other forms of compensation such as long-term incentive plans (LTIPs) or annual bonuses (Main, 2011; Conyon et al., 2011) to curtail managerial excessive risk-taking, particularly when the firm's performance targets are unrealistic (Committee on Corporate Governance Report, 1998 p. 33; Greenbury Report, 1995 6.19 – 6.40). It seems to imply that giving UK managers a large component of stock options encourages more risk-taking policies. With this suggestion, it is reasonable to find out what kind of activities managers consider more risky and how their compensation design relates to such activities, knowing that the probability distribution of the firm's performance (cash flow or stock returns) is dependent on the interaction of these two corporate variables and other firm-related characteristics.

Furthermore, managerial risk-taking may be reflected in both investment and financing policies. For example, some existing studies typically viewed research and development activity as highly risky compared to capital expenditure on property, plant and equipment (Bhagat and Welch, 1995; Kothari et al., 2001). Others including Amihud and Lev (1981), May (1995), and Tufano (1996) describe diversification through acquisition as low risk investment. Additionally, managers can also increase the firm's idiosyncratic risk through more borrowing (Grossman and Hart, 1982; Rajan and Zingales, 1995). Following this, an obvious empirical question is how, through a risk-motivated reason, managers' compensation packages relate to the selection of investment and the concomitant financing policies. Therefore, given the recommendation of the Greenbury Report (1995), it is unclear at this stage how the UK managers' compensation components affect the value-critical managerial decisions, specifically those derived from investment and financial leverage policies. This remains the focal point of the study.

1.2 Motivation for the study

As indicated, one of the recommendations of the Greenbury Report (1995, 6.19 – 6.40) suggests that the board of directors should curtail the use of stock options and apply other forms of incentives, particularly when the firm has no realistic performance targets, in order to minimise managerial excessive risk-taking. The risk-taking activities often emanate from managerial operational activities, i.e. investment and financial leverage, suggesting a linkage between executive pay components and the nature of the activities they undertake. Interestingly, prior studies (e.g. Bhagat and Welch, 1995; May 1995; Kothari et al., 2001; Manso, 2011) view intangible activities as more risky than tangible ones, whilst high debt ratio is also considered risky (Jensen and Meckling, 1976; Grossman and Hart, 1982; Rajan and Zingales, 1995). Extending this link to find out how managerial compensation design impacts the nature of firm investment and its concomitant leverage decisions is important to enhancing our understanding on how their interdependence helps influence managerial quality to achieve shareholder value.

Based on optimal compensation theory, some US researchers including Coles et al. (2006), Chava and Purnanandam (2010), Croci and Petzemas (2015), Nguyen (2018) among others provide a detailed analysis of the potential link between managerial compensation incentives and their risk-taking activities. Specifically, this stream of research shows that, through stock options incentive, managers are more (less) likely to increase the firm's idiosyncratic risks by spending more (less) on intangibles (capital expenditure) as well as increase debt level.

The Greenbury Report (1995) proposal on management remuneration differs in structural levels to that of the United States. For instance, Conyon and Murphy (2000) confirm this by arguing that UK managers receive substantial cash-based compensation relative to their US counterparts. More specifically, for the UK in 1997, they suggest the following pay components: cash-based 77% (salary 59% and cash bonus 18%) and with 19% constituting stock options and LTIPs. However, the US executive pay components show a composition of 46% and 46% respectively.

Furthermore, though firms operating in these economies (the US and the UK) enjoy similar financial and institutional traditions, the UK firms are seen to have a relatively low leverage ratio compared to the US ones (Antoniou et al., 2008; Rajan and Zingales, 1995). For instance, capital structure literature, e.g. Antoniou et al. (2008), made this empirical observation. The authors report a descriptive leverage mean (median) of 27.4% (26.9%) for American firms while the British firms show 17.9% (16.0%) (see Table 1.1 below). Clearly, the observed statistics show different risk appetite among managers operating in a relatively similar system and that such difference is likely to be instigated by the way these corporate officers are remunerated. Therefore, given the differences in the level and composition of managerial compensation and corporate governance practices between these Anglo-Saxon countries (the US and the UK), it becomes an interesting question as to whether the UK shareholders use different pay components to influence managerial operational risk-taking activities.

The present study is closely related to certain prior literature (e.g. Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012) but also makes several important extensions to this relatively new strand of literature, on the link between managerial compensation incentives and the firm's operational risk-taking activities using the UK FTSE 350 companies.

Table 1. 1 Comparative Leverage Descriptive Statistics

	UK	US
	Leverage	Leverage
Mean	0.179	0.274
Median	0.160	0.269
Std Dev	0.146	0.185
Kurtosis	2.271	1.265
Skewness	1.182	0.790
Minimum	0.000	0.000
Maximum	0.995	0.998

1.3 Contributions of the study

Although academic research on executive compensation is quite voluminous, the focus has been substantially tilted towards the determinants (e.g. Jensen and Murphy, 1990; Core and, Guay, 1999; Ryan and Wiggins, 2001; Ozkan, 2007). Until recently, it was unclear how managerial compensation influences a firm's risk-taking (see Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012; Croci and Petmezas, 2015; Nguyen, 2018). These studies are predominantly limited to the US setting, though limited evidence does exist for the UK (Kabir et al., 2013; Florackis et al., 2009). Specifically, the current study makes important contributions to this growing strand of literature, operational risk-taking activities (investment and/or leverage) and managerial compensation, and these are fourfold:

1) How the level and composition of managerial compensation influence risk-taking related to investment.
2) How compensation deviations (excesses) are related to the probability of managers committing investment distortion.

3) The link between managerial compensation and financial leverage; and
4) Adopting a more stringent modelling and econometric remedies to analyse risk-taking activities and managerial compensation using a wide coverage of three top executives' compensation data.

First, in relation to the link between managerial compensation and investment activities, the study makes three important contributions to the literature. Unlike Coles et al. (2006), who limit their investment data to only research and development and net capital expenditure (measured as net property, plant and equipment), the present study extends the data coverage to include other fixed assets expenditure and fixed intangible activities. In fact, the exclusion of these major investments is more likely to underestimate investment – managerial pay relationships, particularly in an attempt to uncover how managers behave relative to risky investment activities given the level and the composition of their pay incentives. For instance, Lewellen and Lewellen (2014, 2016) argue that the net capital expenditure measure does not represent a fair view of the firm's fixed tangible investment activity. Therefore, studying the impact of executive compensation incentives on corporate investment within the context of only R&D and net capital expenditure is likely to underestimate the effect of average executive pay on corporate investment activities.

Furthermore, the authors (Lewellen and Lewellen, 2014, 2016) indicated that the other fixed assets investments reported in the Compustat database are often cash-sponsored activities. The implication of the non-inclusion of such observable fixed assets expenditure in Coles et al. leaves a gap in our understanding of how managers' compensation packages influence this type of managerial decision, particularly when analysing the linkage from risk-motivated perspectives. Corporate executives often receive lucrative compensation packages for such major corporate activity (Grinstein and Hribar, 2004; Ozkan, 2012) and such activity tends to change a firm's idiosyncratic risk profile (Datta et al., 2001). More precisely, regarding whether other fixed assets activity typically increase a firm's risk profile is still unclear. One view claims that it increases executives' risk exposure (Lehn and Zhao, 2006; Mitchell and Lehn, 1990; Agrawal and Mandelker, 1987) whilst other authors posit risk reduction (Lewellen, 1971; Amihud and Lev, 1981; Shastri, 1990; May, 1995). Therefore, based on a risk-related explanation, the present study seeks to provide further evidence on executive pay - investment linkage using more recent data to reconcile how different pay components (e.g. stock options grants, long-term incentive plans (hereafter LTIPs) grant, cash bonuses) relate to such activity. Additionally, if the other fixed assets investments are often cash-sponsored items, as indicated by Lewellen and Lewellen, then it is reasonable that the board of directors is likely to substitute cash compensation with other forms of compensation as the firm's cash flow depletes (Guay, 1999) via other fixed assets activity. Despite this intuitive reasoning, empirical examination on this issue is limited, and non-existing in the UK context. This present study fills this knowledge gap in our understanding to detect how stock-based and/or cash-based compensation induces other fixed assets investment.

Moreover, the non-treatment of fixed intangible expenditure does not provide a clear picture on the managerial pay - investment relation under the risk-based explanation. This is because executive managers are likely to be influenced to undertake this kind of investment activity given the level and the composition of their pay incentives. Without advancing any reasons (as in the case of Coles et al., 2006; Croci and Petmezas, 2015; Nguyen, 2018), the non-inclusion of fixed intangible activity leaves a gap in our understanding of how managerial compensation packages relate to this type of activity. Hence, by investigating how executives' remuneration packages influence a complete set of firm investment activities (using broad investment measures: capital expenditure – net property, plant and equipment and other fixed assets' acquisition and intangibles – R&D and fixed intangible), we are able to present a relatively complete analysis and draw concrete conclusions for investment in general and not just for only R&D and property, plant and equipment activities as intimated by prior literature. Our unique datasets aid our contribution to the literature in this direction by examining the extent to which the nature and the level of executives' pay affect the riskiness of corporate investment decisions.

Second, the study makes further contribution to the literature on investment inefficiency (distortions) and compensation deviation. As theoretically demonstrated by Strobl (2014), shareholders may tend to deviate from normal compensation levels to influence managers to continually undertake both positive and negative investment activities, which can potentially lead to investment distortions. Coles et al. (2006) also made a similar conjecture by arguing that shareholders can intentionally apply excessive pay incentives to induce managers to substantially alter investment policy. This seems to suggest that the quality of a firm's investment activity may be affected when managerial compensation incentives are inefficiently designed.

Drawing on the above proposition, it is imperative to find out if indeed shareholders intentionally award executives more compensation incentives to induce investment distortion. In this regard, the present study attempts to provide evidence on the extent to which managerial compensation deviation induces the probability of investment distortions (i.e. under-investment and/or over-investment). This is the first study that has considered the issue using UK datasets.

Third, regarding managerial flow compensation and the firm's observed leverage linkage, the study advances the existing literature in three ways:

a) Examining the effect of managerial compensation on leverage level.
b) Examining the association between managerial compensation and the firm's leverage level within the context of growth opportunities.

c) Exploring how the corporate governance mechanism interacts with compensation to influence managerial leverage policies.

In particular, on the impact of managerial compensation on leverage, the study contributes to this relatively limited research in the UK. Significantly, the existing literature in this area is limited to the US market (see Coles et al., 2006; Chava and Purnanandam, 2010; Cassell et al., 2012; Kini and Williams, 2012) with little attention given to the subject area outside the US environment. This study specifically re-examines the managerial compensation effect on leverage using UK data. This is because capital structure decisions vary across countries (Rajan and Zingales, 1995; Antoniou et al., 2008) and leverage can mitigate agency problems between shareholders and managers (Jensen and Meckling, 1976; Grossman and Hart, 1982; Jensen, 1986), which can ultimately affect the design of executive compensation (John and John, 1993). More explicitly, UK firm managers are seen to use debt more conservatively compared to American corporate officers. Therefore, if US executives' appetite for debt financing is substantially different from that of their UK counterparts, then the US-based evidence (e.g. Coles et al., 2006; Kini and Williams, 2012) may not necessarily be applicable to the UK, hence re-examination of the issue in a different environment is urgently needed.

In fact, one study that has come close to the issue is Florackis and Ozkan (2009), who examine this issue but with limited data on managerial incentives. Specifically, the authors used only CEO's inside ownership to proxy for manager's incentives. The present scholarly study provides relatively more direct evidence on how executives' compensation influences corporate leverage while accounting for their ownership incentive. With this, the study provides more direct evidence on the compensation - leverage relationship.

Furthermore, the study also examines the extent to which executive compensation – leverage is influenced by a firm's growth opportunities. Prior studies assume that the association between managerial compensation and leverage is symmetric across all firms. Therefore, the present study attempts to show the extent to which managerial compensation and the firm's growth opportunities interact to affect leverage level.

Existing literature posits that high-growth firms often face higher information asymmetry than low-growth firms (Myers and Majluf, 1984), due to the inherent unpredictability associated with the nature of the firms' growth investment opportunities (Core, 2001; MacLaughlin et al., 1996), and this can affect executives' compensation design (Holmstrom, 1979). High-growth firms are likely to influence managerial leverage policies via generous compensation. In line with this view, the literature argues that shareholders should apply more (less) equity-based (cash-based) incentives to motivate managers of high-growth firms (Jensen and Meckling, 1976; Holmstrom, 1979; Ryan and Wiggins, 2001). Consistent with this intuition, we argue that executive compensation – leverage link is likely to be affected by the firm's growth opportunities.

Lastly, in the same breath, the study further considers the role of the firm's corporate governance practices within the context of executive compensation – leverage linkage.

As posited by Florackis and Ozkan (2009), firms with a good corporate governance system tend to use less stock-based compensation and can easily access the debt market at a lower cost of debt capital (see Cremers et al., 2004; Klock et al., 2005), which plays a significant role in determining the firm's choice of capital structure. In line with this, we examine how well-governed firms design executives' compensation to influence their leverage decisions.

Fourth, the study applies a research technique similar to that of Coles et al. (2006) but makes further improvement. Specifically, Coles et al. develop a system of simultaneous equations and apply a three-stage least squares (3SLS) technique to estimate their empirical models. In the pay for performance estimation, the authors apply just an identifying restriction procedure. This approach restricts internal instruments to these variables: capital expenditure, R&D, firm risk and leverage in the compensation incentives framework, thereby excluding other governance variables. However, the present study employs three-stages least squares (3SLS) estimation and utilises executive pay both as a predictor and/or predicted within the framework of investment – pay incentives and pay incentives – investment sensitivity by controlling a variety of other governance variables (e.g. managerial ownership, institutional and block-holders' ownership, and non-executive directors' shareholdings), consistent with Nguyen (2018). For instance, it is argued that a firm with effective corporate governance practices influences not only executives' excessive pay levels but also the structure of their pay packages (Mallin et al., 2015; Newton, 2015; Jouber and Fakhfakh, 2012), which can consequently affect their risk-related decisions. This is important, particularly for the UK firms that have witnessed significant corporate governance reforms since the rise of the corporate failure debacle.

Moreover, our comprehensive data on managerial compensation afford us the opportunity to specifically examine how these compensation components (cash bonus, LTIPs and stock options) influence the firm's risk-taking activities, different from the prior studies (e.g. Coles et al., 2006; Kini and Williams, 2012; Eisdorfer et al., 2013; Croci and Petmezas, 2015). More specifically, the Hampel (1998) and Higgs (2003) disclosure mandate of top executives' compensation enables the study to obtain annual pay components of the three (3) top executives: CEO (chief executive officer), CFO (chief financial officer) and CO (chief operating officer). Extant literature (e.g. Kim et al., 2011; Chava and Purnanandam, 2010; Sainani, 2018) shows the extent to which CFOs impact corporate policies. For instance, Sainani (2018) argues that a strong CFO influences a firm's value-maximising acquisition projects, whilst Kim et al. (2011) conclude that a CFO's option-based incentives induce a firm's risky policies. Therefore, by using compensation data of the three top executives, we are able to incorporate and relate the incentive of other top executives together with the CEO on the firm's risk-taking decisions within the UK context.

1.4 Objectives of the study

Having indicated the primary contribution of the study in the previous section, the research proceeds to formally state the objectives. Broadly, this study aims to establish a causal relation between managerial compensation packages and the firm's risk-taking activities. The key objectives of this study are threefold:

1. To demonstrate whether the association between executives' compensation and firm's investment persists in the UK dataset that includes fixed intangible and other fixed assets expenditure. This gives a comprehensive analysis of the firm's investment in a single study.
2. To provide supplementary and exploratory evidence to show the extent to which managerial compensation deviation induces investment distortions. This part attempts to further explain how incentive deviation affects managerial behaviour to under- or over-invest.
3. To examine the role of managerial compensation on the firm's observed leverage level. It also seeks to show the extent to which the relationship is conditioned on the firm's growth opportunities. More so, it intends to provide further evidence on how the firm's governance system shapes the leverage – compensation association.

The thesis's contributions to the literature are directly related to the achievement of the stated objectives. The outlined issues have not received much attention, and the empirical examination of these issues in the UK context is urgently needed.

1.5 The structure of the thesis

We structure the rest of the chapters along these strands:

Chapter 2 concentrates on risk-taking activities and managerial compensation. It structures the risk-taking activities into two parts (parts 2a & 2b).

Part 2a reviews the literature on investment and managerial compensation. It focuses on why managers undertake investment: i) agency-related motives and ii) behavioural imbalances (overconfidence). It also shows why managerial compensation is related to the firm's investment style. It discusses various components of executive compensation. In addition, literature that covers managerial compensation and investment linkages is also reviewed. The issues arising from the reviewed literature are utilised to develop investment hypotheses (Chapter 4).

Chapter 2b examines financial leverage and managerial compensation. The chapter discusses why firms borrow, theories of capital structure. It also shows how executives' compensation relates to leverage. It reviews relevant literature on financial leverage and executive compensation. The central hypotheses are developed in a later chapter (5).

Chapter 3 presents and discusses general data collection procedure. Specifically, it shows the designed methods and variable definitions and measurements of key explanatory variable. It shows the estimation strategy adopted by the study and discusses its suitability for the empirical analyses. It also provides descriptive statistics for the independent variables. It also presents pie and bar charts of the independent variables, and a conclusion.

Chapter 4 concentrates on the empirical part of executive compensation and investment. It develops hypotheses and defines and measures the key variables – investment measures – and other control variables to be utilised in the analysis. It provides and discusses empirical results, and also conducts robustness checks, and finally provides a conclusion.

Further, Chapter 4 section 4.8 discusses executive compensation deviation and investment distortions. It provides a brief literature review on investment distortion and managerial compensation and develops testable hypotheses. It states the empirical method (i.e. investment distortion probability model), defines two main variables – investment distortions and compensation deviation – and discusses the results.

Chapter 5 examines financial leverage and managerial compensation. The chapter develops hypotheses and discusses variable descriptions. It presents the empirical model, i.e. system of equations, and justifies the estimation technique. It provides analyses of the descriptive statistics and provides discussions of the empirical leverage findings based on the tested hypotheses. It also performs and discusses robustness tests and includes a conclusion to the chapter. The chapter also covers the moderating effects of managerial compensation and growth opportunity and or governance on leverage policy.

Finally, Chapter 6 presents a summary of the results and conclusions of the study. It highlights the implications of the findings and the overall contributions of the study to the knowledge literature. It also provides the study's limitations and some suggestions for future research.

Chapter 2

2.0 Managerial Risk-Taking Activities and Compensation Incentives

2.1 Introduction

As stated earlier, the primary objective of this study is to establish a causal relation between corporate operational risk-taking activities and managerial compensation scheme. Largely, corporate firms often embark on many operational activities which partly contribute to determine the overall value of the firm. Specifically, the scope of operational risk-taking policies covered by the study is those derived from both investment policy and financial leverage policy. These corporate value-critical decisions interact with the organisational characteristics including management compensation scheme and governance mechanisms to determine the probability distribution of the firm's stock return and cash flow, suggesting a possible linkage between the valued-critical operational risk activities and the management compensation design. More specifically, the chapter delineates operational risk-taking activities into two parts: a) investment and b) financial leverage and discusses the relevant literature along this line. The first section starts with the investment literature before we move on to the leverage literature.

2.2 Corporate Investment Activities (Part A)

2.2a Corporate investment activities: A literature review

Investment is one of the key observable managerial decisions, which, in part, determines the probability distribution of the firm's cash flow. Such operational risk-taking decisions of managers are often influenced by their personal characteristics, which make them not act as ideal Bayesian decision-makers. Specifically, this section offers an explanation of how these factors define corporate investment. This explanation is offered under two theoretical themes: agency theory and managerial hubris.

Furthermore, the chapter also explains the extent to which compensation helps minimise managerial personal incentive and induces them to select appropriate investment. Within this context, we build upon the managerial compensation literature to explain why the level and composition of managers' compensation influence investment activities. Again, we review the relevant literature that relates managerial compensation to firm investment. This enables us to formulate a framework to analyse the study's empirical work in the later chapter.

Importantly, the investment part (1) is organised as follows. Section 2.2.1 reviews the key views on the theory of investment, which is grouped under two main themes: agency theory and managerial hubris/optimism. Section 2.2.2 lays emphasis on the theoretical framework under which managerial compensation is linked with investment. Section 2.2.3 provides a comprehensive review of the literature. It covers the two perspectives: literature that considers the effect of managerial compensation on investment, and literature that explores the reverse question. Section 2.2.4 provides an overall conclusion for the investment part.

2.2.1a The dominant views on the theory of investment

The existing literature on corporate finance offers a possible explanation of why managers undertake investments. Investment literature has put forward a variety of reasons (Stein, 2003 p. 121). Significant among them include agency motives – where managers pursue corporate policies to suit their own interests, to shareholders' detriment (Jensen and Meckling, 1976; Jensen, 1986, 1993; Tirole, 2005) – and managerial optimism/hubris motives – managers become overly optimistic about investment outcome (Roll, 1986). The underlying idea is that, due to imperfection in the corporate governance system, managers' selection of operational activities is likely to be motivated by either agency and/or overconfidence reasons, which can be costly to the shareholders. Thus, managerial risk-taking activities such as property, plant and equipment, and other fixed asset acquisition, and intangibles (i.e. R&D and fixed intangible) are based on non-economic factors. We discuss these significant theoretical implications that are relevant to understanding the primary reasons for which corporate managers are more likely to undertake these kinds of investment activities.

More specifically, this section focuses on literature that speaks directly to the issue of agency theory and managerial optimism on a firm's investment behaviour relating to tangible and intangible investments. Considerably, we devote more special attention to the agency-motivated reasons relative to managerial optimism/hubris. This helps to unearth the extent to which compensation incentives induce managerial behaviour to make efficient investment decisions.

2.2.1.1a Agency-motivated reasons for corporate investments

An agency problem is one of the dominant themes in management, accounting and corporate finance literature. In particular, the theme "agency theory" is at the heart of virtually every major topic in corporate finance from capital structure, corporate governance, compensation contracts and financial intermediation, to mention but a few (Stein, 2003). Indeed, these strands of literature underscore the importance of the paradigm in corporate settings with a lineage dating back to Berle and Means (1932), and the seminal work of Jensen and Meckling (1976).

Primarily, a key assumption underlying the theory is that managers of publicly traded firms may pursue policies to benefit themselves even if these policies lead to shareholder value destruction (Jensen, 1986; Stulz, 1990; Tirole, 2005). In fact, such acts of non-benevolence towards shareholders often manifest in managers' risk-taking activity, particularly investment and/or financing decisions. Specifically, at this point and for the purposes of this discussion, we will survey those variants of the agency problem that pose direct implications for firms' investment behaviour.

a) Empire-building

One major rationale under the agency theoretic framework for investment is empire-building. The literature posits that managers may develop an excessive appetite to run larger firms, as opposed to profitable ones (see Baumol, 1959; Marris, 1964; Williamson, 1964; Jensen, 1986, 1993). For instance, Jensen (1986) argues that managers with a private incentive to build their "empire" are more likely to spend essentially all internal cash surplus on low return or even negative net present value (NPV) activities (Stulz, 1990). Some of these unprofitable risky activities include acquisitions, property, plant and equipment, and other intangibles' investment. Consequently, the literature suggests ex-ante over-investment and eventual ex-post under-investment as the firm's internal cash flow depletes (Jensen, 1986; Myers, 1977).

In a related development, other literature highlights executive managers' desire to pursue empire-building ambitions. Significantly, both social and economic benefits associated with a manager's decision to overly invest corporate resources, either through merger acquisitions or property, plant and equipment or knowledge-based assets, have been advanced in the literature.

More specifically, corporate managers may gain private incentives for managing bigger corporations. This includes a sense of self-satisfaction and personal achievement, upliftment of social stature in their community and among their peers, and, more importantly, increase in remuneration as well as an enhanced consumption of perquisites (Masulis et al., 2007). Again, in support of size anomaly literature, for instance, the British Airways CEO (Willie Walsh) and finance director saw their base salary rise by 12% and 43% respectively following the successful merger with Iberia in 2010 (Arnold, 2013, p. 863). Though some of these individual unobservable characteristics are often not openly debated, it is worthwhile stating that these may in part affect a manager's investment decision-making process.

b) Empire-preservation, entrenchment and diversification

Another important agency-motivated factor for a firm's investment is the managers' desire to continually maintain their market power through various investment-related strategic ways including empire-preservation, entrenchment and diversification. Unlike the synergy motive (Myers and Majluf, 1984), the empire-driven managers' main concern is to continually maintain and appropriate the benefits that come along with managing larger corporations. Underlying this strand of literature, several reasons have been articulated by the prior studies (see Shleifer and Vishny, 1989; Berkovitch and Narayanan, 1993). They advance the view that managers may spend corporate resources on low-yielding investment, because such projects suit their own knowledge and expertise.

Gordon et al. (2009) articulate a similar sentiment through their defensive mechanism model. Specifically, the authors point out that manager may embark on acquisition for safeguarding their firm from being acquired by other market competitors. In the same spirit, Shleifer and Vishny (1989) posit that managers may tend to deliberately pursue investment activity that suits their “specialist” area of expertise. This type of agency-incentivised decision is common to inorganic investment activities such as acquisitions of assets in which executive managers are keen to acquire a line of business or firm that may eminently require their specific human capital (Berkovitch and Narayanan, 1993). Relatedly, Masulis et al. (2007) also show that corporate managers may undertake certain investment decisions with the common aim of enlarging their firm size, which, in turn, afford them the opportunity to extend their market influence and eventually augment their pay incentives. A consistent view is held by other prior literature (e.g. Ozkan, 2012; Moeller and Schlingmann, 2005; Agrawal and Mandelker, 1987).

Moreover, corporate diversification is another significant element that is more likely to show up if indeed managers have the taste to manage large corporate empires. Thus, managers use diversification as a strategic investment tool. One paramount reason that has been cited in the corporate finance literature is risk-reduction incentives (Amihud and Levi, 1981; May, 1995). For instance, Amihud and Levi (1981) argue that managers diversify their investment portfolio partly to minimise the firm’s risk exposure and to enjoy their continual presence in the market through the empire ambition strategy.

c) Reputational and career concerns

Another important factor that reflects on how managers' interest may deviate from shareholders' through investment is career concern. The markets reward good managers and punish bad ones. Due to this, managers may tend to select risk-taking activities that are likely to increase their career prospects as well as professional reputations. Because the markets consume information regarding investment, managers with such private incentive tend to announce their presence in the market via more investment. For instance, Holmstrom (1999a) points out that, for an undervalued manager to ascertain recognition and reputation in the public eye, they may tend to pursue many investment projects, likewise the talented managers. In essence, the market's recognition of the managerial talent is synonymous with risk-taking preference.

In addition, such managers are more likely to overly invest in activities they consider less risky with the intention to eliminate their employment and/or career risk. Therefore, managers' incentives, via reputation and future career opportunities, can induce them to manipulate firm investment policy irrespective of the long-term wealth implication to shareholders (see Berkovitch and Narayanan, 1993; Hirshleifer and Thakor, 1992; Shleifer and Vishny, 1989).

Overall, it is worth noting that some implicit considerations, i.e. reputation and career risk, influence managers when assessing and selecting investment preference, which to some extent can result in a firm's investment distortions. Within this vein, Dewatripont, Jewitt and Tirole, (1999) argue that, in cases where the firm's formal incentives scheme is crude and constrained, implicit managerial incentives often become more problematic. In that circumstance, managers' decisions are extremely tailored towards their personal satisfaction, with little or no concern for shareholders' needs or interests.

d) Short-termism

It is also argued that managerial concern for reputation often impels managers to take a decision purposely to boost short-term performance at the detriment of long-run stockholders' value (Narayanan, 1985; Bebchuk and Stole, 1993). For instance, Narayanan (1985) points out those managers may embark on an aggressive investment policy with the aim of inflating short-run profitability.

In a related way, Stein (1989) contends that, due to information asymmetry, managers' myopic investment decisions can affect the market assessment of their firms' stock prices and cash flow over a short-term horizon. In some cases, however, managers may, for short-term incentive reasons, intentionally boost reported earnings by undertaking less investment in hard-to measure assets, such as plant and equipment maintenance, research and development, employee training and development, customer care and loyalty, etc., even though disinvesting in such activities could ultimately impoverish shareholders in the long run. In a more corroborated sense, Bebchuk and Stole (1993) observe that short-term reputation influences managers to engage in investment distortions. For example, managers may choose to over-invest to create artificial near-term stock prices rise, as this is interpreted by the markets to represent the quality and efficiency of managers' skills.

Furthermore, Gompers (1996) and Baker (2000) assert that managers of newly established firms with no market reputation are more prone to engage in distortionary activities to announce their presence in the markets.

The overall material implication of the short-termism model suggests that firm managers' risk-taking decisions, particularly investment-related ones, create incentive for managers to boost short-term performance.

e) Herding

Another specific manifestation of managers' career threat is linked to the excessive tendency of managers to follow the investment styles of others. The literature on behavioural economics offers a possible explanation for why managers may have an incentive to herd. One notable point indicates that managers may tend to conform to the judgements and behaviours of their professional counterparts with the intention to minimise career concerns (Hirshleifer, 2001). Taking note of the inefficient management hypothesis (Manne, 1965), corporate managers' performance is often evaluated based on certain benchmarks such as stock indices or average industry performance indicators. This tends to imply that firm managers whose share price falls below the standardised industry indicator are assumed to be inefficient managers. Consequently, such managers are more likely to face career risks once their stocks perform poorly relative to the market benchmark. To salvage their career prospects, managers may have an incentive to copy the investment tactics of other industry competitors to prevent substantial underperformance and to secure their job.

Moreover, Scharfstein and Stein (1990), using a reputation-based model, predict how managers are incentivised to do as others (managers) do. They suggest that managers tend to disregard their own information and follow group information particularly when their contrarian investment views are unattractive to the markets. The authors offer managerial reputation, age and experience as likely factors to cause managers to herd. For instance, they argue that young and inexperienced managers may prefer to fail conventionally than to succeed unconventionally.

Managerial herding behaviour can be either intentional or unintentional. For instance, Walter and Weber (2006) argue that intentional herding arises when a manager blatantly copies the investment actions of others. However, unintentional herding occurs when managers analyse from a similar perspective because they have access to similar information.

In the light of this, it is important to note that managers, for fear of job security and damage reputation, may tend to design their investment activities to follow the majority views.

f) The quiet life hypothesis

As an extension to Hicks (1935), Bertrand and Mullainathan (2003) proposed what became known as the "quiet life hypothesis", another classic principal – agent problem which can pose serious implications for managerial investment decisions. Contrarily to the empire-building and career concerns models, "**the quiet life theory**" suggests that managers' investment behaviour may be influenced by some inherent risk-averse determinants. They highlight that managers become excessively conservative when it comes to either taking a new or disembarking an old investment decision. In fact, such a cross-sectional variation in managers' decisions may have potential implications for both over- and under-investment incentives. For instance, a manager may be reluctant to shut down a non-performing business project, which could exacerbate the firm's over-investment problem. Significant reasons may contribute to the manager's indecision to off-load or diversify the poorly performing line of business. Notable among them includes the manager's inherent risk-aversion characteristics, and the market's perception regarding management efficiency if the firm decides to terminate an unprofitable activity. Supporting this view, Boot (1992) and Baker (2000) argue that managers disembarking on new or already existing non-profitable projects may be viewed by the market to represent an admission of failure on the part of management. Therefore, in an attempt to minimise information asymmetry effects, managers may tend to keep such a poorly performing venture irrespective of how value destroying the project may seem to be.

The managerial labour market posits that the "quiet life" managers are seen to be content with their current wages and that they may not anticipate any future opportunistic wage revision as they have revealed no further information about their abilities.

In short, the existing evidence suggests that management risk-taking preference may potentially be influenced by some unobserved risk-motivated factors.

2.2.1.2a Managerial overconfidence/hubris

Another potential investment-related problem is offered by behavioural economists (Roll, 1986). It is argued that managers may be overly optimistic about the prospects of their investment activity, and that they may fail to act as ideal Bayesian decision-makers (De Bondt and Thaler, 1985; Malmendier and Tate, 2002).

Research studies show that overconfident managers are more susceptible to valuation errors because they tend to attach extra weight to their private information regarding the prospects of the said investment (Foster, 1983). Such optimistic behaviour is often influenced by factors including talent, faith, beliefs, experience and sometimes one's entrepreneurial flair to turn uncontrollable events (Arnold, 2013, p. 863). These implicit systemic distortions can inhibit managers' decisions not only to over-invest in projects such as fixed tangible assets, fixed intangibles and R&Ds, but they may also end up spending more on acquiring the said activity (DePamphilis, 2010; Roll, 1986).

In addition, the literature posits that managers' overconfidence about a particular investment project is often induced by the firm's internal available funds. Citing signalling effect and rent-seeking hypothesis (Myers and Majluf, 1984; Jensen, 1986; Travlos, 1987), research shows that managers may prefer to finance their overly optimistic investment decisions with internal cash reserves rather than to use other external sources, all things being equal.

One pertinent issue associated with the "hubris hypothesis" is that the managers' motive may not necessarily depict a deliberate pursuit of their self-interest, but, however, their sense of judgement on investment prospects is often distorted by some behavioural imbalances, which in turn affect the firm value.

Collectively, this section has advanced two broad perspectives on why executive managers undertake investments: agency motives and managerial optimism. The agency-motivated reasons show how managers' risk-taking (investment) decisions tend to safeguard their own interests to the detriment of shareholders'. Managerial optimism (hubris) also indicates managers' unwarranted overconfidence about investment outcomes, which can affect the firm's level of investment. Clearly, these managerial egocentric tendencies (resulting from agency and overconfidence) are likely to affect managers' allocation of resources to these risk-taking activities (e.g. property, plant and equipment, R&D, fixed intangible, other fixed assets), and the consequential effects on firm value. Through efficient compensation contracts, these managerial investment-related imbalances are reduced, thereby causing managers to select value-critical investment projects (Coles et al. 2006; Jensen and Murphy, 1989 p. 1).

The next section provides reasons to suggest why managerial compensation impacts the way they (managers) make investment decisions, before we move on to provide a detailed literature review on investment and managerial compensation incentives.

2.3a Managerial compensation theory

The previous discussion highlighted the various factors that can affect managers' risk-taking (investment) decisions. Other researchers have also theorised that, through efficient contractual provision, managers are able to make value-critical decisions including investment and/or financial leverage (Holmstrom, 1979; Haugen and Senbet, 1981; Coles et al., 2006).

In fact, there are two opposing views on managerial compensation contract (Ntim et al., 2016 p. 4; Weisbach, 2007). These are: i) optimal contracting theory (OCT) (Holmstrom, 1979; Murphy, 1985; Coles et al. 2006) and ii) managerial power hypothesis (MPH) (Bebchuk and Fried, 2003, 2004; Weisbach, 2007). The next subsections provide a brief overview of these theories of managerial compensation.

i) Optimal contracting theory (OCT)

As extant literature suggests, managers may be sufficiently self-interested (Shleifer and Vishny, 1989) and/or risk averse due to the over-investment problem and the consequent under-diversification of their human and economic wealth portfolio (Jensen and Meckling, 1976; Fama, 1980). Thus, such an agency-motivated incentive could hurt shareholder value-enhancement via inefficient investment selection.

The optimal contracting theory (OPT) suggests that, by rewarding managers with appropriate compensation incentives (e.g. salary, cash bonus, long-term incentive plans, stock options), managerial investment-related imbalances may be significantly reduced, thereby enhancing the quality of investment (Kini and Williams, 2012; Coles et al. 2006; Jensen and Murphy, 1990). Since the structure and the level of compensation components offer different risk incentives to managers, the optimal contracting theory assumes that shareholders through the board of directors should offer a suitable compensation package to managers to improve the quality and efficiency of managerial decisions regarding investment and/or leverage (Benston, 1985).

ii) Managerial power hypothesis (MPH)

Contrary to optimal contracting theory, the managerial power hypothesis (MPH) views executive compensation arrangements as products of close negotiations between powerful executives and a weak corporate board of directors (hereafter BODs) (Bebchuk and Fried, 2003; Weisbach, 2007). Bebchuk and Fried (2003) argue that executives with excessive power can easily manipulate appointment to the BOD, which could afford executives the leeway to gain control over the board's decisions regarding compensation determination and to facilitate excessive rent extraction (Gomez-Majia et al., 1987). In such a case, the compromised BODs may approve generous pay packages to executives in anticipation of receiving similar reciprocal gestures including appointment to another directorship position in the firm (Morse et al., 2011; Brick, Palmon and Wald, 2005; Core et al., 2003; Crystal, 1991). Supporting this view is Brick, Palmon and Wald's (2005) mutual backscratching or cronyism proposition. The authors argue for the presence of mutually beneficial collusion between top management and the board of directors when setting managerial compensation incentives.

One significant issue associated with managers' power to influence their own pay setting is that it can erode the efficiency of compensation incentives to affect managerial utility function. Thus, the quality of risk-taking decisions (investment and/or leverage) is likely to deviate from the expected standard, which, in turn, can affect a firm's value (Weisbach, 2007; Grinstein and Hribar, 2004; Core et al., 1999).

In sum, this section highlights the theoretical frameworks through which risk-taking policy and managerial compensation interaction is analysed. As stated, the key argument of the study is that shareholders use different components of managerial compensation to influence risk-taking activities arising from investment and/or leverage by addressing the extent to which managerial compensation is predicted by other firm-related characteristics including risk-taking activities.

A considerable amount of research on executive compensation often utilises different incentive components such as salary, cash bonuses, value of stock options and value of long-term incentive plans (value of restricted stock and performance stock), and each component has a different implication for the managerial decision-making process, particularly regarding risk-taking projects. One important advantage of the present work is that we are able to provide wide data coverage on the managerial compensation and relate it to managerial risk-taking activities. Essentially, before we look at the different components of managerial compensation, we first provide a brief overview of the UK regulatory system which has influenced the way executives are remunerated in the UK.

2.3.1a Institutional framework and executives' compensation in the UK

The United Kingdom is known to have one of the most developed and advanced financial markets in the world. As a global player in the capital markets, the UK legislative and regulatory frameworks on corporate governance have systematically evolved due to a series of high profile "ad-hoc" committee reports, some of which were designed to respond to internally generated corporate failures in the UK or as a reaction to similar failures in other parts of the world. Largely, several corporate governance reports were issued in the 1990s, as governance and compensation issues led to many policy documents, which were later incorporated in the London Stock Exchange Combined Code. The reports include Cadbury Reports (1992), Greenbury Reports (1995), Hampel Reports (1998), Higgs Reports (2003) and the relatively more recent Walker Reports (2009). The study provides a cursory glance at the various reports.

The Cadbury Report (1992) mainly highlights the responsibilities of institutional shareholders as an important powerhouse to restrain management from any expropriation behaviour through consumption of perquisites, awarding themselves bumper pay bonuses and other forms of corporate misbehaviour. The report was commissioned in the aftermath of several high-profile corporate bankruptcies in the early 1990s and recommended some important corporate governance changes including the role of remuneration committees, institutional investors, and the board of directors. For instance, the report makes a quasi-mandatory call for corporations to have in place an independent remuneration committee to oversee managers' compensation schemes, although the report shows little specific guidance on the executive directors' remuneration packages.

The Greenbury Report (1995) specifically focused on the design of executives' compensation scheme and the performance evaluation criteria. The report states that management should not be compensated based on share price behaviour and that the use of a share options incentive should be curtailed, particularly if the performance target is unrealistic. The implication of the committee position was to prevent corporate managers from taking excessive risks, and instead proposes that performance-related pay components (e.g. long-term shares, other annual bonuses) can be used to motivate managers. More explicitly, the committee recommends that a share options package can be issued to executives only to help stimulate realistic performance goals and it also ruled out the common practice of discounting share options by 15% at the grant date share price.

A simple observation that can be drawn from the Greenbury findings is that the distinctive nature of the executive pay components (LTIPs, bonuses and share options) poses different risk-related incentives. In other words, these compensation components differently influence managerial risk-taking activities relating to investment and financing. This constitutes one of the primary motivations of this study. In this way, the study aims to find out if indeed the board of directors apply certain type of compensation for risk-motivated purposes.

The Hampel Reports (1998), on the other hand, stressed the need for corporations to disclose detailed information on executives' compensation entitlements similar to the US style of reporting managerial compensation information. In addition to the full disclosure of boardroom members' pay packages, the committee further highlights remuneration committees' membership and compositions as well as clarification of any compliance issues. Hampel findings suggest that non-executive directors should be rewarded with fixed fees, and where possible part of their remuneration can be given in the form of shares for the purposes of aligning their incentives with the shareholders.

It is important to mention that the various committees' reports were incorporated into the London Stock Exchange Combined Code (hereafter LSE) and then in statute by the 2002 UK Directors' Remuneration Report Regulations (UK DRRR Bulletin, 2002). Specifically, the 2002 Act makes it mandatory for the remuneration committees through the board to seek the approval of the shareholders on executives' remuneration packages at the annual general meeting, although the vote is only advisory and may not constitute a binding document on the company.

The Higgs Reports (2003), a relatively more recent report, tasked corporate firms to be more transparent in setting up executive compensation schemes as well as individual board of directors' pay structure. The draft that was incorporated into the Combined Code further recommends that executive directors' compensation packages should be structured in a way to entice management to work hard to achieve the shareholder value maximisation objective.

Moreover, another specific regulatory framework was also introduced in the financial sector following the series of banking failures in 2007. The Banking Remuneration Code underpinned by the recommendation of the Walker Report (2009) make it mandatory for financial institutions (i.e. UK banking and other financial sectors) to fully disclose the levels and the nature of executives' remuneration packages. The report further indicated that executives' compensation components (e.g. long-term incentive plans-LTIPs, bonuses) should constitute at least half of the overall compensation entitlement and that the eligibility requirement should have a minimal three-year period. The consultative bill (Banking Remuneration Code) became operationalised in January 2011, although it has still not yet received the statutory status. The

Financial Service Authority (FSA) has made it a requirement for all financial institutions to follow such guidance in order to participate in the Government's Asset Protection Code. The Walker commission also makes it mandatory for remuneration committees to fully engage in the setting up of lower workforce remuneration within a firm's overall risk framework.

Overall, these reports played a crucial role in enforcing detailed disclosure rules for UK executive compensation. Clearly, UK public listed companies now provide sufficient annual information on executive compensation packages and this has enabled the current study to specifically examine the raised issues. The next discussion is centred on the different remuneration components used by UK shareholders to reward executives.

2.3.2 Cash-based compensation

Corporate institutions often tend to use cash-related compensation to attract, retain and motivate managers to adhere to shareholder wealth maximisation (Chen et al., 2016).The literature posits that the use of a cash-based incentive is a less powerful instrument in reducing the risk-motivated agency problem (see Core and Guay, 1999; Fenn and Liang, 2001). This is because risk-averse managers are less likely to increase the firm's idiosyncratic risk when a large component of their compensation is cash-related. It can also encourage earnings management. The two forms of cash-based compensation, salary and cash bonus, are discussed below.

2.3.2.1 Basic salary

Basic salary is the foundational component of executives' structural compensation arrangement, often featured in the employment contract (Murphy, 1998). It guarantees a fixed minimum pay for the executive for the stipulated period of the contract. It also forms the basis upon which further incentive claims including cash bonus, LTIPs, stock options, defined pension and other severance arrangements are largely measured.

Specifically, early research on the agency problem shows that a higher salary encourages management-shareholders' unity, because any upward adjustment in managerial salary component is linked to firm performance (cash flow or earnings). This, in effect, may contribute to the reduction of agency conflicts as shareholders and managers share the benefit together. For instance, Jensen and Murphy (1990) find that management salary increases ($0.02) are associated with a $1000 increase in corporate value.

However, other literature subscribes to a different view regarding the salary adjustment mode of compensation. Based on the risk-motivated explanation, in cases where executives only have a fixed incentive claim and face the decision to implement an aggressive debt policy, risk-averse managers may be more reluctant to favour a high-risk policy, even if such a decision can improve shareholders' value. In essence, shareholders' frequent revision of managerial salary can discourage risk-taking activities.

2.3.2.2 Cash bonus

Cash bonus incentive is one of the components of executive compensation packages. The pay-out is often dependent on meeting certain specific accounting performance targets such as cash flow, earnings, sales revenue. Thus, a manager is motivated to attain the accounting-related threshold (Chen et al., 2017). However, cash bonus can also create an incentive problem. For instance, the surveyed literature suggests that managers may be more inclined to decrease maintenance expenditure on certain investment projects, especially research and development, in order to increase the reported profit when their performance is tied to such short-term accounting metrics (Xue, 2007; Coles et al., 2006). Sacrificing long-term investment opportunities, managers are able to artificially generate positive and immediate stable cash flow and earnings to meet their financial targets, a requirement for cash rewards (Holmstrom and Milgrom, 1987).

Against this background, Lambert and Larcker (1985) suggest that giving managers a deferred cash compensation package would potentially reduce their under-investment incentive. Thus, deferred cash incentives minimise myopic managerial behaviour.

Furthermore, some studies also suggest another agency theoretic implication for cash compensation plans. Specifically, Smith and Watts (1983) argue that, in instances where senior executives' compensation is tilted towards cash component, top management may have an incentive to convince the firm's board of directors to retain a substantial part of corporate profit as a buffer to meet any expected future cash payment obligation. Consequently, financial slack is encouraged to some extent, which could have a negative effect on the firm's investment opportunity sets and ultimately shareholders' value (Kashyap, Lamont and Stein, 1994; Himmelberg and Petersen, 1994; Hall, 1992). In ameliorating this, Lewellen et al. (1987) contend that a firm's compensation package could be selectively structured in a manner that the proportional increase in cash compensation (salary and bonus) affects the firm's dividend pay-out, especially where there is no feasible investment present.

In brief, although cash bonus can be used to motivate managers, it is evident that managers with substantial cash bonus compensation may develop a more risk-avoiding incentive to limit the firm's overall risk profile, which can be beneficial to bondholders (Duru, Mansi and Reeb, 2005; Coles et al., 2006).

2.3.3 Equity-based compensation

Agency theory suggests divergence of interest between managers and shareholders in matters relating to the operational activities of the firm. Equity-based incentives are seen as an effective mechanism in ameliorating the conflict of interest. The differences may be reflected in decisions such as investments, debt level, cash holdings and earnings management, which the equity compensation incentive is assumed to resolve. We discuss the equity-based components below.

2.3.3.1 Stock options compensation

Stock options incentive is a relatively modern compensation package designed to induce managers' risk-increasing incentives (Guay, 1999; Coles et al., 2006; Chava and Purnanandam, 2010). The convex payoff features inherent in stock options influence managers to pursue and implement risky investment and financing policies. This is because the probability of the firm's positive stock return is closely associated with the managerial risky investment and financial policies, which may directly increase the value of the manager's stock options as the firm's stock volatility goes up. This makes both managers and shareholders benefit as stock volatility increases, thereby aligning shareholders and managers' interests (e.g. Chava and Purnanandam, 2010; Coles et al., 2006; Palia, 2001; Mehran, 1995; John and John, 1993). Thus, tying agents' expected utility to the principal(s) value via stock options incentives increases the likelihood of managerial risk-taking particularly for high-growth opportunities (Holmstrom and Ricarti Costa, 1986; Smith and Watts, 1992; Bizjak, Brickley and Coles, 1993; Core and Guay, 1999).

One of the major implications of the stock options incentive is that it encourages managers' risk-shifting incentive (John and John, 1993). For instance, the increase in the firm's idiosyncratic risks via investment and higher leverage ratio may inadvertently lead to a higher probability of financial distress and the possible bankruptcy risk, which can influence rational debtholders to demand a high lending rate before they lend to the firm. This effect can be mitigated by the firm using convertible debt and or more deferred stock incentive (Ortiz-Molina, 2007).

Moreover, others point out that financial accounting treatment makes the stock options component much more preferable to cash bonus or restricted stocks. More specifically, cash and restricted stocks bonuses are treated as income and expenditure items, while stock options grants are shown in a footnote and treated in the financial balance sheet. This can influence the board to offer more managerial stock options. In addition, because share options are not reconciled as an expenditure item, a financially constrained firm with low accumulated earnings, perhaps because of regular debt covenant payments, may resort to a stock options package to enhance its ability to continually incentivise its managers (Core and Guay, 1999, 2001a; Dechow, Hutton and Sloan, 1996).

2.3.3.2 Performance stock compensation

This component of the compensation package often has special performance targets as a vesting condition. This distinctive feature provides different risk incentives to managers compared to other forms of compensation incentives. Like stock options, performance stocks may induce more risk-taking behaviour. This is because managers may not be able to benefit from such an incentives scheme if they fail to achieve the required performance benchmarks (e.g. stock return, cash flow, profits). This, therefore, encourage managers to pursue risky policies in order to meet the required performance criteria. However, as managers' willingness to increase firm risk goes up via more debt, bondholders or creditors anticipating this will demand a higher risk premium to lend to the firm.

Other existing literature argues that setting a specific performance benchmark via performance stock compensation encourages opportunistic managerial behaviour (Kuang, 2008; Prevost, Rao and Skousen, 2008). Specifically, Prevost, Rao and Skousen (2008) argue that managers are likely to commit earnings management when a large component of their incentive is performance stock. Moreover, Yermack (1995) and Bryan, Hwang and Lilien (2000) show that, through tax motivation purposes, many corporate institutions use performance stock-based compensation to reward top management and it is less expensive for firms with lower marginal tax rates.

2.3.3.3 Restricted/deferred stock compensation

Like performance stock, restricted stock incentives also provide certain prescribed targets and such targets must be achieved before vesting. In the UK, for instance, executives are often handed a restricted stock package for achieving a stipulated shareholder return target. In some cases, the expected target to be met by the executive is to remain at the firm for a stated time duration. One of the implied reasons underlying the firm's decision to offer duration-specific incentives (e.g. three- or five-years' deferred stock) to well-performing managers is to induce them to stay and to some extent prevent competitors from hiring them, so that they can continue to sustain and increase shareholders' value. Yermack (1995) offers a managerial "horizon problem" argument by stating that shareholders use restricted stock to motivate managers nearing retirement to continue to undertake risky decisions.

2.3.3.4 Camouflage payments

As the name suggests, this form of payment to executives is often relatively less transparent to the principal(s) (Bebchuk and Fried, 2004). Examples of this type of incentives payment include golden hello, goodbye payment and executive loans. Specifically, the "golden hello" payment is applied by firms (the board on behalf of shareholders) to attract the services of the most talented managers to join them. This payment can be in the form of cash or stocks or a stock options grant and is relatively transparent (Murphy, 1999). In many cases, firms use a golden hello as a compensation for the loss of bonuses, stocks and stock options from the manager's previous employment. A typical example in the UK was the payment of £4 million to Pascal Soriot when he became the CEO of AstraZeneca.

On the other hand, "golden goodbye" or "parachute" rewards are made to an executive on departure, either voluntary or otherwise. Largely, this kind of payment is sometimes kept away from shareholders and this has raised genuine concerns from both the public and shareholders regarding whether such payments are often part of a manager's contractual arrangement (Bebchuk and Fried, 2003).

Executive loans were predominantly used in the US until early 2000s, and are loans offered to executives at a preferential rate (Bebchuk and Fried, 2004). In the UK, this type of incentives package is relatively limited, and to some extent non-existent, because such a scheme is prohibited by UK company law.

Overall, the discussion so far has enumerated various components of executive compensation. We have also shown the underlying intuition of firms implementing stock-based and cash-based incentives and that their distinctive feature makes it empirically testable to see how these incentives' components relate to managerial risk-taking, specifically, those of investment and financial leverage decisions. In particular, the variable equity-based incentives reflect an integration of management into the ownership structure with the purposes of increasing managers' motivation and organisational commitment to improving the firm's value (Hall, 2000; Jensen and Meckling, 1976). In contrast, although the cash-related incentive deepens manager-shareholder unity, it can also induce managerial opportunism, if not appropriately designed.

One important observation in our annual compensation data is that the board of directors uses a mixture of equity-based and cash-based compensation to reward their executives. The simultaneous application of these incentive packages, salary adjustment, cash bonuses, stock options and LTIPs (performance stock and restricted stock), calls for a more sophisticated modelling and econometric technique to isolate the effect of managerial compensation on a firm's risk-taking activities.

In the later chapters (4&5), we will develop the study's testable hypotheses utilising these highlighted compensation components (e.g. cash bonus, value of LTIPs grant – value of performance stock plus restricted stocks, value of stock options) to explain separately how each component impacts managerial investment and the concomitant financing decisions using UK data. The next subsection provides a literature review on investment and managerial compensation.

2.4a Literature review on investment and managerial compensation

As stated earlier, one of the key objectives of the study is to examine a causal relation between managerial compensation and investment decisions. Having indicated the reasons under which compensation is likely to influence managerial investment policies, this section specifically reviews the existing material evidence on investment and managerial compensation. Importantly, two strands of literature on investment and compensation are reviewed: the first review concentrates on the literature that looks at the effect of managerial compensation on investment (e.g. Coles et al., 2006; Xue, 2007; Cassell, Huang, Sanchez and Stuart, 2012; Kini and Williams, 2012; Hayes et al., 2012; Shen and Zhang, 2013; O'Connor et al., 2013; Croci and Petmezas, 2015; Chen et al., 2017; Feito-Ruiz and Renneboog,, 2017; Nguyen, 2018), and the second focuses on the literature that applies investment activities as a determinant of managerial compensation. Thus, the studies that concentrate on the reverse question, investment and other characteristics as predictor of managerial compensation (e.g. Core and Guay, 1999; Guay, 1999; Ryan and Wiggins, 2001; Adu-Amoako et al. 2011; Humphery-Jenner et al., 2016). It is worth indicating that the current study is closely related to the former and guided by this literature we develop the study's central hypotheses in chapter 4.

Using a sample of US oil and gas firms spanning 1992-1997, Rajgopal and Shevlin (2001) examine the extent to which stock option incentive links with corporate exploration investment activities. The authors report a positive relation between executive stock option (ESO) incentives and the future exploration of risk-taking activity. Specifically, they define dependent variable as the coefficient of variation of future cash flows from exploration activity, a proxy for investment, whilst executive stock option (ESO – independent variable) incentives is measured as the sensitivity of the CEO's options portfolio value to a 1% change in the underlying stock return volatility. Applying simultaneous equation technique to the following proxies: exploration investment activity, ESO risk incentives and other exogenous factors including firm leverage and growth opportunities (using exploration risk factor score analysis), they find that an increase in stock option rewards endogenously determines future exploration investment activity. They interpret the result to show that shareholders use stock options to encourage executive risk-taking, consistent with the central assumption of the agency model of managerial risk aversion (Holmstrom, 1979; Guay, 1999; Knopf et al., 2002).

In furtherance of the risk-motivated idea, Rajgopal and Shevlin (2001) provide additional evidence on managerial stock options and the oil price risk hedging. Specifically, they find a significant negative relationship between the executive stock option incentives and the oil price risk hedging in their system of equation model. The result tends to imply that stock options reduce managerial incentive to hedge against oil price fluctuation. The key implication of these results is that shareholders use option-based packages to encourage risk-taking rather than risk reduction.

Similar evidence is also presented by Xue (2007) when he examines how management compensation incentives influence strategic investment choices for US high-tech companies. Employing a simultaneous equations framework, the author finds that managers with heavily weighted cash compensation are more likely to embark on acquisition of high-technology assets, whilst those with a stock-based incentive are likely to spend more resources on research and development in an attempt to develop such high-tech internally.

In a related vein, Coles, Daniel and Naveen (2006) provide further evidence on the relation between CEOs' compensation incentives and corporate policy (investment) using a US dataset for the period 1992 to 2002. They define dependent variables: R&D scaled by total assets and capital expenditure (i.e. property, plant and equipment) scaled by total assets, whilst CEO's option-based incentives – vega (measured as a dollar change in the value of CEO wealth portfolio for 0.01 change in the stock return volatility), delta (dollar change in the value of CEO wealth for a 1% change in stock price) and cash compensation (salary plus cash bonus) as a fraction of total compensation. Applying different estimation techniques, three-stage least squares regression (3SLS) and ordinary least squares (OLS) to the data, they report some interesting results. Specifically, they find a positive and significant association between stock-based (measured vega and delta) compensation and R&D investment but find a negative effect on capital expenditure. The authors suggest that giving managers a greater vega component in their compensation portfolio induces them to invest more in riskier assets including more investment in firm innovation activity and less capital expenditure activity.

Moreover, regarding delta incentives, the paper attributes it to the alignment hypothesis, where managers seek to satisfy the interests of shareholders when a large component of their compensation is equity-based incentives. Applying cash compensation as a control variable, they show a negative relation between R&D and cash compensation, whilst a positive coefficient estimate on cash incentive is reported in the capital expenditure model. They suggest that managers become more wary of increasing firm risk, i.e. R&D expenditure (e.g. Bhagat and Welch, 1995), particularly when they are motivated with cash incentives. One possible implication of the result is that managers are more likely to cut down on R&D expenses in order to boost reported earnings and cash flow, which is often used by the shareholders as the key performance indicator for cash bonuses. In contrast, managers with more cash-based incentives prefer to invest more in relatively low-risk capital tangible investment. Clearly, the evidence lends credence to the managerial risk-aversion assumption (Fama, 1980).

On the control variables, the researchers find R&D expense and firm size, CEO tenure, market-to-book and stock return to be negatively related, whilst surplus cash, sales growth and leverage are all positively linked.

Relatedly, Kini and Williams (2012), based on a tournament incentives proposition, argue that option-like compensation encourages more risk-taking investment. Specifically, the authors find that greater tournament incentives to senior managers induce them to allocate more spending on research and development, but lower capital expenditure intensity.

Cassell, Huang, Sanchez and Stuart (2012) examine the extent to which managerial inside debt compensation affects the selection of the riskiness of investment and financial policies. Specifically, this part of the review concentrates on risk investment activities: R&D expenses and diversification activity. They define R&D expense as the ratio of R&D expenditure to total sales, and diversification activity similar to Jacquemin and Berry (1979), and Bushman, Indjeikian and Smith (1995), whilst CEO's inside debt compensation is measured as the natural log of the ratio of the CEO's debt-to-equity ratio to the firm's debt-to-equity ratio. The authors find that pension and deferred (CEO's inside debt) compensation is negatively related to R&D expense, whilst a positive relation is reported among inside debt and diversification activity. The authors explained this to imply that CEOs with large inside debt compensation tend to prefer less risky investment activities than risky ones. They made this conclusion when they applied different estimation methods (OLS, two-stage least squares) to the data and controlling other firm-specific factors.

Hayes, Lemmon and Qiu (2012) also look at the relationship between risk-taking activities and the CEOs' compensation, employing data for firms listed on the Standards and Poor's index from 2002 through 2008. The risk-taking activities include research and development, capital expenditure, leverage, cash holdings and volatility. We only concentrate on variables relevant to this review. They define dependent variables research and development (R&D) scaled by total assets and capital expenditure (CAPEX) divided by total assets, and measure independent variables, CEO's compensation using vega, delta and cash compensation proxies similar to Coles et al. (2006). In the investment equations, they modelled individual activities (R&D and CAPEX) and regressed each dependent variable on vega, delta and cash compensation together with other control variables. The authors report a positive but insignificant relation between vega and R&D expense, whilst delta is negative and significant. Cash incentives and R&D are positively related. On the capital expenditure, vega is negative and significant. They argued that CEOs with vega incentives tend to decrease spending on low-risk capital expenditure; however, delta and cash compensation show a positive insignificant coefficient. The authors made this revelation after applying a fixed effect estimator to the data and controlling other factors including firm size, market-to-book, surplus cash flow, sales growth, leverage and annual stock return.

Shen and Zhang (2013), on the other hand, investigate the extent to which CEOs' risk incentives interact with research and development investment within the dynamic framework of the firm value. They measure CEOs' risk incentives as the sensitivity of the executive compensation portfolio value to stock return volatility (vega) and find that firms with a higher CEOs' vega compensation component have a greater propensity to significantly increase research and development investment. They use two identification strategies, probit model and ordinary least squares (OLS) techniques, and employ four different proxies for research and development expenditure: large _R&D (is a dummy variable equal to one when a firm is experiencing large R&D investment and zero otherwise), R&D expenses is given as the ratio of R&D to total assets, %*Δ*(R&D) is the percentage change in R&D expenses and the %*Δ*(R&D/Assets) shows the percentage change in the ratio of R&D expense to total assets. The authors find the following results after regressing the dependent variable (large_R&D expense) on the option incentives (vega) and other predetermined factors (e.g. firm size, market-to-book ratio, leverage, CEOs' characteristics, cash flow, industry effect and year effects) that have been found to explain R&D investment (see Lang et al., 1996; Coles et al., 2006). They show that the coefficient estimate on CEOs' vega incentive is positive and statistically significant. The result tends to imply that shareholders apply option-based packages to induce managerial risk-taking attitude.

Significantly, similar results were also observed across the two main specification techniques, using the additional three different (R&D) measures.

Shen and Zhang (2013) further extend their empirical analysis by examining the efficiency of research and development investment to show if indeed there is a systematic difference in long-run abnormal returns as a result of large R&D investment across excess vega compensation rewards. Specifically, applying high-vega as the explanatory variable of interest, they conclude that CEOs' higher vega incentive does not support both firm abnormal stock returns and abnormal operating performance following R&D increases; instead, high-vega encourages managers to engage in over-investment distortion in R&D projects.

In sum, the findings seek to suggest that corporate executives' inefficiently over-invest in R&D activity when they have a substantial vega compensation portfolio. A plausible implication is that higher vega incentives create an intangible over-investment incentive, which can ultimately constrain or hurt shareholder value.

O'Connor, Rafferty and Sheikh (2013) also provide further support for the relation between equity compensation and the sensitivity of research and development expenditure to financial market abnormalities. Here, the authors examine two important issues: first, whether executive equity compensation drives R&D spending, and, second, to test the extent to which equity compensation affects the sensitivity of R&D investment to the firm's internal funds. Employing an unbalanced dataset for 1104 US firms for the period 1994–2005 with 7,884 firm-level observations, they define research and development investment activity as the ratio of R&D expenditure to total assets and measure compensation with these proxies: vega (sensitivity of CEOs' equity-based wealth portfolio to stock market return volatility), delta (sensitivity of CEOs' equity-based incentives to the firm's stock market price) and cash compensation (salary plus cash bonus).

Applying a dynamic generalised methods of moment (GMM) estimator to deal with the interrelated problem, their empirical evidence shows that equity incentives and corporate R&D activity are negatively correlated after regressing investment (R&D) on equity compensation and other exogenous factors. This may possibly suggest that, as executives' equity incentives increases, they become more cautious of the overall firm risk, and hence may decide to cut down long-term investment projects (R&D). In other words, rewarding equity-based managers to incur more risk has a minimal effect on the firm's overall R&D expenditure. This, in contrast, undermines the predictive power or intended purpose of equity incentives in resolving agency problems and financial market frictions. In addition, using a similar econometric technique and modelling cash compensation as endogenously determined, they document a significant negative association between cash incentive and R&D expenditure. With this, it can be inferred from the US data that cash compensation tends to reduce the sensitivity of R&D investment to financial market frictions.

Using a sample of US firms from 1996 – 2010, Croci and Petmezas (2015) examine the extent to which managerial stock-based compensation affects: (1) acquisition investment activity, (2) the role of CEOs' overconfidence, and (3) the role of corporate governance.

Croci and Petmezas (2015) postulate that risk-taking incentives (vega) induce CEOs to undertake more acquisition activity. They made this conjecture after analysing total observations of 28,853 firm-year acquisitions composed of 3144 publicly listed firms on NYSE, AMEX and NASDAQ indexes. Specifically, they defined key variables of follows: the dependent variable is the sum of the deal values of acquisition investment made in a given year scaled by sales in the previous year, whilst the independent variables are vega measures compensation incentives as the dollar change in the value of the CEO's wealth portfolio to a percentage change in the stock volatility, delta incentives is the dollar change in the value of the CEO's wealth portfolio to a percentage change in the stock price at the end of the fiscal year, and other control variables including firm size, cash reserve, cash flow, market-to-book, leverage, firm risk, CEO tenure, age, gender, abnormal return, industry and year effects. Applying different estimation techniques (OLS, predicted value approach and three-stage least squares) to the data and controlling for the stated factors, they show that vega is positive and significantly related to the acquisition activity, whilst delta shows a positive sign but lacks statistical significance. The authors suggest that shareholders use risk-motivated (vega) incentives to encourage acquisition investment.

On the role of CEOs' overconfidence, their evidence shows that, offering risk-incentives to overconfident CEOs does not increase acquisition investment. Again, in the presence of good governance factors, vega incentives still induce managers to spend more on acquisition activity.

The control variables including cash compensation, size, cash reserves, cash flows, abnormal return and M&A liquidity are all positive whilst leverage and CEOs' characteristics (gender, age and tenure) show a negative relation with acquisition.

Nguyen (2018), based on an investment risk-related explanation, provides further practical evidence on how chief executive officers' stock-based (i.e. unvested stock options) compensation influences long-term innovative activity. In his empirical analysis, the author applied a sample of 13,279 firm-year observations associated with 1900 listed firms in the US stock market from 1992 to 2006. In particular, the author applies two main measures for the dependent variables. First, he defines innovation variable as the number of patent applications filled scaled by the average number of patents of all firms in the NBER patent database in a given year. The second measure of innovation activity is the number of citations per patent.

Consistent with prior literature (e.g. Jensen and Murphy, 1990; Coles et al.,2006), the author defines CEO's total compensation as the sum of the CEO's annual total pay (salary and bonuses) plus the changes in the value of the CEO's portfolio of stock and stock options. The author measures compensation incentives as the change in the value of the CEO's stock-based portfolio to a percentage change in the firm value divided by the total annual pay. The researcher further measures the individual compensation components; for instance, he computes each compensation component ratio for vested stock options and unvested options scaled by the total annual pay. Again, he obtains ratios of restricted stock and unrestricted stock by dividing each component by total annual pay.

Using a fixed effect technique and regressing the innovation patent variable on the key separate independent variables (options and stock incentives) and long-term incentives and short-term incentives) together with other control variables, the author finds all these CEO compensation components to be positively linked to innovation activity, with only stock options incentives and long-term incentive plans (LTIPs) being highly significant. Specifically, he reports coefficient estimates for the respective compensation components: options (0.0026, t-statistics 2.76) and stock (0.0001, t-statistics 0.65) after accounting for other control variables in his model.

Additionally, Nguyen later separately includes all the compensation components – unvested options, vested options, restricted stock and unrestricted stock – in a single regression model to test its effects on the innovation output variable. He finds the coefficient estimate on unvested options (0.0076, t-stats 2.87) to be positive and statistically significant, whilst vested options, restricted and unrestricted stocks are all positive but insignificant. The author interprets this to suggest that an unvested option induces more risk-taking activity. He also reports similar findings when he applies citations patent as the dependent variable, implying managers' willingness to spend more on innovation (citation patent) when a large component of unvested options forms their compensation incentive. The result remains unchanged after controlling for firm-specific characteristics and other corporate governance variables (e.g. CEO duality, board independence, tenure, etc.) in the multivariate regression model.

The author applies a three-stage least squares (3SLS) strategy to test if the result is robust to the endogeneity problem existing among investment (innovation output) and stock-based compensation incentives. Still, the researcher's evidence further confirms the positive linkage between innovation activity and unvested options incentives, which indicate that the innovation-compensation (unvested options) nexus is robust to the 3SLS identification strategy.

Moreover, other studies have also considered managerial compensation and risk-taking activities from a non-US setting; for instance: Feitu-Ruiz and Renneboog (2017), Sainani (2018), Chen, Chen and Yang (2017) and Datta, Iskandar-Datta and Raman (2001).

Feitu-Ruiz and Renneboog (2017) provide empirical evidence on the link between acquisitions and CEOs' equity-based compensation using companies in the European markets. They measure the dependent variable as the shareholder valuation following acquisitions activity (abnormal returns) and the independent variable as the CEO's equity-based compensation (long-term incentive plans (LTIPs) plus stock options). Applying an ordinary least squares (OLS) method, they find a positive association between equity-based compensation and acquisitions value after they control for other variables. However, the positive relation is eroded when they interact equity incentives with other monitoring proxy (concentrated ownership), postulating substitution effects. The researchers interpret the results as implying that the efficacy of equity incentives to motivate managers to undertake a risky acquisitions project is dependent on the level of concentrated ownership. In addition, Feitu-Ruiz and Renneboog (2017) further explore CEOs' excess equity compensation and acquisition value and find a negative relation between them. They explain this to show that managerial rent extraction from shareholders is noticed by the market and that they are able to ignore the firm's acquisition activity.

Sainani (2018), on the other hand, specifically considers how chief financial officers' characteristics affect mergers and acquisitions (M&As) activity. He characterises the following CFO features – executive director, outside board, age, financial expertise, education, relative pay tenure and CFO index – and segregates these characteristics into strong and weak. He defines the dependent variable using an M&As dummy proxy of one (1) and zero (0) otherwise. Utilising logit regression analysis and regressing acquisition dummy on CFO characteristics, the author reports that a strong CFO influences takeover activity. He made this observation after accounting for other firm-related characteristics such as sales growth, leverage, cash flow, firm size, board size, executive ownership, non-executive ownership, board independence, etc. He further shows that the strong CFOs are able to detect valued acquisitions, thereby creating value for shareholders.

In another vein, Datta, Iskandar-Datta and Raman (2001) provide further evidence on how managerial compensation affects investment decisions. With a sample consisting of 1,719 acquisitions including mergers and tender offers for the period 1993 – 1998, they report a significant and positive relation between high CEO equity-based incentives (stock options) and the corporate merger activities. The authors find their results still robust after controlling for some observable determinants (payment methods, executive ownership, growth opportunities). With this, they postulate that the selection of appropriate risky investment activity by managers is linked to their incentive's rewards (stock options grants) (Smith and Stulz, 1985).

In the Asian Pacific environment, Chen, Chen and Yang (2017) contribute to the literature on the managerial compensation incentives and research and development expense after examining a sample of 4,436 firm-year observations spanning the period 2008 – 2013. Using firms listed on the Taiwan Security Exchange and Tapei Exchange and applying simultaneous equation modelling, their evidence shows that R&D expenditure and equity and cash incentives are positively associated. More specifically, employing a two-stage least squares estimator to the data and regressing the dependent variable (R&D expenditure) on the tested variables (equity and cash incentives) and other determinants of R&D, the authors report a significant increasing relationship between R&D activity and compensation packages. Additionally, the authors further confirm that the investment (R&D) and CEO compensation association is intensified by the managerial liability insurance scheme. Thus, managers with a liability insurance scheme are more likely to encourage CEOs to spend more resources on R&D activities and make the executive compensation incentive efficacious on the firm's long-term investment projects.

On the control factors (e.g. lagged R&D, CEO ownership, leverage, size, market-to-book, free cash flow, CEO tenure, institutional ownership, market share, industry and year effects), the authors show the following relationship. They find that lagged R&D, CEOs' shareholdings, tenure, institutional ownership and market share are positive, whilst leverage, cash flow, firm size, market-to-book and square of CEOs' tenure are all negatively related to R&D investment.

Overall, these findings tend to portray that CEOs are motivated to invest more in risky R&D activities particularly when the agency problem is severe.

Contrary to the studies that consider the investment – compensation relation, other existing literature also argues that shareholders consider the nature of the firm's investment, leverage and future growth opportunities together with other governance factors when determining executives' compensation incentives. In other words, this type of literature looks at the determinants of the managerial optimal compensation contract (e.g. Chen et al., 2016; Humphery-Jenner, 2016; Ozkan, 2012; Duru et al., 2005; Ryan and Wiggins, 2001). For the purposes of time and space constraints, we only provide a review of some of these studies that have considered this issue.

Chen, Lin, Lu and Ma (2016) use executives' cash compensation incentives (salary component) to empirically examine the interaction between salary compensation, research and development and accounting performance, and the extent to which an effective governance mechanism affects pay for accounting performance and corporate innovation expenditure using China's stock market for the period 2007 to 2011.

Specifically, they use the total salary compensation for three main executives' as a proxy for the dependent variable, whilst return on assets (ROA) and return on equity (ROE) are used as proxies for accounting performance (independent variable), and a dummy of one for reported R&D and zero otherwise. They perform regression analysis after controlling other explanatory variables (size, leverage, growth opportunity, risk, capital expenditure, board size, and the percentage of independent directors), and report a positive linkage between R&D expenditure and executives' salary compensation. They argue that corporate owners become more comfortable to offer executives a higher salary to induce them to increase R&D activity particularly in a severe agency environment to reduce agency cost associated with innovative activity.

Another direct inference from the R&D expenditure and salary compensation positive correlation argument is that, because managers receive physical cash incentives instead of equity-based compensation, they (managers) can diversify and reduce their risk exposure to the firms they manage. Consequently, a managerial risk aversion incentive is reduced, causing managers to downplay the complexity associated with long-term investment in research and development activity. Chen et al.'s (2016) further analysis shows that the strong positive association between pay for accounting performance and the corresponding R&D expenditure increase is dependent on low governance practices, postulating a weaker relationship with an improved corporate governance system. In other words, firms use cash incentive benefits to minimise the agency cost of under-investment in R&D expenditure.

Moreover, their reported evidence shows these control variables (e.g. capital expenditure, leverage, firm risk, size and growth) are negatively related to salary compensation except for firm size, which posits a positive connection. However, the capital expenditure coefficient is insignificant, whilst leverage, firm risk, size and growth variables are all economically and statistically significant. The findings (leverage, firm risk) conjecture that managers become wary of increasing the overall risk of their firms when they are cash motivated.

In conclusion, the empirical study by Chen et al. (2016) contributes to the literature by providing evidence to suggest that firms in a severe agency environment consider accounting performance (ROA, ROE) and investment in research & development activity in setting up managerial cash compensation incentives.

Humphery-Jenner et al. (2016) also explore the managerial overconfidence and compensation structure using a US dataset. They define the dependent compensation variables, stock options, equity and cash incentives, as a ratio of total annual compensation value, while overconfidence is measured as the average value per vested option scaled by average strike price. Applying an OLS method to their model, they find a positive relation between managerial overconfidence and stock-based (option, equity) incentives, while a negative sign is reported on cash incentives. The authors interpret this to suggest that shareholders of firms with overconfident managers use more (less) stock-based (cash-based) incentives to exploit their positive bias views of the firm's operational prospects.

Employing 147 completed mergers and acquisitions dataset spanning 1999 – 2005, Ozkan (2012) documents a positive relationship between managerial compensation (measured as cash bonuses, salary, stock options and long-term incentive plans) and acquisition activity (using an investment dummy for cross-border M&As). Her results remain positive and statistically significant after accounting for other control variables such as growth opportunities and firm size. The author interprets the result to suggest that managers are heavily rewarded for undertaking cross-border M&As. In a separate cross-sectional regression analysis, she includes domestic M&As in the compensation model and finds a positive but insignificant effect on executive pay incentives. This tends to imply that executives gain extra benefit for undertaking cross-border acquisition activity.

In short, Ozkan (2012) later concluded that managerial preference for cross-border M&As deals is motivated by the managerial incentive problem because the increase in executive incentives following the cross-border M&As is indifferent to firm performance.

In contrast, Girma and Wright (2006) find a weak correlation between executive compensation and merger activity in the UK context. Examining 472 firms' merger activity spanning 1981 to 1996, their data fail to explore a strong connection among executive incentives and their investment efficiency.

Similarly, Ryan and Wiggins (2001) provide evidence of the effect of firm and managerial characteristics on the structure of executive compensation. They apply an ordinary least squares (OLS) technique to a sample of 1,095 US firms for fiscal year 1997. Their results suggest that other determinants including capital expenditure, R&D expense, leverage, firm size, block ownership, institutional ownership, CEOs' ownership, CEO age, tenure and cash volatility variously influence the managerial compensation structure (cash bonus, stock options and restricted stock). Specifically, the authors document a positive relation between R&D investment and stock options incentives, whilst R&D expense is negatively related to cash bonus and restricted stocks. It shows that shareholders use risk-motivated incentives to encourage risky intangible activity but apply less cash bonus and restricted stock to motivate R&D expense. Capital expenditure is negatively related to cash bonus and restricted stock, whilst stock options and capital expenditure are positively linked.

Bizjak, Brickley and Coles (1993) provide evidence on how managerial compensation affects the neoclassical investment behaviour using Jensen and Murphy's (1990c) data with a few modifications to the dataset. Their analyses were based on the compensation sample of 430 firms in the Forbes executives' survey over the period 1975 – 1989. They use growth opportunities (market-to-book) and relative R&D expenditure as key explanatory proxies for investment behaviour for both regulated and non-regulated firms. They separate compensation into salary and bonuses (dependent variables) and perform an ordinary least squares regression analysis. Their reported results show that both independent variables – growth opportunities and R&D expenditure – are inversely related to managerial salary and/or bonus incentives. The results tend to suggest that firms with huge growth opportunities (measured market-to-book) and R&D expense offer lower cash-based incentives to managers. Again, they find similar results when they perform a separate regression using total incentives as a dependent variable. Specifically, the coefficients for the independent variables (market-to-book and research and development) are negative and marginally significant, after controlling other determinants. In all cases, the supplied findings across regulated and non-regulated firms show similar results. The authors' evidence suggests that high-growth firms provide relatively lower incentives packages (salary/bonus) to their managers, compared to low-growth firms, which is inconsistent with the conventional compensation model (Clinch, 1991; Gaver and Gaver, 1993). An alternative explanation could be that, because R&D activities are less supported by the debt markets, managers tend to use internal resources to finance such activities, leading to lower managerial cash compensation for high-growth firms.

In brief, the reviewed evidence shows that shareholders consider other firm characteristics when designing managerial compensation schemes.

Collectively, the observed review conducted in this subsection provides substantial evidence to suggest that managers' risk-taking activities (e.g. capital expenditure, R&D, other fixed expenditure, fixed intangible) are influenced by the level and composition of their compensation incentives (i.e. salary, cash bonuses, long-term incentive plans, stock options). In contrast, we also observe other factors that determine managerial compensation.

Essentially, these two independent strands of literature suggest the existence of endogeneity and causation problems in the study's empirical design, particularly in the attempt to establish a direct causal impact of management compensation on risk-taking investment. Simultaneity bias is a major problem in research that ignores the simultaneous determination of the two corporate variables. This study adds to the existing literature that examines the impact of managerial compensation components on risk-taking activities by suggesting and addressing the presence of reverse causality bias. Accordingly, the literature review conducted on investment and compensation will be utilised to develop the study's main hypotheses in Chapter 4.

2.5a Overall conclusions

This part of Chapter 2 has utilised the existing literature to establish the causal relation between managerial compensation and investment activities. The following sections were explored: the central tenets of investment activities – agency-related issues and managerial overconfidence/hubris. Again, due to the imperfections in corporate governance system and risk-related incentive problem, it theorised the extent to which managerial compensation affects the firm's investment activities. Thus, under optimal contracting theory (OPT), shareholders use different pay components to encourage (discourage) the nature of risk-taking investment activities, which, in turn, increases the value of the firm. However, in cases where professional managers determine their "own pay" (Bebchuk and Fried, 2003, 2004), the efficiency of managerial investment could be undermined, which can ultimately prove costly for shareholders. The chapter also discusses two related strands of literature that consider the investment – compensation nexus. For instance, one strand of study argues that, through a risk-related motive, executive compensation and investment are potentially related (e.g. Coles et al., 2006; Kini and Williams, 2012; Croci and Petmezas, 2015). The other strand discusses the literature that concentrates on the reverse question, i.e. the determinants of managerial compensation. Essentially, the two interdependent literature strands raise concerns about the possible endogeneity problem, particularly in an attempt to establish a direct causal effect of compensation on investment. One major contribution of the present study is the adopted research modelling and robust econometric technique (3SLS) to estimate the direct causal relationship among the corporate variables using data from UK publicly listed companies.

A later chapter (4) develops the central hypotheses and states the empirical specification and the analytical strategy to be used to test the study hypotheses.

2.2B: Financial Leverage (Part B)

2.2b A literature review: Financial leverage

2.2.1b Introduction

As shown by the previous part (i.e. investment literature), managerial compensation incentives influence optimal investment decisions under the agency framework. It is also argued in the literature that managerial compensation induces managers to sponsor corporate projects with debt finance (e.g. Agrawal and Mandelker, 1987). For instance, in the wave of the leveraged buyout (LBO) of the 1980s, firms (financiers) applied high performance-sensitivity compensation packages to encourage managers to use high levels of debt (Berkovitch, Israel and Spiegel, 2000), postulating a linkage between managerial compensation and the leverage level.

In a related vein, the Greenbury Report (1995) recommends that shareholders should substitute stock options with long-term incentive plans (LTIPs) and cash bonuses to minimise excessive risk-taking (i.e. via more borrowing). It seems to show that, through compensation design, risk averse managers are likely to increase the firm's idiosyncratic risks by using a greater debt source of financing to sponsor value-enhancing corporate activities. Therefore, with different sources of financing (e.g. internal sources, debt, equity, etc.) available to firm managers, we specifically investigate if the managerial compensation scheme is important in the setting of the firm's capital structure (observed leverage ratio) level, and more importantly, to find out if the relationship between the leverage – executive compensation nexus is predicated on risk-related motives. In other words, do shareholders apply compensation packages to affect the firm's observed leverage level? This is because the two corporate variables (i.e. financial leverage and managers' compensation scheme) interact through the agency framework to achieve the probability distribution of the firm's cash flow and stock returns (Berkovitch, Israel and Spiegel, 2000).

More specifically, the empirical analysis in this part seeks to extend the existing literature on the link between financial leverage and managerial compensation incentives by directly investigating the following issues:

1. Is there a link between financial leverage and managerial compensation pay packages? This part contributes to the relatively new growing literature that considers the effect of managerial compensation on the firm's observed leverage level.

2. The role of the firm's growth opportunities in the executive compensation – leverage linkage. It suggests that the effect of compensation on leverage is either accentuated or moderated by the firm's growth potential, and, lastly

3. The extent to which corporate governance practices impact the compensation and financial leverage policy relationship. Through substitution effects, well-governed firms are more likely to monitor managers' activities, thereby limiting the level of managerial compensation, which in turn can affect managerial financing decisions.

This part makes important contributions to the existing literature by simultaneously linking financial leverage and managerial compensation incentives. With this approach, we are able to deal with the associated reverse causality concern and other possible endogeneity. In fact, no direct study has considered the matter from the UK perspective, and extending this to the FTSE 350 companies is important to enhance our knowledge of managerial compensation incentives and financial leverage policy based on a risk-related argument.

Moreover, this part also suggests that the presence of good corporate governance practice is likely to impact managerial compensation and capital structure linkage. In the same breath, it also considers the extent to which firms' growth opportunities influence compensation –

leverage association. Further, utilising the compensation packages of the three top executives (CEOs, CFOs and COO (chief operating officer)) further aids our understanding of the discussed issues. For example, Chava and Purnanandam (2010) argue that the chief financial officer (CFO) plays a more important role in determining the firm's capital structure (leverage ratio) than the chief executive officer (CEO). With this, the current study can be seen to provide an in-depth analysis of the compensation – leverage relationship by incorporating CFOs' incentives into our framework.

The remaining part is organised as follows: section 2.2b looks at the central theory of capital structure, subsection 2.3b considers the key empirical studies on the relation between capital structure and compensation structure, and finally section 2.4b concludes. A later chapter (5) formulates capital structure and executives' compensation hypotheses and provides empirical analyses of the relationship.

2.3b The central theory of capital structure

The literature on capital structure is large and significant, following the seminal work of Modigliani and Miller's (1958) "capital structure irrelevance theory", which started the discussion on the subject matter. An extensive stream of research (both theoretical and empirical) has variously tested and challenged the 'irrelevance' theory and made a unanimous conclusion that capital structure plays a significant role in determining firm value under real-world conditions (Jensen and Meckling, 1976; Myers, 1977; Stulz, 1990; Rajan and Zingales, 1995). For instance, by incorporating real investment frictions and traditional financial imperfections such as transaction costs, taxation, bankruptcy costs, agency problem and asymmetry information, etc., capital structure may affect a firm's value (Myers, 1977; Myers and Majluf, 1984; Graham, 2000; Tsyplakov, 2008). Following these stylised facts, others (e.g.

Coles et al. 2006; Berkovitch, Israel and Spiegel, 2000) argue that managers should be given appropriate compensation incentives to influence them to make value-critical financial decisions. This part of the thesis seeks to further such thinking by examining the effect of managerial compensation incentives on firm financial leverage.

Meanwhile, in the next subsection, we briefly discuss the two dominant views under capital structure: trade-off theory and the asymmetry information theory.

2.3.1b The trade-off theory

The theory "trade-off model" posits that corporate managers through optimal design of the capital structure are more likely to generate extra value for their firms. Thus, the model suggests that firm value is created when the benefits of debt usage are just enough to offset the costs of debt (Fama and French, 2005; Graham, 2000). The underlying economic intuition is that corporate firms may forfeit debt-related benefits if their leverage ratio is below the expected level. Likewise, firms may face huge costs if their actual borrowing exceeds the optimal debt level. Within this context, Frank and Goyal (2007) postulate that the optimal financing decisions depend on rational evaluation of the various benefits and costs of alternative leverage arrangements. Therefore, because of the implication associated with leverage deviation, a wealth-increasing manager may try to achieve the optimal leverage target in an attempt to create value for shareholders.

The trade-off literature highlights the following important reasons that are associated with costs and benefits of debt financing: bankruptcy costs, agency problem and tax benefits. Specifically, we provide a brief discussion on these themes that runs through the setting of optimal capital structure. We first start with the literature that highlights debt capital benefits.

a) Tax benefits

Following the pioneering work of Modigliani and Miller (1958), one dominant view that has emerged is that the different tax codes among countries provide extra benefits for firms with a debt component in their capital structure (van Binsbergen, Graham and Yang, 2010; Graham, 2000; Graham, 1996a). The trade-off literature argues that, by expensing interest payment in the income and expenditure statement, firms with debt capital tend to benefit through a tax-savings mechanism, whereas no such potential benefit exists for dividend payment on equity capital (Jensen and Meckling, 1976; Modigliani and Miller, 1963). In essence, the debt-financing instrument becomes an important wealth-maximising and a preferable financing option over equity finance, ceteris paribus.

Consistent with tax savings generated by debt financing, van Binsbergen, Graham and Yang (2010) provide empirical support to show that, through the tax shield mechanism, an estimated 10.4% of the book value of total assets for 126,611 firm-year observations was attributed to debt policy benefits. In a related vein, Graham (2000) provides similar findings. The author notes that on average about 9.7% of asset value for his sampled firm observations of 87,643 spanning 1973 to 1994, were estimated tax benefits. Within this context, it worth stating that, all other things being equal, the benefit of corporate taxation significantly reduces the cost of debt capital, but the caveat is that such incremental tax reward is wiped out, especially in cases where borrowings exceed the expected marginal threshold.

b) Bankruptcy costs

Notwithstanding the benefits accrued from debt capital, other literature posits that management becomes more disciplined because of the threat of bankruptcy (Grossman and Hart, 1982; Borio, 1990; Andrade and Kaplan, 1998). Graham (2000) suggests that corporate firms often adjust their debt portfolio below the optimal level in order to minimise bankruptcy risks. In his empirical investigation, he found about 44% of the total sample used debt significantly below the optimal target (underleveraged). The author further argues that among these extremely underleveraged firms are those large, liquid and profitable ones.

Similarly, Molina (2005) attributes less debt usage by firms to predominantly financial distress motives. Molina stresses that the increased in debt issuance are closely linked with debt rating downgrades and higher default probabilities. Relatedly, Andrade and Kaplan (1998) note that bankruptcy and financial distress threats are very costly for firms and that increasing leverage above the expected level could make firms more vulnerable or susceptible to facing high future costs of capital, and possible bankruptcy.

c) Agency problem

Through agency theory, capital structure plays an important role among these three players: shareholders, bondholders and the agents (Jensen and Meckling, 1976; Myers, 1977; Jensen, 1986). For instance, Jensen (1986) and Stulz (1990) formalised the discussion on the free cash flow problem by suggesting that, through debt contraction, managers and shareholders' interests are aligned. Specifically, the literature argues that through debt managers become disciplined and may tend to use the firm's surplus cash flow efficiently. Thus, since debt capital commits firms to making regular annual interest payments as well as constant periodic monitoring by creditors, bondholders and other rating agencies, managers become conscious of and may take decisions that seek to enhance shareholder wealth, rather than concentrating on those decisions that advance their parochial interests (Bhawaradji and Shivdasani, 2003; Stulz, 1990; Grossman and Hart, 1982).

In contrast to the agency benefit of free cash flow resulting from debt acquisition, others highlight the risk-shifting or asset substitution problem (Jensen and Meckling, 1976; Myers, 1977; Stulz, 1990; John and John, 1993). The theory posits that bondholders may demand a high rate of borrowing as a firm keeps a high debt level on its books (Leland, 1998), which can consequently affect the firm's future debt level.

In another development, Berger, Ofek, and Yermack (1997) also offer an entrenchment effect explanation. They argue that managers may prefer to keep a conservative debt level in their books to avoid external control and constant supervision by both bond market and other lenders. Such self-serving behaviour can affect the firm's debt level, which, in turn, can affect firm value. Related to the entrenchment motives, Jung, Lang and Stulz (1996) concede that corporate managers through their discretional power may intentionally issue equity instead of, say, "debt" finance to sponsor investment activity. The authors highlight the disciplinary role of debt finance as the key underlying motive of managers' intention to use debt more carefully or conservatively.

2.3.2b Information asymmetry-based model

The informational asymmetry model offers a different explanation for capital structure. The theory rests on the simple assumption that, when management are taking financing decisions, they often consider their private information about the "true" value of their firms (Myers and Majluf, 1984; Baker and Wurgler, 2002). Unlike the trade-off model, existing studies argue that, because the privileged managers hold some vital information about their managed corporations, they may tend to use this discretionary information at the detriment of disadvantaged owners, when selecting available financing options (Baker and Wurgler, 2002).

Mainly, the two strands of literature on asymmetric information models for capital structure are organised under these themes: a) pecking order theory and b) market timing hypothesis. We now provide a brief discussion on these theories.

a) The pecking order theory

This line of reasoning suggests that raising external finance (e.g. debt or equity) from the capital market is relatively expensive because the investors feel that corporate managers do know the true prospects of the firm, compared to the shareholders (Myers and Majluf, 1984; Myers, 1984). The theory argues that managers may prefer financing options in these sequential orders: internal cash flow, debt and equity finance. It suggests that stock issues become a second-order importance to debt financing because of the adverse selection problem associated with equity finance. Other studies have also shown empirical supports for the pecking order hypothesis. For example, Shyam-Sunder and Myers (1999) report that firms directly use leverage when an internal financing deficit exists. Thus, firms apply leverage after they have fully exhausted all internal earnings to sponsor investment projects.

b) The market timing theory

The theory posits that firm managers may issue equity when the cost of equity is lower relative to alternative sources of financing (Graham and Harvey, 2001; Baker and Wurgler, 2002; Huang and Ritter, 2005). It suggests that a firm's managers opportunistically exploit temporary abnormal fluctuations in the share price and sponsor their activities with equity capital (Baker and Wurgler, 2002; Huang and Ritter, 2005). An opportunistic manager may prefer to issue equity instead of debt when the market value is relatively high (i.e. when firm stock is mis-priced by the markets). Similarly, others including Loughran and Ritter (1997), Rajan and

Servaes (1997) and Teoh, Welch, and Wong (1998) connote that managers use equity finance particularly in cases where investors (shareholders) are enthusiastic about the firm's earnings.

In general, capital structure theories offer possible different explanations for why corporations may prefer one external capital (debt) to other (equity). Mainly, trade-off theory suggests tax benefits and the possibility of mitigating the agency cost of cash flow as the primary motivating factor for firms' usage of debt capital. However, managers also feel cautious about adverse effects of debt, including bankruptcy costs and debt overhang problem, leading to possible asset substitution or risk-shifting problem. Despite these numerated concerns, the trade-off theory and pecking order models suggest debt capital should be chosen over equity if the accrued benefits to debt capital exceed the costs, albeit for different reasoning.

Again, market timing theory also suggests that equity financing would be more preferred by managers, particularly when the firm's stock price is overvalued by the capital markets. Although the market timing model is unrelated to the study's main hypotheses, of primary importance is that it is possible that managers' exploitation of a stock market's mis-valuation could affect firm leverage behaviour.

Overall, these theories provide reasons to suggest the extent to which firm leverage behaviour is affected. The present study offers a different view by arguing that the efficiency of a firm's financial leverage policy to enhance its value is dependent on how managers are compensated. In other words, through an optimal compensation scheme, managers are able to make quality financing decisions, which could ultimately affect shareholders' value. In this way, we contribute to the new strand of literature that looks at the effect of managerial compensation on firm leverage level.

The next section highlights the extent to which financial leverage and managerial compensation are related before we move on to review the extant literature on the subject.

2.4b Financial leverage policy and managerial compensation theory

This section seeks to establish a link between the predictions of managerial compensation and the firm's capital structure by summarising the key theoretical arguments and reviewing some empirical studies on the subject in the later subsection.

2.4.1b The major arguments

The literature on capital structure suggests that, through agency motivated reasons, capital structure and managerial incentives may be directly related (Jensen and Meckling, 1976; Berkovitch et al., 2000; Coles et al. 2006; Kini and Williams, 2012). For instance, Jensen and Meckling (1976) argue that a risk-averse manager may choose to apply debt more conservatively (Kim and Knofsinger, 2007) to prevent financial distress and possible bankruptcy charges. That is, a manager's reluctance to borrow more to sponsor corporate activities can cause the firm to lose out on profitable activity, which may consequently affect the firm value. Attempting to minimise managerial risk aversion, shareholders design the compensation contract to induce managers to undertake appropriate risky activities including increasing leverage level (Kini and Williams, 2012). Thus, through an efficient compensation scheme, managers are able to make efficient decisions regarding leverage level (Berkovitch et al., 2000).

In fact, shareholders use different compensation components to influence managerial value-critical decisions. These are, stock-based (risk-taking incentive) and cash-based/restricted stocks (risk-avoiding incentive) (Coles et al., 2006; Chava and Purnanandam, 2010; Cassell et al., 2012; Hayes et al., 2012). The risk-taking incentive motivates managers to increase leverage level (Coles et al., 2006). Contrarily, a risk-avoiding incentive is employed by shareholders in a highly levered firm to minimise possible agency costs of debt finance (John and John, 1993; Duru et al. 2005). This means that, through the compensation scheme, shareholders can induce managers to increase (reduce) managerial excessive risk-taking activities.

A clear implication of the executive financial compensation incentives on capital structure is that the efficient design of managerial compensation helps optimise the benefits associated with optimal debt financing. *In fact, the key argument underlying this scholarly work is to explore how executives' financial incentives packages affect the firm's debt level.* We review the relevant related literature in the next subsection.

2.4.2b Literature review on leverage and compensation incentives.

The main intention of this section is to draw on a comprehensive review of empirical studies that concentrate on how debt financial policies and compensation structure policies are related. An implication of this will help us formulate the study's central hypotheses to show the extent to which compensation contracts influence managerial risk-taking such as corporate leverage policy. Moreover, we also consider other literature that looks at the opposite question: how financial leverage influences optimal managerial compensation.

Specifically, we structure the literature as follows: first, review literature on the impact of compensation incentives on leverage; second, literature that considers the reverse issue; and finally draw a conclusion.

Freund, Latif and Phan (2017) provide evidence on how chief executive officers' inside debt compensation incentives affects the firm's choice of accessing external debt (equity) finance. They base their analysis on a sample of 5,955 firm-year observations of 1,371 unique firms from the Standard and Poor's database during the period 2007 – 2012. They construct two measures for CEOs' inside debt holdings: first, relative CEOs' leverage defined as the ratio of a CEO's debt compensation to equity scaled by the firm's debt to equity ratio, and, second, relative CEOs' incentives measured as the marginal change in the CEO's inside debt compensation over the marginal change in their inside equity, divided by the marginal change in the firm debt over the marginal change in the firm equity, given an overall unit change in the firm value. Freund et al. measure the firm's net debt issue (i.e. long-term debt issuance minus long-term debt reduction scaled by the assets' book value) and financing choice (as the sum of cash dividends, net investment, and change in working capital minus surplus cash flow, all normalised by the book value of assets at the start of the firm year). The authors use dummy variables to represent the dependent variable, i.e. corporate financing choices available. Specifically, they apply financing choices dummies: 1 for equity only, 2 for equity and debt and 3 for debt only.

Using a multinomial logit regression analysis, and regressing financing choice on the test variable - CEO inside debt compensation together with other standard control variables used in the capital structure model (size, growth opportunities, profitability, tangibility, leverage, fixed effects etc.), they find some interesting evidence. Given the relevance of this review, we concentrate more on the debt issue financing option. They document a positive and statistically significant link between CEO's inside debt compensation and firm's financing choice. Specifically, the relative CEO leverage shows a positive coefficient of 0.815 on debt finance choice, implying that, the higher the relative CEO's debt compensation, the greater the likelihood of the firm issuing a debt source of financing, all else equal. Again, the authors report a similar result (coefficient 0.788) when the relative CEO's incentives test variable is used. Further, the magnitude of effects was relatively much larger when they applied predictive values of relative CEO's leverage (inside debt) compensation and relative CEO's incentives (i.e. showing coefficients of 5.378 and 7.172 respectively) on debt financing choice.

Moreover, the authors later applied real data on the firm's net debt issue to provide further analysis on whether firms with greater CEO's inside debt incentives show increased preference for the debt financing option. Consistent with their earlier results, their empirical evidence suggests an increasing impact between the firm's net debt issues and relative CEO's leverage compensation. Reportedly, the relative CEO's leverage coefficients estimate ranges from 0.019 to 0.106 after controlling for other firm characteristics such as firm size, growth, profitability, tangibility, lagged book leverage, year and industry effects. Again, they find similar qualitative results when they apply net debt and equity issues on CEO's inside debt holdings.

The overall findings postulate that CEOs' inside holdings do not influence them to adopt a risk-decreasing attitude to firm risk (debt ratio), which is a worrying case for debtholders in a more levered firm. This is because debtholders tend to suffer more in bankruptcy instances as shareholders can easily walk away due to the limited liability principle. Suffice to say that Freund et al.'s (2017) data provide evidence to suggest an accentuating effect on the agency cost of debt financing.

Kabir, Li and Veld-Merkoulova (2013), using a sample of UK firms listed on the Financial Times Stock Exchange All Share Index for the period 2003 – 2006, provide further supporting evidence to suggest the link between CEO compensation incentives and the firm's cost of debt finance. Specifically, they define their dependent variable (i.e. cost of debt) as the yield spread of corporate bond, estimated as the difference between the firm's bond and a UK government bond of comparable maturity, and construct the parameter of interests (e.g. salary, cash bonus, stock options, pension, restricted stock and stock) as a proportion of total CEO's compensation incentives. Applying an ordinary least squares (OLS) estimator to the measure of yield spread, CEO's pay incentives and other control variables (e.g. firm size, debt ratio, profitability, market-to-book, firm risk, year and industry fixed effects), the authors reveal some interesting results. With relatively small firm-year observations (150), they report that the CEO's debt-like incentives (defined as pensions and deferred rewards) are negatively related to the firm's cost of debt. Specifically, the coefficients for debt-holding incentives range from -1.52 to -1.90 using different estimates, and they are all statistically significant at 1% confidence level. They argue that the CEOs' long-term deferred incentives in the form of pensions induce them to be cautious and adopt a more conservative risk-management style, which, in turn, naturally aligns the CEO's interest with that of other debt holders. This, according to the researchers, shows that bondholders take into consideration the CEO's debt-like pay elements before requiring a lower risk premium. On the cash bonus-yield spread relationship, they show a negative link across all the different estimators (pooled regression and multivariate analyses). With the coefficient estimates ranging from -1.48 to -1.63, the authors stress that cash incentives influence managers to concentrate on relatively short-term projects, instead of risky ones, which debtholders often consider when lending to corporations. In other words, bondholders pay attention to the CEO's cash bonus to see the firm's ability to honour the debt covenants (e.g. constantly meeting annual debt interest payments and the later deposits).

The authors also document that stock options and stock grants are positively related to the bond yield spread. They highlight that the debt markets strongly respond to the CEO's stock options incentives, which suggests that shareholders use options and stock incentives to align shareholder-agent interests, thereby jeopardising bondholders' welfare (benefit). Moreover, when the authors split stock options (performance-vested options and traditional options) and run a separate regression, their evidence indicates that the CEOs with performance-based options pay a relatively high cost of borrowing compared to executives with traditional options.

Shen and Zhang (2015) empirically analyse the sensitivity of CEOs' inside-debt incentives on the costs of equity capital using datasets from the Standard and Poor's Compustat database spanning 2006–2013. They document that CEOs' debt-like incentives have a significant negative effect on the cost of equity. They carefully argue that the CEOs' debt-equity ratio may incentivise minimal aggressive managerial behaviours, which, in effect, can lead to lower demand from the shareholders as firms languish in such an uncompetitive position. In addition, they note that, as CEOs' inside-debt increases, the negative relation is constrained. With this, the authors suggest that the shareholders become wary of the endangered shareholder-bondholder conflicts and may tend to use lower pay performance sensitivity. Again, the inverse relationship is much stronger, particularly with companies that fall on the edge of possible bankruptcy.

Hayes et al. (2012) also investigate the role of managerial stock compensation on risk-taking investment and financing policies: capital expenditure, research and development, leverage, cash holdings and stock volatility. Measuring independent variables similar to Coles et al. (2006) and applying fixed effect cross-sectional regressions, they find that both vega and delta incentives are negative and significantly related to the changes in debt ratio. For example, they report coefficients for both vega (-0.000034) and delta (-0.00000425) after controlling for the following factors: firm size, return on assets, research and development, property, plant and equipment) in the leverage model. This result indicates that vega and delta compensation incentives encourage a managerial risk-reduction attitude rather than risk-increasing incentive, which is a concern to shareholders using stock options to induce managers to undertake more risky decisions. Again, the authors also find that delta and vega incentives are negatively related to the cash holding, which confirms the risk-motivated incentive of stock-based compensation.

Using a sample of US firms from 1993 to 2005, Chava and Purnanandam (2010) examine how managerial (i.e. CEOs and CFOs) compensation incentives affect: (1) book leverage, (2) cash holding, (3) debt maturity and (4) accruals. Here, the review will place more emphasis on those aspects of their study that are of direct relevance to the subject matter. They construct the main key dependent variables as follows: book leverage is measured as the ratio of total debt to the book value of total assets, cash holding as the ratio of cash and short-term investment to the book value of total assets, whilst debt maturity is measured as the ratio of debt with maturity greater than three years to the total debt of the firm. The key independent variables are delta (measured as a percentage change in the stock price of the executive stock portfolio) and vega (measured as 0.01 change in the stock return volatility of the executive stock portfolio).

In general, Chava and Purnanandam (2010) postulate that managerial compensation incentives influence a firm's financial policies. In particular, in the book leverage model, the authors find the coefficient (-0.0063, t-stats -2.52) on delta incentives to be negative and statistically significant. They interpret this to suggest that CEOs with risk-decreasing compensation are more likely to decrease leverage level and increase cash balances. However, vega incentives show a positive coefficient of 0.0059 (t-stats 1.99), implying that vega increases managerial incentives to increase debt ratio. Further, they also show a negative relation between vega and cash balance, which confirms the risk-taking incentive when a large component is vega incentives. The researchers find similar results for the CFOs' incentives: delta is negative (-0.0020, t-stats, -0.70) and vega shows a positive coefficient (0.0009); however, the coefficients are insignificant in statistical terms.

Chava and Purnanandam (2010) find the CFO's incentives to be statistically significant in the firm's debt maturity and accrual models. Thus, delta and debt maturity are positively related, whilst vega shows a positive link with debt maturity. They argue that CFOs' financial expertise enables earnings smoothing and that they manage debt maturity more cautiously than the CEOs.

In a relatively different setting, Florackis and Ozkan, (2009) use UK data to examine how executive ownership (incentives) and corporate governance help explain leverage behaviour. Extracting data on all industries excluding financial and utilities companies for the period 1999–2004, their data reveals some interesting results. The researchers measure the dependent variable as book leverage as the ratio of book value of total debt to the book value of total assets, whilst executive incentives are measured as the percentage of executive ownership. First, the univariate regression shows a negative relationship between executive wealth (ownership) and leverage. However, because of the statistical estimation problems associated with the univariate test, they run a separate regression using three different estimators: pooled OLS estimator, fixed effect estimator and OLS lagged method. Regressing book leverage on executive ownership and corporate governance interactive term and other control variables, Florackis and Ozkan find non-monotonic relation between leverage and executive wealth.

Specifically, their evidence suggests that, when CEO ownership is low, an increase in CEO ownership causes firm leverage (debt) to rise. However, when CEO ownership is high, leverage turn out to be low. They interpret this to suggest that CEOs become wary of debt levels when their residual interest is high. Again, on the role of corporate governance, the authors find that governance factors play a significant role in the executive incentives and leverage linkage.

They also document a positive and significant relation between leverage (debt) and other control variables (assets tangibility, firm size and profitability), except for market-to-book value, which shows a negative interaction.

With these findings, the authors argue that the effectiveness of corporate governance practices may define the non-monotonic relationship between CEOs' wealth and leverage.

Moreover, Coles, Daniel and Naveen (2006) empirically investigate the link between managerial incentives and risk-taking applying Standard and Poor's and Compustat Industrial segment datasets spanning the period 1992 to 2002.

Specifically, they examine the extent to which managerial incentives affect: (1) capital expenditure, (2) research and development, (3) leverage and (4) firm risk. The review conducted here places more emphasis on leverage level measures which have direct relevance to this analysis.

The authors measure the key explanatory variables for executive compensation incentives as follows: delta (i.e. defined as the change in the dollar value of total executive wealth for a percentage change in stock price), vega (defined as sensitivity of executive wealth to a change in stock return volatility) and cash compensation (salary plus bonus), and define the dependent variable (book leverage) as the book leverage scaled by total assets.

Using three different explanatory variables, lagged values, residual and predicted values for both vega and delta to control the endogeneity problem, they find a positive and significant relation between vega and leverage across all specifications after controlling for these additional proxies (e.g. size, tenure, market-to-book, ROA, Z-score, net fixed assets, research and development, year and industry effects). The result suggests managers' preference to increase firm risk (leverage) when their vega incentives component increases. The delta component and book leverage were negatively linked with the coefficient estimate ranges (-0.008 to -0.087). Also, cash compensation is negative and significant, postulating a decrease in financial leverage following an increase in executive cash incentives.

Coles et al. (2006) further utilise a three-stage least squares (3SLS) estimator to deal with the issue of reverse causality inherent in the compensation and leverage association. The results for vega and delta incentives continue to hold, although the coefficient estimates seem much larger in magnitude. Specifically, the estimated coefficient for vega (1.32) is positive and both economically and statistically significant at 1% confidence level. The delta, in contrast, is negative and significant, which implies that higher delta influences managers to implement lower leverage. Again, cash compensation and book leverage still show a negative correlation.

In short, Coles et al.'s (2006) evidence suggests that executive compensation structure provides enough explanation for our understanding on the firms observed financial leverage behaviour.

Similarly, in support of the risk-motivated argument, Kini and Williams (2012), using a US data sample, find that an option-based incentive induces a managerial risk-taking incentive. The authors made this conjecture when their empirical examination revealed a positive relation between option-like (defined as vega) incentive and firm leverage.

Lewellen (2006) explores how managerial incentives explain firms' observed corporate leveraging using a sample of 1,568 large US publicly traded companies during the period 1993 – 2001. From the data, he computes managerial incentives as a certainty equivalent (CE) of the CEO's wealth, and any variation in firm debt is associated with a corresponding change in the CEO's wealth. Employing this estimate (CEO wealth incentives or CE), Lewellen provides evidence (both time-series and cross-section analyses) to suggest that managerial incentives (CE) have an important impact on firm financing policies. In particular, regressing debt changes on lagged changes in managerial incentives (CE) and other determinants of debt, his results show a negative relationship between incentives and firm debt. The author draws a simple interpretation from the results. He argues that managers' incentives to seek more risk declines particularly if their stock options are in the money and that can substantially decrease executive preference for risks.

Furthermore, the author finds that a change in CEO compensation (CE) has an incremental impact on debt-equity choice. Applying a probit model to 3,376 firm-year observations, the coefficient on incentives' compensation (CE) for all specifications is positive and statistically and economically significant (1% level) with reported t-statistic ranging from 4.7 to 10.7. Again, his results show similar significance (t -3.7 to -7.1) when he accounts for cross-correlation problems by estimating a separate probit regression. The author connotes that increasing managerial incentives by one standard deviation decreases the probability of debt issue by 4.3-6.2% percentage points, depending on specification used. He also finds the probability of debt issue to be positively related to other control variables: stock options and return on assets.

Using multiple data sources from the US market, Cohen, Hall and Viceira (2000) examine how managerial stock options incentives impact a manager's risk-appetite. Applying modelling and econometric methods to a sample of 478 randomly selected firms tracking from 1980 through 1994, they report that the sensitivity of stock options incentives to firm risks (debt ratio) is positive and significant. Specifically, after controlling fixed and firm-specific characteristics, the coefficient of CEO wealth elasticity (i.e. defined as stock return change) on the log of leverage is 0.163 (t-statistic 3.32). In addition, estimating the magnitude of such change, they apply a standard increase starting from zero (0) to 0.36 (0 – 0.36) and find that stock option grant on average would produce a change in log leverage of (0.06), which is a significant, given the median sample on log leverage as -0.30. Further, their evidence shows that firm leverage and cash bonuses are positively related.

Also, consistent with Cohen, Hall and Viceira's (2000), leverage – CEO wealth positive connection, Mehran (1992) finds similar results when he investigates the relation between capital structure and managerial incentive plans using US market data.

Contrarily to the studies that concentrate on the effect of compensation on leverage, others suggest that shareholders consider the firm's leverage level when setting managerial compensation. In other words, this strand of research looks at the role of leverage in the optimal design of executives' compensation (e.g. Kim, Patro and Pereira, 2016; Brockman, Martin and Unlu, 2010; Ortiz-Molina, 2007; Duru et al. 2005).

Kim, Patro and Pereira (2016) make an important contribution to the managerial compensation incentives and risk-taking linkage literature. Specifically, they investigate how firm leverage levels influence the link between option-based incentives and managerial risk-taking by employing US datasets for the period 1995 – 2011. They define the dependent variable (risk-taking) as the standard deviation of monthly stock return (i.e. stock return volatility) and measure the key explanatory variable, option-based incentives, using three different estimates: options incentives (as measured as current option grants normalised by total annual compensation), options delta ratio (measured as the sensitivity of the manager's current option grants to 1% change in firm stock price scaled by total compensation), and option vega ratio (sensitivity of option value to changes in firm's return volatility), all normalised by total compensation incentives, whilst book leverage is the ratio of total leverage scaled by total assets).

To empirically test this hypothesis, thus, leverage effect on options incentives and risk-taking relation, they first apply univariate regression tests and observe that firm leverage status influences a positive relationship between option incentives and risk-taking. More specifically, they find that, in the highest leverage quintile, the correlations among options incentives and risk-taking (5.70% – 13.30%) are all negative and significant at 1% level, across the three measures. At the lowest leverage quintile, however, a positive and significant correlation is observed among options and risk, and the change in correlation from lowest to highest leverage quintile still remains significant at 1% confidence level. Accordingly, Kim et al. argue that the univariate tests explain the attenuation role of leverage pertaining to the existing linkage between options incentives and managerial risk-taking.

Further, using the multivariate regression analysis, Kim et al. provide strong support for the moderating effect of leverage. They find the coefficient for the interaction term (option incentives multiplied by leverage) is negative and statistically significant at 1% level across all the three different incentives measures after controlling for other exogenous factors including growth opportunities, firm size, capital expenditure, research and development, plant property and equipment, etc. With this result, the authors suggest that a 1% increase in firm leverage reduces the positive impact of option-based incentives on risk-taking. Again, the authors observe similar qualitative results when they apply a two-stage least squares (2SLS) specification.

Similarly, Kim, Li and Zhang (2011) also provide evidence on the extent to which managerial equity compensation induces stock market crash (risk). Using a large US sample spanning 1993–2009, they reveal these findings. Specifically, the researchers apply a logit multivariate regression model and find that the CFO's option incentive is positively related to the firm's stock crash, whilst the CEO's option incentive is negative and insignificant.

Further, the authors run a separate regression, by taking account of the role of firm leverage. They report that, for those firms with high leverage status, CEO's option incentive (coefficient -0.649 t-stats -1.68) is negative, whilst CFO's option (1.578 t-stats 2.53) is positive and are both statistically significant. With this tentative evidence, the authors argue that a CFO's options incentive to induce stock crash is more significant for those with a high level of debt ratio on the books.

Brockman, Martin and Unlu (2010) investigate the role of short-term debt within the framework of executive compensation incentives for US publicly traded companies over the period 1992–2005. With a sample of 6,825 firm-year observations, they show that short-term debt (i.e. using proxy of debt maturity) plays a role in explaining the sensitivity of CEOs' incentives portfolio on both stock prices (delta) and stock return volatility (vega). They estimate the two CEO incentives packages, stocks (delta) and stock options (vega), using the Black-Sholes (1973) option pricing model, adjusted for dividend pay-out. Firstly, their results from pooled cross-section and time-series regressions document these findings. Specifically, the authors show that CEOs' incentives (e.g. delta, coefficient -0.0385) are negatively and significantly related to short-term debt, whilst there is a positive and significant relation between CEOs' incentives (vega, coefficient 0.0309) and short-term debt. Given the statistical evaluation and economic significance of the results, they argue that, when the stock price sensitivity (delta) changes from the 50^{th} percentile to the 95^{th} percentile, the firm's short-term debt decreases by 8.7%, likewise in return vega incentives increase by 4.4%.

Brockman, Martin and Unlu (2010) provide further tests by employing the generalised method of moments (GMM) to find if indeed a correlation exists between debt maturity and leverage (long term). Again, regressing short-term debt on the CEOs' incentives sensitivity and other control variables, they still find both the estimated coefficients for CEOs' incentives (delta -0.0829 and vega 0.0984) and both are statistically significant.

Finally, regressing leverage (long-term debt) on CEOs' incentives portfolio, Brockman, Martin and Unlu (2010) document that managers' use of long-term debt finance is negatively related to delta (-0.3495) and positively (0.0720) related to vega, whilst short-term maturity and leverage are negatively linked (-0.3495). The authors argue that managers use short-term debt to mitigate agency conflicts between shareholders and bondholders.

Ortiz-Molina (2007) examines the effects of financial leverage on executive pay incentives of the largest publicly traded companies in the US for the period 1993–1999. The final sample consists of 1,652 CEOs data and a total of 7,499 firm-year observations. Ortiz-Molina provides an interesting revelation by reporting an economically significant effect among leverage and the structure of CEOs' pay packages. The author defines both dependent and independent variables as follows: dependent variable (i.e. pay-performance sensitivity) as the change in firm's specific wealth, and the independent variable: market leverage (measured as book value of debt scaled by market value of equity and the book value of debt) and book leverage (e.g. book value of debt as a fraction of book value of assets).

Employing median regression (MR) and two-stage least absolute deviation (2SLAD) estimation techniques to the sampled data, he reports a statistically significant negative relationship between CEOs' pay performance sensitivity and leverage after controlling for other exogenous factors (e.g. size, market-to-book). Specifically, the negative coefficient estimates on leverage are much larger in magnitude when the 2SLAD approach is applied, which suggests that neglecting the simultaneity bias existing in the leverage and compensation relation could potentially underestimate the strength of the analysis. Furthermore, the author makes two leverage classifications, straight debt and convertible debt, and performs separate regression analyses. The findings show that convertible debt is positive and significant, whilst straight debt maintains a strong inverse relation after controlling for simultaneity and other control factors (e.g. firm size, growth opportunities, ownership, tenure).

In addition, Ortiz- Molina shows that the stock options compensation scheme is more sensitive to differences in capital structure. His evidence reveals a significantly negative relation among stock options incentive and leverage increases, in contrast to the positive variance effect on convertible debt. He further connotes that, in a highly levered firm, stock options incentives become less effective in mitigating shareholder-bondholder conflicts of interest as shareholders anticipate minimising the cost of debt financing. In support of this view, Duru et al. (2005) further contend that shareholders of firms with high leverage use more cash bonus compensation to lower future cost of debt.

In short, these results imply that financial structure and executive compensation practices interact in a unique manner to attenuate agency cost of debt.

Ryan and Wiggins (2001) also examine the influence of firm and manager characteristics on the level and structure of executive compensation using US datasets. Specifically, they find that leverage relates positively (negatively) to cash bonus (stock-based incentives – stock options, restricted stock). However, the coefficients on cash bonus and restricted stock are insignificant. Further, on the convertible debt ratio, the authors' results show leverage is negatively related to risk-avoiding incentive (cash bonus, restricted stock) but has a positive relation with stock options.

Overall, the observed empirical literature suggests two ways by which capital structure and managerial compensation are related. The literature shows the effect of managerial compensation on financial leverage (Coles et al., 2006; Chava and Punanandam, 2010; Hayes et al., 2012; Kini and Williams, 2012). More specifically, the evidence on stock options incentives (vega) produces mixed findings. Thus, large stock options incentives induce managers to increase firm leverage level (e.g. Coles et al., 2006; Chava and Purnanandam, 2010), whilst other authors postulate a negative relationship (Lewellen, 2006; Hayes et al., 2012). More so, the increment in risk-avoiding incentives (i.e. restricted stock, cash bonus) influences managers to decrease firm financial leverage (Coles et al., 2006; Hayes et al., 2012; Cassell et al., 2012), *all else equal*. These findings tend to suggest that executives' attitude to either increase or decrease firm risk (leverage level) is influenced by the level and structure of their compensation incentives.

In contrast, others including Brockman, Martin and Unlu (2010), Ortiz-Molina (2007), Duru et al. (2005) also find evidence to support the role of leverage in the determination of managerial compensation. In fact, this evidence (i.e. determinants of managerial compensation) raises theoretical and econometric concerns, particularly when considering the causal relation between financial leverage and compensation. Endogeneity is likely to be present and so the study adopts suitable econometric modelling and a technique to isolate the causal effect of managerial compensation on leverage. In this way, the study clearly shows how managerial compensation components influence leverage decision. Thus, the core contribution of this academic thesis is to explore a direct causal effect of compensation components on financial policy by modelling a simultaneous system of equations and applying a 3SLS method to extract the intricate link. This is important to clearly establish the idea that it is the level and nature of compensation incentives that influence managers operational decisions (Coles et al., 2006).

Moreover, investigating this issue within the UK context is important because UK firms are seen to use leverage more conservatively relative to US firms (Rajan and Zingales, 1995; Antoniou et al., 2008), and considering the issue from compensation perspectives would further enhance our understanding of UK firms' conservative debt policy.

2.5b Overall conclusions

This part of Chapter 2 has utilised the existing literature to establish a causal relation between managerial compensation and corporate leverage. The following issues were explored in the chapter. It theorised the extent to which managerial compensation, due to the imperfections in corporate governance system and risk-related incentive problem, is an important determinant of firm leverage. Thus, under optimal contracting theory (OPT), shareholders use different pay components to encourage (discourage) corporate borrowing, which in part contributes to the overall value of the firm. The chapter also discusses the two related strands of literature on leverage: compensation linkage (the impact of compensation on leverage) and the reverse issue of whether leverage is a predictor of managerial compensation. This interdependent literature highlights the simultaneity problem, especially in an attempt to establish a direct causal effect of managerial compensation on leverage. This issue will be given the needed attention in a later chapter. Again, the later chapter (5) will extract from the direct relevant literature to develop the central hypotheses.

Chapter 3

3.0 Data and Method for Empirical Analysis

3.1 Introduction

The overall aim of the study is to critically analyse the extent to which a firm's operational risk-taking activities and managerial financial compensation incentives are related. Specifically, two broad research questions are formulated under the risk-taking activities: first, the link between investment and managerial compensation, and second, the interdependence among leverage and managerial compensation incentives (in Chapter 5). In attempting to achieve the research objectives, it is important to choose a suitable research approach and to collect an appropriate set of data, as well as to employ the required analytical techniques needed to satisfy the study's specific aims. This is because an inappropriate research design can lead to inconsistent estimates and draw wrong inferences.

For instance, the reviewed literature on risk-taking investment suggests a two-sided relationship between investment and executive compensation incentives. This can generate the wrong causal effect if a single model analysis is adopted. Considering this econometric problem, therefore, the study must be able to identify the right research method that is robust enough to deal with the said problem in order to produce consistent estimates and to arrive at a logical conclusion. In support of this view, Murphy (1997, p.4) suggests that a chosen research method should be suitable to answer the research question so that the inferences drawn can be consistent with what was intended. Given the importance of this research (i.e. understanding how managers make risk-taking decisions given the level and the composition of their compensation incentives), the choice of research design and analysis method is of primary concern, particularly because establishing valid causal claims among two interrelated corporate policies can be a daunting task for researchers. Thus, using a single model may not consistently be able to produce a true causal estimate, which could ultimately lead to wrong causal inferences. As stated earlier, the overriding goal is to establish a causal effect of managerial compensation on risk-taking decisions, therefore adopting appropriate causal designs and applying econometric procedures and techniques to the UK data is crucial to achieving the research objectives.

In order to facilitate the research, aim and purpose, the study needs to collect the required data and define appropriate proxies to examine the linkage. For instance, Bryman (1984) suggested two main methods of data collection can be applied in empirical studies. They are quantitative and qualitative methods. The quantitative methods are characterised by using hypothesis testing and fixed measurements, while qualitative methods are interpretative in nature, seeking to explore rather than verify, and often provide the bases for further studies (Bryman, 1984; Thomas, 2003). Consequently, the present study applies quantitative methods to provide analyses for the study's questions and the chapter is discussed along this line.

The chapter primarily focuses on sample collection, variables' definitions and estimations of the core variables. We highlight various challenges and limitations of the data and provide possible explanations and justifications for the chosen technique. We also state the research empirical model. The main analytical strategy relevant to estimate the testable hypotheses is also discussed in this chapter.

More specifically, the chapter is structured as follows. Section 3.2 shows the data availability and sample selection process. We also highlight data limitation challenges. Section 3.3 outlines and defines the key variables that are of utmost importance to the study: corporate investment activities, financial leverage and executives' financial compensation incentives. Section 3.4

provides a summary analysis of the descriptive statistics for the compensation variables. The section also shows the trends in compensation packages of the UK FTSE 350 top three executives (chief executive, chief financial officer and chief operating officer) and, finally, section 3.5 concludes the chapter.

3.2 Data availability

This section outlines the sample collection techniques and procedures involved in the data selection process. In line with the aim and the nature of this investigation, the study utilises multiple data sources. First, the accounting and financial data for the UK FTSE 350 firms are obtained from the Compustat and Bloomberg databases. Second, the data on the values of executives' financial compensation incentives, managerial ownership and other corporate governance variables (e.g. block-shareholding and non-executive directors' ownership) were mainly hand-collected from the sampled firms' annual reports, combined with some electronic supplementary data from MorningStar database. In fact, such a labour-intensive activity (see Ntim et al., 2013) involved in manual collection does not only enhance the rich data sampling needed for this study; the process is crucially important for the study's originality purposes.

3.2.1 The available datasets

The first part of the data collection procedure pertains to identifying all UK publicly traded companies listed on the London Stock Exchange and assimilates those firms in the FTSE 350 index. The data utilised in this study are obtained from multiple sources. We use the Compustat and Bloomberg databases to collect firm-specific annual accounting and financial data for the sample period 2006–2015 inclusive, whereas information on executives' compensation, ownership stakes, age, large ownership and non-executive ownership were manually collected.

We merge the manually collected data with the electronic datasets and, where there is missing compensation data for the executives, we de-select that firm-year observation. In addition, consistent with prior research and ensuring the observed cross-sectional relation between executives' pay and risk-taking decisions is robust, the firm's minimum information coverage over a four-year period is required (Ozkan, 2007, 2011; Ntim et al., 2016). For accounting data, we obtained comprehensive data on fixed assets expenditure (e.g. plant, property and equipment and other fixed assets) and intangibles (e.g. research and development, fixed intangibles) and the book leverage over the study's period (2006–2015) from Compustat. The resource availability enhances our rich dataset and enables the study to establish and answer the research questions relating to the links between the executives' compensation incentives and investment activities on one hand and the financial leverage and compensation incentives on the other hand.

In fact, despite the improvement in the managerial compensation information following the Greenbury (1995) and Hampel (1998) reports, the compensation data are still unavailable in electronic form, hence the researcher's mundane attempt to hand-collect compensation data from the firms' annual reports. Mainly, the following considerations underpinned the study's usage of the firms' annual reports as the source of information. First, the annual report is the only statutorily required piece of information that provides a detailed record of the organisation's overall activities for a specified period, which shareholders and other stakeholders often rely on particularly in assessing what has transpired in the business.

Second, the annual report is usually prepared to meet a certain prescribed standard and that standard of preparation makes it easy and even more suitable for an independent auditor to authenticate the information supplied in it. This important feature associated with a company's annual proxy statement demystifies the long-standing debate on the substance of the annual report as a credible and substantive source of corporate information. This, notwithstanding that the company annual report is often fraught with problems and other deficiencies as a potential business information sources, means that it remains the most popular, least error prone and most reliable instrument of communication in the modern corporate environment (Holland and Foo, 2003; Davison, 2002). Therefore, given the annual report's easy accessibility and quality in terms of the authenticity of the information contained in it, the study utilises such readily available datasets. This primary source provides comprehensive information on management including remuneration packages, ownership stakes, ages, large shareholdings and non-executive holdings during the financial year. This rich dataset for the listed FTSE 350 firms enables the study to conduct the empirical investigation.

Moreover, with regard to the study data coverage time frame (2006 – 2015), the thesis was motivated by two reasons. First, the sample start period (i.e. 2006) is chosen to minimise missing data for the executives' financial compensation incentives. For instance, it was observed that a significant number of firms had missing data on managerial compensation prior to 2006. Again, even though our chosen timeframe also coincided with these time periods, before, during and after economic crisis, it is expected that the study results will not be affected by the market abnormalities resulting from the financial crisis because the time-specific effects (e.g., stagflation, inflation rates, economic shocks) which are common to all firms and can change through time are modelled in our analysis. This is consistent with prior studies (e.g. Nguyen, 2018; Petzmas and Croci, 2015; Kini and Williams, 2012). Finally, the cut-off financial year is pegged at 2015 and shows the last period for which data were available at the time of collecting this sample data. Our data seek to provide a fresh impetus into the topic area.

The initial firm-specific information is obtained from these respective databases: Compustat and Bloomberg, for financial accounting statements and stock price information, whilst manager-specific data and other governance information were manually collected from the companies' annual reports. Specifically, the values of executives' compensation incentives data (base salary, cash bonuses, share options, equity-based rewards (performance shares and restricted or deferred shares – LTIPs) and the executives' inside ownership and other governance variables such as large ownership stakes and non-executive ownership for the sampled firms were mainly hand-collected, with some further cross-checking from the MorningStar database.

Through each firm's annual report, we identify three top executives – Chief Executive Officer (CEO), Chief Financial Officer (CFO) and Chief Operating Officer (COO) – and collect annual data on their incentives packages and ownership stake. Consistent with other empirical studies (e.g. Ryan and Wiggins, 2001; Coles et al., 2006; Ozkan, 2007; Ntim et al., 2016; Nguyen, 2018), we eliminate all firms operating in the financial and utilities sectors. The study performs this exercise for three reasons: first, these firms often have a different capital structure, which could affect the leverage variable estimation (Ozkan, 2007, 2011; Coles et al., 2006). Second, firms operating in these sectors are heavily regulated and their managers have less discretion over investment decisions compared to unregulated ones (Smith, 1986; Guest, 2009; Ntim et al., 2016). Lastly, they are eliminated in order to facilitate comparisons with prior studies (e.g. Coles et al., 2006; Xue, 2007; Chava and Purnanandam, 2010), which also excluded financial and utilities companies from their analyses. Additionally, firms with no reported data on executives' compensation incentives for a minimum of four years are automatically discounted, consistent with Ozkan (2007).

The research employed this filter and obtained a final sample consisting of 213 UK publicly traded companies with a total of 1,900 firm-year observations spanning 2006 – 2015, across the nine (9) main industries (see Table 3.1). These industries are: mining and quarrying (10.8%), oil and gas (3.9%), healthcare (10.5%), consumer defensive (5.5%), manufacturing/industrials (25.3%), consumer cyclical (26.1%), real estate (8.5%), technology (5.6%) and communication services (1.5%). The final sample size of 1,900 covers all the nine industries from the FTSE 350 index and can be seen as the maximum number of observations to be utilised in our unbalanced panel data analysis. In fact, it is worth mentioning that the sample is highly representative of the entire UK population of large companies. The sample involves firms distributed across the UK and operating in various industries and market sectors. Therefore, the overall sample of 213 firms (excluding financial and utilities firms) can be termed as highly representative of the sample population.

Table 3. 1 Year and Industry Distribution of Sample Firms

Data details	Number of firms	Number of observations
FTSE 350 Index companies	350	3500
Financial companies (banks and insurance & other trust)	73	730
Utilities companies (excluded)	12	120
Missing data	52	750
Final sample	213	1900
Distribution by year	**Percentage**	**Number of observations**
2006	8.9 %	164
2007	9.1%	168
2008	9.4%	175
2009	9.7%	184
2010	10.1%	189
2011	10.2%	191
2012	10.4%	197
2013	10.7%	206
2014	10.8%	211
2015	10.8%	214
Total	**100%**	**1900**
Distribution by industry		
Mining and Quarrying	10.8%	208
Oil and Gas	3.9%	77
Consumer	10.5%	204
Healthcare	5.5%	107
Manufacturing/Industrials	25.3%	494
Real estate	8.5%	168
Technology	5.6%	103
Communication services	1.5%	30
Consumer cyclical	26.1%	509
Total	**100%**	**1900**

This table presents the number of firms in each of the sample years distributed according to industry.

3.4 The empirical estimation strategy

As postulated in Chapter 2, examining the causal effect of managerial compensation on the firm's value-critical risk-taking (investment and/or leverage) policies is a daunting task for researchers. This is because the two corporate variables are interrelated and so the research needs to adopt the appropriate processes, procedures and techniques to isolate the effect of compensation on investment and/or leverage policy. Specifically, it was observed in the reviewed investment literature (see Chapter 2) that not only does executive compensation affect a firm's risk-taking activity, but also how much they (executives) are paid is determined by the specific characteristics of the firm such as growth opportunities, size, risk-taking activities (e.g. R&D, property, plant and equipment, leverage), etc., as well as the presence of other governance mechanisms (block-shareholdings, institutional shareholdings, non-executive ownership), suggesting that a two-sided relationship exists between these variables (Coles et al., 2006; Kini and Williams, 2012). The bi-directional effect raises a major concern for the study particularly in our attempt to establish a direct causal relation between investment/leverage and executive compensation, in that the two corporate variables are part of a simultaneous process to determine corporate value. The resulting simultaneity bias is one of the primitive causes of endogeneity, which occurs when two variables simultaneously affect each other. This can lead to inconsistent estimates when an inappropriate estimation technique (OLS) is adopted (Antonakis et al., 2010, 2014; Kennedy, 2003; Wooldrige, 2002).

Endogeneity may also occur when the estimated model directly or indirectly omits important variable(s) (i.e. unobserved heterogeneity). The unmodelled variable may be correlated with the dependent variable and the independent variable(s) and/or the random error term, which can affect the coefficient estimates. For instance, as shown earlier, our key independent variables (e.g. cash bonus, stock options and LTIPs) are not explicitly exogenous; it is possible that the expected causal impact on the dependent (investment) variable could be instigated by other variable(s) external to the main investment model. This means that an unmodelled source of variance (error term) is likely to correlate with the independent variables (i.e. compensation components) creating a possible endogeneity problem, thereby producing inconsistent parameters when OLS is applied (Kennedy, 2003). This is problematic, and the study needs to deal with this troublesome factor by removing the supposed effect that is correlated with the independent variable(s). For example, executive managers' characteristics – age, private wealth, ownership, gender – and/or other governance indicators – large ownership, non-executive directors' ownership, board size – are likely to correlate with the compensation (independent) variables (see Nguyen, 2018; Ryan and Wiggins, 2001; Mehran, 1995; Core et al., 1999), to affect managerial investment choice. Therefore, in order to ascertain "true estimates" (causal effect of the independent variables – cash bonus, stock options, LTIPs – on the dependent variable) and prevent spurious inferences, we need to adopt an efficient and robust estimator that can purge the unwanted association on the incentives' variable(s).

Furthermore, another way that endogeneity can occur is through measurement error. This happens when the key variable is wrongly measured. It can occur either by poor reporting of the executive's compensation incentives in the firm's annual report (our main information source for managers' compensation). In fact, because our key variables were manually collected and some of this issue may not be observed directly by the study, applying a robust technique to deal with this unfathomed or unexpected event is necessary and much needed.

Clearly, the issues discussed above encapsulate the fact that endogeneity can stem from a plethora of situations wherein a regressor (independent variable) correlates with the dependent variable and/or the model's error term, thereby violating the underlying assumptions of ordinary least squares (OLS). (**Appendix 1** ***mathematically shows how these numerated econometric problems – i.e. simultaneity bias, omitted variable bias and unobserved heterogeneity – are illustrated and the extent to which our adopted method removes possible***

endogeneity bias). The presence of endogeneity may potentially threaten the validity of the research findings (i.e. causal effect of managerial compensation on investment and/or leverage in Chapter 5) if appropriate research modelling and the right estimation techniques are not employed (Antonakis et al., 2014). In line with this view, Murphy (1997, p. 4), argues that the chosen research methods should be appropriate enough to answer the anticipated research question and the inferences drawn should be consistent with the intended consequences. With this, it is clear that the choice of research design and its applied method is of utmost importance in providing consistent estimates capable of delivering informed policies and changing practices.

To deal with these aforementioned econometric challenges, we develop system of equations and apply three-stage least squares (3SLS) as the study's workhorse method to analyse the quantitative data (see Coles et al., 2006; Kini and Williams, 2012; Croci and Petmezas, 2015; Nguyen, 2018). It allows for efficient estimation of simultaneous equations with endogenous predictors (compensation variables, investment and/or leverage). By applying the 3SLS estimator to the structural models, the study is able to provide efficient estimates by removing the endogeneity effect associated with the endogenous explanatory regressor. More specifically, the 3SLS method efficiently and robustly deals with endogeneity resulting from omitted variables, measurement error and simultaneity (Antonakis et al., 2014; Greene, 2008; Coles et al., 2006; Cameron and Trivedi, 2005; Kennedy, 2003).

The systems of equations method (i.e. 2SLS) made its way into the literature in the 1950s via Henri Theil and Robert Basmann (Gujarati, 2009 p. 719) purposely to deal with regressors that are simultaneously determined. The underlying idea is that some regressors may endogenously be related to either the dependent, other regressors and/or stochastic error term, which makes the ordinary least squares (OLS) estimates biased and inconsistent. Due to this, early scholars Theil (1953) and Basmann (1957) independently developed the 2SLS method to estimate equations riddled with endogenous problems. Theoretically, the method provides a consistent estimate by "purifying" the endogenous regressor through system of equations to get rid of the unwanted component of the regressor in order to obtain the correct estimate. Thus, unlike conventional single equation modelling, the system of equations model has the advantage of allowing simultaneous interdependence among endogenous variables, which in turn makes the 2SLS (or 3SLS) estimator a more convenient and consistent estimation method.

Conventionally, the two-stage least squares (2SLS) and three-stage least squares (3SLS) serve the same purposes, thus both allow for consistent estimation of simultaneous equations with endogenous predictors. However, the later method (3SLS), which was developed in the early 1960s by Zellner and Theil (1962), improves the efficiency of the parameter estimates. It uses the two-stage least squares estimated moment matrix of the systems stochastic disturbances to estimate the coefficients of the entire system simultaneously. One potential advantage of the 3SLS method over two-stage least squares (2SLS) is that it provides efficient coefficient estimates even in cases where the selected instruments weakly predict the endogenous regressor. Thus, estimation by 2SLS can be imprecise if the chosen instruments is weakly correlated with the endogenous variable (Bound, Jaeger and Baker, 1995; Antonakis et al., 2014 p. 32). With this, it is therefore not surprising why the 3SLS method is known as the most potent and versatile technique in treating endogeneity (Antonakis et al., 2014) and this undoubtedly explains why the method is extensively used in finance, economics and management studies (Rajpoyal and Shevlin, 2002; Coles et al., 2006; Kini and Williams, 2012; Ntim et al.., 2013; Croci and Petmezas, 2015, Nguyen, 2018).

For instance, Ntim et al. (2013) argue that the reported non-existent, extremely weak correlation between executive compensation and performance could partly be attributed to estimating the conventional single equation model and suggest the need to control for possible simultaneous interdependencies among the two corporate variables. The authors made this concluding remark when they found a strong association after estimating simultaneous equations with the 3SLS method, which allows for possible interdependence among the dependent and independent variables. Similarly, and of direct relevance to the present study, Coles et al. (2006) concede that firm's risk-taking activities and executive compensation are interdependent and that an appropriate estimation method (3SLS) should be used to reduce the likelihood of drawing spurious inferences from the OLS results analysis.

Moreover, in spite of the benefits of using the 3SLS method, the method is scarcely used in other social sciences, with a few exception (see Cameron and Trivedi, 2005; Foster and McLanahan, 1996; Gennetian, et al., 2008). For instance, Gennetian, et al. (2008) advanced the literature on developmental science after employing a system of equations strategy (2SLS) to analyse the causal association between children's environmental factors and developmental outcomes. The authors further recommended the need for future research in developmental science to adopt an analytic strategy (2SLS) that allows identification of the precise nature and direction of the expected association among dependent and independent variables.

Motivated by its (3SLS) efficient estimates (Zellner and Theil, 1962; Wooldridge, 2002; Antonakis et al., 2014) and the popular usage in the management literature, the present study adopts a system of equations and utilises the 3SLS method as the study workhorse. This estimation approach will be given further attention in the respective chapters.

More explicitly, the study shows the estimation process including mathematical demonstration involved in the 3SLS method. It shows the step-by-step processes involved in the estimation process to aid the reader's understanding. Here, the study utilises an investment measure for demonstration purposes.

Essentially, two steps are involved in the 3SLS estimation approach having identified the key endogenous variables (i.e. investment measures and pay components – LTIPs, stock options and cash bonus) and stating the system of equations to be estimated. The first step serves to estimate the moment matrix of the reduced form disturbances term in the first-stage regression where the endogenous independent regressor, in this case pay component (i.e. either LTIPs, stock options, cash bonus), is regressed on all the determinants including instruments to obtain a clean portion (predicted values) of the incentive component.

The second step estimates the original (e.g. investment) model to obtain the parameters of interest (coefficients for LTIPs, stock option, cash bonus) after its jointly dependent compensation variable(s) are "purified" in the first-stage regression model. Thus, the predicted values obtained from each of the pay components are included in the second-stage (investment) equation and the estimates derived for the predicted pay component(s) in the investment model are interpreted as the causal effect on investment. The estimated coefficients are interpreted to show the magnitude and significance of the investment-executive compensation relation. It is worth mentioning that the computation processes are done simultaneously.

Computationally, these four systems of equations are estimated simultaneously using a 3SLS estimator readily available in programs akin to a statistical tool (STATA). In STATA, the structural equations models are set up as one equation each for the three incentive components and each equation for the policy measures (CAPEX, R&D and fixed intangible and/or leverage) and then apply the three-stage stage least squares estimator to run the regression analysis based on the test hypothesis.

In the following stage, we present both structural and mathematical demonstrations of how the systems of equations are set up and estimated akin to STATA. This is intended to provide the reader with a further explanation on how the chosen technique performs the estimation, and it shows this in two ways. The first one shows the easy part where four equations are structurally set up and apply 3SLS estimator command to run the regressions in STATA. Lastly, the study typically shows the cumbersome processes involved in the estimation (mathematical).

For example, the risk policy (i.e. investment and or leverage) structural equation model is stated below:

Risk policy (investment/ leverage) equation

$$LTIPs_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (1)$$

$$ESO_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (2)$$

$$CashB_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (3)$$

$$Risk\ policy_{it} = \alpha_0 + \alpha_1 LTIPs_{it} + \alpha_2 ESO_{it} + \alpha_3 CashB_{it} + \alpha_4 Controls_{it} + \epsilon_{it} \quad (4)$$

Where endogenous dependent variables: *LTIPs, ESO and CashB* represent long-term incentive plans, executive stock options and cash bonus respectively (i.e. first stage models: 1, 2 and 3), *Risk policy* indicates either investment or leverage (endogenous variable), controls are firm size, market-to-book, cash flow, stock return, salary, executive ownership, non-executive ownership, large ownership, industry and year effects and instruments are executives' average age, dividend pay-out and stock return volatility (i.e. the proxy choice is specific to incentive component) and ϵ_{it} is the random error term. We also include each incentive component in the compensation equation e.g. LTIPs and stock options are included in the cash bonus model to conform to the underlying intuition that the pay components are simultaneously selected.

In Eq. (4), *Risk policy* is the dependent variable (either investment or leverage) in the second stage model, *LTIPs, ESO and CashB* represent predicted incentive components and *controls* are risk policy determinants that have been found in the literature.

In fact, although the structural equation model shown above is quite straightforward and intuitive, we further demonstrate mathematically the step-by-step processes involved in the estimation, where the unwanted effect is purged from the endogenous variable in the first-stage regression.

As already stated, risk policy (investment or leverage) and pay components are endogenously determined, implying that the endogeneity effect has to be removed in the first-stage regression model. We estimate the individual pay component to derive the predicted values for the said pay component. We show this estimation procedure by specifying the model.

Here, we estimate each compensation component (first-stage) to obtain the predicted values to be utilised in the second-stage regression.

LTIPs incentive model

$LTIPs_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it}$ .... (1)

$\text{LTIPs} = \lambda_1 \text{I} + \lambda_2 \text{K} + \text{u}$……………………………………..….……..…………....(1.1)

Where, *LTIPs* = long-term incentive plans, *Risk policy* is the endogenous investment and leverage variable, K is the exogenous variable(s) of LTIPs determinants (firm size, market-to-book, stock return, cash flow, salary, executives ownership, large ownership, non-executive ownership, industry and year fixed effects and instruments – executive average age, dividend pay-out, u = error term. We also include stock options and cash bonus in the LTIPs model because of the simultaneous determination. We simplify the reduced form using nth explanatory variable in vector notation:

$\text{LTIPs}_\text{n} = \text{K}\pi_\text{n} + \varepsilon_\text{n}$ ………………………………………………………………..(1.2)

Where, LTIPs_n, $\text{K}\pi_\text{n}$ = all instruments including investment, exogenous factors of LTIPs incentive and the relevant instruments, and ε_n = error term. We then apply an OLS estimator to equation (1iii), and then obtain the predicted values of long-term incentive ($L\check{T}IPs_n$) to be included in the original investment model.

$L\check{T}IPs_n$ = K $(K'\ K)^{-1}K'L\check{T}IPs_n$.

Where $L\check{T}IPs_n$ = $L\check{T}IPs_n$ if K is in a column vector.

The predicted value of LTIPs (represented by hat sign) is included in the second-stage risk policy model (investment or leverage).

Stock options model

$ESO_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it}$ ………………………………… (2)

ESO = $þ_1$R + $þ_2$K + u ……………………………………………………………………(2.1)

Where, ESO = stock options, R= *Risk policy* is the endogenous investment and leverage variable, K is the exogenous variable(s) of ESO determinants (firm size, market-to-book, stock return, cash flow, salary, executives ownership, large ownership, non-executive ownership, industry and year fixed effects and instruments – executive average age, dividend pay-out and stock return volatility and u = error term. Again, LTIPs and cash bonus are also included in the model to account for the joint effects.

We simplify the reduced form using kth explanatory variable in vector notation:

$ESO_i = K\pi_i + \mathcal{E}_i$ ……………………………………………………………………..(2.2)

Where,$ESO_i =$ stock options, $K\pi_i$ = all instruments including risk policy variable (investment and or leverage), exogenous factors of ESO determinants and the relevant instruments, and$\mathcal{E}_i$= error term. We then apply an OLS estimator to eq. (2ii) and then obtain the predicted values of stock option (E$\hat{S}$**O)**to be included in the original Risk policy model.

$E\hat{S}O_i$ = K $(K'\ K)^{-1}K'\hat{S}O_i$.

Where, $E\hat{S}O_i$ = $\hat{S}O_i$ if K is in a column vector.

Cash bonus model

$CashB_{it} = \beta_0 + \beta_1 Riskpolicy_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it}$ ………………………… (3)

$CashB_{it} = þ_1 R + þ_2 K + u$ ……………………………………………………………………………(3.1)

Where, *CashB* = cash bonus, R= *Risk policy* is the endogenous investment and leverage variable, K is the exogenous variable(s) of *CashB* determinants: firm size, market-to-book, cash flow, salary, executives ownership, large ownership, non-executive ownership, industry and year fixed effects and instruments – executive average age and dividend pay-out and u = error term. Also, LTIPs and stock options are included in the model to account for the joint effects. We simplify the first-stage regression using kth explanatory variable in vector notation.

$CashB_K = Z\pi_K + \mu_K$ ………………………………………………………………………………(3.2)

Where, $CashB_K$, $Z\pi_K$ = all instruments including investment and leverage, exogenous factors of cash bonus determinants and the relevant instruments, and μ_K= error term. We then apply OLS estimator to equation (3ii), and obtain the predicted values of $\hat{C}ashB_k$

$\hat{C}ashB_k = Z\,(Z'\,Z)^{-1}Z'CashB_k$.

Where, $\hat{C}ashB_k$ = $CashB_K$ if Z is in a column vector.

Thus, the predicted values of LTIPs, stock options and cash bonus (in the first stage) are included in the risk policy model (investment or leverage – second-stage) together with other control variables to obtain the coefficient estimates. The estimates for *LTIPs, ESO* and *CashB* obtain from the second-stage regression show the effects on the risk policy (Eq. 4).

$Risk\ policy_{it} = \beta_0 + \beta_1 L\check{T}IPs_{it} + \beta_2 E\hat{S}O_{it} + \beta_1 \hat{C}ashB_{it} + \beta_4 X_{it} + \varepsilon_{it}$,.. ………………..(4)

It is worth mentioning that the key idea behind adopting a simultaneous system of equations (3SLS) removes the portion of variance in the independent variable that correlates with either the dependent variable or error term by including instruments in the first-stage estimation to obtain the predicted values of the endogenous independent regressors (i.e. assumed to be uncorrelated with error term), and that the (predicted) values are used in the original (second) stage to predict the dependent variable (Kennedy, 2003; Antonakis et al., 2010; Antonakis et al., 2014). In essence, the instruments help purge the endogenous (independent or dependent) regressor from variance that overlaps with the error term. However, the inclusion of instruments (i.e. the study over-identifying restrictions) in the structural equation modelling (SEM) makes R-square an inappropriate goodness of fit measure. Thus, such models can produce extremely low or even negative R-squares (Antonakis et al., 2014 p.34). That is, because SEM models include additional variables as instruments, the residual sum squares (RSS) is no longer constrained to be smaller than the total sum squares (TSS) and so RSS can exceed the TSS, leading to negative model sum squares (MSS), hence a negative R-square. Thus, over-identifying restrictions make R-square invalid and so researchers often do not report it (see Coles et al., 2006; Kini and Williams, 2012). Due to this, researchers commonly use the Sargan chi-square statistic or Hansen-Sargan statistic (Hansen, 1982; Sargan, 1958) test as a model's goodness of fit in structural equation modelling (Antonakis et al., 2014 p.35). Specifically, the Sargan chi-square statistic examines whether the residuals of the original dependent model correlate with the instruments in the first-stage model, and the Sargan chi-square statistic is simply calculated as the sample size multiplied by the R-square from the regression model (i.e. $N*R^2$). Therefore, similar to Antonakis et al. (2014 p.35), the study reports the Sargan chi-square statistic to show if indeed the model is properly specified.

3.5 Descriptive statistics for executives' compensation

As suggested by Wooldridge (2005), the frequency distribution tests are the initial step for analysing a population sample. The tests show the differences and similarities between the distributions through the measures of central tendency (mean, median and mode) and the measures of variability (standard deviation, variance, the minimum and maximum variables). Table (3.2) provides primary descriptive statistics of the study's key explanatory variables. It covers the base sample of 1,899 firm-year observations for the compensation variables: salary, cash bonus, share options and long-term incentive plans (LTIPs). The statistics show 10-year averages computed from the information on the variables covering the study period between 2006 and 2015 inclusive.

The executives' cash-based compensation shows these statistics: base salary has a mean (median) of £1,414,200 (£1,227,500) with a maximum pay of £9,160,000 whilst cash bonus shows an average of £1,105,100 (£836,000), and the total cash compensation has an average of £2,519,300 (£2,077,000) with the maximum pay of £16,890,000 and the standard deviation of 1703.7. For the stock-based incentives, the average value of stock options granted is £324,800 (median £0) with a maximum bonus of £29,233,000, which suggests that options compensation is skewed to the right side of the distribution. The mean (median) values for restricted stock and performance stock are £934,200 (263,500) and £2,089,700 (£1,327,500) respectively, whilst the mean of long-term incentives plans (LTIPs) is £3,024,000 (£1,715,500) with a maximum pay of £61,547,000 and the standard deviation of 4190.7. It is clear that the stock-based components exhibit high variability across the sample period. The total compensation shows an average of £5,868,000 (£4,141,500) and a maximum value of £63,296,000. The provided statistics show a snap analysis of the individual compensation variable behaviour.

Moreover, Figure 3.1 shows the pie chart constructed using the average trends of the four main components of compensation: cash bonus, LTIPs (sum of restricted stock and performance stock pay), stock options and salary (used as control variable in the model). Specifically, the percentage components are presented as follows; LTIPs (50%), cash bonus (20%), stock options (6%) and salary (24%) and are shown in the pie chart. The section also utilises the average values of the executives' compensation components (main independent variables) to provide bar charts and plots to further explain the incentives data and this is shown in Figure 3.2.

Table 3. 2 Descriptive Statistics for Compensation Variables

	Obs.	Mean	Standard dev.	min	p50	Max
Executives Compensation (£'000)						
Salary	1899	1414	59.7	120	1227	9160
Cash Bonus	1899	1105	1201.1	0	836	15586
Total Cash pay	1899	2519	1703.7	120	2077	16890
Stock Options	1899	325.	1288.5	0	0	29233
Deferred Stock	1899	934	2142.4	0	263	35564
Performance Stock	1899.	2089	3010.6	0	1327	49425
LTIPs	1899	3024	4190.7	0	1715	61547
Total compensation	1899	5868	5473.5	120	4141	63296

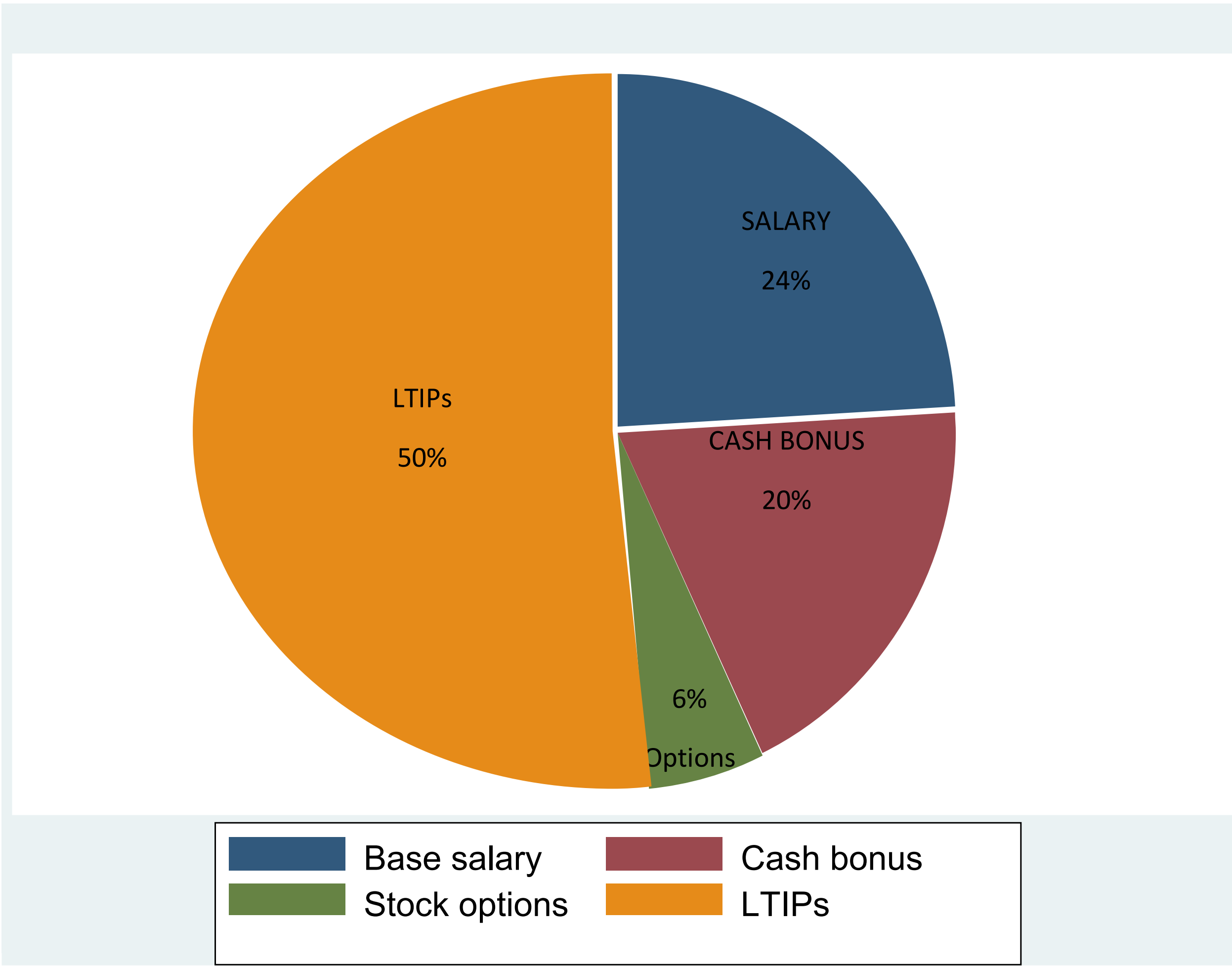

Figure 3. 1 Pie chart for executives' average pay components 2006 - 2015

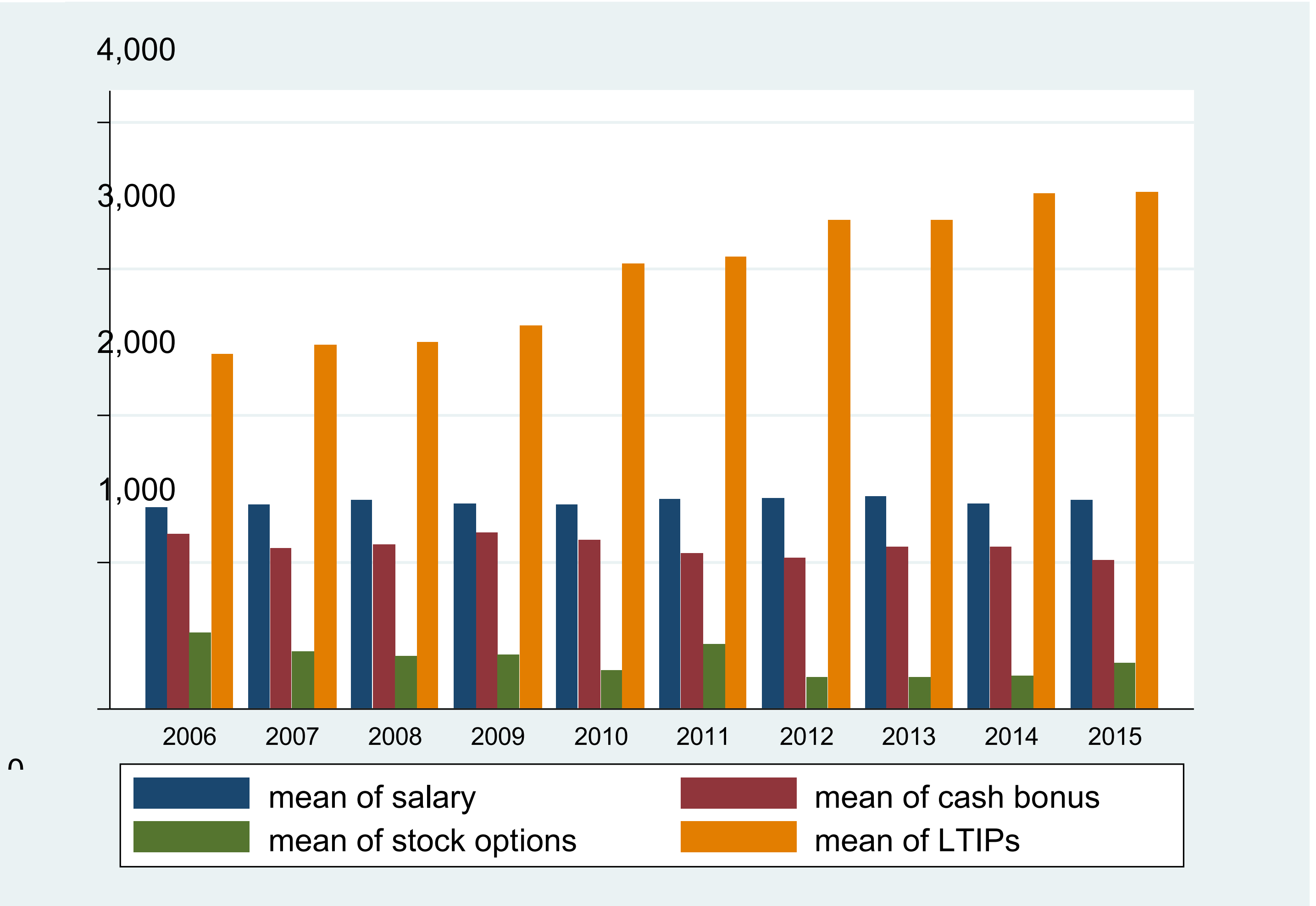

Figure 3. 2 Trends in executives' compensation across 2006 - 2015

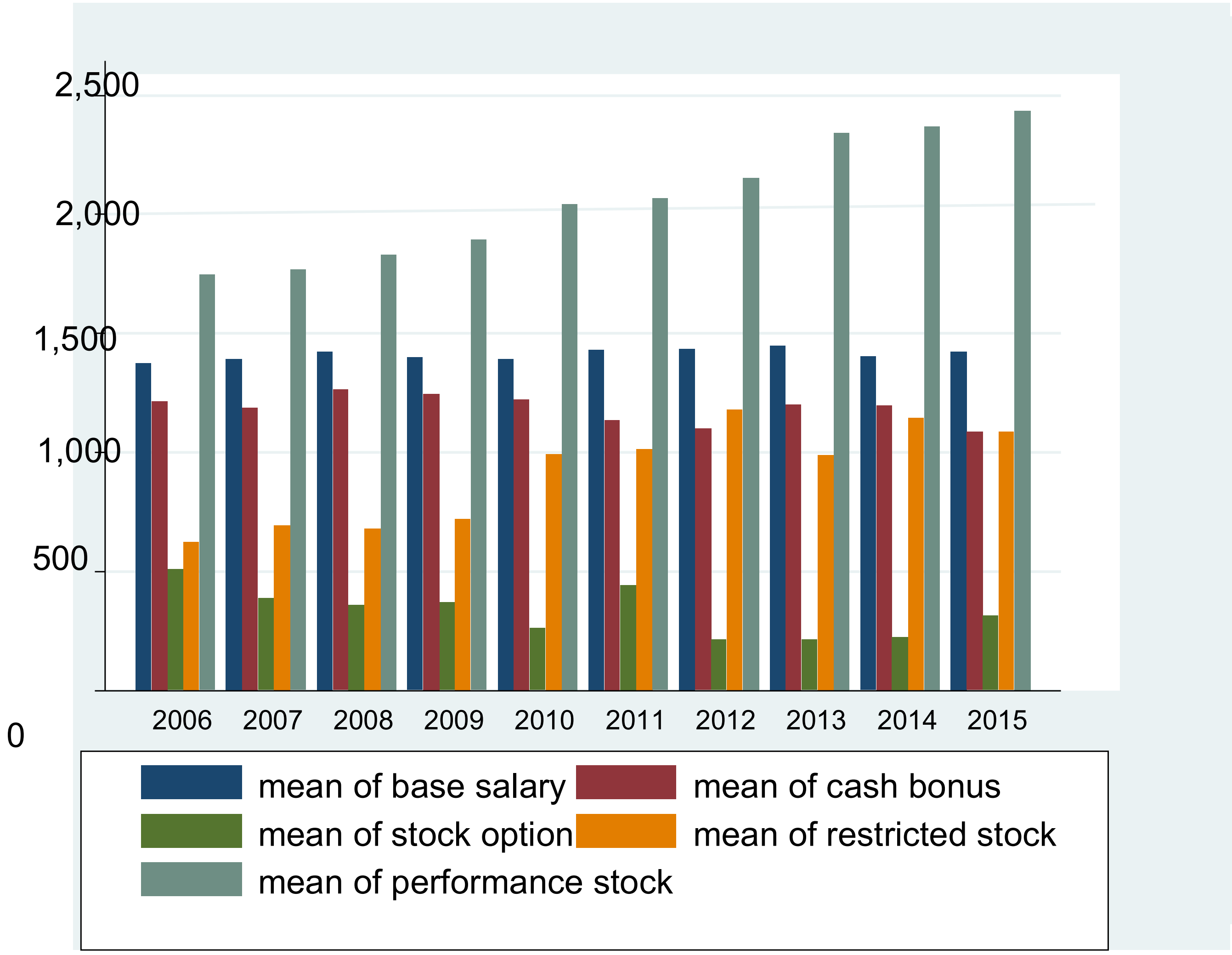

Figure 3. 3 Average trends of executives (5) pay components from 2006 - 2015

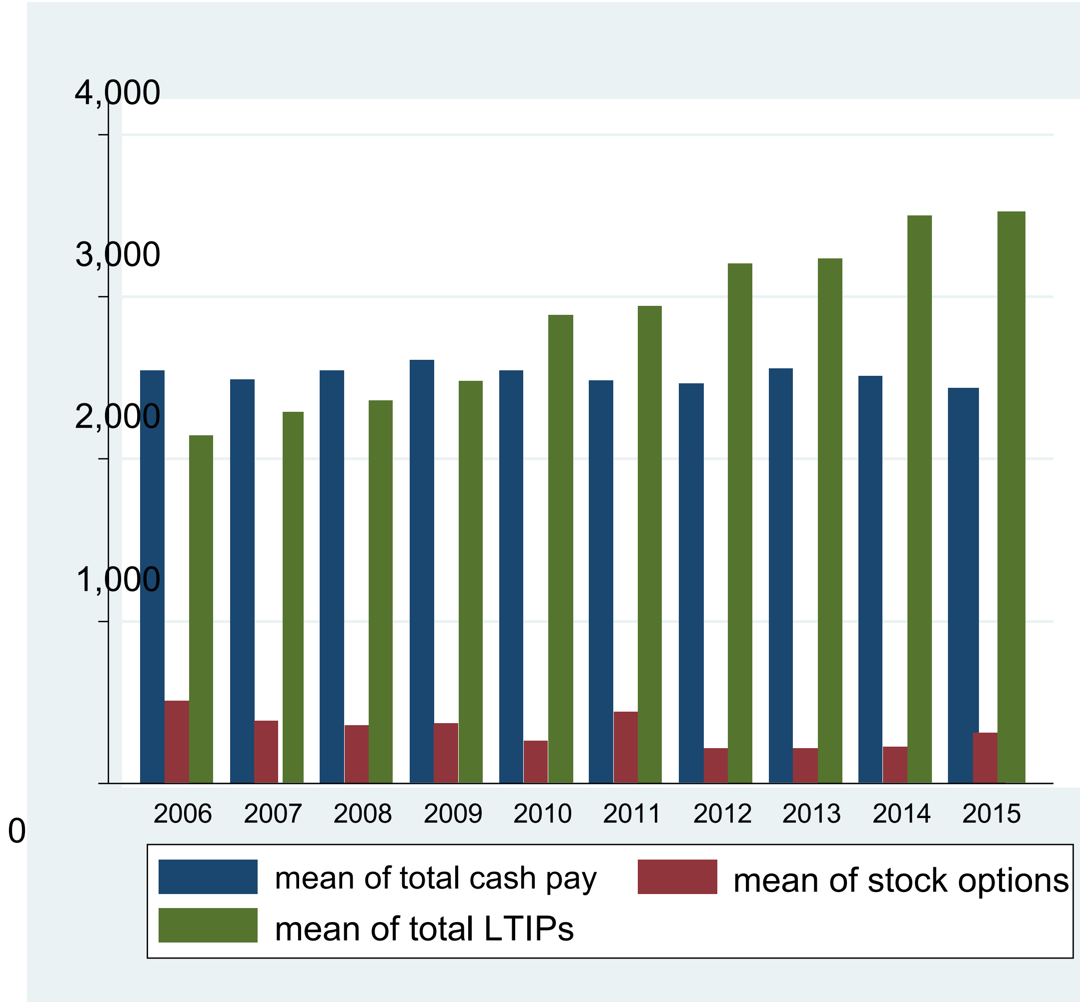

Figure 3. 4 Average trends in total executives' pay components

3.6 Conclusion

In this chapter, the study has outlined the sample selection process, the definition of key compensation variables and the adopted research strategy to examine the causal relation between risk-taking and managerial compensation. First, the study obtained the datasets from multiple sources: Compustat database for the firms' financial accounting data and the annual reports for the executives' compensation and other governance variables. Second, it has provided descriptive statistics for the main independent variable (pay components) and also displayed trends in the compensation variables across the sample period.

The chapter has also established the rationale for the empirical research strategy chosen to analyse the study. In achieving the study's goals, (specifically risk-taking–compensation relationship), we adopt an appropriate structural specification (simultaneous equation modelling) and estimation technique (3SLS) to analyse whether managerial compensation has a causal effect on the firm's risk-taking activities by considering the extent to which the latter (risk-taking) and other firm-related characteristics determine the amount paid to executives. The detailed discussion above also sets out appropriate variables to be utilised in examining the interrelationship between the executive compensation and risk-taking activities.

Chapter 4

4.0 The Relationship between Managerial Compensation and Investment Activities – Hypotheses, Proxies, Empirical Strategy, Analyses, Results and Discussions

4.1 Introduction

Having considered the related literature on investment and compensation in the preceding chapter, this chapter proceeds to empirically examine the causal relationship between the two variables. Accordingly, in order to achieve the research objective, it is important to clearly develop testable hypotheses, and identify and define variables of interests before we proceed to provide an analysis of the descriptive statistics and empirical results and a discussion of the key findings. In fact, it is worth stating that the significant innovation of the study is the adoption of appropriate empirical models and statistical techniques to answer the question of whether managerial compensation has a greater influence on the firm's investment activities by accounting for the feedback effect of investment and other factors on the level and structure of managerial compensation. More specifically, as already stated, the study develops simultaneous equation modelling and employs a 3SLS estimator to analyse the compensation and investment linkage.

The chapter is organised as follows: the first section develops the hypotheses and defines and measures the variables to be utilised in the empirical investigation. It also provides summary statistics of the key and other variables of interest. The second section performs correlation analyses to detect the value and direction among the utilised variables, and also to detect if these variables suffer autocorrelation problems. The third section presents the results and discussions after estimating the system of equations using a 3SLS estimator based on the hypotheses establishing the compensation and investment relationship. The fourth section concentrates on the robustness checks and or alternative testing, and the final section provides an overall conclusion relating to the supplied statistical results and analyses.

4.2 Framework to analyse the effect of managerial compensation on risk-taking activities

In Chapter 2, the study synthesised a detailed review of the relevant literature on executive compensation and risk-taking investment decisions (i.e. financial leverage chapter 2b). More specifically, as indicated earlier, managerial compensation and investment activities are related through agency theory. That is, through optimal contracting theory (OCT), managers are influenced to make value-critical investment decisions (Kini and Williams, 2012; Chava and Purnanandam, 2010; Coles et al., 2006). One major way shareholders consider is to use appropriate pay incentives which have different distinctive features, risk-motivated incentive (stock-based) and risk-avoiding incentive (cash-based), to induce managers operational policy choices (Coles et al., 2006; Nguyen, 2018). Relatedly, other literature makes risk-related investment classifications: where intangibles are seen to be more risky than tangible capital activity (Holmstrom, 1989; Bhagat and Welch, 1995; Kothari et al., 2001), while other fixed assets (patents acquisition) expenditure is also described as a low-risk activity (Amihud and Levi, 1981; May 1995; Tufano, 1996). Following this investment-related classification, a growing strand of literature has considered a link between stock-based incentive (risk-taking incentive) and the riskiness nature of the firm's investment activities. Specifically, as argued by studies that concentrate on risk-motivated incentives (e.g. Rajgoyal and Shevlin, 2002; Coles et al., 2006; Xue, 2007; Kini and Williams, 2012; Cassell et al., 2012; Hayes et al., 2012;

Chen et al., 2017; Nguyen, 2018), risk-averse managers are rewarded with stock-based (cash-based) compensation to encourage more (less) intangibles (i.e. R&D, innovative activity). More specifically, Coles et al. (2006) find that stock-based incentives encourage more R&D but discourage capital expenditure, whereas a cash-based component induces more capital expenditure but less R&D activity.

Moreover, as indicated by the Greenbury Report (1995), the board of directors (BOD) is advised to substitute stock options with LTIPs and bonuses to prevent managerial excessive risk-taking activities, implying a link between compensation and managerial operational risk-taking activities in the UK context. Like the prior literature (e.g. Coles et al., 2006; Xue, 2007; Cassell et al., 2012; Kini and Williams, 2012; Hayes et al., 2012; Nguyen, 2018), we expect a connection between the different types of firm investment activities and the level and composition of managerial compensation incentives.

Accordingly, the discussion below shows the extent to which different managerial compensation components affect the kinds of firm investment. We will be guided by this in our hypotheses development.

4.2.1 Hypotheses development

As pointed out above, through agency theory, compensation incentives may partly influence managerial investment decisions (Coles et al., 2006; Kini and Williams, 2012; Nguyen, 2018). Here, we provide specific testable hypotheses to show how investment and compensation incentives are linked. Accordingly, we provide reasons for why different components of managerial compensation relate differently to the types of investment activities. Specifically, these subsections, 1a, 1b, 1c; 2a, 2b, 2c etc. delineate the different hypotheses utilised by the study. The developed hypotheses are tested in a later section.

4.2.1.1 Capital expenditure and executives' compensation

In theory, managers' allocation of resources into real asset investment exhibits the nature of growth investment opportunity sets available. Such hard asset investment results in observable performance indicators (e.g. expansion in production line, inventory turnover, product differentiations, and increase in supply chain) and it is easily monitored. This makes such activity inherently low risk compared to intangibles (Amihud and Levi, 1981; Coles et al., 2006; Xue, 2007). Further, risk-avoiding incentive (cash bonuses) is linked to accounting-based measure (Zakaria, 2012; Liu and Stark, 2008). Because such tangible activity is treated in the accounting books as capital expenditure (Xue, 2007) and its impact is directly observable, shareholders are more likely to use cash bonuses (accounting profit measure) to reward such low risk-taking activity, suggesting an increasing relationship. In contrast, managers with more equity-based compensation (LTIPs – performance stock, restricted/deferred stock and stock options) are likely to lower tangible capital investment. This is because stock reward managers often gain extra value to their stock portfolio wealth when they embark on risky activities (Holmstrom, 1989; Lambert, 1986). More explicitly, Hayes et al. (2012) and Coles et al. (2006), based on a risk-motivated argument, posit an inverse relation between stock options and capital expenditure. Based on this intuitive argument, we make a natural prediction to suggest that cash bonus, LTIPs and stock options affect capital expenditure differently. Therefore, we propose the following hypotheses:

H1a. There is a positive relation between capital expenditure and the executives cash bonus incentives.

H1b: Capital expenditure and equity-based (LTIPs) incentives are negatively related.

H1c: There is a strong negative link between capital expenditure and stock options incentive.

4.2.1.2 Intangibles investment and executives' compensation incentives

As such capital expenditure activity, corporate managers make further essential decision regarding resources allocation into intangible activities. Managerial incentives to forgo intangibles (e.g. intangible, R&D) arise due to the high-risk nature of such activities (Fama, 1980; Lambert, 1986; Holmstrom, 1989; Bhagat and Welch, 1995). Managers are inherently risk averse because their human capital is inalienable and difficult to diversify. In contrast, shareholders can hold different investment portfolios to minimise their wealth exposure, causing them (shareholders) to be less risk conscious compared to managers. Consistent with this premise, the extant literature (e.g. Rajpogal and Shelvlin, 2002; Coles et al., 2006; Kini and Williams, 2012) argue that offering managers stock-based compensation motivates them to reduce their risk aversion and increase intangibles expenditure. For instance, risk-motivated incentive literature (e.g. Coles et al., 2006; Manso, 2011; Kini and Williams, 2012; Nguyen, 2018) shows that the convex payoff of stock options incentives makes the stock options package a powerful incentive tool to encourage risk-averse agents to accept relatively more long-term riskier projects (e.g. research and development, innovation activity). Conversely, Xue (2007) argues that, because research and development naturally increase a firm's idiosyncratic risks and are usually expensed in the accounting books, shareholders are less likely to use a short-term accounting-based measure (cash bonuses) to reward managers. Thus, shareholders use a more (less) risk-motivated incentive (risk-avoiding incentive) to encourage relatively more risky investment.

Overall, under intangible activities (fixed intangible and R&D expenditure), we propose a relatively similar conjecture for these two types of intangibles. The underlying motive is to specifically observe managerial risk-behaviour regarding these two risk-taking activities with relatively different resource allocation. In line with the above argument, we develop six testable hypotheses to detect how managers' compensation components relate to intangible activities (fixed intangible, R&D). We first state the hypotheses for research and development before we move on to the fixed intangible. Thus, we propose the following hypotheses:

H2a. Research and development expenditure and equity-based (LTIPs) incentives are positively linked.

H2b. There is a strong positive relation between research and development expenditure and stock options incentives.

H2c. Research and Development expenditure and cash incentives are negatively related.

Our second propositions relate to fixed intangibles and compensation incentives:

H3a. Fixed intangible expenditure and equity-based (LTIPs) incentives are positively linked.

H3b. There is a positive link between fixed intangible expenditure and stock options incentives.

H3c. Fixed intangible and cash bonus incentives are negatively related.

4.2.1.3 Other fixed assets expenditure and compensation incentives

As existing studies argue, managers use diversification (e.g. other fixed assets expenditure or acquisition) for risk-reduction motives (e.g. Amihud and Levi, 1981; May 1995; Tufano, 1996; Comment and Jarrell, 1995). In contrast, Datta et al. (2001) contend that acquisition activities (either whole or partly stripping another firm's assets) are an uncertain net present value (NPV) project, because such activity alters the firm's risk profile. Again, the unpredictability of such an activity could expose managers to a certain degree of risk, which could even cause them (managers) to be fired if such activity fails (Lehn and Zhao, 2006; Mitchell and Lehn, 1990). Based on risk-motivated reasons, shareholders are more likely to use a stock-based incentive to encourage other fixed assets activity. For instance, Croci and Petmezas (2015) posit that the convexity feature of stock options (measured as vega) induces managers to increase expenditure on acquisitions activity. Guay (1999) also observes a similar correlation. More so, if Croci and Petmezas's (2015) risk-increasing argument for acquisition activity is correct, then we would expect a decreasing effect on risk-avoiding incentive (cash bonuses). Therefore, based on the risk-related assumption, we predict that stock-based (cash-based) incentives encourage more (less) other fixed assets activity. More specifically, three main hypotheses are developed and tested:

H4a. There is a positive relation between other fixed assets (patents acquisition) expenditure and LTIPs incentives.

H4b. There is positive link between other fixed assets expenditure and stock options incentive.

H4c. There is a negative relationship between other fixed assets expenditure and cash bonus incentive.

4.2.2 Investment theoretical model

Based on the stated hypotheses, this subsection states the investment theoretical model underpinning the study. It shows that, through agency-motivated reasons, managerial compensation is likely to be related to the firm's risk-taking (investment) policy.

$$Investment_{it} = \beta_1 Incentives_{it} + \varepsilon_{it} \qquad (5)$$

Where, *investment* is the different investment activities (e.g. research and development (R&D), fixed intangible (FINTANG) and capital expenditure (CAPEX) (PPE plus other fixed assets), Other fixed assets (CAPEX2), *Incentives* represent managerial compensation incentives (value of stock options grants, LTIPs grants and cash bonus) and the random error term ε_{it}. More specifically, we state the investment model using specific investment measures (i.e. CAPEX, FINTANG and R&D).

$$\mathrm{CAPEX_{it}} = \alpha_0 + \alpha_1\mathrm{LTIPs_{it}} + \alpha_2\mathrm{ESO_{it}} + \alpha_3\mathrm{CashB_{it}} + \epsilon_{it} \quad (5.1)$$

$$\mathrm{FINTANG_{it}} = \alpha_0 + \alpha_1\mathrm{LTIPs_{it}} + \alpha_2\mathrm{ESO_{it}} + \alpha_3\mathrm{CashB_{it}} + \epsilon_{it} \quad (5.2)$$

$$\mathrm{R\&}D_{\mathrm{it}} = \alpha_0 + \alpha_1\mathrm{LTIPs_{it}} + \alpha_2\mathrm{ESO_{it}} + \alpha_3\mathrm{CashB_{it}} + \epsilon_{it} \quad (5.3)$$

4.3 Variable descriptions

In fact, at the heart of this empirical study is to present evidence on how the level and the composition of executives' compensation influences firm-level contemporaneous risk-taking investment activities. To achieve this expectation, the study identifies appropriate proxies to represent the variables of interest: dependent variables – firm investment activities such as property, plant and equipment, other fixed assets, R&D and fixed intangible – and the independent variables – executives' pay components (LTIPs, stock options and cash bonus). The subsections below define and measure the dependent variable (investment activities) before moving on to construct compensation independent variables. We also describe and measure other control variables to be utilised in the investment regression estimation. The section will also construct and measure control variables to be included in the compensation model (first-stage regression model).

4.3.1 Measurement of investment activities variables

This subsection turns our attention to the definition and measurement of investment variables. Corporate investment activities are major management strategic decisions which involve a substantial outflow of corporate resources. Such risk-taking activities include property, plant and equipment, other fixed assets (patents acquisitions), fixed intangibles, and research and development expenditure, all of which increases a firm's idiosyncratic risks (Datta et al., 2001).

Under this section, we classify investment into two activities: tangible capital investment and intangibles investment. The study's unique datasets obtained from the Compustat database allows us to extend the scope on investment activities and compensation nexus. More specifically, one novel contribution of this research is our extensive investment datasets coverage, which allows us to explore a complete picture on investment – compensation linkage – and can be seen as an extension of prior works (e.g. Coles et al., 2006; Croci and Petmezas, 2015; Nguyen, 2018). Here, our tests consider four measures of investment; specifically, two measures for capital expenditure (***CAPEX, CAPEX2)*** and two variable measures for intangibles activities ***(e.g. fixed intangible and research & development – R&D)***. The variables are defined and measured below.

4.3.1.1 Capital expenditure investment

Unlike Coles et al. (2006), our first measure of capital expenditure (CAPEX) is simply net capital expenditure (property, plant and equipment) plus other fixed assets scaled by total value of firm assets for the year. This variable includes a firm's spending on the other fixed assets (acquisitions) expenditure, consistent with Lewellen and Lewellen (2016) and Guay (1999). Our second measure of capital expenditure (CAPEX2) is defined as other fixed assets (acquisitions) expenditure divided by the total value of firm assets. We use this measure to test the extent to which managerial compensation relates to such activity. With this measurement approach, we are able to provide a more comprehensive coverage of a firm's capital expenditure activities.

4.3.1.2 Intangibles investment

Under this measurement, we capture all risk-taking intangibles. Two main measures are utilised. First, R&D expense ratio is measured by dividing R&D expenditure by the firm's total assets (e.g. Coles et al., 2006; Hayes et al., 2012). The second variable is fixed intangible expenditure and it is estimated by using total firm assets as the denominator.

4.3.2 Managerial compensation variable measurement

Under this section, we briefly state and define managerial compensation components to be utilised in the analysis. These include LTIPs (value of performance stock plus deferred/restricted stock), stock options, salary and cash bonus. Extensive discussions of the compensation components can be found in Chapter 2.

4.3.2.1 Salary compensation

This component of compensation shows the total amount of base salary of the three executives during the year. This component represents managerial risk aversion. As highlighted by Bebchuk and Fried (2005), the top executives' salary component has a minimal influence on managerial risk behaviour. We measure total salary ratio as a fraction of the total compensation (i.e. total compensation is defined as the total value of LTIPs, stock options, salary and cash bonus). However, Coles et al. (2006) use cash-based compensation (measured as salary plus cash bonus) as a control variable for risk aversion. Indifferent to Coles et al., the study argues that cash bonus may induce managerial risk-taking behaviour and so only salary is used as a control proxy for risk aversion.

4.3.2.2 Cash bonus

This compensation component is traditionally linked to executives meeting sets of accounting performance threshold (e.g. cash flow, profits, etc.). However, in some circumstance corporate firms reward top management with a cash bonus regardless of these accounting indicators (e.g. Bebchuk and Fried, 2003). We also try to adjust the annual bonus if the bonus for one year is reported in the subsequent year. For instance, bonuses for the year 2009 are reported in the following year's (2010) proxy statement. Such incentive or bonus is rightfully added to those in 2009. Again, we measure cash bonus ratio as the total of the executives' cash bonus divided by total compensation pay.

4.3.2.3 Long-term incentive plans (LTIPs) grants

The LTIPs compensation incentives are the sum of performance stock value and deferred stock value. Specifically, each component is valued using the face value of the restricted stock and/or performance stock at the grant date (e.g. Mehran, 1995; Core et al., 1999). It is calculated (i.e. face value) as the number of the respective stocks (restricted or performance) multiplied by the share price on the grant date. The LTIPs ratio is measured as the total value of LTIPs grants scaled by the total compensation.

4.3.2.4 Executive stock options compensation (ESO)

This component of executive compensation is relatively sophisticated to measure compared to other components (e.g. LTIPs) as it involves the inclusion of microeconomic and macroeconomic factors in its computation. Different valuation methods have been suggested in the literature. For example, Black-Scholes (1973) option pricing model (Mehran, 1995; Ozkan, 2007; Conyon et al., 2009), binomial valuation technique and Monte Carlo valuation.

Similar to Mehran (1995), we adopt the Black-Scholes option valuation method due to its popularity in the literature. Again, to avoid further complication in valuing stock options, we use executive stock options at grants (e.g. Mehran, 1995; Brick et al., 2006; Ozkan, 2007a). Thus, we value the stock options granted to the executives for the fiscal year using the modified Black-Scholes (1973) options valuation technique. We construct the annual stock options ratio grant parameter by dividing total annual stock options value to the total compensation. The fair value of the stock options award granted is calculated below:

$$\text{Award Value} = N\ [\ Se^{-dT} \phi\ (Z) - X\ e^{-rT}\ \phi\ (Z - \sigma \sqrt{T}\ )]$$

Where;

$$Z = [\ \ln (S / X) + T\ (r - d + \frac{\sigma^2}{2}\ )]\ /\ \sqrt[\sigma]{T}$$

N = number of share options granted to executives

S = stock price on the grant date (proxy statement, Bloomberg)

X = exercise price (proxy statement)

T = time to expiration (proxy statement)

r = risk – free interest rate

d = dividend yield (Compustat database)

σ = stock return volatility over the option life (we use historical volatility)

ϕ = cumulative standard normal distribution function

4.3.3 Other control variables for investment

The selection of the control variables is based on prior theoretical and empirical literature on investment and shows the extent to which these primitive characteristics are related to the firm's investment decisions. Mainly, these control variables in the investment model are based upon the investment literature. Overall, eight (8) other control variables are included in the model. Following investment literature, we include leverage, firm size, market-to-book, cash flow, sales growth, stock return, industry dummy and year dummy (Coles et al., 2006; Borisova and Brown, 2012; Hayes et al., 2012; Eisdorfer et al., 2013; Nguyen, 2018).

In the next subsection, we provide a brief discussion of these control variables and how they relate to investment.

a) Leverage

Myers (1977) posits that highly levered firms are more likely to suffer investment distortions. This is because, with limited access to external debt (i.e. over-leveraged) and high asymmetry costs of issuing equity (Myers and Madjluf, 1984), the firm may have to forgo such investment opportunities. On the other hand, firms with high capacity to borrow (e.g. under-leveraged ones) can easily access the debt market to sponsor their investment projects, all things being equal. This shows that debt may influence the level of corporate investment activities. Therefore, to control for the effect of firm debt ratio in the model, we include the ratio of the sum of long-term debt and short-term debt to the book value of the firm's total assets. This measure is less noisy compared to the market perspective measure. Again, because the model also controls for market-to-book, which accounts for the market expectation of the firm and is similar to market leverage intuitive reasoning, the study applies book leverage proxy. This is similar to prior studies (e.g. Coles et al., 2006; Florackis and Ozkan, 2009; Chava and Purnanandam, 2010).

b) Firm size

Large firms, compared with small ones, are usually less exposed to agency conflicts, because they often have access to a wider variety of financing sources and tend to enjoy a better reputation in the bond markets (Diamond, 1993). Moreover, with a relatively large tangible assets base, large firms are easily attracted to the financial markets (Jensen and Meckling, 1976; Rajan and Zingales, 1995). Therefore, such financial flexibility makes large firms more likely to invest intensely and less likely to encounter bankruptcy risks (Hovakimian et al., 2001). Firm size is proxied by the natural logarithm of sales or natural log total assets.

c) Cash surplus/cash flow

Jensen's (1986) free cash flow hypothesis suggests that corporate firms with surplus internal funds are more susceptible to using the excess funds (resources) on low investment activity. With this, it is conceivable that firms with high free cash flow are more likely to undertake more investment activities (Travlos, 1987). Accordingly, we account for this impact, by measuring cash surplus as the ratio of cash and cash equivalents to the total assets (see Richardson, 2002).

d) Annual stock return

We include in our investment model the firm's stock return over the fiscal year. Specifically, the inclusion accounts for performance effects as suggested by Manne (1965). Thus, firms with a high stock return can be seen as better-performing firms and are often more likely to undertake further investment projects. Moreover, Shleifer and Vishny's (2003) mis-valuation hypothesis also highlights managers' motivation to sponsor new investment activities with their overvalued stocks (Morck et al., 1990; Stein, 1996).

e) Growth opportunities

Corporate firms with substantial growth potentials tend to carry out more investment activities (Hayashi, 1982; Hall, 1992). Thus, investment opportunity sets are highly correlated with firm observed investments which ultimately impact corporate value (Lach and Schankerman, 1989). However, firms with more investment opportunities are likely to face investment-related agency conflicts (Smith and Watts, 1992). Consistent with Coles et al. (2006), we include the market-to-book value ratio in our regression model to proxy for growth opportunities.

f) Sales growth

Firm sales growth may pose a potential effect on investment activities. High sales growth firms are more likely to embark on expansion projects (e.g. PPE, R&D, acquisitions) to maintain the market power (Stigler, 1964). Like Coles et al. (2006), we measure the effect of sales growth as the logarithm of the ratio of sales in the current year to the sales in the previous year.

g) Industry concentration

Corporate firms' investment activities could also be affected by the extent of the industry concentration. Firms operating in a more homogenous industry may have less operational flexibility to create expansion within such a restricted industry. On the other hand, firms in a heterogeneous industry may enjoy wider investment opportunities. In essence, operating firms in highly concentrated industries may be influenced by the investment level. We therefore include the industry Herfindahl index in the regression to effectively capture the extent of industry homogeneity. Consistent with Nguyen (2018), we use a two-digit SIC code to proxy industry concentration.

h) Time dummies

It is conceivable that a country's macroeconomic conditions could fluctuate over time and such changes can affect a firm's risk-taking (investment) behaviour. In order to account for and capture the effects including interest rates and inflation rates which occur within and across different years, we include a year dummy in the model for the sample period, consistent with prior studies (e.g. Coles et al., 2006; Chava and Purnanandam, 2010; Croci and Petmezas, 2015). Moreover, to minimise the perfect collinearity problem in our regression analysis, we exclude the base year 2006 dummy from the regression. It is worth stating that, for brevity purposes, the coefficients estimates are not reported in our presentation and analyses of the results.

4.3.4 Other independent governance variables

As noted in the literature, executive compensation is one of the most important tools shareholders use to influence managerial corporate decisions. Other studies have also shown that firm governance attributes are used in tandem to affect managers corporate policies (Ozkan, 2007). The following governance mechanisms: large ownership, non-executive ownership, executives ownership and executives age, are selected from prior literature (e.g. Core et al., 1999; Ryan and Wiggins, 2001; Ozkan, 2007; Amoako-Adu et al., 2011; Nguyen, 2018).

Large investors' ownership: large shareholdings by institutional investors, block-holders, have become dominant in the capital markets and with their huge stake they are able to exert greater influence on corporate issues including how much executives are paid. For instance, consistent with the monitoring hypothesis, agency expenditure is reduced as the large shareholders' stake increase, postulating a negative relation (Ozkan, 2007; Hartzell and Starks, 2003; Mehran, 1995). Accordingly, we measure this variable by dividing total number of large shareholdings (defined as stakes above 3%) by the total number of the firm's year common shares.

Non-executive directors' ownership: another governance mechanism is the role played by non-executive directors to align owners-managers' interests. This means that, with increased ownership, non-executive directors are more likely to step up their monitoring responsibilities, which may in turn reduce incentive alignment packages and, also influence corporate policies (Ozkan, 2007). Thus, we proxy non-executive ownership as the ratio of total share holdings of non-executives including the board chair divided by the overall number of the firm's year common shares.

Executives' (insiders) ownership: agency conflict is reduced via managerial stock ownership (Jensen and Meckling, 1976; Coles et al., 2006). The idea is that, as managers' shareholdings increase, they (managers) tend to share a common interest with shareholders, thereby minimising the incentive risk problem. We use total executives' (CEO, CFO and COO) ownership stakes scaled by total overall firm shareholdings.

Executives' age: executive compensation literature suggests the possibility that both oldest and youngest executives are more likely to concentrate on short-term suboptimal decisions. For example, young executives (CEOs) are likely to select short horizon projects for reputational purposes (Hirshleifer, 1993), whilst old ones may tend to accept projects that pay off before retirement (Gibbons and Murphy, 1993; Dechow and Sloan, 1991). Such managerial myopic behaviour resulting from executive age can affect the quality of corporate decisions, and that one way to control this is through compensation incentives (Kole, 1997). Thus, by offering more stock-based incentives and fewer cash incentives to both young and old executives, the managerial incentive problem is reduced. With this, a convex relation is expected between equity-based incentives and executive age while a concave link is expected between cash incentives and executive age. We account for the executive age as an additional independent factor.

4.3.4.1 Instruments

Consistent with prior studies (e.g. Nguyen, 2018; Coles et al., 2006), all the above described variables (controls and other independent) are potential instruments for compensation incentives in our attempt to robustly deal with endogeneity issue. The following additional instruments: executive average age, dividend pay-out and stock return volatility are accounted for in the first-stage (compensation) model and that our selection is based on economic intuition. An important feature for a valid instrument is that it should affect the second-stage variable (i.e. risk policy) only through its effect on the first-stage endogenous variable (i.e. compensation) (Antonakis et al., 2014; Roberts and Whited, 2011).

Executive average age: extant literature suggests that both young and old managers operational policies are likely to be affected by their personal characteristics (Gibbons and Murphy, 1993; Hirshleifer, 1993; Yim, 2013; Sainani, 2018). Hence, awarding appropriate compensation incentives to managers minimize such investment related behavioural imbalance (Kole, 1997; Ryan and Wiggins, 2001). With this, our first chosen instrument is executive average age and it is measured as the average of CEOs and CFOs age. We contend that executive average age only has indirect effect on investment through its direct impact on compensation design.

Dividend pay-out: agency theory argues that one way to reduce the over-investment problem is to pay a surplus cash balance to shareholders in the form of a cash dividend pay-out (Jensen, 1986; Stulz, 1990). With this, it can be argued that, through efficient compensation scheme corporate managers are likely to pay excess cash to shareholders in the form dividend to minimize over-investment problem. In such circumstance, for instance, Chang (1993) argues that shareholders are likely to substitute equity-based incentives with cash bonuses particularly when the firm has no prospective investment opportunity. Hence, we expect a negative relation between dividend pay-out and stock-based incentives, whilst cash bonus and dividend pay-out are expected to be positively connected. We proxy a dividend pay-out as a dummy variable of one (1) when firms pay a dividend, otherwise zero (0). This constitutes our second instrument.

Stock return volatility: Risk averse managers are likely to embark on low risk policies. Therefore, by providing executives stock options limit their downside risk, causing them to make efficient policy choices. Yermack (1995) suggests a positive relation between executive stock options and stock volatility. Based on this, we argue that through stock options incentive managers make investment and financing decisions to affect firm's stock volatility. Therefore, the only way stock volatility relates to firm's risk policy is through stock options incentive. We measure stock return volatility as the natural logarithm of the variance of daily stock returns.

Table 4. 1 Description of Variables

Dependent Variables	**Description**	**Literature**
Capital expenditure (CAPEX)	Capital expenditure (property, plant and equipment plus other fixed assets scaled by total assets	Lewellen and Lewellen (2014; 2016)
Fixed intangible (FINTANG)	Fixed intangible expenditure divided by total assets	
Research & Development (R&D)	R&D expense divided by total assets	Coles et al. 2006; Kini and Williams, 2012
Other fixed expenditure (CAPEX2)	Other fixed assets expenditure scaled by total assets	Lewellen and Lewellen (2014; 2016)
Independent compensation variables		
Long-term incentive plan (LTIPs)	Total value: performance stock plus deferred stock scaled by total compensation	Kabir et al. 2013
Performance stock (PS)	Sum of performance share awards, share matching plan scaled by total compensation	Kabir et al. 2013
Deferred / restricted stock (DS)	Total face value: deferred shares/stock scaled by total compensation.	Kabir et al. 2013; Ryan and Wiggins, 2001
Cash bonus (CashB)	Total annual cash bonus scaled by total compensation	Kabir et al. 2013; Ryan and Wiggins, 2001
Executive stock options (ESO)	Total share options value (using Black and Scholes,1973). Share options value divided by total compensation	Kabir et al. 2013; Ryan and Wiggins, 2001
Total compensation	Sum value: salary, cash bonus, share options and LTIPs.	Kabir et al. 2013
Control variables		
Salary (*SAL*)	Total of base salary, allowances, benefits (monitory value) divided by total compensation	Cadman, Carter, and Hillegeist, 2010; Chen et al. 2016.
Leverage (LEV)	Defined as total debt divided by book value of assets	Coles et al. 2006; Kini and Williams, 2012
Firm size (Size)	Natural logarithm of total sales	Coles et al. 2006
Market-to-book (MKTB)	Defined as market value of assets divided by their book value.	Floarackis et al. 2009; Chava and Purnanandam, 2010
Annual stock return (*STKR*)	Annual stock return (12-months)	Coles et al. 2006
Cash flow (CF)	Cash flow scaled by total assets.	Coles et al. 2006; Ryan and Wiggins, 2001
Sales growth (SGR.)	Log ratio of sales in the current year to the sales in the previous year	Coles et al. (2006)
Industry & Year fixed effect	Dummy variable of 1 otherwise 0	Coles et al. (2006)
Other independent variables		
Large Ownership (%) (Large Own)	Shareholdings of owners above 3% scaled by the total common shareholdings	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999
Non-executives ownership (%) (NonE.Own)	Annual shareholdings of non-executives divided by the firm's total common shareholding.	Mehran, 1995
Executives Ownership (%) (E.Own)	Annual executives shareholdings scaled by common shareholdings.	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999

Table 4. 2 Compensation Determinants and their Predicted Signs

Variables:	Predicted signs Stock options	 LTIPs	 Cash bonus
CAPEX	positive	positive	negative
FINTANG	positive	positive.	negative
R&D	positive	positive	negative
LEV	negative	negative.	uncertain
STKRV	positive	. -	-
Size	positive	positive	uncertain
MTKB	positive	positive.	negative
STKR	Positive	positive	-
CF	negative	negative	positive
Large Own	negative	negative	negative
NonE.Own	negative	negative	negative
CEO age	Convex	convex	concave
CFO age	convex	convex	concave
E.Own	negative	negative	negative
E.Av Age	Convex	convex	concave
DPO	negative	negative	positive

Predicted relation may be positive, negative, concave, convex, uncertain or none. Concave or convex shows a curvilinear relation. Uncertain can be positive or negative based on theoretical argument. (e.g. similar to Ryan and Wiggins, 2001).

4.3.5 Investment empirical specification

To analyse the effect of managerial compensation on investment, we adopt structural equation modelling. As indicated in Chapter 2, our key variables (investment and compensation variables) are jointly determined, which, in turn, can affect our parameter estimates when an OLS estimator is employed. To reduce possible endogeneity concerns, we use a system of equations similar in structure to the specification used in Coles, Daniel and Naveen (2006) and Croci and Petmezas (2015), and they are specifically stated below. It shows how each investment measure is estimated akin to 3SLS in STATA.

Investment model

$$\text{LTIPs}_{it} = \beta_0 + \beta_1 \text{Investment}_{it} + \beta_2 \text{Controls}_{it} + \beta_3 \text{Instrument}_{it} + \epsilon_{it} \quad (1)$$

$$\text{ESO}_{it} = \beta_0 + \beta_1 \text{Investment}_{it} + \beta_2 \text{Controls}_{it} + \beta_3 \text{Instrument}_{it} + \epsilon_{it} \quad (2)$$

$$\text{CashB}_{it} = \beta_0 + \beta_1 \text{Investment}_{it} + \beta_2 \text{Controls}_{it} + \beta_3 \text{Instrument}_{it} + \epsilon_{it} \quad (3)$$

$$\text{Investment}_{it} = \alpha_0 + \alpha_1 \text{LTIPs}_{it} + \alpha_2 \text{ESO}_{it} + \alpha_3 \text{CashB}_{it} + \alpha_4 \text{Controls}_{it} + \epsilon_{it} \quad (5)$$

Where, in Eq.(5), investment represents each investment measure (CAPEX, CAPEX2, FINTANG, R&D), incentive is each endogenous pay component values (LTIPs, ESO and CashB) predicted from the first-stage model and control variables are firm size, market-to-book, cash flow, sales growth, stock return, leverage and industry and year effects. Equations (1, 2, and 3) for incentive components (LTIPs, stock options and cash bonus) have been defined above. It is worth indicating here that, each investment equation (e.g. CAPEX, FINTANG, R&D and CAPEX2) will be numbered chronologically as 5.1, 5.2, 5.3 and 5.4 respectively.

4.4 Simultaneous equations modelling (SEM)– 3SLS method

In order to test the stated investment hypotheses developed above **(H1a – H4c**), two steps are involved in our estimation approach having identified the key endogenous variables (i.e. investment measures and pay components – LTIPs, stock options and cash bonus) and stating the systems of equations to be estimated.

The first step serves to estimate the moment matrix of the reduced form disturbances term in the first-stage regression where the endogenous independent regressor, in this case pay component (s) (i.e. LTIPs, stock options, cash bonus – one equation each for each component), is regressed on all the determinants to obtain a clean portion of the incentive component (see

Kennedy, 2003; Kini and Williams, 2012). These determinants include endogenous investment measures, leverage, growth opportunities, firm size, firm risk, cash holdings, executive ownership, large ownership, non-executive ownership and other instruments (executive average age, dividend pay-out). We draw these determinants from prior literature (e.g. Core and Guay, 1999; Ryan and Wiggins, 2001; Adu-Amoako et al., 2011; Humphery-Jenner et al., 2016).

As stated by Antonakis et al. (2014), it is consequently desirable to include all available exogenous variables (determinants) as instruments to help improve the overall coefficient estimates. In fact, the implication is that, by including all the predictors in the endogenous compensation regressor model, any "foreign" connection which could otherwise instigate the investment–compensation relation is avoided (Balgati, 2002). This makes our adopted approach slightly different from Coles et al. (2006) and Croci and Petmezas (2015) but consistent with others (Nguyen, 2018; Core and Guay, 1999). For instance, Coles et al. (2006) apply "just" identifying restriction, whereas the current study employs "over"-identifying restriction and so our adopted estimation method (3SLS) improves coefficient estimates (Antonakis et al., 2010, 2014).

The second step estimates the original investment model to obtain the parameters of interest (coefficients for LTIPs, stock options, cash bonus) after its jointly dependent compensation variable(s) are "purified" in the first-stage regression model. In other words, the predicted values obtained for each of the pay components are included in the second-stage (investment) equation and the estimates derived for the predicted value pay component(s) in the investment model are interpreted as the causal effect on investment. Thus, the estimated coefficients are interpreted to show the magnitude and significance of the investment– executive compensation relation. It is worth mentioning that the computation processes are performed simultaneously.

More specifically, the specifications above show how each of the equations in the structural systems is estimated using the three-stage least squares (3SLS) method. In fact, for each investment measure (CAPEX, research and development and fixed intangible), we develop four systems of equations consisting of one equation for the respective investment measure and one equation for each of the executives' compensation variables (key independent variables LTIPs, stock options and cash bonus) in the first-stage regression. In the first-stage equation, the unwanted effect on each of the compensation components is removed or purged, thereby replacing the "purified" compensation component values (fitted values) in the investment model and then estimating it. Computationally, these four systems of equations are estimated simultaneously using a 3SLS estimator readily available in programs akin to the statistical tool (STATA). In STATA, the structural equations models are set up as one equation each for the three pay components and each equation for the investment measures (CAPEX, R&D and fixed intangible) and then the three-stage least squares estimation technique is applied to achieve the stated purposes.

Essentially, one underlying reasoning for using the simultaneous equations model (3SLS) is that it applies contemporaneous values of the endogenous variables rather than lagged values, hence the study's adopted approach tends to follow static model analysis. In fact, because static models do not often account for spill-over effects of a shock across the time periods, the original model (second-stage) estimates are likely to be affected by a serial correlation problem. This is because the 3SLS technique employs OLS or fixed-effects (FE) estimators in the second-stage estimation. The study reduces the effect of serial correlation on the coefficient estimates by employing robust standard errors to account for possible correlations between residuals for observations of a firm (Wooldridge, 2002). It is worth mentioning that, although this approach (3SLS) intuitively addressed the research aims (i.e. overcoming the simultaneity concern and producing efficient estimates), other researchers tend to employ dynamic model analysis, where the lags of the dependent variable contain the entire time path of the independent variables. This approach is briefly highlighted.

Conventionally, dynamic models use internal lags as instruments and, as the lagged dependent variable moves toward zero (0), the influence of the independent variable increases exponentially. Thus, the economic intuition is that there are spill-over effects of a shock across time and that the dependent variable (Y) is not only influenced by the current value of the independent variable (Xt) but also the value of the independent variable in the past periods (Xt_1, Xt_2, Xt_3, etc.). One potential advantage of a dynamic model is that it is able to distinguish both short-run and long-run effects of the independent variables on the dependent variable.

Statistically, instrumental variable (IV) and generalised methods of moments (GMM) estimators are often used to estimate dynamic models (Anderson and Hsiao, 1982; Arellano and Bond, 1991). The IV method involves transforming the dynamic equations by first differencing them to eliminate the individual effects and their potential correlation with the lagged values of the dependent variables (Anderson and Hsiao, 1982; Dang 2011 p.234). The GMM technique, on the other hand, further exploits all linear restrictions under the assumption of no serial correlation. It involves first-differencing the dynamic equations as employed by IV and then creating a matrix of instrumental variables by using the orthogonality conditions between the lagged values of the dependent variable and the error term. For example, the study shows structural settings of the dynamic model using, e.g., investment as the dependent variable.

$$INV_{it} = \beta_0 + \beta_1 \mathrm{INV}_{it\_1} + \beta_2 \mathrm{\hat{C}ashB}_{it\_1} + \beta_3 \mathrm{E\hat{S}O}_{it\_1} + \beta_4 L\check{T}P_{it\_1} + \beta_5 \mathrm{INVX}_{it\_1} + z_i + \varepsilon_{it}, \ldots\ldots (6)$$

$$LTIPs_{it} = \gamma_0 + \gamma_1 \mathrm{LTIPs}_{it\_1} + \gamma_2 \mathrm{INV}_{it} + \gamma_3 \mathrm{LTIPsX}_{it} + \pi_i + \epsilon_{it}, \ldots\ldots (6.1)$$

$$ESO_{it} = b_0 + b_1 \mathrm{ESO}_{it\_1} + b_2 \mathrm{INV}_{it} + b_3 \mathrm{ESOX}_{it} + s_i + \mu_{it}, \ldots\ldots (6.2)$$

$CashB_{it} = \mathrm{a}_0 + \mathrm{a}_1\mathrm{CashB}_{it\_1} + \mathrm{a}_2\mathrm{INV}_{it} + \mathrm{a}_3\mathrm{CashBX}_{\mathrm{it}} + \mathrm{z}_{\mathrm{i}} + \mathrm{w}_{\mathrm{it}}$,…..........................(6.3)

Where, in equation (4), INV = investment, INV_{it_1} lagged investment,$\hat{\mathrm{C}}\mathrm{ashB}_{it}$, $\mathrm{E\hat{S}O}_{it}$ and $L\check{T}IPs_{it}$ are the predicted compensation values for cash bonus, stock options and long-term incentives,$\mathrm{INVX}_{\mathrm{it}}$ is the control variables for investment, z_{i} unobservable fixed effects and $\varepsilon_{\mathrm{it}}$ is the error term. Equations (6.1 – 6.3) show the predicted models of the respective compensation variables, namely cash bonus, stock option and long-term incentive plans.

Thus, for example, when IV or GMM estimators are applied to equation (4), the dynamic equation is transformed by first differencing so that the individual effects and their potential correlations with the lagged values of the dependent variables are removed. Hence, applying the first IV technique to the proposed model yields this transformed equation.

$\Delta INV_{it} = \beta_1\Delta\mathrm{INV}_{it\_1} + \beta_2\Delta\hat{\mathrm{C}}\mathrm{ashB}_{it\_1} + \beta_3\Delta\mathrm{E\hat{S}O}_{it\_1} + \beta_4\Delta L\check{T}IP_{it\_1} + \beta_5\Delta\mathrm{INVX}_{\mathrm{it\_1}} + \Delta\omega_{\mathrm{it}}$..(6)

Additionally, one advantage of the GMM estimator is that it employs more internal lagged instruments (e.g. INV_{it_2}, INV_{it_3}, INV_{it_4}, etc.), and this in turn improves the coefficient estimates with the passage of time.

4.5 Data analyses and discussion of investment results

This section provides analyses and discussion of the descriptive statistics as well as the study's regressions results from the estimated investment equation. It starts with the descriptive statistics, followed by the investment regression results. The investment regression results are presented in four columns (1, 2, 3 and 4) and are discussed accordingly.

4.5.1 Descriptive statistics for the selected variables

This section starts the empirical analyses by providing summary statistics for the sampled datasets. The tests assess the differences and similarities between the distributions through the measures of central tendency (mean, median and mode) and the measures of variability (standard deviation, variance, the minimum and maximum variables). The descriptive statistics of the investment measures, executives' compensation components and the underlying control variables for the examination period are discussed below.

Table (4.3) provides the detailed descriptive statistics of the study's dependent, independent and control variables for the 213 sampled firms from the FTSE 350 companies. Panel A summarises the average (standard deviation) executives' compensation components and other characteristics. The average total cash compensation is £2,519,000 (1703.7) with a median of £2,077,000. With this, an average component for salary (SAL) is £1,414,000 (759.7) with a median of £1,227,000, whilst the average cash bonus (CashB) is £1,105,000 (1201.1) and a median of £836,000. Further, the average value of stock options (ESO) granted is £324,000 (1288.5) with a median of zero (£0), which shows that options are skewed to the right side of the distribution. The average values for deferred/restricted stock (DS) and performance stock (PS) are £934,000 (2142.4) with a median of £263,000 and £2,089,000 (3010.1) with a £1,327,000 median respectively. The mean of long-term incentives plans (LTIPs) value shows £3,024,000 (4190.6) with a median of £1,715,000, whilst the overall total compensation shows an average of £5,868,000 (5473.5) with a £4,141,000 median value. Again, on the other characteristics we observe that the mean ages for the CEOs and CFOs are 52 years old (6.13) and 50 years old (5.67) with an average age of the two executives of 51 years (4.75). Additionally, it also shows the executives' ownership stake of 4.7% (0.223).

On the governance variables, panel B shows the average of non-executive directors' ownership (NonE.Own) of 2.1% (0.127) with a median of 0.03%, whilst the block-shareholder ownership

(Large Own) mean is 39.3% (18.9) and has a median of 37.6%. Moreover, panel C also show the statistics of the measures of corporate policy proxies. For example, capital expenditure (CAPEX) has a mean (median) of 0.394 (0.317), fixed intangible (FINTANG) average is 0.257 (0.225), and research and development (R&D) are 0.006 (0) with the following respective standard deviations: 0.291, 0.211 and 0.031. Largely, our sampled firms spend substantial resources on both tangible capital assets and fixed intangible.

The other control variables listed in panel D also present these statistics. The average (standard deviation) firm has a leverage (LEV) of 0.3583 (0.246), sales growth (SGR) of 0.014 (0.342), stock return (STKR) of 0.066 (0.510), a market-to-book (MKTB) of 9.189 (77.74), a cash flow (CF) of 0.120 (0.195) and a firm size (Size) of 9.014 (0.859). In fact, the control variables display wide variations, except market-to-book ratio.

Table 4. 3 Descriptive Statistics for Investment, Compensation and Control Variables

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Dependent variables						
CAPEX	1,888	0.394	0.317	0.291	0.001	0.990
FINTANG	1,642	0.257	0.225	0.211	-0.000	0.877
R&D	1,888	0.006	0.00	0.031	-0.304	0.413
CAPEX2	1,791	0.172	0.049	0.292	0.000	0.989
Compensation variables						
SAL (£'000)	1,899	1414	1227	759.8	120	9160
CashB (£'000)	1,899	1105	836	1201.5	0	15586
ESO (£'000)	1,899	324	0	1288.1	0	29233
DS (£'000)	1,899	934	263	2142.7	0	35564
PS (£'000)	1,899	2089	1327	3010.0	0	49425
LTIPs (£'000)	1,899	3024	1715	4190.3	0	61547
Total compensation (£'000)	1,899	5868	4144	5471.5	120	63296
Firm characteristics						
LEV	1899	0.3585	0.3581	0.2468	-0.0712	4.6917
Size	1,829	9.014	9.002	0.859	0	11.507
MKTB	1,894	9.189	1.445	77.742	0.000	15.684
CF	1,803	0.120	0.106	0.195	-4.154	0.556
SGR	1,807	0.014	0.024	0.342	-3.288	5.543
STKR	1,828	0.066	0.095	0.510	-5.456	6.896
Gov. proxies&instruments						
E. Own (%)	1,869	4.7	0.22	0.223	0	6.1
Non.E. Own (%)	1,843	2.1	0.03	0.127	0	3.5
Large Own (%)	1,854	39.3	37.6	18.9	0	85.07
CEO age	1,557	52	52	6.363	36	73
CFO age	1,438	49	50	5.816	32	65
Ex.Av. Age	1,402	50	51	5.311	34	65
STKRV	1828	0.335	0.253	0.592	-0.255	13.086
DPO	1,852	0.617	1	0.489	0	1

This table presents the descriptive statistics for the data used for the study. The sample comprises 213 UK FTSE 350 firms over the period 2006 to 2015. The variable descriptions are provided in Table 4.1 above.

4.5.1.1 Correlation matrix coefficients

Table (4.4) presents the correlation matrix results among the independent variables. We perform this test to check for the presence of multicollinearity, which could affect the study's findings. Consistent with this view, Gujarati (2003) posits that the efficiency of the regression results is likely to be distorted if the degree of correlation exceeds the 80% threshold. In general, the results indicate relatively very low correlation among the explanatory variables. The highest value is 0.535 (53.5%), which is a reported correlation between firm size and equity (LTIPs) incentive. This is not surprising, given that large firms are likely to be more exposed to agency conflicts and that more equity-based incentive is needed to align both shareholders' and managers' interests (Ryan and Wiggins, 2001). In fact, the low reported correlation coefficients among the regressors are quite comforting, because our findings are less likely to be distorted by the problem of multicollinearity.

Table 4. 4 Correlation Matrix for Independent Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9).	(10)	(11).	(12)	(13).	(14).	(15)
1. SAL	1.00														
2. CashB	-0.172	1.000													
3. ESO	-0.046	-0.125	1.000												
4. LTIPs	-0.496	-0.234	-0.118	1.000											
5. LEV	-0.082	-0.046	-0.063	0.038	1.000										
6. SGR.	0.003	-0.031	-0.024	0.038	0.023	1.000									
7. STKR	-0.076	0.092	0.054	-0.124	-0.027	0.035	1.000								
8. MKTB	-0.083	-0.003	-0.004	0.117	-0.094	-0.003	0.003	1.000							
9. CF	-0.001	0.063	-0.028	-0.007	-0.142	-0.002	0.085	-0.034	1.000						
10. E.Own	0.333	0.013	0.009	-0.134	-0.165	0.023	0.010	-0.028	0.042	1.000					
11. Large Own	0.331	0.165	-0.003	-0.343	-0.067	0.001	-0.024	-0.055	0.052	0.436	1.000				
12. NonE.Own	0.187	-0.029	-0.049	-0.116	-0.004	0.017	-0.015	-0.015	0.005	-0.033	0.214	1			
13. CEO age	-0.004	-0.011	0.008	0.088	0.009	0.049	-0.009	0.109	-0.041	-0.068	0.006	0.031	1		
14. CFO age	0.014	-0.028	-0.049	0.024	-0.005	-0.008	0.017	-0.027	-0.042	0.134	0.047	-0.003.	0.317	1	
15. Size	-0.327	-0.232	-0.075	0.535	0.175	0.074	-0.059	-0.161	-0.102	-0.204	-0.357	-0.054	0.016	0.016	1

4.5.2 Discussions of investment empirical results

This section generates and discusses empirical results obtained from the two-way relationship between the remuneration components measure and risk-taking investment activities using a simultaneous equation estimation technique. The analytical findings are grouped and discussed under the respective investment measure. The discussion is structured as follows: it first discusses investment results, followed by control variables, and finally the executive compensation determinants' results.

4.5.2.1 Discussions of empirical results on capital expenditure

The results presented in Table (4.5) report the findings for capital expenditure (henceforth CAPEX) using the three-stage least squares regression. First, LTIPs incentive is positive and statistically significant at 5% confidence level. In particular, the coefficient on the LTIPs variable is 0.1248 (t-statistics 2.36) and it is both economically and statistically significant. The empirical result postulates that LTIPs (equity)-incentivised managers are likely to increase investment into capital expenditure. In other words, LTIPs incentivised managers are more motivated to channel investment resources into observable capital activities. This is consistent with the Greenbury Report (1995) recommendation and the prior research (e.g. Guay, 1999; Feitu-Ruiz and Renneboog, 2017). The Greenbury Report (1995) recommends that the firm's board of directors (BOD) should use more LTIPs to minimise managerial excessive risk-taking activity. However, the finding is inconsistent with the risk-motivated hypothesis **(H1b**). A possible interpretation is that managers may tend to become less diversified as their LTIPs incentives increase, and one way to limit their portfolio risk exposure is to divert funds away from relatively high-risk intangible activities (Bhagat and Welch, 1995) to low-risk capital expenditure. The re-allocation of investment funds could pose severe consequence to the firm's prospects or value particularly if the firm's investment opportunity sets are directly related to intangible activities. Away from the risk-motivated explanation, shareholders could also use the LTIPs (equity) incentive for alignment motives, suggesting a positive relation among LTIPs and capital expenditure activity.

Moreover, the managerial stock options incentive is also positive and both statistically and economically significant. With the estimated coefficient of 0.3547 (t-statistics 4.17), the result shows that an increase in share options incentives, on average, induces managers to allocate more resources into capital expenditure, ceteris paribus. In other words, executives with more risk-taking incentives are more likely to undertake observable capital expenditure activities, contrarily to the study's central hypothesis. The result is in line with Agrawal and Mandelker (1987), Croci and Petmezas (2015) and Guay (1999), who observe a similar relation between stock options compensation and capital expenditure. In the spirit of Croci and Petmezas (2015), the study argues that capital expenditure (defined as net PPE plus other fixed assets/patents acquisition expenditure) can be seen by British shareholders as risky and that they award stock options to induce managers to invest in such activity. This is plausible because the payoff of capital expenditure activity is often uncertain and can alter a firm's status quo (Datta et al., 2001), as well as causing the firm to become a potential takeover target if such huge capital extensive activity fails (Mitchell and Lehn, 1990). This, in essence, can inhabit a manager's decision to undertake such a project and so awarding managers more share options could potentially influence their decision to divert corporate resources into such an activity. This, however, is in contrast with other studies (e.g. Coles et al., 2006; Kini and Williams, 2012). The authors find a negative relation and interpret their evidence based on risk theory to suggest managers' disapproval or disinclination to invest in capital expenditure. Again, to further enhance our understanding on whether stock options explicitly induce other fixed assets acquisition activity (which is included in our capital expenditure definition) as specifically argued by Croci and Petmezas (2015), we will attend to this issue in a later section.

Furthermore, the coefficient on the cash bonus variable is negative and both statistically and economically significant at 1% confidence level. More specifically, the parameter estimates of -0.7296 (t-statistics -12.85) in the CAPEX model, imply that cash bonus partly influences managers to disinvest in real assets activities. This is inconsistent with hypothesis **(H1a)**, which suggests that rewarding managers with more cash bonus incentives induces them to engage in more lower risk-taking capital expenditure activities (Kim and Knofsinger, 2007; Xue, 2007; Coles et al., 2006). In fact, the negative association could be explained by the fact that managers may sponsor capital expenditure activities with either internal resources (cash flow) or debt finance. In such a case, the firm's cash balance depletes, causing managers to lose out on any supposed cash bonus because there would be no sufficient or adequate cash reserves to sponsor managerial cash bonuses, leading to the negative relation. Alternatively, capital expenditure-intensive firms are likely to hold more debt (because they often tend to have observable tangible assets which makes them easily attracted to the debt markets), which could deplete cash balance reserves via interest payments. Cash-motivated managers are likely to forgo capital expenditure projects in order to meet their accounting performance target (e.g. surplus cash flow or profits). In other words, because cash bonuses are based on accounting performance measures, sponsoring capital expenditure activity via internal resources or debt finance is likely to cause executives to miss out on meeting the performance threshold. This view is partly supported by the study's datasets and our measurement of capital expenditure which encapsulates property, plant and equipment plus other fixed assets. Thus, other fixed assets expenditure includes patents bought (acquisitions) from other firms which are often cash-sponsored items (Lewellen and Lewellen, 2016, p.9), suggesting a potential implication on the firm's cash balance reserve and its ultimate cash bonus behaviour. In another vein, managers disinvesting in capital expenditure could partly signal an entrenchment problem. As argued in the literature, capital expenditure activities easily gain the bond market's attention (Rajan and Zingales, 1995). However, cash-incentivised managers disregard of the use of debt finance to sponsor such an activity could be interpreted to show their intention to avoid an external lenders' monitoring role which can prevent managers expropriating shareholders.

In general, the reported findings on the capital expenditure and compensation incentives linkage are so far largely consistent with the literature on optimal contracting incentives. More explicitly, stock-based compensation (stock options and LTIPs) motivates managers to increase capital expenditure projects (Feitu-Ruiz and Renneboog, 2017; Croci and Petmezas, 2015; Guay, 1999; Agrawal and Mandelker, 1987), whilst cash bonus induces lower capital expenditure activity, inconsistent with prior studies (see Coles et al., 2006; Xue, 2007; Kim and Knofsinger, 2007).

As indicated, the reported positive relationship among share options incentives and capital expenditure could possibly be attributed to our CAPEX measure, which encapsulates both tangible capital expenditure (Eisdorfer et al., 2013) and other fixed assets expenditure item in Compustat database. Our definition is consistent with Guay (1999) and Lewellen and Lewellen, (2016). These two related investment activities have different risk profiles (Datta et al., 2001; Coles et al., 2006; Croci and Petmezas, 2015). For instance, based on a risk-motivated explanation, Coles et al. (2006) suggest that corporate managers lower capital expenditure (measured as a ratio of net capital expenditure to total assets) when they are rewarded with option-based incentives (defined as vega). In contrast, Guay (1999) finds a positive relation between capital expenditure (measured as net PPE plus other fixed assets/acquisition) and share options and interprets it to support incentive alignment.

In fact, it is worth mentioning that the choice of capital expenditure measure might also contribute to explaining CAPEX and the stock-based (stock options, LTIPs) and cash bonus relationship. In line with this view, hypotheses **H4a – H4c** specifically measure other fixed assets (CAPEX2) activity (similar to Croci and Petmezas, 2015) and we show how managers' compensation components relate to such project in a later section.

4.5.2.1.1 Control variables for capital expenditure

This section highlights analyses of the important control variables utilised by previous studies (e.g. Coles et al., 2006; O'Connor et al., 2013; Eisdorfer et al., 2013). We provide a brief discussion of the following selected control variables: salary, book leverage, firm size, market-to-book, cash flow, sales growth and stock return, which have been found to determine capital expenditure.

Specifically, the leverage coefficient is negative (-0.0180 t-statistics -0.48), implying that highly leveraged firms are likely to suffer when undertaking capital expenditure activities. Thus, given the huge resources involved in sponsoring capital expenditure, high-debt firms are less likely to undertake such capital investment projects (Uysal, 2011). However, the coefficient is insignificant.

In addition, the coefficients on firm size and market-to-book are negative and significant. For instance, the estimates for firm size (-0.0554 and t-statistics -3.96) and market-to-book coefficient (-0.0063 and t-statistics -3.03) imply that that small and growth firms invest more in CAPEX than large and mature firms with relatively fewer growth opportunities. Again, stock return is negative and insignificant. In contrast, cash flow has a positive effect on CAPEX, which resonates with the assertion that firms with substantial cash reserves are more tempted to spend more on CAPEX. Also, the coefficient for sales growth (0.0062) is positive but insignificant. Moreover, executives' salary is positively and significantly related to capital expenditure (CAPEX). As expected, executives with a substantial salary incentives component are seen as risk averse and are more inclined to devote large resources to relatively low-risk CAPEX projects.

4.5.2.1.2 Discussion of the compensation components results

The results reported in the CAPEX table columns 2, 3 and 4 show the results of the main components (LTIPs, stock options and cash bonus) of executive compensation determinants, which include firm-related characteristics, governance factors and other executives' characteristics.

In the LTIPs equation (column 2), the estimated coefficient on salary (-0.4538) is negative and it is both statistically and economically significant at 1% confidence level. This implies that the board of directors uses the base salary component as a close substitute for equity compensation, which is consistent with Coles et al.'s (2006) substitution explanation. In other words, the board's annual adjustment in salary incentive leads to a decrease in the amount of LTIPs grants handed to managers. Again, the result also tends to confirm Conyon and Murphy's (2000) assertion that British executives (CEOs) receive a considerably large component of compensation in their base salary relative to the other compensation components.

Similarly, the coefficients on stock options (-0.1614 t-statistics -14.65) suggests a substitution effect, whilst cash bonus (0.1205 t-statistics 16.68) is positive and significant, implying simultaneous usage of pay incentives (Coles et al., 2006). The results show that corporate boards of directors simultaneously choose to use either LTIPs or share options and/or cash bonus to reward managers.

Further, the other firm-related characteristics show a positive correlation with LTIPs incentive: firm size, market-to-book, capital expenditure, fixed intangible, R&D, leverage, cash flow, non-executive ownership, executive average age and dividend pay-out. The coefficient estimates for firm size, market-to-book, CAPEX, R&D, fixed intangible and cash flow are 0.2203, 0.0285, 2.9295, 0.5579, 1.2074 and 1.2415 respectively, and are all statistically and economically significant. For instance, large and high-growth firms use more of the LTIPs component to reward their executives, which is consistent with the view that, as a firm expands (either organically or inorganically), managerial operational activities become more complex, which can lead to possible agency conflicts of interest. Therefore, to mitigate this possible conflict, the board tends to use more of the LTIPs component to align both shareholders' and managers' common interests. Large firms are likely to use more LTIPs to attract and retain high-quality managerial talents (Core et al., 1999; Basu et al., 2007; Amoako-Adu et al., 2011). Additionally, it shows that shareholders use LTIPs to encourage growth expansion in investment activities (Guay, 1999; Ryan and Wiggins, 2001; Coles et al., 2006; Humphery-Jenner et al., 2016; Chen et al., 2017). The reported positive coefficients on the selected instruments, executive average age (0.0089) and dividend pay-out (0.0238), suggest that shareholders of firms with older managers tend to use more LTIPs incentive and that such firms experience high dividend pay-out. This is plausible given that older managers are often risk averse, which in turn may constraint their risk-taking policies (Gibbons and Murphy, 1993; Dechow and Sloan, 1991; Yim, 2013). Therefore, incentivising older managers with the LTIPs incentive mitigates the managerial risk incentive problem (Kole, 1997; Gibbons and Murphy, 1993).

In contrast, other characteristics such as stock return, large ownership and executive ownership are negatively related to LTIPs awards. Thus, the large ownership coefficient estimate is -0.0013 and it is significant at 10% confidence level. It tends to imply that the effective presence of large ownership reduces the managerial incentive problem, hence less LTIPs incentive is needed to motivate managers (Hartzell and Starks, 2003; Amoako Adu et al., 2011).

For the share options model (3), we find that salary (-0.0463) and LTIPs (-0.0803) are negative, which confirms the substitution effect, whilst cash bonus (0.0219) suggests simultaneous determination.

Moreover, the coefficients for other determinants including firm size (0.0393), market-to-book (0.0078), CAPEX (0.5110), fixed intangible (0.2722), stock return volatility (0.0092), cash flow (0.3753), non-executive ownership (0.0033) and executive average age (0.0024) show positive signs. Significantly, large and high-growth firms use more stock options to induce managers to make appropriate decisions. Again, the results suggest that shareholders strongly consider investment projects, cash flow and executives' age when awarding a share options incentive. However, other characteristics such as leverage, R&D, large ownership, executive ownership and dividend pay-out are all negatively related to the share options incentive. An economic intuition is that shareholders of high-debt firms use less of the share options incentive and, as monitoring improves via concentrated (large) ownership, shareholders tend to use a lower stock option incentive.

Furthermore, for the cash bonus equation (4), it shows positive coefficients on salary, LTIPs and stock options incentives, implying that the incentives are simultaneously determined. The coefficient on large ownership is positive, postulating shareholders' usage of managerial cash bonus in a well-monitored firm. In contrast, others including firm size, market-to-book, book leverage, CAPEX, R&D, fixed intangible, cash flow, executive ownership, non-executive ownership, dividend pay-out and executive average age all show negative signs. In particular, large and high-growth firms tend to lower cash bonuses. This can possibly be due to the fact that such firms reserve an internal cash surplus to sponsor future growth expansion, thereby lowering cash bonuses. This confirms the reported negative relation between cash bonus and investment activities (CAPEX, R&D, fixed intangible).

Table 4. 5 Capital Expenditure Regression Results

	(1) CAPEX	(2) LTIPs	(3) ES0	(4) CashB
LTIPs	0.1248**		-0.0803***	0.0570***
	(2.36)		(-14.43)	(10.27)
ESO	0.3547***	-0.1614***.		0.0667***
	(4.17)	(-14.65)		(9.94)
CashB	-0.7296***	0.1205***	0.0219***	
	(-12.85)	(16.68)	(4.82)	
SAL	0.1343***	-0.4538***	-0.0463	0.1566**
	(3.51)	(-4.37)	(-1.54)	(2.50)
LEV	-0.0180	0.0092	-0.0457**	-0.0126
	(-0.48)	(0.12)	(-2.28)	(-0.27)
Size	-0.0554***	0.2203***	0.0393***	-0.1044***
	(-3.96)	(6.92)	(3.84)	(-5.21)
MKTB	-0.0063***	0.0285***	0.0078***	-0.0142***
	(-3.03)	(5.15)	(4.71)	(-4.11)
CF	0.0409	1.2415***	0.3753***	-0.4492**
	(0.63)	(3.79)	(3.29)	(-2.22)
SGR	0.0062			
	(0.44)			
STKR	-0.0003	-0.0059	0.0091	
	(-0.04)	(-0.55)	(1.38)	
CAPEX		2.9295***	0.5110***	-1.641***
		(6.79)	(3.40)	(-6.02)
R & D		0.5579*	-0.0157	-0.2065
		(1.64)	(-0.13)	(-1.08)
FINTANG.		1.2074***	0.2722**	-0.4642**
		(3.80)	(2.44)	(-2.32)
STKRV			0.0092	
			(1.25)	
Large Own		-0.0013*	-0.0008***	0.0010**
		(-1.79)	(-3.38)	(2.44)
E. Own		-0.0441	-0.0982***	-0.0146
		(-0.48)	(-3.12)	(-0.29)
Non E.Own		0.1664	0.0033	-0.1315
		(0.96)	(0.05)	(-1.37)
E.Av.Age		0.0089***	0.0024**	-0.0035*
		(2.64)	(2.15)	(-1.75)
DPO		0.0238	-0.0118	-0.0034
		(0.78)	(-1.12)	(-0.20)
Constant	0.5835***	-2.2650***	-0.3083**	1.3749***
	(4.85)	(-5.36)	(-2.08)	(5.19)
Industry & Year	YES	YES	YES	YES
N	1102	1102	1102	1102
Chi-square	758.04	960.96	982.21	401.47

Simultaneous system of equations (3SLS) regression of CAPEX and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the CAPEX model. The models included fixed effects in all estimations. The reported t-statistics are based on robust standard errors are within parentheses. Compensation models include investment, controls and instruments (i.e. E.Av.Age, DPO and STKRV). Variable definitions are described in Table 4.1 *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.5.2.2 Discussions of empirical results on fixed intangible expenditure

Table (4.6) shows the results for the three-stage least squares (3SLS) regression analyses. Our system of equations model (estimated using 3SLS estimator) accounts for several endogenous and exogenous variables in the specifications. The underlying objective is to look at how the level and the composition of executives' compensation relates to fixed intangible expenditure. The lack of empirical evidence relating to the issue underlines our central motivation.

Specifically, the findings presented in Table (4.6) are discussed below. Column (1) presents the regression results for fixed intangible. In particular, we find that the relationship between LTIPs (equity) incentive and fixed intangible is positive and significant at 1% level of confidence. The coefficient estimate (0.4577, t-statistics 8.78) show that managers are more likely to increase fixed intangible spending when their residual interest in the form of LTIPs incentive increases. A likely interpretation of the result is that firms with intensive fixed intangible activities tend to apply more equity rewards to influence managers to allocate more resources into intangibles. Another possible alternative explanation is that, because intangibles are uncertain, risky and long term (Holmstrom, 1989; Lambert, 1986; Manso, 2011) and are often less attractive to the capital market, managers may become unwilling to devote the firm's resources into such activity. Therefore, one way shareholders motivate managers to invest more in fixed intangible activity is to offer them (managers) more equity incentives. This view is consistent with the risk-motivated explanation, in that shareholders want the executives to invest in all risky intangible activities (Manso, 2011).

On the stock options incentive, the coefficient estimate (0.6213 t-stats 9.82) is positive and statistically and economically significant. This finding is consistent with the hypothesis (**H3b**), which suggests that corporate executives gain extra incentive by spending more on fixed intangible (which increases the firm's idiosyncratic risks) when share options incentives are handed to them. To be more precise, the convex nature of stock options payoff partly induces executives to increase investment in fixed intangible or knowledge-based expenditure (Manso, 2011; Nguyen, 2018). Thus, in line with risk-related explanation, shareholders offer managers share options to encourage them to undertake riskier intangible activity so that both shareholder(s) and agent(s) can share long-term economic benefits together.

Furthermore, a similar result is reported for the cash bonus compensation. The finding shows that cash bonus is positively and significantly associated with fixed intangible, which is inconsistent with our natural prediction (**H3c)**. The result supports the fact that executives who receive cash bonuses may prefer to channel more corporate resources (funds) into fixed intangible spending. In fact, one possible direct inference from this evidence is that shareholders rather use cash bonus compensation to motivate managers to invest more into fixed intangible activity. This is because, fixed intangible is uncertain and risky (Lambert 1986; Holmstrom, 1989; Bhagat and Welch, 1995), which makes risk-averse managers more likely to cut down expenditure on such activity in order to reduce the firm's idiosyncratic risks. Again, firms may encounter difficulties raising debt to sponsor intangibles, making it likely for managers to disinvest in such activity particularly when internal cash flow is insufficient, even if the future payoff could improve overall firm value. Therefore, UK shareholders through the board of directors (BOD) reward executives with a cash bonus to induce them to allocate more resources into fixed intangible.

In short, the evidence provided so far in this section suggests that the pay components (LTIPs, stock options and cash bonus) and fixed intangible are likely to be explained by both risk-motivated incentive and alignment argument.

Clearly, all the incentive components are positively and significantly related to fixed intangible, which seems to imply that corporate owners with substantial growth opportunities in fixed intangible activity use any of the components to induce managers to allocate more resources into such activity.

4.5.2.2.1 Control variables for fixed intangible expenditure

This subsection provides a snap discussion of the control variables in the fixed intangible model. The coefficient estimates on salary, leverage, stock return and sales growth are positive, whilst firm size, market-to-book, and cash flow are negatively related to fixed intangible expenditure. Firstly, the positive coefficient on salary connotes managerial risk aversion and that managers with heavy salary remuneration are likely to increase fixed intangible. Secondly, leverage is also positive and significant, implying that firm managers may use debt capital to fund fixed intangible, which is inconsistent with the assumption that bond markets are unlikely to sponsor intangible activity. Thirdly, sales growth is supportive of fixed intangible. On the other hand, firm size, market-to-book and cash flow are negative and statistically significant. For instance, large and high-growth firms are less supportive of fixed intangible activity. In other words, larger and higher-growth firms are unlikely to expand their operational activities via increasing fixed intangible activity. The cash flow is negative, which suggests that well performing firms are less likely to sponsor fixed intangible from internal cash surplus.

4.5.2.2.2 Discussion of the compensation components results

Columns 2, 3 and 4 of the fixed intangible table show the results of the determinants of managerial compensation.

Specifically, the LTIPs model (column 2) shows that stock options and cash bonus are all negative, postulating a substitution effect (Coles et al., 2006). Further, the following characteristics show positive signs: firm size, market-to-book, stock return, CAPEX, R&D,

fixed intangible, cash flow, executive ownership, non-executive ownership, dividend pay-out and executive average age. As indicated, large and high-growth firms apply more LTIPs incentive and shareholders consider activities such as CAPEX, R&D and fixed intangible when determining the LTIPs incentive. Moreover, executive ownership is positively related to LTIPs reward, inconsistent with Ryan and Wiggins (2001), whilst non-executive directors' ownership shows support for the shareholders' usage of the LTIPs incentive. However, other factors including leverage and large ownership are all negatively related to the LTIPs incentive. As argued by Jensen (1986) and Harford (1999), leverage mitigates shareholder-manager agency conflicts, which makes it an effective tool for high-leverage firms to use fewer LTIPs to reward managers. The effective presence of large ownership leads to lower LTIPs incentive rewards.

Similarly, column (3 – stock options) reports negative and statistically significant coefficients for LTIPs and cash bonus. Firm size, market-to-book, CAPEX, R&D, fixed intangible, cash flow, stock return, executive ownership, non-executive ownership, executive age and dividend pay-out are all positive. In contrast, leverage, stock return volatility and large ownership are all inversely related to the stock options incentive.

The cash bonus equation in column (4), shows that LTIPs and stock options are negatively linked to cash bonus. Further, leverage and large ownership both show negative signs. On the other hand, firm size, market-to-book, CAPEX, R&D, fixed intangible, cash flow, executive ownership, non-executive ownership, dividend pay-out and executive age are all positive and statistically significant. For instance, one possible explanation is that the firm's board of directors may use cash compensation incentives as a substitute for equity packages particularly when the firm has a huge unused cash balance in their books (Core and Guay, 1999; Amstrongand Vashistha 2012), and may also make higher cash dividend payments to shareholders when the firm has no immediate growth opportunities.

Table 4. 6 Fixed Intangible Regression Results

	(1) FINTANG	(2) LTIPs	(3) ESO	(4) CashB
LTIPs	0.4577***		-0.1578***	-0.1157***
	(8.78)		(-12.53)	(-10.02)
ESO	0.6213***	-0.1286***.		-0.0598***
	(9.82)	(-26.99)		(-14.58)
CashB	0.7028***	-0.2400***	-0.1618***	
	(12.81)	(-22.01)	(-18.52)	
SAL	0.0311	0.0691	0.0915	0.0024
	(0.90)	(0.54)	(0.88)	(0.04)
LEV	0.0887***	-0.3641***	-0.3254***	-0.1963***
	(2.64)	(-3.07)	(-3.33)	(-3.26)
Size	-0.0493***	0.3017***	0.1987***	0.1176***
	(-3.88)	(6.01)	(4.38)	(3.89)
MKTB	-0.0078***	0.0468***	0.0362***	0.0223***
	(-4.18)	(5.57)	(4.84)	(4.93)
CF	-0.1335***	1.9003***	1.6506***	1.3117***
	(-2.71)	(3.74)	(3.41)	(4.22)
SGR	0.0068			
	(0.50)			
STKR	0.0005	0.0234	0.0150	
	(0.06)	(1.33)	(1.06)	
CAPEX		1.8511***	1.4549***	0.9586***
		(4.43)	(3.64)	(3.62)
R & D		1.2634**	0.9860**	0.8101***
		(2.56)	(2.31)	(2.96)
FINTANG		5.5452***	4.4139***	2.8819***
		(7.50)	(6.23)	(6.15)
STKRV			-0.0046	
			(-0.42)	
Large Own		-0.0018**	-0.0016**	-0.0004
		(-1.96)	(-2.08)	(-0.74)
E. Own		0.4944***	0.3880***	0.2562***
		(3.02)	(2.74)	(2.80)
NonE. Own		1.7499***	1.3889***	0.8573***
		(4.17)	(3.54)	(3.34)
E.Av. Age		0.0068*	0.0056*	0.0043**
		(1.91)	(1.85)	(2.22)
DPO		0.0856*	0.0728*	0.0868***
		(1.88)	(1.86)	(3.51)
Constant	0.1137	-3.7527***	-2.6427***	-1.5408***
	(1.04)	(-5.62)	(-4.18)	(-3.66)
Industry & Year	YES	YES	YES	YES
N	1102	1102	1102	1102
Chi-Square	434.49	1784.99	1073.89	762.03

Simultaneous system of equations (3SLS) regression of FINTANG and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the CAPEX model. The models included fixed effects in all estimations. The reported t-statistics are based on robust standard errors are within parentheses. Compensation models include investment, controls and instruments (i.e. E.Av.Age, DPO and STKRV). Variable definitions are described in Table 4.1 *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.5.2.3 Discussions of empirical results on research and development expenditure

The results from the three-stages least squares (3SLS) estimates are presented in Table (4.7). Column (R&D – 1) reports the results for the research and development expenditure. We find a significant negative relationship between research and development and LTIPs (equity) incentive. Specifically, the estimated coefficient on equity is negative (-0.0133 t-statistics -2.32) and significant at 5% confidence level. This shows that an increase in executives' equity compensation (LTIPs) cause managers to lower investment in innovative activity (R&D) expenditure. In other words, managers are more likely to under-invest in R&D activity particularly if large component of their residual interest is in the form of LTIPs incentive. This is consistent with prior studies (e.g. Cassell et al., 2012; O'Connor, Rafferty and Sheikh, 2013) that find an inverse relation between equity-based incentives and R&D expenditure. One possible interpretation is that, because knowledge based-asset investments are hard for the capital markets to value due to their long development cycles and are often more uncertain in terms of the pay-out prospects (Bange and DeBondt, 1998), managers become hesitant to commit more resources to finance such projects especially as their equity stakes increase. Thus, the high level of informational asymmetries associated with R&D expenses could cause managers to relatively invest less pounds sterling in innovation activity when a substantial component of their compensation is in the form of equity. This is, however, inconsistent with the underlying intuition of managerial risk-motivated incentive argument. LTIPs-incentivised managers are expected to allocate more resources to relatively risky but positive net present value (R&D) activities (Jensen and Murphy, 1990; Clinch, 1991; Smith and Watts, 1992; Chen, Chen, Yang, 2017).

Similarly, the finding on stock options is also negative and statistically significant. With the estimated coefficient estimates of -0.0219 (t-statistics -2.64), the result appears to support the view that managers tend to become less responsive to R&D activity when their residual interest in the share options incentives is large. It suggests that an increase in share options incentives, on average, is associated with a 2.2% decrease in R&D investment, all things being equal. This direct evidence is in contrast with the popular assertion that managerial risk aversion is significantly reduced when managers receive large share options incentives. A possible explanation can be linked to the fact that, because R&D activity is relatively more risky, managers become more wary when their share options are in-the-money and may tend to lower R&D expenses to prevent further stock price volatility associated with increased R&D innovative activity (Lewellen, 2006). Alternatively, it could possibly suggest that the firm's board of directors uses stock options to satisfy other specific purposes such as attracting more talented managers and for cash flow constraints (substitution motives) (Core and Guay, 1999). The finding supports prior studies (e.g. Lewellen, 2006; Hayes et al. 2012; O'Connor, Rafferty and Sheikh, 2013) but is inconsistent with other literature (see e.g. Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012; Nguyen, 2018) that reports an increasing relation. For instance, using vega to represent the sensitivity of CEOs' (stock-based) portfolio wealth to stock return volatility, Coles et al. (2006) find a positive association between vega and research and development expenditure, and interpret the finding to suggest that the risk-taking incentive (vega) induces more risk-motivated activity (R&D) of managers.

Moreover, the finding on cash bonus (coefficient 0.0350 t-statistics 11.41) is positive and statistically significant. This tends to indicate that cash-motivated managers are likely to allocate more resources into riskier R&D activity. This is inconsistent with the study's hypothesis. One possible explanation that can be drawn from the regression result is that shareholders use a cash bonus to ameliorate the earnings management problem. Thus, because managerial cash bonus is often dependent on accounting performance measures (e.g. cash balance, profits, etc.), managers are more likely to lower R&D expenditure or discretionary activities in order to meet the performance threshold. In an attempt to alleviate this, the board of directors on behalf of the shareholders may award managers cash bonus incentives after satisfying a required investment into R&D activity, suggesting a positive linkage between them. This is particularly important for high-growth R&D firms to induce managers with cash incentives so that they (managers) can allocate more corporate resources into R&D activity. The finding is consistent with Hayes et al. (2012) and Chen et al. (2017) but contrary to other prior studies (see Coles et al., 2006; Xue, 2007). For example, Hayes et al. (2012) find a positive and statistically significant relation between cash compensation and research and development expenditure in their panel fixed effect cross-sectional examination.

Collectively, the findings on stock-based incentives (LTIPs and share options) seem to indicate that managers tend to disinvest in R&D activity as their residual interest in the form of stock incentive increases. This raises further concern on the shareholders' intention to use stock-based compensation to influence managerial risk-taking attitude (more R&D spending) and to align their interests with managers. This is because shareholders want risk-averse managers to invest more in inherently risky activity (R&D), thereby offering managers risk-motivated incentive packages to motivate them. Thus, stock-based compensation does not reduce managerial risk-related incentive problem. In contrast, cash bonus compensation posits otherwise. Cash bonus encourages more investment allocation into innovative (R&D) activity.

4.5.2.3.1 Control variables for research and development expenditure

The study also provides results for the control variables. We find the following predetermined variables to be positively related to research and development expenditure: firm size (coefficient 0.0015), market-to-book (coefficient 0.0001) and sales growth (coefficient 0.0033). For instance, high-growth firms are likely to spend more on research and development activity for new discovery and expansion purposes. Again, because large and mature firms often operate in a concentrated business environment and the only way to create further expansion could be through research into a new market, human and product development, consumer expectation, etc., in that sense large firms are more likely to increase R&D expenses. Also, firms with high sales growth are likely to increase spending on R&D activity. In contrast, others including leverage (coefficient -0.0036), cash flow (coefficient -0.0038), stock return (coefficient -0.0009) and salary (-0.0017) are negatively related. Specifically, leverage shows the unwillingness of the bond market to sponsor R&D. Again, the negative coefficients on cash flow and stock return signal that firms do not follow a pecking order and that they are less likely to sponsor R&D activity with internal cash surplus or common stock issue. Moreover, the negative coefficient on salary shows that risk-averse managers are likely to lower relatively risky R&D investment. In other words, managers are reluctant to increase R&D expenditure when salary constitutes a large component of their compensation package. However, one caveat of the results is that the coefficient estimates are largely insignificant.

4.5.2.3.2 Discussion of the compensation components results

In the R&D model, column (2 – LTIPs/equity) shows salary and stock options are negatively associated but cash bonus is significantly positive. Others including firm size, market-to-book, dividend pay-out, cash flow, and executive average age all show positive signs with only dividend pay-out and executive average age that are statistically significant. For instance, shareholders use more LTIPs to reward managers as they become older whilst dividend pay-out firms use more LTIPs to incentivise managers to ameliorate investment related agency problem such as empire-building especially when there is no growth investment opportunity (Fenn and Liang, 2001; Bates et al., 2009). However, leverage, CAPEX, R&D, fixed intangible, large ownership, non-executive ownership and executive ownership all suggest an inverse association with LTIPs.

Relatedly, column (3) stock options incentive shows salary and LTIPs are all negative whilst cash bonus is positive. Also, market-to-book, stock return volatility, cash flow, dividend pay-out and executive average age are all positive. In contrast, firm size, leverage, CAPEX, R&D, fixed intangible, large ownership, executive ownership and non-executive ownership are all negatively associated with share/stock options.

Moreover, cash bonus (4) column reports positive coefficients on salary, LTIPs and stock options incentives, suggesting a jointly determined impact on cash bonus incentive. Also, leverage, CAPEX, R&D, fixed intangible, large ownership, cash flow, executive ownership and non-executive ownership are all positive. However, firm size, market-to-book, dividend pay-out and executive average age all show negative signs with only dividend pay-out and executive average age (instruments) that are statistically significant.

In summary, the reported findings suggest the interdependence of managerial compensation incentives and other firm-related characteristics, implying that shareholders consider other factors when determining managers' pay. Generally, the reported results are largely consistent with prior studies (e.g. Core et al., 1999; Guay, 1999; Ryan and Wiggins, 2001; Amoako-Adu et al., 2011; Humphery-Jenner et al., 2016), although some proxies lack statistical significance in other specifications.

Table 4. 7 Research & Development Regression Results

	(1) R & D	(2) LTIPs	(3) ESO	(4) CashB
LTIPs	-0.0133**		-0.1482***	0.0548***
	(-2.32)		(-23.08)	(9.19)
ESO	-0.0219***	-0.1368***.		0.0430***
	(-2.64)	(-23.68)		(10.06)
CashB	0.0350***	0.1520***	0.1435***	
	(11.41)	(18.19)	(21.60)	
SAL	-0.0020	-0.3536	-0.2367	0.0970
	(-0.34)	(-1.32)	(-1.19)	(0.70)
LEV	-0.0036	-0.1479	-0.1418	0.0752
	(-0.65)	(-0.64)	(-0.83)	(0.63)
Size	0.0015	0.0338	-0.0208	-0.0113
	(0.72)	(0.37)	(-0.30)	(-0.22)
MKTB	0.0001	0.0001	0.0002	-0.0007
	(0.25)	(0.03)	(0.02)	(-0.09)
CF	-0.0038	-0.0979	0.0051	0.2274*
	(-1.55)	(-0.40)	(0.03)	(1.74)
SGR	0.0033*			
	(1.69)			
STKR	-0.0009	-0.0131	-0.0105	
	(-1.21)	(-0.93)	(-0.94)	
CAPEX		-0.4455	-0.3999*	0.2628*
		(-1.57)	(-1.88)	(1.77)
R & D		-66.3753***	-50.5034***	36.6966***
		(-4.27)	(-4.35)	(4.52)
FINTANG.		-0.4277	-0.4115	0.3588**
		(-1.23)	(-1.58)	(1.97)
STKRV			0.0048	
			(0.62)	
Large Own		-0.0028	-0.0024	0.0023**
		(-1.30)	(-1.48)	(2.03)
E. Own		-0.1848	-0.1596	0.0669
		(-1.27)	(-1.46)	(0.85)
NonE.Own		-1.2216*	-0.9925*	0.6664*
		(-1.78)	(-1.93)	(1.84)
E.Av.Age		0.0085*	0.0067*	-0.0046*
		(1.80)	(1.91)	(-1.82)
DPO		0.1148***	0.0916***	-0.0518**
		(2.82)	(3.00)	(-2.28)
Constant	-0.0029	1.1247	1.2784	-0.4941
	(-0.16)	(0.98)	(1.50)	(-0.83)
Industry & Year	YES	YES	YES	YES
N	1,102	1,102	1,102	1,102
Chi-Square	421.08	1720.17	1686.14	745.68

Simultaneous system of equations (3SLS) regression of R&D and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the R&D model. The models included fixed effects in all estimations. The reported t-statistics are based on robust standard errors are within parentheses. Compensation models include investment, controls and instruments (i.e. E.Av.Age, DPO and STKRV). Variable definitions are described in Table 4.1 *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.5.2.4 Discussions of empirical findings on other fixed assets expenditure

As indicated earlier, our capital expenditure measurement encapsulates both net tangible capital expenditure and other fixed assets expenditure which represents other assets acquired in the Compustat database (Lewellen and Lewellen, 2014; 2016). However, because these activities carry different risk profiles and value implications for shareholders as well as the managers, it is possible that the managers' choice is likely to be influenced by the relative riskiness of the two major corporate activities (property, plant and equipment and other fixed assets). In furtherance to this, we attempt to establish the extent to which the nature and the level of managerial compensation packages influence managers' selection of other fixed assets (CAPEX2) investment type. We perform tests for the stated hypotheses (**H4a, H4b and H4c).**

The first column in Table (4.8) presents the results of other fixed assets (CAPEX2) expenditure. Specifically, the LTIPs incentive is negative and significant at 1% level. This is inconsistent with hypothesis (**H4a)**, which suggests that LTIPs incentive grants influence managers to increase other fixed assets investment. To be specific, the coefficient estimates of -0.1894 (t-statistics -6.00) imply that managers that receive LTIPs (equity) grants are less likely to carry out firm expansion through other fixed activity. This is contrary to both incentive alignment and risk-motivated expectations. In other words, shareholders want managers to invest in all valued other fixed acquired activities. One interpretation could be that, because such activity is often large and uncertain as well as a capital-intensive project, risk-averse managers with huge equity compensation are more likely to forgo such projects as their residual interest in LTIPs in their managed firm increases.

Relatedly, the stock options incentive is also negative and significant at the 1% confidence level. With the estimated coefficient of -0.3020, the finding indicates that an increase in the managerial share options package, on average, leads to a 30.2% decrease in other fixed projects, all things being equal. This is contrary to other scholarly works (e.g. Croci and

Petmezas, 2015; Agrawal and Mandelker, 1987). In line with the risk-taking incentive explanation, Croci and Petmezas (2015) argue that acquisition (inorganic acquired fixed assets) activity increases the firm's idiosyncratic risk and may expose managers to job security risks, particularly when it turns out to be value deteriorating. Due to this, shareholders may tend to apply stock options to motivate managers to undertake more other fixed assets activity. Although this argument is intuitively appealing, we find opposite evidence. A possible interpretation could be that, because most of the stock options compensation is often in the money at the point of grants (Lewellen, 2006), a risk-averse executive would be less inclined to allocate more resources to such risky activity (other fixed assets), given that he or she could be fired (Lehn and Zhao, 2006) or their firm may become a potential takeover target if the said activity fails (Mitchell and Lehn, 1990).

The cash bonus compensation is negatively and significantly related to other fixed assets investment. The coefficient estimate is -0.3587 (t-statistics -9.48), implying that cash-motivated managers are likely to reduce spending on other fixed acquisition activity, consistent with hypothesis **(H4c)**. As suggested by Lewellen and Lewellen (2014), other fixed assets bought (reported in the Compustat database) from other firms are often cash sponsored (internal cash or debt finance). Sponsoring such activities involves a huge cash outflow, which can constrain the cash balance or reserve at the end of the financial year. Further, because cash bonus is largely dependent on accounting performance measures, risk-averse managers are likely to lower such cash-financed projects in order to reserve enough cash balance to enable them to meet their annual cash bonus incentive. Thus, earnings management to some extent is likely to prevail.

In short, the empirical findings on LTIPs, stock options and cash bonus imply that managerial financial compensation incentives partly explain other fixed assets investment behaviour. An important implication of the results is that the LTIPs, stock options and cash bonus incentives are all less likely to encourage managers to invest more in other fixed activity. Significantly, the presented evidence seems to suggest that British corporate managers' compensation packages are less likely to positively influence capital-intensive activity like other fixed assets.

4.5.2.4.1 Control variables for other fixed assets expenditure

Importantly, the determinants of other fixed investment were also controlled in the second-stage model. These are factors that the prior literature has found to explain investment behaviour. For instance, we find that the following coefficients estimates – leverage, firm size and market-to-book, cash flow and sales growth – are all negative, with only firm size and cash flow being significant. More explicitly, the leverage shows that high-debt firms are likely to forgo such activity, whilst large-size firms are less likely to embark on expansion via other fixed investment. Also, growth firms do not use such expansion activity. In addition, firms with a substantial cash reserve do not sponsor acquisition with internally generated resources, inconsistent with the pecking order hypothesis.

In contrast, others including salary and stock return are positive. To be precise, salary is used to proxy for executives' risk aversion and shows support for acquisition of other fixed assets, implying that risk-averse managers are likely to spend more on other fixed assets activity. Also, firms with good-performing stocks, proxied by stock return, are likely to use equity source to sponsor such activity. However, the coefficient on stock return is insignificant.

Table 4. 8 Other Fixed Assets Expenditure (CAPEX2) Regression Results

	(1) CAPEX2	(2) LTIPs	(3) ESO	(4) CashB
LTIPs	-0.1894***		-0.0787***	0.0216***
	(-6.00)		(-18.79)	(4.51)
ESO	-0.3020***	-0.0835***.		0.0090***
	(-6.63)	(-20.42)		(2.67)
CashB	-0.3587***	0.0111**	0.0145***	
	(-9.48)	(2.02)	(3.65)	
SAL	0.1990***	-0.0076	0.0244	0.0502**
	(10.48)	(-0.25)	(1.13)	(2.13)
LEV	-0.0147	0.0251	-0.0499***	-0.0092
	(-0.78)	(0.93)	(-2.68)	(-0.42)
Size	-0.0431***	0.1179***	0.0158**	-0.0432***
	(-5.95)	(12.22)	(2.28)	(-5.55)
MKTB	-0.0009	0.0062***	0.0039***	-0.0001
	(-0.89)	(4.11)	(3.74)	(-0.08)
CF	-0.0773**	-0.0202	0.0632*	0.0213**
	(-2.12)	(-0.36)	(1.64)	(1.97)
SGR	-0.0066			
	(-0.50)			
STKR	0.0019	0.0121	0.0114*	
	(0.28)	(1.31)	(1.72)	
CAPEX		0.0802***	-0.0380*	-0.1056***
		(2.81)	(-1.92)	(-4.75)
R & D		-0.2433*	-0.2205**	0.2054*
		(-1.84)	(-2.32)	(1.92)
FINTANG.		0.1195***	-0.0313	0.0628**
		(3.72)	(-1.40)	(2.50)
STKRV			0.0056	
			(0.77)	
Large Own		-0.0016***	-0.0008***	0.0014***
		(-5.08)	(-3.82)	(5.97)
E.Own		-0.1970***	-0.1324***	-0.0584*
		(-4.71)	(-4.57)	(-1.79)
NonE.Own		0.1401*	-0.0190	-0.0621
		(1.76)	(-0.35)	(-1.00)
E.Av. Age		0.0003	-0.0003	-0.0027
		(0.28)	(-0.38)	(-0.23)
DPO		-0.0199	-0.0177*	0.0453***
		(-1.38)	(-1.76)	(4.05)
Constant	0.0490	-0.6506***	0.1302*	0.3662***
	(0.76)	(-5.65)	(1.68)	(4.03)
Industry & Year	YES	YES	YES	YES
N	1063	1063	1063	1063
Chi-Square	2744.80	1162.11	501.14	313.95

Simultaneous system of equations (3SLS) regression of CAPEX2 and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the CAPEX2 model. The models included fixed effects in all estimations. The reported t-statistics are based on robust standard errors are within parentheses. Compensation models include investment, controls and instruments (i.e. E.Av.Age, DPO and STKRV). Variable definitions are described in Table 4.1 *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.6 Robustness check

The results from the three-stage least squares (3SLS) technique provide support for the empirical implications of Croci and Petmezas (2015), Hayes et al., (2012) and Guay (1999) but are inconsistent with other prior studies (e.g. Coles et al., 2006; Xue, 2007; Kini and Williams, 2012) regarding the risk-motivated effects of managerial compensation on investment activities. In this section, we perform several tests to examine if the preceding findings in Tables (4.5, 4.6, 4.7 & 4.8) are robust to other additional independent variables including managerial characteristics (ownership and ages), governance factors as well as alternative model specifications. Thus, the study tests the sensitivity of the main findings to corporate governance mechanisms that may independently impact management corporate policies such as large ownership and non-executive ownership. More specifically, we characterise these additional factors into two sub-headings: managerial characteristics and corporate governance factors.

In the interests of brevity, the current analyses are restricted to the behaviour of our key explanatory variables, LTIPs, stock options and cash bonus, on the investment activities.

4.6.1 Managerial characteristics

Broadly, prior literature on corporate governance (e.g. Mehran, 1996) suggests that shareholders design incentive compensation to minimise the agency problem. However, in cases where managers have substantial shareholdings in the firm, shareholders are likely to reduce managerial incentive alignment packages (Mehran, 1996; Hartzell and Starks, 2003; Florackis and Ozkan, 2009). Contrarily, others suggest that concentrated (large) executive ownership leads to entrenchment and possible extraction of rents via higher salaries and bonuses (Holderness and Sheehan, 1988; Cheung et al., 2005). Due to this, shareholders tend to consider managerial ownership when designing executive compensation because the different level of ownership induces a managerial control mechanism which in turn could affect managerial policy behaviour (Nguyen, 2018; Ryan and Wiggins, 2001). The estimated investment model failed to account for executive ownership, and we included this variable in our extended investment model.

Additionally, managerial personal characteristics including age, educations, skills and experience are likely to affect managers' risk-taking behaviour relating to investment (Yim, 2013; Hirshleifer, 1993; Gibbons and Murphy, 1993). For instance, Gibbons and Murphy (1993) and Dechow and Sloan (1991) argue that older managers are likely to subscribe to investment policies that pay off before retirement. Relatedly, Hirshleifer (1993) observes that young executives are more likely to engage in short-term projects to boost their career reputations; whilst Yim (2013) empirically demonstrates that younger CEOs are more likely to engage in acquisition activity. In line with the above discussion, we also include executives age in the investment model to see the extent to which this proxy affects investment behaviour.

4.6.2 Governance mechanisms

Throughout the empirical analyses, shareholders via the BODs are assumed to apply different types and levels of managerial compensation (LTIPs, stock options and cash bonus) to ameliorate or alleviate the investment-related agency problem. In fact, the incentive compensation is one of the important monitoring mechanisms often used in tandem with other governance mechanisms to reduce the agency problem (Hartzell and Starks, 2003; Ryan and Wiggins, 2001; Mehran, 1995). For instance, Mehran (1995) suggests that the presence of effective external monitoring systems (i.e. proxied by block shareholder ownership) reduces managerial incentive compensation. In addition, with their large stakes (Jafarinejad et al., 2015) coupled with rich knowledge and skills (Ntim et al., 2016), institutional or large owners may have an incentive to constantly monitor managerial corporate activities (Smith, 1996) as well as the power (i.e. in theory) to influence executive pay packages through the board. Relatedly, however, managers might have influence over the setting of their pay incentives especially in a poor governance environment (Bebchuk and Fried, 2003; Weisbach, 2007). In addition, the effective presence of non-executive members helps monitor managerial activity and minimise rent extraction (Ryan and Wiggins, 2001; Mehran, 1995). For robustness purposes, the investment specifications account for these additional variables.

In fact, consistent with investment-compensation nexus literature (e.g. Coles et al., 2006; Xue, 2007; Croci and Petmezas, 2015; Nguyen, 2018), our base specifications exclude other monitoring governance factors which could possibly affect the nature and selection of investment activity. In other words, the reported (Tables 4.5 – 4.8) association between executives' incentive compensation and investment decisions could be sensitive to other governance indicators. This subsection tests the extent to which governance mechanisms significantly impact a firm's investment behaviour. The analysis is necessary because the inclusion of governance proxies (i.e. block-shareholder ownership and non-executive shareholdings) in the investment models would further aid our understanding on how these factors affect investment, and, more importantly, to check if indeed our results still remain robust. Thus, the study extends the second-stage model (e.g. investment equation – e.g. CAPEX, R&D and fixed intangible) by including these additional factors. We present the results of the extended specifications in Tables (4.9, 4.10, 4.11 & 4.12). We start with capital expenditure, then fixed intangible and research and development expenditure.

4.6.2.1 Capital expenditure robustness test

As displayed in columns (1) to (4) of Table (4.9) CAPEX models, the additional managerial and governance variables do not change our key findings. Specifically, the coefficient on executives ownership is positive and significant. It suggests that managers are more likely to allocate more resources into CAPEX activity as their executive ownership increases. The CEO's age is negatively related to CAPEX activity, implying that, as an executive gets older his/her appetite for such activity decreases. This is consistent with Yim's (2013) argument that young CEOs are likely to undertake capital-intensive projects.

Furthermore, the board of directors who are non-executive directors provide internal assurance and institute various schemes to protect shareholders from managerial expropriation. With this fiduciary responsibility, the independent board is likely to affect – either directly or indirectly – executives' corporate activities. We account for this effect by including the number of shareholdings of non-executive directors. Again, non-executives' ownership and CAPEX is positive and it is both statistically and economically significant across the specifications. It tends to imply the non-executive directors' approval for capital expenditure projects.

Lastly, large (block) ownership is positively and significantly related to CAPEX activity. This appears to suggest that large shareholders (measured as either individuals or institutions with stakes above 3% of the firm's total shareholdings as reported in the annual account) support management allocation of more resources to CAPEX investment. This evidence, however, could pose serious implications for minority shareholders. For instance, Conyon and He (2011) argue that block shareholders can connive with executives to select activities that maximises their immediate interests.

In short, our key compensation components (LTIPs, stock options and cash bonus) coefficients qualitatively remain unchanged after the inclusion of both managerial and governance characteristics in the CAPEX model. In essence, our earlier reported findings are insensitive to these independent factors.

Table 4. 9 Capital Expenditure Robustness Test

	(1)	(2)	(3)	(4)
	CAPEX	CAPEX	CAPEX	CAPEX
SAL	0.1461***	0.1985***	0.2150***	0.2188***
	(3.76)	(4.89)	(5.30)	(5.39)
LTIPs	0.1514***	0.1964***	0.2057***	0.2047***
	(2.72)	(3.53)	(3.73)	(3.73)
CashB	-0.7094***	-0.7239***	-0.7068***	-0.7037***
	(-12.41)	(-12.79)	(-12.57)	(-12.56)
ESO	0.4035***	0.4739***	0.5051***	0.5071***
	(4.60)	(5.41)	(5.82)	(5.86)
LEV	-0.0013	-0.0121	-0.0216	-0.0211
	(-0.04)	(-0.32)	(-0.58)	(-0.56)
CF	0.0616	0.0785	0.0852	0.0712
	(0.99)	(1.22)	(1.30)	(1.12)
SGR	0.0059	0.0049	0.0012	0.0034
	(0.43)	(0.37)	(0.15)	(0.26)
Size	-0.0560***	-0.0552***	-0.0576***	-0.0578***
	(-4.00)	(-3.94)	(-4.14)	(-4.16)
STKR	-0.0012	-0.0005	-0.0007	-0.0009
	(-0.15)	(-0.07)	(-0.09)	(-0.12)
MKTB	-0.0074***	-0.0067***	-0.0073***	-0.0072***
	(-3.57)	(-3.26)	(-3.54)	(-3.50)
E. Own	0.0935*	0.0149	0.0437	0.0377
	(1.70)	(0.26)	(0.75)	(0.65)
Large Own		0.0019***	0.0017***	0.0017***
		(4.40)	(4.02)	(4.05)
Non.E.Own			0.3671***	0.3501***
			(3.46)	(3.29)
CEO age				-0.0014
				(-1.61)
Constant	0.5051***	0.2480*	0.2107	0.2729*
	(4.14)	(1.84)	(1.57)	(1.95)
N	1102	1102	1102	1101
Chi-square	763.71	793.91	823.45	823.78

Simultaneous system of equations (3SLS) regression of CAPEX and LTIPs, ESO and CashB results. The predicted sign for the variable of interests are shown in the CAPEX (second-stage) model and we report only the results in the second-stage regression by accounting for additional independent variables. Thus, *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.6.2.2 Fixed intangible expenditure robustness test

On the fixed intangible expenditure (Table 4.10), the coefficient on executives' ownership is negative, whilst CEOs' age is positive, but both lack statistical significance. It suggests older CEOs are likely to support fixed intangibles. This is unsurprising given that fixed intangibles are not known to be a too risky activity.

Similarly, non-executive shareholding is negative and statistically significant. With the coefficients ranging from -0.5522 to –0.5753, it tends to suggest outside directors' disapproval for fixed intangibles. Large ownership is also negatively related. A possible implication is that, because fixed intangibles are unobservable and often less predictable in terms of the pay-out outcome (Holmstrom, 1989), block shareholders are more unlikely to support such intangible activities.

Importantly, the implications of these findings on the fixed intangibles–compensation nexus show that the study results are unaffected by the inclusion of both managerial features, internal and external governance mechanisms.

Table 4. 10 Fixed Intangible Expenditure Robustness Test

	(1) FINTANG.	(2) FINTANG	(3) FINTANG	(4) FINTANG
SAL	0.0256	0.0075	-0.0175	-0.0221
	(0.73)	(0.21)	(-0.49)	(-0.61)
LTIPs	0.4614***	0.4513***	0.4421***	0.4720***
	(8.20)	(7.99)	(8.04)	(8.64)
CashB	0.7348***	0.7409***	0.7101***	0.7900***
	(13.04)	(13.19)	(12.99)	(14.18)
ESO	0.6384***	0.6284***	0.6061***	0.6831***
	(9.65)	(9.48)	(9.48)	(10.59)
LEV	0.0858**	0.0883***	0.1045***	0.1119***
	(2.55)	(2.62)	(3.17)	(3.35)
CF	-0.1317***	-0.1354***	-0.1398***	-0.1472***
	(-2.67)	(-2.74)	(-2.96)	(-3.12)
SGR	0.0083	0.0082	0.0133	0.0125
	(0.61)	(0.63)	(1.03)	(0.97)
Size	-0.0480***	-0.0487***	-0.0454***	-0.0452***
	(-3.76)	(-3.83)	(-3.65)	(-3.62)
STKR	0.0006	0.0000	0.0005	0.0014
	(0.08)	(0.01)	(0.06)	(0.18)
MKTB	-0.0074***	-0.0075***	-0.0076***	-0.0081***
	(-3.98)	(-4.03)	(-4.18)	(-4.44)
E.Own	-0.0329	-0.0037	-0.0474	-0.0268
	(-0.66)	(-0.07)	(-0.91)	(-0.51)
Large Own		-0.0006*	-0.0004	-0.0004
		(1.70)	(-1.01)	(-1.14)
NonE. Own			-0.5753***	-0.5522***
			(-6.11)	(-5.83)
CEO age				0.0009
				(1.08)
Constant	0.1534	0.2420**	0.2975**	0.2265*
	(1.39)	(1.98)	(2.49)	(1.80)
Industry & Year	YES	YES	YES	YES
N	1102	1102	1102	1101
Chi-square	439.83	503.03	505.17	548.54

Simultaneous system of equations (3SLS) regression of FINTANG and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the FINTANG (second-stage) model and we report only the results in the second-stage regression by including additional independent variables. Thus, *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.6.2.3 Research and development expenditure robustness test

As shown in Table (4.11) our modified research and development specification (including managerial and governance proxies) does not qualitatively alter our main results. In particular, executives' shareholding is negative but insignificant, reluctantly suggesting executives' disapproval of allocating more funds into research and development. This is plausible given the fact that the payoff of R&D activity is uncertain, and often has a long-term horizon period. Therefore, executives with concentrated ownership are likely to reduce the firm's risk exposure by disinvesting in such activity. Similarly, CEOs' age is also negative, postulating executives' unwillingness to increase innovative spending as they grow older.

Moreover, both the non-executives' ownership and block ownership are inversely and significantly associated with R&D activity. It shows that non-executive directors and large ownership holders are unlikely to support R&D activity.

More importantly, our key results remain qualitatively unchanged in the robustness specifications.

Table 4. 11 Research and Development Expenditure Robustness Test

	(1) R&D	(2) R&D	(3) R&D	(4) R&D
SAL	-0.0033	-0.0091	-0.0108*	-0.0107*
	(-0.54)	(-1.45)	(-1.70)	(-1.69)
LTIPs	-0.0203***	-0.0226***	-0.0220***	-0.0224***
	(-3.31)	(-3.78)	(-3.74)	(-3.85)
CashB	0.0310***	0.0314***	0.0313***	0.0312***
	(10.56)	(11.93)	(12.46)	(12.74)
ESO	-0.0316***	-0.0350***	-0.0342***	-0.0347***
	(-3.57)	(-4.04)	(-4.02)	(-4.11)
LEV	-0.0045	-0.0037	-0.0025	-0.0029
	(-0.79)	(-0.64)	(-0.44)	(-0.50)
CF	-0.0028	-0.0021	-0.0024	-0.0023
	(-1.14)	(-0.19)	(-1.18)	(-1.19)
SGR	0.0017	0.0008	0.0012	0.0010
	(0.83)	(0.43)	(0.60)	(0.55)
Size	0.0020	0.0024	0.0019	0.0019
	(0.95)	(1.14)	(0.87)	(0.91)
STKR	-0.0002	0.0000	0.0001	0.0003
	(-0.24)	(0.05)	(0.07)	(0.43)
MTKB	0.0001	0.0001	0.0001	0.0001
	(0.41)	(0.35)	(0.30)	(0.32)
E.Own	-0.0124	-0.0026	-0.0049	-0.0050
	(-1.49)	(-0.29)	(-0.56)	(-0.56)
Large Own		-0.0002***	-0.0002***	-0.0002***
		(-3.23)	(-2.95)	(-2.96)
NonE.Own			-0.0373***	-0.0370**
			(-2.26)	(-2.24)
CEO age				-0.0000
				(-0.08)
Constant	0.0008	0.0303	0.0332	0.0325
	(0.05)	(1.46)	(1.60)	(1.57)
N	1102	1102	1102	1101
Chi-square	469.38	564.43	732.54	783.02

Simultaneous system of equations (3SLS) regression of R&D and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the R&D (second-stage) model and we report only the results in the second-stage regression by including additional variables. Thus, *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.6.2.4 Other fixed assets expenditure robustness test

On the other fixed assets expenditure robustness testing (Table 4.12), the study continues to use executive ownership, CEOs' age, non-executive shareholdings and large ownership as our additional independent variables. Significantly, executives' ownership is positively correlated with other fixed assets expenditure, whilst CEOs' age is negative and significant. Thus, older managers are less likely to support other fixed activity (patents acquisitions).

Large ownership is positive, indicating support for such projects. The non-executives' shareholdings also support other fixed assets expenditure. The results on incentive compensation (i.e. LTIPs, stock options and cash bonus) are robust to all the alternative model modifications.

Collectively, across all our investment specifications, the inclusion of managerial characteristics and internal and/or external monitoring mechanisms does not change our reported findings. In other words, our results are insensitive to these factors.

Table 4.12 Other Fixed Assets Expenditure (CAPEX2) Robustness Test

	(1) CAPEX2	(2) CAPEX2	(3) CAPEX2	(4) CAPEX2
Salary	0.2052***	0.2046***	0.2052***	0.2086***
	(10.80)	(10.26)	(10.23)	(10.39)
LTIPs	-0.1139***	-0.1156***	-0.1160***	-0.1146***
	(-3.36)	(-3.38)	(-3.39)	(-3.35)
CashB	-0.3157***	-0.3150***	-0.3124***	-0.3104***
	(-8.18)	(-8.13)	(-8.03)	(-7.99)
ESO	-0.2053***	-0.2075***	-0.2065***	-0.2017***
	(-4.32)	(-4.33)	(-4.31)	(-4.20)
LEV	-0.0085	-0.0085	-0.0088	-0.0064
	(-0.46)	(-0.46)	(-0.47)	(-0.34)
CF	-0.0793**	-0.0794**	-0.0788**	-0.0815**
	(-2.18)	(-2.18)	(-2.16)	(-2.24)
SGR	-0.0082	-0.0082	-0.0082	-0.0073
	(-0.63)	(-0.63)	(-0.63)	(-0.56)
Size	-0.0480***	-0.0479***	-0.0479***	-0.0481***
	(-6.70)	(-6.68)	(-6.67)	(-6.71)
STKR	-0.0003	-0.0003	-0.0004	-0.0006
	(-0.05)	(-0.05)	(-0.06)	(-0.09)
MKTB	-0.0015	-0.0015	-0.0015	-0.0014
	(-1.49)	(-1.44)	(-1.48)	(-1.40)
E. Own	0.0756***	0.0762**	0.0775***	0.0729**
	(2.69)	(2.59)	(2.61)	(2.45)
Large Own		-0.0000	-0.0000	-0.0000
		(-0.10)	(-0.15)	(-0.07)
NonE. Own			0.0166	0.0006
			(0.31)	(0.01)
CEO age				-0.0012**
				(-2.13)
Constant	0.0168	0.0190	0.0163	0.0672
	(0.26)	(0.27)	(0.23)	(0.90)
N	1063	1063	1063	1062
Chi-square	2810.71	2812.28	2811.86	2827.60

Simultaneous system of equations (3SLS) regression of CAPEX2 and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the CAPEX2 (second-stage) model and we report only the results in the second-stage regression by including additional variables. Thus, ***,** ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

4.6.3 Alternative specification – ordinary least squares (OLS) method

Throughout the empirical analyses conducted so far, the study employed a 3SLS technique to the system of equations. Here, the OLS method is applied separately to the investment measures (CAPEX, fixed intangible and R&D) to check if the earlier produced results are robust to alternative specification.

Table (4.6.5) shows the OLS regression results of the investment measures. It reports the estimates from regressing capital expenditure (column a), fixed intangible (column b) and R&D (column c) on lagged compensation values (LTIPs, stock options and cash bonus) and other control variables defined in Table (4.1). It is worth stating that the focus is on the coefficients estimate of the primary explanatory variables: LTIPs, stock options and cash bonus. The reported t-statistics and p-values are based on standard errors clustered at the firm level.

Column (a) of the capital expenditure (CAPEX) shows that both stock options and LTIPs are positive, whilst the cash bonus coefficient sign is negative, which is consistent with the study's earlier findings. However, the estimate for stock options is insignificant. The weak correlation can partly be attributed to the endogeneity issue.

Furthermore, the fixed intangible (column b) model shows positive coefficients estimates for LTIPs, stock options and cash bonus, similar to the earlier reported positive signs, whereas research and development (column c) shows a negative relation among the selected pay components: LTIPs, stock options and cash bonus. However, one caveat of the reported results is that the estimates are largely insignificant, and such low correlation can be a result of the endogeneity problem. This is consistent with Antonakis et al. (2014), who argued that the endogeneity presence among variables can lead to weak and spurious correlations estimates.

Overall, the reported results from the ordinary least squares (OLS) specification are similar to the earlier presented evidence, except that most of the estimates from the conventional single equation are insignificant.

Table 4.6 1 Alternative Specification (OLS) Robustness Test

	(a) CAPEX	(b) FINTANG	(c) R&D
SAL	0.253***	-0.188**	0.00464
	(3.56)	(-2.88)	(0.39)
CashB	-0.163**	0.162*	-0.0113
	(-2.05)	(1.83)	(-1.21)
ESO	0.00364	0.0166	-0.0192
	(0.05)	(0.21)	(-1.49)
LTIPs	0.123**	0.0514	-0.0108
	(2.17)	(0.83)	(-0.99)
LEV	-0.0760	0.0248	-0.0046
	(-1.34)	(0.39)	(-1.33)
Size	0.0087	-0.0223	-0.0006
	(0.31)	(-1.01)	(-0.50)
MKTB	-0.0010	-0.00513***	-0.00013**
	(-1.47)	(-3.97)	(-2.62)
CF	0.159**	-0.156*	-0.00824*
	(3.04)	(-2.57)	(-2.31)
SGR	0.0184	0.0298*	-0.00111
	(1.18)	(1.96)	(-0.64)
STKR	-0.0065	-0.00345	0.00046
	(-0.70)	(-0.37)	(0.64)
E.Own	0.0203	-0.153*	-0.0009
	(0.22)	(-1.69)	(-0.08)
NonE. Own	0.310	-0.550***	-0.0313***
	(1.07)	(-2.93)	(-2.61)
Large Own	0.00053	-0.00034	-0.0001
	(0.59)	(-0.45)	(-1.41)
Constant	0.190	0.456**	0.0229*
	(0.68)	(2.15)	(1.74)
Industry & Year	YES	YES	YES
N	1477	1346	1477
R^2	0.446	0.265	0.072

The table shows the OLS estimation results of the effects of LTIPs, stock options and cash bonus on investment (CAPEX, FINTANG and R&D). All variable definitions are described in Table 4.1 and ***, ** and *** indicate** statistical significance at the 10%, 5% and 1% levels, respectively**.**

4.6.4 Alternative measure of independent (compensation) variable.

As indicated earlier, our key independent (raw values of LTIPs, stock options and cash bonus) variable is measured as a fraction of total compensation. This section measures the independent variable as a logarithmic value of LTIPs, stock options and cash bonus rather than the raw values and apply OLS technique to the investment measures (CAPEX, fixed intangible and R&D).

Specifically, Table (4.6.2) shows the results of the OLS regression by regressing capital expenditure (column d), fixed intangible (column e) and R&D (column f) on lagged natural log of compensation values and other control variables. For brevity, our focus is on key independent measure estimates (log of LTIPs, stock options and cash bonus).

Column (d) of the capital expenditure (CAPEX) shows that LTIPs is positive, whilst both share options and cash bonus coefficient is negative with only cash bonus that shows statistical significance. This is consistent with the study's earlier findings. However, the estimate for LTIPs depicts right sign but it is insignificant.

Furthermore, the fixed intangible (column e) model shows positive coefficients estimates for LTIPs, stock options and cash bonus, similar to the earlier reported positive signs, whereas research and development (column f) shows a negative relation among the pay components: LTIPs, stock options and cash bonus. However, one caveat of the reported results is that the CAPEX and R&D model estimates are largely insignificant, and such weak correlation can partly be attributed to the endogeneity problem.

Table 4.6 2 Alternative Compensation Measure Robustness Test

	(d) CAPEX	(e) FINTANG	(f) R&D
LTIPs	0.0055	0.0198***	-0.0008
	(0.83)	(2.66)	(-1.22)
ESO	-0.0079	0.0117**	-0.0009**
	(-1.55)	(2.26)	(-2.17)
CashB	-0.0304***	0.0167**	-0.0009
	(-3.87)	(2.33)	(-1.25)
SAL	0.184***	-0.0351	-0.0023
	(4.25)	(-0.99)	(-0.48)
CF	0.185***	-0.130***	-0.0065**
	(7.74)	(-3.53)	(-2.01)
LEV	-0.078**	0.0094	-0.0044**
	(-2.46)	(0.33)	(-2.27)
Size	-0.0038	-0.0182	-0.0013*
	(-0.26)	(-1.62)	(-1.81)
STKR	-0.0101	-0.0005	0.0022*
	(-0.94)	(-0.01)	(1.91)
SGR	-0.0709*	0.112**	-0.0044
	(-1.70)	(2.14)	(-0.92)
MKTB	-0.0014***	-0.0046***	-0.0001***
	(-4.04)	(-4.92)	(-4.15)
E. Own	0.0407	-0.189***	0.0017
	(1.00)	(-4.00)	(0.36)
NonE. Own.	0.360***	-0.577***	-0.0267***
	(3.37)	(-7.29)	(-4.76)
Large Own	0.0011***	-0.0005	-0.0001***
	(2.82)	(-1.26)	(-2.82)
Constant	-0.121	0.418***	0.0362***
	(-1.06)	(3.94)	(2.70)
Industry &Year	YES	YES	YES
N	1477	1346	1477
R^2	0.428	0.249	0.075

The table shows the OLS estimation results of the effects of log values of LTIPs, stock options and cash bonus on investment. All variable definitions are described in Table 4.1. ***, ** and *** indicate** statistical significance at the 10%, 5% and 1% levels, respectively**.**

4.7 Conclusions and implications

This chapter contributes to the body of research that links managerial compensation incentives to investment decisions by employing simultaneous equation modelling to extract the intricate relationship between the different compensation components, LTIPs, stock options and cash bonus, and investment types. The findings also suggest that treating cash bonus compensation as a control variable (e.g. Coles et al., 2006; Croci and Petmezas, 2015) may underestimate the causal relationship between cash-related incentive and investment activities. In particular, Coles et al.'s (2006) and Croci and Petmezas's (2015) empirical models underestimate cash compensation and managerial policy linkage when they limit the sensitivity of their investigation to only stock-based incentives.

We find that the LTIPs motivate managers to divert more investment funds away from R&D activity into capital expenditure (CAPEX). This is consistent with prior literature (Chen et al., 2017; Croci and Petmezas, 2015) but inconsistent with Coles et al. (2006) and Kini and Williams (2012). For example, Croci and Petmezas (2015) argue that stock incentive (measured as delta) induces more capital-intensive activity. Also, LTIPs encourages more fixed intangible but discourages R&D investment.

Furthermore, the risk-motivated stock options incentive influences managers to support relatively more CAPEX and fixed intangible activities but decreases R&D spending. This is consistent with prior studies (e.g. Croci and Petzemas, 2015; Hayes et al., 2012; Guay, 1999) but contrary to others e.g. Kini and Williams (2012), Xue (20007), Coles, Daniel and Naveen (2006) and Rajgopal and Shevlin (2002). The finding postulates that, because fixed intangibles are uncertain, risky and long horizon (Pisano, 1989; Holmstrom, 1989), managers are likely to lower investment into such activity. Therefore, shareholders use stock options incentives to mitigate the under-investment incentive associated with such relatively riskier activity. Again, similar to Croci and Petzemas's (2015) explanation, capital intensive expenditure involves some sort of inherent risk which can increase the firm's idiosyncratic risks as well as cause executives their jobs when such huge investment fails (Mitchell and Lehn, 1990). This, in turn, can inhabit managers' decision to spend the firm's resources on such (CAPEX) projects. Therefore, by awarding the stock options incentive, managers are induced to allocate more spending into capital expenditure activity, inconsistent with Coles et al.'s (2006) risk-related explanation.

Moreover, a cash bonus package also encourages more corporate spending on intangibles investment – R&D and fixed intangible (Chen et al., 2017) – but discourages capital expenditure activity. Specifically, the evidence tends to imply that shareholders through the board of directors utilise a managerial cash bonus (accounting-based measure) to influence managers to undertake more intangibles. In other words, shareholders apply a cash bonus to reduce managerial earnings incentive. Thus, shareholders use cash compensation to minimise potential under-investment incentive associated with intangibles (Hayes et al., 2012), which is incompatible with Coles et al.'s (2006) risk-related explanation.

Contrary to the managerial risk aversion assumption, however, cash bonus shows a decreasing effect on capital expenditure. The key implication is that UK firms do not use a cash bonus incentive to motivate relatively low-risk capital expenditure.

Furthermore, as indicated, the relative riskiness of the two defining components of capital expenditure (i.e. other fixed assets and net property, plant and equipment) provides the needed impetus to separate these investment expenditures and relate them to the different compensation components. Significantly, LTIPs, stock options and cash bonus show a reduction in other fixed assets expenditure.

Overall, after controlling for executives' pay-performance sensitivity, and applying modelling and econometric techniques (3SLS) that allow for the endogenous feedback effects of investment activities on the structure of managerial compensation incentives, our results show that higher risk-motivated incentives (LTIPs and stock options) implement more low-risk investments including capital expenditure (Guay, 1999; Croci and Petmezas, 2015) and fixed intangible, and less in research and development, whilst a lower risk-motivated incentive (cash bonus) induces more research and development (Hayes et al., 2012; Chen et al., 2017) and fixed intangible, and less capital expenditure. Largely, the evidence complements some existing literature (e.g. Hayes et al., 2012; Croci and Petmezas, 2015; Chen et al., 2017) but is inconsistent with others including Coles et al. (2006) and Kini and Williams (2012). One key concern of the reported results is that the fixed intangible activity is positively related to both the risk-avoiding incentive (cash bonus) and risk-motivated incentive (LTIPs and stock options), which makes its risk status unclear. However, a possible explanation could be that shareholders apply these pay components with minimal intention of influencing managerial risk level.

In fact, the reported findings on the nature and the level of managerial compensation components are assumed to show the intentional or permanent effects on investment policies. However, what remains unclear is whether our compensation data are typically explained by either optimal contracting theory or managerial power hypothesis/theory. For instance, prior studies including Coles et al. (2006) looked at similar issues (e.g. managerial compensation incentives and risk-taking policy) and attributed their evidence in support of optimal contracting theory. However, in their discussion, the authors make an interesting observation relating to executive (CEO) excessive pay which is synonymous with or suggestive of a managerial power assumption. While we partly admit that the authors' US data may be conceptually explained by the optimal compensation theory, we are unclear if indeed the firms' boards intentionally deviate from optimal compensation level to alter investment policy and so we cannot confidently conclude that the UK data would give a similar conclusion.

More specifically, the authors (Coles, Daniel and Naveen, 2006) put forward two important issues which warrant further attention. First, they argue that managerial discretionary power unwinds the stock-based incentives in their compensation plans, and/or, second, the boards may purposefully attempt to offer CEOs excessive stock-based incentives to encourage more investment activity. This tends to suggest that managers are more likely to be overly compensated in order to create investment distortion, which is consistent with Strobl's (2014) theoretical assertion. For instance, Strobl (2014) theoretically demonstrated that the shareholders can offer more stock-based incentive to managers to motivate them to commit investment (over-investment) distortions. This theoretical assumption calls for further investigation to find out if indeed overly (lowly) compensated managers are likely to over-invest (under-invest) or create investment distortions. In addition, investigating this issue will further enhance our understanding on the extent to which the optimal compensation theory explains our UK firms' datasets. To this end, we seek to provide a useful addition to the literature on managerial compensation and investment activities.

Accordingly, the next section focuses on the optimal compensation deviation within the context of investment-related decisions. Prior to undertaking this analysis in the proceeding subsection, the study first points out the key issues that provide the needed motivation to further examine the extent to which excess compensation influences investment distortions. It is also worth mentioning here that the distortion in investment is not as a result of managerial aberrant or opportunistic behaviour as suggested by empire-building, short-termism and entrenchment motives (e.g. Jensen, 1986; Stein, 2003). In contrast, investment distortion is a result of shareholders' attempting to induce managers via compensation settings. The next subsection deals with this subject issue.

4.8 Managerial Compensation Deviation and Investment Distortion

4.8.1 Introduction

The main findings in the previous part is that managerial financial compensation incentives partly influence optimal investment activities. Moreover, it is argued in the literature that shareholders can design compensation incentives to induce investment distortion (Strobl, 2014; Eisdorfer et al., 2013). For instance, Eisdorfer et al. (2013) show that top executives with more stock-based (stocks and options) compensation tend to over-invest in capital expenditure, whilst those with more inside debt compensation (e.g. pensions, restricted stock) under-invest in such activity. This seems to suggest that corporate top managers are more likely to invest above or below the expected level depending on the level and the composition of their compensation incentives. In other words, shareholders reward executives with excess compensation incentives to create investment distortions.

In fact, given that the excesses in managerial pay could either be as a result of shareholders' intention or managerial discretionary power (Bebchuk and Fried, 2003; Weisbach, 2007), it is quite unclear if indeed the pay excesses are meant to encourage investment (over) distortions as described by Strobl (2014). This section seeks to specifically explore the extent to which excesses in managerial compensation influence investment distortions (over- or under-investment). More specifically, the section's exploratory analysis extends the existing literature on the link between managerial compensation incentives and corporate investment by investigating the following essential issues:

1. Is the deviation from the optimal stock-based (LTIPs) compensation level related to investment distortions?
2. Are the excesses in share options compensation related to investment distortions? and

finally

3. Are the excesses in cash bonus compensation linked to investment distortions?

The key contributions of this part are mainly related to answering the above indicated questions. Broadly, the analyses contained in the current section make a novel contribution to the existing literature by being the first study to empirically explore how excess stock-based and cash-based compensations are related to investment distortions. In this way, it directly contributes to the theories of managerial compensation incentives. More explicitly, it shows if indeed the investment–managerial compensation nexus is particularly explained by the optimal compensation theory. In other words, this examination further aids us to better enhance our conceptual understanding or knowledge on whether shareholders generously apply compensation incentives for the purposes of inducing the over- or under-investment incentive of managers.

In short, the study tests whether managerial excessive pay (compensation excesses) is as a consequence of shareholders' optimistic intention to cause investment distortions.

The rest of the section is structured as follows. Subsection 4.8.2 briefly provides a review of the relevant literature, develops hypotheses to be tested and also states the empirical specification. Subsection 4.8.3 measures the main subsamples and control variables. Subsection 4.8.4 considers the analytical procedure (the choice of probit model), while subsection 4.8.5 discusses the empirical findings and, finally, subsection 4.8.6 concludes the chapter and also draws attention to the implications of the key findings on the theory of managerial compensation and the theory of firm investment.

4.8.2 The key related literature and hypotheses development

The primary aim of this section is to build on the limited literature that has explored investment distortions and the managerial compensation excesses. We later formulate the testable hypotheses based on this direct material evidence.

As pointed out by Jensen (1986 p. 327) and Stein (2003 p. 121), managers' incentive to control more assets (empire-building incentive) causes them to invest the firm's surplus cash flow on unprofitable projects, leading to an over-investment problem. Different from Jensen's free cash flow assumption, others including Strobl (2014) and Eisdorfer et al. (2013) posit that the amount of stock-based compensation can also induce managers to commit investment distortions. This tends to imply that the over-investment incentive of managers is not only limited to the firm's ability to have excess cash flow, but shareholders can intentionally or purposefully use compensation incentives to induce managers to over-invest in some kinds of firm activities.

For instance, based on the optimal contracting theory, Strobl (2014) theoretically demonstrated that shareholders (via the board) may tend to design managers' compensation incentives to influence managers to over-invest in corporate activity. The author conjectured this from his theoretical model which considers managerial stock-based compensation and investment distortion (over-investment) in the presence of stock price information production. He asserts from the finding that managers tend to accept both positive and negative projects (causative elements of over-investment) when they receive higher compensation incentives from the shareholders, implying that managerial pay excess is not only as a result of managerial rent extraction purposes. According to him, shareholders see over-investment as an incentive to induce information production which in turn increases the firm's stock price volatility and its terminal cash flow uncertainty, and that, through compensation design, shareholders are able to influence managers to commit to over-investment. In essence, over-investment is not linked to enhancing managers' private incentives such as empire building, entrenchment or short-termism motives; rather, it is in the best interests of shareholders.

In support of this view, Eisdorfer et al. (2013) provide strong empirical evidence on managerial compensation excesses and investment distortion linkage. Applying a sample of US firms during 2000–2009, Eisdorfer, Giaccotto and White (2013) examine the extent to which top executives' compensation incentives affect the quality of investment decisions. Their examination reveals that managers with more inside debt-like compensation (i.e. measured as the present value of pensions and deferred compensation) tend to under-invest whereas managers that receive more equity-based (stocks and stock options) incentives over-invest in tangible capital activities. Employing two estimators – ordinary least squares (OLS) and two-stage least squares (2SLS) – to the US data, the researchers report some interesting results after accounting for other control variables in their excess investment specification. First, they find that higher equity compensation and capital expenditure distortion are positively related. Second, they also show a positive relation between capital expenditure distortion and compensation leverage gap. The authors interpret the findings to suggest that managers with more equity compensation (inside debt like-compensation ratio) invest more (less) in capital expenditure activity.

More specifically, the authors measure the dependent variable (i.e. investment distortion) as the difference between actual investment and the industry median investment, whilst the independent variable is measured as the number of shares multiplied by the share price. Also, stock options value was estimated using a modified Black and Scholes valuation approach. Each estimated compensation component is scaled by the total compensation. Again, in measuring executive compensation leverage gap ratio, they use the present value of managerial pension funds and express it as a fraction of the total compensation. Based on this estimate, they measure leverage gap as the difference between compensation leverage ratio and firm leverage ratio. With this, the authors confirm their findings by relating equity compensation to excess investment (distortion), which signals the inducement effect of managerial equity on tangible capital expenditure distortion policy. It implies that managers tend to spend more (over-invest or invest above the expected level) on tangible capital activities as they receive higher equity incentive increases. In addition, on the role of compensation leverage gap, their evidence shows that managers tend to possibly under-invest in capital expenditure activity (investment distortion) when they are overly compensated in the form of deferred stocks and pension scheme. The average marginal effect of compensation leverage gap on investment distortion is positive and statistically significant. In economic terms, a one standard deviation increase in the absolute difference between compensation leverage ratio and firm leverage ratio increases the extent of the investment distortion by 0.004 – 0.006, accounting for 17% – 24% of the unconditional average of investment distortion (under-investment). A plausible implication of the result is that, as executives' inside debt portfolio increases, they become more susceptible to deviate from optimal investment (i.e. possibly commit to an under-investment incentive in order to safeguard their residual interests). Alternatively, shareholders may tend to apply more debt-like compensation component to induce managers to under-invest in real assets projects.

In conclusion, the study by Eisdorfer et al.'s (2013) contributes to the literature by providing evidence to suggest that managers with more inside debt compensation relative to the firm leverage are likely to commit investment distortion whilst those with more stocks and options compensation spend more on capital expenditure projects (overinvestment).

Moreover, relatively more recent evidence is provided by Feito-Ruiz and Renneboog (2017), who consider these two important issues: 1) the extent to which top executives' excess equity compensation influences acquisition decisions; and 2) the extent to which equity-based incentives induce shareholders' value maximisation via takeover activity. The authors base their analyses on a sample of 216 acquisition cases from both Continental Europe and the UK spanning the period 2002 to 2007. They measure the key variables: dependent variable is the bidder's cumulative abnormal returns (CARs) around the takeover announcement date, using the market model based on the two-day window before and after the announcement date and the equity compensation as the natural logarithm of one (1) plus the total CEO equity compensation (stock options and restricted stock) scaled by the total compensation (salary, bonuses, restricted stock and stock options) as the independent variable. In their multivariate regression analysis, they regress cumulative abnormal returns (CARs) on equity compensation together with other control variables (such as size, growth, cash flow, governance indicators and the CEOs' characteristics) using ordinary least squares (OLS) technique. They find a positive association between equity incentives and bidders' takeover abnormal returns supporting alignment hypothesis. Also, their additional test reveals that the positive linkage between CEOs' equity and takeover abnormal returns is eroded in the presence of block-shareholdings, suggesting the substitution effects of concentrated ownership particularly among the Continental European firms.

Feito-Ruiz and Renneboog (2017) provide further documentary evidence to show if indeed managers that enjoy excessive equity-based pay actually improve shareholder value. They define excess equity incentives as the difference between the actual (real equity-based value ratio) and the expected equity (based on the equity compensation model estimation). Thus, they subtract expected equity compensation (derived from the equity compensation model) from the actual equity incentives ratio to derive the excess equity compensation. In the multivariate regression, they relate equity excess pay to how the takeover decisions are received by the market. The evidence demonstrates that managerial excess compensation is negatively related to acquisition abnormal returns, postulating a negative market sentiment of the bidder firm's stock valuation of the takeover announcement (Bebchuk and Fried, 2003; Weisbach, 2007). A major implication of the finding suggests that powerful CEOs are able to influence their pay packages, which in turn affects the quality of the takeover (investment) projects they undertake. Simply put, top executive managers are more likely to reward themselves excessively, which can consequently affect the efficiency of their investment decisions.

In short, one of the key relevances of Feito-Ruiz and Renneboog's work to the present part is the fact that deviation from optimal compensation level can lead to inefficient managerial investment decision.

In conclusion, the brief review conducted above shows that managerial compensation deviation affects firms' investment efficiency, posturing that there is a need for firms to keep to the optimal compensation levels. Again, shareholders deviate from the optimal compensation to distort investment policy (Coles et al., 2006; Eisdorfer et al., 2013; Strobl, 2014). Likewise, investment distortion can be as a result of managers' influential power to extract rent from shareholders by paying themselves hefty compensation (Bebchuk and Fried, 2003). Therefore, this part of the thesis seeks to explain further if indeed managerial compensation deviation is due to the shareholders' willingness to purposefully influence managers to engage in investment distortions. This, in essence, seeks to empirically test the validity of the underlying assumption of the two competing theories of managerial compensation: optimal compensation theory and managerial power hypothesis.

4.8.2.1 Hypotheses development

The briefly reviewed literature suggests a connection among managerial compensation excesses and investment distortions. This part specifically highlights the underlying reasons why these two corporate variables are linked together.

4.8.2.1a Excess compensation and corporate investment distortions

Consistent with optimal contracting theory, Strobl (2014) argues that shareholders may intentionally award executives more (above optimal level) stock-based compensation to influence them (managers) to overinvest in some corporate activities. The underlying idea is that awarding top executives more (overly) stock-based (e.g. LTIPs, stock options) compensation would induce them to heavily spend corporate resources on both positive and negative investment projects, resulting in overinvestment. Overinvestment (albeit investment in profitable and unprofitable projects) increases a firm's information production, which in turn increase its stock price volatility or terminal cash flow uncertainty as informed investors consume the available information. Consequently, the firm's overall value is enhanced as the stock price volatility surges on (Dow et al., 2011) In essence, the resultant overinvestment is in the best interests of shareholders.

Supporting this view, Coles et al. (2006) and Eisdorfer et al. (2013) share a similar sentiment by arguing that shareholders may purposefully deviate from the managerial optimal compensation to distort investment policy.

Contrarily to the Strobl (2014) explanation, others including Bebchuk and Fried (2003) and Grinstein and Hribar (2004) argue that managers are able to award themselves excessively through their own influence, which in turn may affect the quality of their corporate policies including investment. Thus, in such a circumstance, highly (excessively) compensated managers are likely to either under- or over-invest in corporate investment activities.

In fact, whatever the stated reasons (either shareholders' intentional purposes or managerial influential power), compensation excesses are likely to cause investment inefficiencies (distortions). In this sense, this subsection investigates whether the deviation from the optimal compensation (LTIPs, stock options and cash bonus) levels is associated with the probability of managers committing investment distortions.

Therefore, our general natural prediction is that optimal compensation deviation increases the likelihood of the firm's investment distortion, all else equal.

In line with Strobl (2014) and Eisdorfer et al. (2013), the section provides a more specific characterisation of the relation between investment distortion and excess compensation incentives. In simple terms, paying executives higher (lower) compensation induces overinvestment (under-investment) in corporate investment. More specifically, it suggests that managers receiving higher (lower) LTIPs/stock options increases (decreases) the probability to overinvest (under-invest) or commit investment distortion probability. We test the following natural hypotheses:

H5a: *Higher (lower) excess LTIPs compensation increases (decreases) investment distortion probability, all else equal.*

H5b: *Higher (lower) excess stock options compensation increases (decreases) investment distortion probability, all else equal.*

Furthermore, consistent with the assertion that overinvestment ultimately increases the uncertainty associated with the firm's terminal cash flow (Strobl, 2014; Dow et al., 2011), it is expected that managers who receive higher cash bonus compensation are more likely to overinvest in the firm's activities. We make a natural prediction that:

H5c: *Higher (lower) excess cash bonus compensation increases (decreases) investment distortion probability, all else equal.*

In order to test these hypotheses **(H5a – H5c)**, the study requires a research modelling and estimation technique different from the previous hypotheses **(H1a – H4c**). Specifically, this part adopts a probability model technique to test these new hypotheses (**H5a – H5c).**

In the next subsection, we state our empirical model and provide the analytical procedure to estimate the hypotheses.

4.8.2.2 Investment distortion probability model

$P_{it}(inv.distortion) = \gamma_0 + \gamma_1 Comp.Dev._{it-1} + \gamma_2 Controls_{it-1} + \varepsilon_{it}$……………………..….(7)

$P_{it}(inv.distortion$ =1 i.e. investment distortion) is the probability of a manager (i) engaging in overinvestment (positive investment j = 1). The Yo represents the intercept, (γ_1) $Comp.Dev._{it-1}$ is over-compensated dummy of one (1) if the managers' compensation component is classified as over-compensated and zero otherwise, and, under-compensated dummy of one (1) if the managers' compensation component is classified as under-compensated and zero otherwise, and Y_2 for control variables. These firm-specific characteristics have already been discussed in the previous section (see Table 4.1). Finally, ε_{it} is the random error term assumed to be serially uncorrelated and homoscedastic.

In order to test the stated **(H5a – H5c)** hypotheses, which consider managerial compensation deviation and the probability of engaging in investment distortion, we adopt a probability model empirical strategy. In fact, the estimation of the cross-sectional probit regression model naturally calls for the measurement of key variables.

The next subsection, 4.8.3, considers the measurement of the main and subsamples and other control variables. We first measure the investment distortion variable before moving on to the excess compensation variables. It is worth stating here that the investment distortion variable is for the respective investment measures (i.e. CAPEX, fixed intangible and R&D).

4.8.3 Measurement of the main subsamples

In measuring the key subsamples to be utilised in the investment distortion probability model, we specifically rely on investment and compensation information to construct investment distortion and excess compensation variables. This section describes the process involved in constructing these key variables. We start with the definition of investment distortion (dependent) variable before we move on to the main independent variable (excess compensation variables).

4.8.3.1 The measurement of the investment distortion variable

As proposed by Eisdorfer et al. (2013) and Richardson (2006), among others, investment distortion shows the extent to which a firm deviates from its optimal investment policy. It is measured as the difference between actual and expected investment. By this definition, the investment distortion variable shows continuous values with both positive and negative distortion, representing over- and under-investment respectively. From our accounting and financial data, we estimate actual investment. However, because the expected investment component is often unobservable and needs to be estimated, finance researchers often disagree on the standard measure for the expected investment proxy. For example, some frequently applied proxies include industry median investment ratio (e.g. Eisdorfer et al., 2013; Eisdorfer, 2011), fitted value from industry-year cross sectional regression of a firm's investment on growth opportunities, measured by the market-to-book ratio (Eisdorfer et al., 2013), and the predicted value from a pooled regression of a firm's actual investment conditioned on a set of control variables that determine the firm's investment activity (Fazzari et al., 1988; Lang et al., 1996; Eisdorfer et al., 2013).

Specifically, the present study applies the latter estimation method (i.e. predicted value approach) to estimate the expected investment ratio. Also, as such its dominance (Fazzari et al. 1988; Lang et al., 1996; Eisdorfer, 2011; Eisdorfer et al., 2013), our choice is influenced by the fact that the method controls for a number of firm-specific factors, as well as industry and other secular elements that explain firm investment, unlike the industry median approach, which concentrates on a single industry in a given year without accounting for other determinants. By this design, the fitted value approach recognises the differences across firms with a wider reflection of macroeconomic characteristics. It must be indicated that by adopting this approach, however, the current study acknowledges the limitations and criticisms of other published work in this area Therefore, we compute the expected investment value by regressing the raw actual investment ratio on a set of control factors.

In order to ensure that our results are robust to other specifications and measurements, in a later section we employ an alternative proxy for the expected investment ratio.

As earlier suggested, we employ a pooled regression estimation method to estimate the expected investment value. Specifically, we state the estimated model as follows:

$$Investment_{it} = \alpha_0 + \emptyset_1 X_{it-1} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots \quad (7.1)$$

Where $Investment_{it}$ represents different measures of a firm's investment activities (i.e. capital expenditure, research and development and fixed intangible activity) and is regressed on several firm-specific proxies, X_{it-1} ,α_0 is a constant term and ε_{it} is the error term assumed to be homoscedastic and serially uncorrelated.

a) The determinants of the expected investment level

This part briefly states the potential explanatory variables included in the expected investment model. Consistent with prior studies, the selected explanatory variables include firm size, growth opportunities, leverage, cash flow, stock return, industry dummy and year dummy (e.g.

Lang et al., 1996; Richardson, 2006; Eisdorfer et al., 2013). The variables are lagged one year (t – 1) to increase the likelihood of causality among the dependent and the independent variables as well as to minimise the reverse causality problem (e.g. Eisdorfer et al., 2013). The definition of these variables is provided in Table 4.1.

b) The fitted investment regression results

Table 4.7.1 presents the pooled regression results of the fitted investment for our investment measures. The estimated coefficients for column (a) CAPEX are largely consistent with expectations and prior studies. For instance, we report that CAPEX decreases with leverage (Lang et al., 1996), whilst free cash flow (Lang et al., 1996; Myers, 1984), stock return, growth opportunities (Eisdorfer et al., 2013; Lang et al., 1996) and firm size (Diamonds, 1993; Lang et al., 1996) are positively related to the capital expenditure.

The R&D column shows negative coefficients of leverage, firm size, market-to-book and cash flow, whilst stock return is positive. However, the coefficients are statistically insignificant.

On the fixed intangible, we find that it increased with leverage, size and stock return but decreased with market-to-book and cash flow. With their statistical significance, large firms tend to reallocate more resources into fixed intangibles; however, the firm’s growth opportunities do not support fixed intangible activity.

Table 4.7 1 Predicted Investment OLS Regression Results

	(a) CAPEX	(b) R & D	(c) FINTANG
LEV	-0.000	-0.005	0.016
	(-0.00)	(-1.50)	(0.75)
Size	0.025***	-0.001	0.035***
	(2.73)	(-0.58)	(4.84)
MKTB	0.000	-0.000	-0.001***
	(0.14)	(-1.38)	(-5.78)
CF	0.028	-0.009*	-0.021
	(0.76)	(-1.90)	(-0.71)
STKR	0.008	0.000	0.003
	(0.61)	(0.20)	(0.25)
Constant	0.118	0.0152	-0.133*
	(1.32)	(1.34)	(-1.88)
Industry & Year effects	YES	YES	YES
N	1668	1668	1668
R^2	0.314	0.050	0.226

t statistics in parentheses $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$. Here, we regress investment on lagged cash flow, lagged stock return, lagged leverage and size and market-to-book are all clustered at the firm level. We utilised this to obtain the excess investment figure for the main investment model.) Standard errors are clustered at the firm level**.**

c) Estimation of the excess investment (distortion) variable

Having estimated the predicted (fitted) investment values for each of the sampled firms from the specified equation (7.1), we apply this proxy to obtain the continuous values of investment (excess) distortion by subtracting predicted investment from the actual investment (Eisdorfer et al., 2013; Richardson, 2006; Lang et al., 1996). In other words, the continuous distortion values represent the residuals from the expected investment model. We categorise excess (distortion) investment into two groups: positive excess (over-) investment (i.e. those investment above the expected median level), likewise negative excess (under-) investment (i.e. investment below the expected median level). We define $P_{it}(investment\ distortion = 1$

or 0) as the probability of manager (i) engaging in over-investment (positive investment j = 1) and zero (0) otherwise, or the probability of engaging in under-investment (negative investment j = 1) and 0 otherwise. More specifically, we define our dependent investment variable for positive (over-) investment distortion as a dummy variable that takes the value of 1 for over-investment and 0 otherwise, and negative distortion value is a dummy variable that takes the value of 1 for under-investment and 0 (zero) otherwise.

Furthermore, in an attempt to achieve the stated objective, thus examining the role of excess compensation on investment distortions, we need to define the excess compensation variable. The following subsection measures this variable.

4.8.3.2 Measurement of excess compensation variable

This part highlights the procedure involved in measuring the excess compensation variable. Having defined the investment distortion variable, the next measure is the compensation excess variable. Specifically, we apply a model predictive regression model similar to Coles et al.'s (2006) and Feito-Ruiz and Renneboog's (2017) technique to measure managerial pay excesses. The technique compares the model predicted (fitted) compensation level with the actual raw unadjusted values and the difference is the pay excess. By this definition, our continuous variable (pay excess proxy) shows both positive and negative values to be utilised in the investment model.

In fact, although the pay excesses variable definition seems fairly straight-forward, its measurement can be very challenging or problematic because of the unobserved nature of the predicted level. While the actual compensation raw values are readily available and computed, the predicted compensation values need to be estimated. The estimation procedures are discussed below.

i) Estimation of the predicted (fitted) compensation level

Due to the relative scanty literature on what the term "expected (fitted) compensation level" implies, some researchers have attempted to adopt a model predictive method to estimate the fitted compensation level (see Coles et al., 2006; Feito-Ruiz and Renneboog, 2017). Since there is no alternative approach for estimating the expected compensation variable vis-à-vis he predictive approach dominance, the present study follows the prior studies and estimates the expected level using the predictive value specification. Again, its popularity or wide usage may be due to the fact that this method controls for a number of firm-specific factors, as well as industry and other secular elements that significantly affect the determination of managerial compensation.

Consistent with this view, we compute the fitted compensation by predicting shareholders' expected compensation incentives conditioned on a set of determinants. Specifically, our adopted specification estimates the expected compensation level by applying a single regression that pools all the firms for the entire sample period (2006–2015) together. With this, it is worth stating that the present study duly acknowledges the limitations and criticisms of this approach. Therefore, with no appropriate alternative approach, it is hoped that any anticipated criticism does not seriously undermine the conclusions of the current study. Similar to Coles et al. (2006) and Feito-Ruiz and Renneboog (2017), the predicted compensation levels for our sample firms are estimated using equation (5) below:

$$Incentives_{it-1} = \mathrm{b}_0 + \mathrm{b}_1 Controls_{it} + \Psi_{it} \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where $Incentives._{it-1}$represents compensation incentives (e.g. value of stock options grants, LTIP grants and cash bonus), $Controls_{it}$includes the selected exogenous variables. These are: research and development, fixed intangible assets, capital expenditure, market-to-book, firm size, book leverage, firm risk, cash flow, large ownership, outside directors' ownership, executives' ownership, executives' average age and dividend pay-out, industry and year effects, and the random error term Ψ_{it}. These characteristics are based on prior compensation literature (Nguyen, 2018; Feito-Ruiz and Renneboog, 2017; Coles et al., 2006; Ryan and Wiggins, 2001; Baber, Janakiraman and Kang, 1996).

More specifically, we state each component of compensation equation (8a – 8c) used to derive the predicted (fitted) values. This is specified as follows:

$$\text{LTIPs}_{it-1} = \beta_0 + \beta_1 \text{Controls}_{it} + \epsilon_{it} \quad \text{(8a)}$$

$$\text{ESO}_{it-1} = \beta_0 + \beta_1 \text{Controls}_{it} + \epsilon_{it} \quad \text{(8b)}$$

$$\text{CashB}_{it-1} = \beta_0 + \beta_1 \text{Controls}_{it} + \epsilon_{it} \quad \text{(8c)}$$

One important contribution of the study is the empirical technique it employs to allow for the possibility that cash bonus is endogenously determined and that our chosen approach also allows us to test for the over-identifying restrictions in the model.

This strategy is consistent with O'Connor et al. (2013) and be seen as an extension to Coles et al. (2006) and Xue (2007), who empirically examine similar issues, but they only use cash incentive as a control variable. These selected explanatory variables are defined in Table (4.1).

ii) The predicted compensation value regression results

Table 4.7.1b presents the result of the pooled regression. Columns (a), (b) and (c) show the findings of the compensation components: LTIPs, stock options and cash bonus respectively. As we have already exhausted the discussion on compensation determinants in the earlier section based on the three-stage least squares (3SLS) method, this part pays less attention to this discussion. Again, the key idea of this part is to estimate the excess compensation variable. In fact, as indicated earlier, the primary motive is to find out the extent to which managerial pay excesses induce investment decision-making. The next subsection estimates the pay excesses.

Table 4.7 2 Predicted Incentives Regression Results

	(a) L.LTIPs	(b) ESO	(c) CashB
CAPEX	0.136***	-0.034	-0.086***
	(3.21)	(-1.03)	(-2.80)
R&D	0.014	-0.184**	-0.065
	(0.09)	(-2.15)	(-0.76)
FINTANG	0.075	-0.027	0.023
	(1.22)	(-0.71)	(0.45)
LEV	0.084**	-0.043	-0.053**
	(2.26)	(-1.35)	(-2.20)
Size	0.079***	-0.016*	-0.024***
	(6.81)	(-1.63)	(-3.20)
MKTB	0.002***	-0.000	-0.000***
	(4.88)	(-1.16)	(-3.87)
STKR	0.021**	0.007	
	(2.18)	(0.97)	
Large Own	-0.001***	0.000	0.001*
	(-2.87)	(0.06)	(1.81)
E. Own	-0.086***	0.010	-0.002
	(-3.18)	(0.49)	(-0.09)
Non-E.Own	-0.054	-0.053	0.012
	(-0.36)	(-0.97)	(0.19)
CF	0.003	-0.032*	0.058
	(0.08)	(-1.65)	(1.30)
DPO	0.027	-0.026	0.024*
	(1.18)	(-1.51)	(1.80)
E.Av.Age	0.001*	-0.001	0.000
	(1.67)	(-1.29)	(0.57)
Constant	-0.377***	0.300***	0.515***
	(-2.87)	(2.88)	(6.48)
Industry& year	YES	YES	YES
N	1262	1262	1262
R^2	0.344	0.062	0.107

t statistics in parentheses $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$. We use robust standard errors.
Predicted lagged incentives (used for excess compensation and investment probability model). We regress lagged incentives on the selected determinants.

iii) Excess compensation dummy variables

As stated earlier, our main task is to look at the extent to which managerial compensation excesses affect the probability of managers engaging in investment distortions. Having defined the investment distortion variable above, our next proxy of interest is the excess compensation proxy. In fact, as indicated the excess compensation is a continuous variable, which shows the gap between actual compensation values (i.e. raw values) and the predicted values estimated from the first-stage compensation model. Therefore, to enhance our understanding on how deviation from the optimal compensation level induces investment distortion probability, we segregate the "derivative excess compensation" variable in to four quartile sub-groups: extremely under-compensated (Q1), moderately under-compensated (Q2), moderately over-compensated (Q3) and extremely over-compensated (Q4).

More specifically, these subsamples (based on the excess compensation values) are formed and sorted in ascending order. The sorted observation is then divided into four quartiles. Based on our classifications, we construct and represent the subsample observations with dummies: first quartile (Q1) – extremely undercompensated, shows large negative excess values; second quartile (Q2) – moderately undercompensated, indicates small negative excess values; third quartile (Q3) – moderately over-compensated subsample shows small positive excess values; and the fourth quartile (Q4) – extremely over-compensated observations indicate the large positive excess compensation values.

As outlined above, shareholders could substantially deviate from the managerial optimal compensation level to constrain investment efficiency (see Strobl, 2014). Accordingly, substantial deviation from the optimal compensation ratio can be represented in one of two ways: a) rewarding managers far above the optimal level (extremely over-compensated), and b) rewarding managers far below the optimal level (extremely under-compensated). In tune with this, and for the purposes of this chapter, we use the extreme compensation deviation values (over-compensated and under-compensated variables) to represent the main independent variables in the investment distortion probability model. Unless otherwise stated, over-compensated (4th quantile) and under-compensated (1st quantile) are used to imply extreme deviations from the optimal level. The following underlying reasons motivate this selection.

It is anticipated that both over- and under-compensated are an indication of shareholders' intention to influence managerial suboptimal investment decisions. Thus, as a means of improving information flow regarding the firm's performance, r-compensated managers are more likely to over-invest by undertaking both positive and negative NPV investment projects in order to increase the probability distribution of the firm's cash flow and stock returns (see e.g. Strobl, 2014). However, under-compensated incentives (managers) can be attributed to some of these reasons: it could signal a firm's lack of investment opportunities (Ryan and Wiggins, 2001). Thus, firms with insufficient growth potentials (which are often represented by the resource allocation into CAPEX, R&D and fixed intangible) are easily monitored by the board, and shareholders may have an incentive to lower the compensation level. Also, firms with a strong governance system are able to minimise managerial incentive behaviour, leading to lower compensation incentives. In other words, the presence and the effectiveness of monitoring mechanisms including institutional ownership, block-shareholding, non-executives' ownership, board size, etc., can potentially influence managers to concentrate on value-maximising activities without necessary increasing their pay packages (Mehran, 1995). Given that the study controls some of these mechanisms in the compensation model, it is possible to attribute extreme under-compensated incentives to minimal investment expenditure.

In contrast, however, moderately under-compensated and over-compensated incentives could presumably be attributed to these reasons. First, the board's inability to perfectly or efficiently track managerial compensation hand-outs. Second, the board mis-judging growth expectations and compensation incentives (moderately over- or under-compensated). Third, moderately over-/under-compensated may not continuously sustain such deviation over a long period of time (Coles et al., 2006).

Based on the underlying motive of this part of the thesis (i.e. whether extreme over- and/or under-compensated induce the probability of investment distortions), it is, however, possible that moderately over- or under-compensated incentives would not explicitly explain the likelihood of UK managers committing investment distortions. Therefore, the study view is that investment distortions (over- or under-investment) is as a result of extreme under-compensated or over-compensated incentives. In this way, we are able to provide specific evidence to support the managerial compensation theory.

In fact, to satisfy the assumption of the probability model, we use indicator variables for over-compensated (i.e. extreme positive excess compensation) or under-compensated (extreme negative excess compensation) incentives. Specifically, **over-compensated incentive** is a dummy variable that takes the value of 1 for those managers classified as extreme earners (i.e. those whose compensation is above optimal level), and 0 otherwise, and **under-compensated incentive** is a dummy variable that takes the value of 1 for those sampled managers classified as extremely under-compensated, and otherwise 0.

4.8.3.3 Other control variables

This subsection turns attention to other explanatory variables that have been found to be related to the firm's decision to undertake investment included in equation (7). The selection of control variables in the model is based upon the extant theoretical and empirical literature on investment discussed in Chapter 3. In all, eight (8) other control variables are included in the investment distortion probability model. Having already discussed these control variables in the previous subsection, they are stated: leverage, firm size, market-to-book, cash flow, sales growth, stock return, industry dummy and year dummy (see Coles et al., 2006; Eisdorfer et al., 2013) to save time and space.

4.8.4 Analytical procedure

As indicated earlier, we assert that different levels of compensation deviation (e.g. LTIPs, stock options and cash bonus) are more likely to encourage investment distortion. In order to test these hypotheses (**H5a–H5c)**, we choose a probit regression model to examine if indeed shareholders deviate from the optimal compensation level to encourage investment distortions.

4.8.4.1 Probability model justifications

The preference for a probability model over other binary probability models such as the logit model or the linear probability model (LPM) is stated below. The probit model estimates the coefficients of the model using maximum likelihood (ML) (see Dougherty, 2007), whereas LPMs are based on ordinary least squares regression. This implies that the ML property helps provide valid standard errors as well as the t-statistics, particularly when the sample is large. In other words, ML produces results that are more asymptotic. In addition, probit models are often insensitive to model misspecifications, because they allow for robust standard errors in their estimation.

Another important reason for using probit models over LPMs is that their predicted probabilities of outcome are bounded between zero (0) and one (1), which makes them intuitively easy to interpret. However, LPMs can produce probabilities greater than one (1) or even less than zero (0) when the independent variables contain extreme values (Wooldridge, 2009).

Comparatively, probit models and logit models are both powerful estimation techniques in their application. The only difference lies in their functional specifications. Specifically, a probit model assumes the standard normal distribution of error term under the cumulative distribution function whilst a logit model applies a logistic function. With these, our choice of probit model over logit model is purely driven by the research preference.

4.8.5 Discussion of investment distortion and compensation deviation results

This section provides the results and discussion of the investment distortion probability regression model. Specifically, it shows the analyses of the different investment measures used in this empirical investigation: capital expenditure, research and development, and fixed intangible. Accordingly, this part discusses the results for each respective investment distortion regression. The discussion only concentrates on the key independent (compensation) variables.

4.8.5.1 Capital expenditure distortion regression results

In this section, we perform our regression analysis by regressing CAPEX distortion on the over- and under-compensated incentives together with other control variables. Here, four (4) specifications are estimated: baseline model (1) and the remaining models (2), (3) and (4) which account for other additional variables are for further robustness purposes.

The findings reported in column OVCAPEX of Table (4.8.1) provide interesting evidence. The result suggests that extremely over-compensated (under-compensated) managers increase (decreases) the likelihood of committing CAPEX over-investment. Specifically, the positive coefficient on **over-compensated (over-equity/LTIPs)** equity is 0.244 and it is statistically significant at 5% level of significance. The finding tends to imply that over-compensated LTIPs, on average, are associated with a 24.4% increased probability of over-investing in capital expenditure (CAPEX) activities. However, the dummy variable for **under-compensated (under-equity)** equity coefficient (-0.0745) is negative but insignificant. The findings seem to be consistent with the view that the board of directors on behalf of shareholders may strategically over-compensate (using LTIPs) managers to induce a managerial over-investment (CAPEX) incentive. The results still remain statistically similar when we account for executive ownership and other governance mechanisms.

Furthermore, the estimated coefficient on **over-compensated (over-options)** stock options is positive, suggesting that the over-compensated stock options increase the chances of managers over-investing in CAPEX, while the under-compensated dummy reduces the likelihood of CAPEX over-investment. To be specific, the negative coefficient estimate is -0.0392 and insignificant. For the over-compensated stock options, the coefficient is 0.261 (t-statistics 2.32) and it is both economically and statistically significant. Again, our robustness test results in models 2, 3 and 4 remain statistically and qualitatively the same.

For cash bonus incentive, the dummy variable for **over-compensated (over-cash)** cash bonus is positively and significantly related to the probability of CAPEX over-investment, but the **under-compensated dummy variable** is negative and insignificant. More specifically, the underlying implication of this finding is that managers with over-compensated cash bonus are about 23.7% more likely to commit over-investment in CAPEX projects. In other words, extremely over-compensated cash incentive managers have an increased tendency to commit managerial investment distortion (CAPEX over-investment). This is not surprising, given that firms with substantial cash reserves are likely to face an over-investment problem (Jensen, 1986; Stulz, 1990) and that the shareholders tend to use more cash incentive rather than stocks (Core and Guay, 1999).

Collectively, the observed results of extreme over-compensated (under-compensated) on CAPEX over-investment probability seem to be consistent with the explanation that the boards strategically apply extreme over-compensated incentives to encourage over-investment – CAPEX (Coles et al., 2006; Strobl, 2014). Thus, our evidence tends to further suggest that over-compensated earners are encouraged to spend more corporate funds on CAPEX (over-investment) by accepting both positive and negative net present value capital expenditure (NPV) projects.

Table 4.8 1 Excess Pay and Capital Expenditure Distortion Test

	(1) OVCAPEX	(2) OVCAPEX	(3) OVCAPEX	(4) OVCAPEX
LTIPs75	0.244**	0.243**	0.245**	0.238**
	(2.11)	(2.09)	(2.10)	(2.04)
LTIPs25	-0.0745	-0.0752	-0.0525	-0.0553
	(-0.64)	(-0.64)	(-0.45)	(-0.47)
ESO25	-0.0392	-0.0382	-0.00655	-0.0190
	(-0.33)	(-0.32)	(-0.05)	(-0.16)
ESO75	0.261**	0.261**	0.252**	0.245**
	(2.32)	(2.32)	(2.25)	(2.18)
CashB25	-0.163	-0.163	-0.152	-0.152
	(-1.51)	(-1.51)	(-1.41)	(-1.41)
CashB75	0.237**	0.236**	0.241**	0.240**
	(2.14)	(2.13)	(2.17)	(2.17)
SAL	1.489***	1.478***	1.442***	1.422***
	(4.55)	(4.37)	(4.25)	(4.18)
LEV	0.836***	0.840***	0.828***	0.808***
	(3.58)	(3.57)	(3.51)	(3.40)
Size	-0.0584	-0.0575	-0.0479	-0.0348
	(-0.82)	(-0.81)	(-0.67)	(-0.47)
MKTB	-0.0321	-0.0321	-0.0314	-0.0301
	(-1.19)	(-1.20)	(-1.18)	(-1.14)
CF	1.525**	1.521**	1.572**	1.569**
	(3.07)	(3.07)	(3.17)	(3.15)
SGR	0.0777	0.0770	0.0698	0.0664
	(0.53)	(0.52)	(0.47)	(0.45)
STKR	0.0126	0.0129	0.0194	0.0236
	(0.15)	(0.15)	(0.23)	(0.28)
E. Own		0.0449	0.116	0.00438
		(0.13)	(0.34)	(0.01)
NonE.Own			1.759**	1.671**
			(2.40)	(2.26)
Large Own				0.00205
				(0.77)
Constant	-0.640	-0.650	-0.789	-0.956
	(-0.88)	(-0.89)	(-1.09)	(-1.25)
Industry&Year	YES	YES	YES	YES
N	987	987	987	987
Pseudo R^2	0.077	0.077	0.082	0.082
Wald Chiz	102.93	103.13	112.86	112.78

The table presents the probit regression results for the OVCAPEX (distortion) models 1, 2, 3 & 4 and include incentives excesses together with controls and fixed effects in all estimations. Variables are described in Table 4.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

4.8.5.2 Research and development distortion regression results

Table (4.8.2) on research and development expenditure (R&D) shows the extent to which extreme **over-compensated (under-compensated)** managers are likely to commit R&D investment distortions. Significantly, the dummy variables estimate for over-compensated (under-compensated) stock-based incentives provide some interesting findings. More specifically, the coefficient estimates for the highly **over-compensated (under-compensated) equity** (LTIPs) **dummy are -0.0836 t-statistics -0.61 (0.344 t-statistics 2.60)** respectively. Thus, the positive coefficient estimate for under-compensated LTIPs is statistically and economically significant, whilst the over-compensated coefficient is negative but insignificant. The finding tends to imply that extremely under-compensated equity managers have an increased probability to commit to R&D over-investment whilst over-compensated managers are less likely to over-invest in R&D above optimal level. However, one caveat is that the over-compensated LTIPs coefficient lacks statistical significance.

On the stock options, the **over-compensated (over-options)** dummy is negatively and significantly related to the probability of R&D over-investment. For instance, the coefficient estimates of -0.463 (t-statistics -3.61) show the decreased likelihood of **over-compensated (options)** managers to over-invest in the R&D activity. The result further suggests that shareholders do not overly use stock options to induce managers to commit to investment distortion in R&D, noting that over-investment is in the best interests of shareholders. However, the **under-compensated options dummy** is positive but insignificant.

The **over-compensated (under-compensated)** cash bonus dummy variable is negative (positive) but statistically insignificant at the conventional levels. Specifically, the coefficient estimate for over-compensated (under-compensated) is -0.134 t-statistics -1.06 (0.114 t-statistics 0.92) respectively.

Table 4.8 2 Excess Pay and R&D Distortion Test

	(1) OVR&D	(2) OVR&D	(3) OVR&D	(4) OVR&D
LTIPs75	-0.0836	-0.127	-0.121	-0.125
	(-0.61)	(-0.93)	(-0.88)	(-0.90)
LTIPs25	0.344***	0.334**	0.383***	0.382***
	(2.60)	(2.51)	(2.86)	(2.85)
ESO25	0.0197	0.0472	0.0641	0.0594
	(0.14)	(0.34)	(0.46)	(0.42)
ESO75	-0.463***	-0.475***	-0.526***	-0.529***
	(-3.61)	(-3.70)	(-4.05)	(-4.06)
CashB25	0.114	0.134	0.159	0.159
	(0.92)	(1.06)	(1.25)	(1.25)
CashB75	-0.134	-0.159	-0.177	-0.177
	(-1.06)	(-1.26)	(-1.40)	(-1.40)
SAL	-0.920***	-1.156***	-1.234***	-1.2401***
	(-2.73)	(-3.13)	(-3.25)	(-3.25)
LEV	0.390	0.476*	0.452	0.438
	(1.44)	(1.74)	(1.63)	(1.56)
Size	0.108	0.122	0.141	0.150
	(1.37)	(1.55)	(1.76)	(1.73)
MKTB	0.0012	-0.0004	0.0009	0.0014
	(0.09)	(-0.03)	(0.07)	(0.11)
CF	1.613**	1.5900***	1.690***	1.6920***
	(2.88)	(2.79)	(3.01)	(3.01)
SGR	0.0424	0.0407	0.0099	0.0079
	(0.27)	(0.25)	(0.06)	(0.05)
STKR	-0.118	-0.105	-0.0842	-0.0814
	(-0.95)	(-0.83)	(-0.68)	(-0.65)
E.Own		0.9581**	1.052**	0.989*
		(1.94)	(2.14)	(1.89)
NonE.Own			3.551***	3.505**
			(2.78)	(2.77)
Large Own				0.001
				(0.32)
Constant	0.141	0.0018	-0.199	-0.301
	(0.18)	(0.00)	(-0.24)	(-0.34)
N	945	945	945	945
Pseudo R^2	0.10	0.103	0.113	0.113
Wald Chiz	94.39	96.64	102.19	102.36

The table presents the probit regression results for the OVR&D (distortion) models 1, 2, 3 & 4 and include incentives excesses together with controls and fixed effects in all estimations. Variable definitions are described in Table 4.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

4.8.5.3 Fixed intangible distortion regression results

The result for the fixed intangible is presented in Table (4.8.3). Both **over-compensated** and **under-compensated stock-based** decreased the likelihood of fixed intangible distortion (over-investment). The dummy variables for extremely **over-compensated** and **under-compensated LTIPs (equity**) dummy are negative and statistically insignificant. The coefficient estimate dummy for **over-compensated** is -0.0668 (t-stats -0.59) and **under-compensated** -0.0425 (t-stats -0.37), reluctantly postulating a decreased probability of committing fixed intangible over-investment.

In addition, similar results were observed for both extremely **over-compensated and under-compensated stock options** dummies. Explicitly, the coefficient estimates for both **over-compensated** (-0.408 t-stats 3.63) and **under-compensated** (-0.886 t-stats 7.39) all show negative signs and are statistically significant. The results tend to imply that **extremely over- and under-compensated** managers are less likely to over-invest in fixed intangible over-investment. This can possibly be attributed to the fact that shareholders' deviation from the optimal stock options incentive may not be motivated by fixed intangible over-investment.

Moreover, the coefficient dummies for **over-compensated (under-compensated**) cash bonus are **negative (positive)** respectively. However, the estimates lack statistical significance. Specifically, the coefficient estimates for **over-compensated cash** bonus is -0.117 (t-stats -1.06), whilst **under-compensated** is 0.103 (t-stats 0.98) both insignificant. The result suggests that both over-compensated (under-compensated) cash bonus is unlikely to induce fixed intangible over-investment distortion.

Moreover, for robustness checks (models 2, 3 and 4), the main results remain statistically unchanged after accounting for these independent variables – executives' ownership, non-executive ownership and large ownership – in the investment distortion probability models.

In sum, the evidence shows that extreme compensation deviation for stock options (over-compensated and under-compensated) decreased the probability of fixed intangible distortion.

Table 4.8 3 Excess Pay and Fixed Intangible Distortion Test

	(1) OVFINTANG	(2) OVFINTANG	(3) OVFINTANG	(4) OVFINTANG
LTIPs75	-0.0668	-0.0403	-0.0401	-0.0438
	(-0.59)	(-0.35)	(-0.35)	(-0.38)
LTIPs25	-0.0425	-0.0316	-0.0872	-0.0884
	(-0.37)	(-0.27)	(-0.74)	(-0.75)
ESO25	-0.886***	-0.921***	-0.996***	-1.002***
	(-7.39)	(-7.68)	(-8.28)	(-8.29)
ESO75	-0.408***	-0.418***	-0.391***	-0.394***
	(-3.63)	(-3.72)	(-3.38)	(-3.39)
CashB25	0.103	0.101	0.0766	0.0765
	(0.98)	(0.96)	(0.72)	(0.72)
CashB75	-0.117	-0.0997	-0.109	-0.109
	(-1.06)	(-0.90)	(-0.97)	(-0.97)
SAL	-1.121***	-0.912***	-0.814**	-0.825**
	(-3.58)	(-2.79)	(-2.48)	(-2.51)
LEV	0.0687	-0.0065	0.0433	0.0321
	(0.29)	(-0.03)	(0.18)	(0.13)
Size	-0.299***	-0.324***	-0.346***	-0.340***
	(-4.08)	(-4.40)	(-4.65)	(-4.47)
MKTB	-0.0006	0.0007	-0.0012	-0.0008
	(-0.04)	(0.05)	(-0.08)	(-0.05)
CF	0.263	0.306	0.242	0.240
	(0.58)	(0.67)	(0.51)	(0.51)
SGR	0.0648	0.0771	0.117	0.116
	(0.42)	(0.49)	(0.71)	(0.70)
STKR	-0.0459	-0.0493	-0.0618	-0.0600
	(-0.54)	(-0.58)	(-0.75)	(-0.72)
E. Own		-1.037***	-1.184***	-1.234***
		(-2.87)	(-3.24)	(-3.09)
NonE. Own			-4.794***	-4.836***
			(-6.02)	(-6.02)
Large Own				0.0009
				(0.34)
Constant	3.215***	3.465***	3.770***	3.694***
	(4.35)	(4.64)	(4.97)	(4.71)
N	986	986	984	984
Pseudo R^2	0.077	0.084	0.110	0.110
Wald Chiz	106.52	114.35	144.25	144.43

The table presents the probit regression results for the OVFINTANG (distortion) models 1, 2, 3 & 4 and include incentives excesses together with controls and fixed effects in all estimations. Variables are described in Table 4.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels and the t-statistics are reported in robust standard error.

4.9 Conclusions and implications

The chapter contributes to the body of research that links managerial compensation scheme to investment decisions by explicitly showing that shareholders' deviations from the expected compensation level, specifically extremely over-compensated managers, increase the probability of managers committing capital expenditure investment distortions. In fact, our results also tend to indicate that underestimating the possibility of shareholders intentionally (in a long period of time) making adjustments to the managerial compensation scheme to induce investment distortion leaves a gap in our understanding of the investment–managerial compensation nexus.

The chapter provides direct evidence to suggest that the board of directors efficiently deviates from the normal compensation level to encourage managerial incentive to over-invest, particularly in capital expenditure activity (Strobl, 2014). The evidence partly tends to suggest that the UK executives' compensation data are more likely to be explained by optimal compensation theory.

Specifically, we find that over-compensated (under-compensated) incentives - stock options, equity and cash bonus increase (decrease) the tendency of over-investment in CAPEX, but a different outcome for intangibles (R&D and fixed intangible). Specifically, over-compensated managers tend to have a reduced possibility of over-investing in intangibles (R&D and fixed intangible).

Substantially, the findings collectively support the assertion that the board of directors (on the shareholders' behalf) may thoughtfully deviate from the optimal compensation level to encourage (discourage) over-investment probability.

An important implication of the results on the theories of managerial compensation is the relevance of optimal compensation theory to managerial investment efficiency decisions

(Coles et al., 2006; Strobl, 2014).

The evidence partly confirms that the firm's board of directors can generously (over-compensated) compensate managers to induce radical changes in managerial decisions relating to capital expenditure investment. This complements Strobl's (2014) observed demonstration on compensation deviation and investment distortions.

In addition, the evidence in the current section also enhances our understanding of the theory of investment. Clearly, it seems to imply that the over-compensated (under-compensated) managers are more (less) likely to over-invest in capital expenditure projects over a long period of time, different from Coles et al.'s (2006) explanation.

In general, our key finding on capital expenditure tends to show that the optimal contracting theory provides a potential explanation as to why the firm's board purposefully over-compensates managers using both stock-based and cash-based incentives to induce managerial investment distortions.

Chapter 5

5.0 The Relationship between Managerial Compensation and Leverage – Hypotheses, Proxies, Analytical Strategy, Analyses, Results and Discussions

5.1 Introduction

The purpose of this chapter is to establish a direct causal relationship between executives' compensation and the firm's observed leverage level. As reviewed in Chapter 2b, managerial compensation and financial leverage are related through agency theory. A detailed material discussion of the leverage–compensation relationship provides the study with the needed impetus to develop and later test the hypotheses to achieve the chapter's research aim. In particular, the chapter is sectioned along this line. Section 5.2 develops the hypotheses, whilst section 5.3 identifies and defines appropriate proxies that are needed to facilitate the empirical investigation. Section 5.4 briefly discusses the analytical strategy and provides descriptive statistics analysis. Section 5.5 is devoted to empirical results and discussions. Section 5.6 contains the robustness testing, whilst 5.7 provides the conclusion regarding the findings.

In fact, it is worth stating that the significant innovation of the study is the adoption of appropriate empirical models and statistical technique to answer the question of whether managerial compensation has a greater influence on the firm's observed leverage ratio by accounting for the feedback effect of leverage on the level and structure of managerial compensation. More specifically, as already stated, the study develops simultaneous equation modelling and employs a 3SLS estimator to analyse compensation and leverage linkage.

5.2 Hypotheses development

As indicated in Chapter 2b, through agency theory, managerial incentives and financial leverage are linked together (Coles et al., 2006; Berkovitch et al., 2000). This subsection provides the following specific testable hypotheses to show the extent to which managerial compensation incentives and financial leverage are related. More specifically, it states reasons why the different components of executive compensation affect a firm's observed debt level. This is because each compensation component possesses a distinctive risk-related feature to managers and this in turn affects how they (managers) use debt to sponsor corporate activities. Therefore, based on our main selected compensation components (LTIPs, stock options and cash bonus), we develop the following testable hypotheses on how each pay component relates to firm leverage.

5.2.1 Cash bonus and leverage

Cash bonus compensation is usually related to managers achieving an accounting performance target (e.g. cash flow, profits), which ensures that the firm remains solvent. One possible way to maintain a firm's solvency is to lower leverage ratio while generating positive and stable cash flows. This is because high debt level increases bankruptcy risk (Grossman and Hart, 1982) and reduces cash flows via interest payment (Jensen, 1986), which in turn could affect managers meeting the cash flow or profits performance threshold, causing them to lose out on their cash bonus incentive. This suggests a negative link between cash bonus and leverage (Coles et al., 2006). Therefore, we propose that executives with a high cash bonus may prefer to keep a low leverage ratio.

H6a: Leverage and executives' cash bonuses are negatively related.

5.2.2 Stock options and leverage

The convex payoff of stock options influences executives to increase risk-taking activities. Black and Scholes' (1973) "option model" argued that risk is a major determinant of stock price behaviour and that the convex payoff feature (i.e. expected payoff is only when share price exceeds the exercise price) associated with stock options provides managers with an incentive to increase risky activities such as borrowing more to sponsor corporate activities (Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012). As the firm's risk policies increase, uncertainty about the firm's cash flow, stock price volatility ensues, as investors continue to engage in constant trading. Consequently, due to high stock price volatility albeit the market abnormality, the value of the firm's stock goes up, benefiting both shareholders and the executives. With this, we expect that stock options will create strong managerial incentives for risk-taking activities. Our natural prediction is that:

H6b: There is a positive relationship between leverage and executives' stock options incentives.

5.2.3 Long-term incentive plans (LTIPs) compensation

Following the Greenbury Report's (1995) recommendation, publicly listed companies in the UK apply this type of incentive package to align shareholder-manager interests. The LTIPs (defined as performance stock plus deferred stock) compensation induces more risk-taking behaviour. This is because managers only benefit by achieving the set targets (e.g. earnings per share (EPS) increase, total stakeholders' return), which in turn increases managers' incentive to borrow more to undertake all valuable projects, particularly in cases where the firm's cash flows are insufficient. We therefore formulate our next hypothesis as follows:

H6c: There is a positive relation between leverage and LTIPs incentives.

5.2.4 Deferred/restricted stock

For instance, in the UK, executives with restricted shares are required to meet certain performance thresholds before vesting. One of them may include an executive remaining at the firm for a stipulated time limit. In cases where this prevails, the executive may become wary of increasing firm risk as his/her residual interests in the form of restricted stock increase. This can cause him/her to shy away from risky activities. For instance, Cassell et al. (2012) argue that, because deferred stock compensation (i.e. executives' inside debt) is generally unsecured and unfunded by the firm, executives with a large proportion of inside debt compensation will display a lower level of risky behaviour (Jensen and Meckling, 1976), especially if the vesting conditions are linked to their period of stay at the firm. Similarly, John and John (1993) argue that a highly levered firm can apply low pay-performance sensitivity (e.g. deferred stock) to reduce managerial risk-behaviour, which in turn may reduce the firm's future cost of borrowing. In line with this intuition, the study proposes that executives with large deferred stock compensation may tend to decrease corporate risk-taking policies (i.e. low leverage). Our last natural prediction is that:

H6d: Leverage and deferred share compensation are negatively linked.

Overall, the basic implication taking to the data is that, if executives' compensation packages are designed in part to mitigate shareholder-manager interests' divergence (thus, in a way to affect managerial risk-taking incentive), then we expect the anticipated prediction to exist between managerial compensation incentives and leverage. These developed hypotheses will be tested in the later section.

5.2b Leverage theoretical model

As argued above, managerial incentives are likely to affect a firm's observed leverage level through agency-motivated reasons. Our theoretical model is stated below:

$$Leverage_{it} = \beta_1 Incentives_{it} + \epsilon_{it} \quad \text{(9)}$$

Where, *Leverage* is the firm's book leverage (long-term debt plus short term-debt), *Incentives* represent managerial compensation components (value of stock options grants, LTIPs grants and cash bonus) and the random error term is ϵ_{it} .

5.3 The data and variable descriptions

The section handles data collection and the measurement of the study variables: dependent variable (i.e. financial leverage), key independent variables and other control variables for the leverage. In fact, because the data collection procedure has been discussed in Chapter 3, we proceed to define our key variables in the next subsection. We first start with the dependent variable, then independent variables and, finally, control variables.

5.3.1 Financial leverage variable

One of the key variables at the heart of this examination is financial leverage and how it associates with compensation incentives. This, in essence, calls for the definition and measurement of our financial leverage variable. In fact, corporate finance literature on capital structure often tends to disagree on how financial leverage should be measured: book leverage vs market leverage. Before we move on to measure this variable, we first define the term "financial leverage" and state the key reasons underlying our choice of financial leverage measure.

5.3.1.1 The measurement of financial leverage

Corporate financial leverage simply shows the relationship between two competing items, debt and equity, in terms of the overall value of the firm (Borio, 1990). With this definition, two major issues arise which make leverage measurement a daunting task in the corporate finance research. First, whether financial leverage (hereafter, leverage) should be considered from the financial market perspectives (market leverage) or from the internal accounting record standpoint (i.e. book leverage), and, secondly, whether the leverage should be measured in terms of book value of total assets or total capital of the firm. For instance, the literature measures leverage as follows: market leverage is defined as the book value of debt scaled by the market value of the firm, whilst the book leverage is measured as the book value of debt divided by the accounting value of total assets.

The present study chooses book leverage over the market leverage based on the following reasons. First, book leverage is less "noisy" than market leverage. That is, in a volatile market condition, a firm's stock price can experience abnormality which can cause fluctuation in market leverage ratio even when actual debt level remains unchanged. The book leverage measure reduces such mechanical changes.

Second, book leverage ratio is more suitable to analyse managerial incentive to increase firm risk (through borrowing) giving compensation incentives. Again, book leverage values make it more preferable to estimate the leverage deviation variable (trade-off theory). Finally, adopting the book leverage measure makes the study result easily comparable with the prior studies (e.g. Coles et al., 2006; Florackis and Ozkan, 2009; Chava and Purnanandam, 2010).

However, although some researchers advance reasons in favour of market leverage, including being forward looking and less subject to management manipulation (e.g. Welch, 2006; Erickson and Wang, 1999), this study adopts book leverage based on the stated motives. Unless otherwise indicated, book leverage (the term leverage is used throughout the study) is preferred over market leverage for the purpose of this analysis.

Accordingly, we state both measures, book leverage measure and market leverage (for comparative purposes). We define the two main measures as follows:

$$\text{Book Leverage} = \frac{Total\ Debt}{Total\ Debt\ +\ Book\ Value\ of\ Equity} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(9.1)$$

Where, total debt is defined as long-term debt plus short-term debt, book value of equity is the accounting value of common shareholders' equity (source: Compustat).

$$\text{Market Leverage} = \frac{Total\ Debt}{Total\ Debt\ +\ Market\ \ Value\ of\ Equity} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(9.2)$$

Where, total debt is defined as long-term debt plus short-term debt, market value of equity is the stock price at the end of the fiscal year multiplied by the number of common shareholdings available. These financial data were sorted from the Compustat database.

In the next section, we describe the key independent variables (i.e. LTIPs and stock options and cash bonus) incentives as well as other control variables.

5.3.2 The key independent variables

Central to the study's aim is to provide evidence on the relation between financial leverage and executives' compensation incentives. To achieve this, the study utilised manually collected compensation components' variables – cash bonus, value of stock options, LTIPs (deferred stock value plus performance stock value) – from the sampled companies' annual reports spanning 2006 to 2015. Following the Greenbury Report (1995) and Hampel (1998) report, publicly listed companies on the London Stock Exchange (LSE) are mandated to provide detailed information on executives compensation packages. The collected data are based on a time series of firm years (2006–2015) which in effect allows the contemporary data information to accommodate both political and economic changes that have occurred within the stipulated sample period. Also, to enable the study to perform a more rigorous econometric analysis, we construct our data in a panel data setting. With this design, we are able to reduce survivorship bias. The detailed information on sample collections and processes have been discussed in chapter 3 (data sample section).

In fact, as stated earlier, the study applies these different compensation components: cash bonus, value of share options, value of LTIPs (performance share value and deferred share value) and salary (as control variable). This is because each component has its own distinctive feature, and that tends to pose different effects on leverage. The sum of the components constitutes the total executives' compensation.

As indicated earlier, our key explanatory variables – cash bonus, stock options and LTIPs – have already been discussed and defined (in Chapter 2) and so, due to space constraints, we only state the measurement of these variables.

Under this section, we briefly state and define managerial compensation components to be utilised in our analysis. These are cash bonus, LTIPs (value of performance shares plus restricted shares) stock options and salary (used as control variable).

5.3.2.1 Cash bonus

We measure cash bonus ratio as the total of executives' cash bonus divided by the total executives' compensation.

5.3.2.2 Stock options compensation

This shows the value of share options granted to the executives during the financial year. We compute this value using the modified Black-Scholes (1973) option valuation technique. We construct the annual stock options grant parameter by dividing total annual stock options value to the total compensation.

5.3.2. 3 Long-term incentive plans (LTIPS) grants

The LTIPs compensation incentive is the sum of performance shares value and deferred shares value. It is measured as the total value of LTIPs grants scaled by the total compensation.

5.3.2.4 Deferred stock incentive

This component of compensation is measured as the total value of deferred stock grants scaled by the total compensation.

5.3.2.5 Salary compensation

This component of compensation shows the total base salary of the executives. This component represents managerial risk aversion and it is used as a control variable. As highlighted by Bebchuk and Fried (2003), top executives' salary component has a minimal influence on managerial risk behaviour. We measure total salary ratio as a fraction of the total compensation.

The next subsection proceeds to discuss other control variables that have been found to affect financial leverage level.

5.3.3 Other control variables for leverage

This section provides an explanation for a set of control variables that extant literature on corporate leverage shows are linked. Motivated by studies such as Rajan and Zingales (1995), Frank and Goyal (2004), Coles, Naveen and Daniel (2006), Kini and Williams (2012) among others, we include the following proxies: market-to-book (growth opportunities), firm size, return on asset (profitability), net PPE (tangibility), research and development (R&D), Z-score (bankruptcy risk), industry effects and year effects. Overall, these control variables are included in the leverage model.

We now provide a brief discussion of these control variables and how they relate to leverage.

i) Firm size: large firms, compared with small ones, are usually less exposed to agency conflicts, because they often have access to a wider variety of financing sources and tend to enjoy a better reputation in the bond markets (Diamond, 1993). Moreover, with a relatively large tangible assets base, large firms are easily attracted to the financial markets (Jensen and Meckling, 1976; Rajan and Zingales, 1995). Therefore, such financial flexibility makes large firms less likely to encounter bankruptcy risks (Hovakimian et al., 2001) and, also they keep huge debt in their books. Firm size is proxied by the natural logarithm of sales or log of total assets.

ii). Profitability/return on asset (ROA): corporate firms with substantial profits are likely to sponsor activities with internal funds instead of external debt (Myers and Majluf, 1984; Myers, 1984). Thus, pecking order theory posits a firm is more likely to use external sources of financing only if its internal funds are insufficient (Myers, 1984). Therefore, to the extent that internal funds are built from earnings (profits), it is most likely that high-profit firms may use less debt (Flanner and Rangan, 2006). Consistent with Coles et al. (2006), we account for this effect and compute the firm's profitability as the ratio of earnings before interest, tax, depreciation and amortisation (EBITDA) scaled by total assets.

iii). Asset tangibility: as argued by Jensen and Meckling (1976) and Rajan and Zingales (1995), firms with huge tangible assets are more likely to borrow more because they can use their large pool of hard assets as collateral security. Also, firms with such substantial assets in place are seen by the financial markets as large, and that they are less likely to run into bankruptcy (Hovakimian et al., 2001). We control for this effect by including ratio of tangible assets to total assets in the model.

iv). Growth opportunities: corporate firms with substantial growth potentials are expected to carry out more investment activities (Hayashi, 1982; Hall, 1992). With this, Myers (1977) argues that firms with huge growth potentials should decrease their leverage ratio to minimise the problem of forgoing positive net present projects (NPV) (i.e. under-investment problem). Consistent with Rajan and Zingales (1995) and Coles et al. (2006), market-to-book ratio is included in our regression model to proxy for growth opportunities.

v). Research and development expenditure: high-growth opportunity firms tend to spend more on research and development. Building on this notion, Uysal (2011) posits that such firms are more likely keep a lower debt level in their books. In a relatively different vein, Titman (1984) states that such firms may often face a high cost of bankruptcy because they tend to have low tangible assets in the overall firm value compositions. Like Coles et al. (2006), we include the ratio of research and development expense to total assets in the model.

vi). Financial distress (Z-score): we apply a modified Altman Z-score (proposed by Mackie-Mason, 1990) to measure the expected bankruptcy of the firm. This tends to suggest that firms with a high bankruptcy risk are likely to avoid further debt finance in order to reduce their bankruptcy exposure (Titman, 1984; Harford et al., 2009). Consistent with Chava and Purnanandam (2010) and Coles et al. (2006), we measure the firm's financial health using the modified Altman's Z-score (Altman, 1977) measure. We define it as follows: [3.3 (EBIT/Total Assets) + 1.0 (Sales/Total Assets) + 1.4 (Retained Profits/Total Assets) + 1.2 (Working Capital/Total Assets)].

vii). Stock returns: market timing theory of capital structure posits that firms tend to use equity financing particularly when their shares are over-valued by the market. Such strategic financing decisions may lead to less debt usage (Baker and Wurgler, 2002). Therefore, leverage ratio and stock return are predicted to be negatively related. We use 12-month average monthly stock return as a proxy for stock return.

viii). Industry fixed effect: we control for the industry homogenous and heterogeneous effect in our leverage model. Specifically, a dummy variable is included in the model to account for all nine (9) industries. This is because firms operating in such a category may have some common characteristics. Consistent with Coles et al. (2006), we use a two-digit SIC code to proxy industry concentration. For brevity purposes, we do not report the industry coefficient estimates in our presentation and analyses.

ix). Time dummies: it is conceivable that a country's macroeconomic conditions could fluctuate over time and such changes can affect a firm's borrowing behaviour. In order to account for and capture the effects including interest rates and inflation rates which occur within and across different years, we include a year dummy in the model for the sample period (2006-2015). To be specific, Hardford (2005) argues that the interest rate spread which to some extent represents a general liquidity indicator in the economy partly influences corporate debt level. Moreover, to minimise the perfect collinearity problem in our regression analysis, we exclude the base year (2006) dummy from the regression. For brevity purposes, the coefficients estimates are not reported in our presentations and analyses of the results. In summary, this section has clearly exhausted the variables (e.g. dependent, key explanatory and controls) to be utilised to conduct our empirical analysis in Table 5.3.1.

Table 5.3 1 Definition of Dependent, Independent and Control Variables

Dependent Variables	**Description**	**Literature**
Book leverage	Total debt = long-term debt plus short-term debt scaled by Total Assets	Coles et al. 2006; Kini and Williams, 2012
Market leverage	Total Debt divided by the (Equity book value + Equity Market value)	Coles et al. 2006
Independent compensation variables		
Long-term incentive plan (LTIPs)	Total value: performance stock plus deferred stock scaled by total compensation	Kabir et al. 2013
Performance stock (PS)	Sum of performance share awards, share matching plan scaled by total compensation	Kabir et al. 2013
Deferred / restricted stock (DS)	Total face value: deferred shares/stock scaled by total compensation.	Kabir et al. 2013; Ryan and Wiggins, 2001
Cash bonus (CashB)	Total annual cash bonus scaled by total compensation	Kabir et al. 2013; Ryan and Wiggins, 2001
Executive share options (ESO)	Total share options value (using Black and Scholes,1973). Share options value divided by total compensation	Kabir et al. 2013; Ryan and Wiggins, 2001
Total compensation	Sum value: salary, cash bonus, share options and LTIPs.	Kabir et al. 2013
Control variables		
Salary (*SAL*)	Total of base salary, allowances, benefits (monitory value) divided by total compensation	Cadman, Carter, and Hillegeist, 2010; Chen et al. 2016.
Firm Size (Size)	Natural logarithm of total sales	Coles et al. 2006
Market-to-book (MKTB)	Defined as market value of assets divided by their book value.	Floarackis et al. 2009; Chava and Purnanandam, 2010
Return on assets (ROA)	EBITDA/Total Assets	Coles et al. 2006
Annual stock return (*STKR*)	Annual stock return (12-months)	Coles et al. 2006
Tangibility (net PPE)	Net Property, Plant and Equipment/ Total Assets	Coles et al. 2006; Kini and Williams, 2012
Research & Development (R&D)	R & D Expense / Total Asset	Coles et al. (2006)
Bankruptcy risk (Z-score)	[3.3 (EBIT / Total Assets) + 1.0 (Sales/Total Assets) + 1.4 (Retained Profits/Total Assets) + 1.2 (Working Capital/Total Assets)]	Coles et al. (2006)
Industry & Year fixed effect	Dummy variable of 1 otherwise 0	Coles et al. (2006)
Other independent variables		
Large Ownership (%) (Large Own)	Shareholdings of owners above 3% scaled by the total common shareholdings	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999
Non-executives ownership (%) (Non E.Own)	Annual shareholdings of non-executives divided by the firm's total common shareholding.	Mehran, 1995
Executives Ownership (%) (E.Own)	Annual executives shareholdings scaled by common shareholdings.	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999

5.3.4 Empirical leverage specification

As stated, the two key variables (dependent and independent variables) are likely to be interdependent, which may affect the study's findings when a conventional single equation model is employed. In dealing with this inherent interdependence among these variables, the study adopts a system of equations model approach. Specifically, the structural specification develops four (4) equations, one each for the three independent variables (LTIPs, stock options and cash bonus) and one for the respective leverage measure.

Structurally, the specification employed is stated as follows. Thus, the four simultaneous equations used to test the developed hypotheses (in Chapter 2) are specified below:

$$LTIPs_{it} = \beta_0 + \beta_1 Leverage_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (1)$$

$$ESO_{it} = \beta_0 + \beta_1 Leverage_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (2)$$

$$CashB_{it} = \beta_0 + \beta_1 Leverage_{it} + \beta_2 Controls_{it} + \beta_3 Instrument_{it} + \epsilon_{it} \quad (3)$$

$$Leverage_{it} = \alpha_0 + \alpha_1 LTIPs_{it} + \alpha_2 ESO_{it} + \alpha_3 CashB_{it} + \alpha_4 Controls_{it} + \epsilon_{it} \quad (9)$$

where, in Eq. (9), $Leverage_{it}$ is the firm leverage (i.e. book leverage measure), incentive components (*LTIPs, ESO and CashB*) are predicted values from the first-stage model, where each pay component (Eq. 1, 2, and 3) is regressed on the determinants (e.g. leverage, investment, firm size, growth etc. defined above) to obtain the equilibrium compensation value, which is used in the second-stage leverage model, *controls* are other factors that affect firm's leverage: firm size, market-to-book, stock return, return on assets, Z-score, net PPE, R&D expense, industry effects and year effects.

Detailed explanations of the firm's observable characteristics (controls) are provided in Table (5.3.1). Also, it is important to state that we are interested in the sign, magnitude and significance of a_1, a_2 and a_3 as they show the extent of association between managerial financial compensation and leverage.

5.4 Analytical procedure

The purpose of this chapter is to examine the causal relationship between a firm's observed leverage ratio and its managerial compensation packages. In an attempt to achieve this aim, we adopt an empirical strategy similar to Coles et al. (2006) and Kini and Williams (2012) but also make a further extension to their approach. Specifically, the study employs a system of equations approach to analyse our unbalanced pooled dataset to statistically examine the effects of executive compensation incentives on leverage ratio. More specifically, we employ a three-stage least squares (3SLS) identification strategy to our panel data.

As noted, the empirical studies on executive compensation and leverage often highlight endogeneity concerns (Kini and Williams, 2012; Coles et al., 2006). For instance, Kini and Williams (2012) argue that executive compensation, leverage and other characteristics are all ultimately part of a simultaneous system to determine corporate value. Such interdependence among these corporate variables makes it a daunting task to establish a causal association because of the endogeneity problem. As already indicated, endogeneity occurs when an unmodelled variable is correlated with the dependent variable and the explanatory variable(s) and/or the random error term. Therefore, noting the study's primary aim (i.e. establish a causal link between executive compensation and leverage), it is expected that the estimated coefficient using ordinary least squares (OLS) would be biased and inconsistent (Wooldridge, 2002; Gujurati and Porter, 2009 p.711; Antonakis et al., 2014). This, in turn, can lead to the wrong causal inference among dependent (leverage) and independent (compensation incentives) variables (Wooldridge, 2002; Antonakis et al., 2014).

As noted by previous research (e.g. Coles et al., 2006; Kini and Williams, 2012), the simultaneous system of equations technique makes it possible for models with endogenous regressors to be consistently and robustly estimated. Consistent with Coles et al. (2006), we apply a three-stage least squares (3SLS) method to generate efficient parameter estimates by removing the portion of variance connected to the explanatory variable(s) and the dependent variable or the error term.

In fact, two key steps are involved in our estimation: first, in the first-stage regression, we regress the endogenous regressor (e.g. value of component of incentive grants: LTIPs, stock options and cash bonus) on all instruments including book leverage, relevant instrumental variables and other exogenous, i.e. control variables for compensation variables to obtain predicted compensation values; and, secondly, we replace predicted compensation values in the right-hand side as our key explanatory variable in the original leverage model together with other control factors that affect leverage level. It is worth mentioning that we use a contemporaneous value of the compensation components (LTIPs, stock options and cash bonus) to conform to the basic reasoning underlying simultaneous equations. This is consistent with existing studies (see Kini and Williams, 2012; Coles et al., 2006). And, finally, we regress leverage on the predicted compensation values and other control variables. The coefficient estimate for the predicted compensation values is our parameter of interest.

Specifically, we show the procedures involved in the use of the three-stages least squares (3SLS) estimator by stating both the leverage model and the endogenous regressor equations. More specifically, as stated above (leverage model), the four equations consisting of one equation for leverage and one equation for each of the executives' compensation variable (LTIPs, stock options and cash bonus) to derive the predicted values for the pay component to be used in the original leverage model. The chosen system is similar in structure to the prior literature (e.g. Coles et al., 2006) specification with slight modifications. For example, our incentive model tests for over-identifying restrictions instead of just-identifying strategy employed by the previous researcher. By this, we are able to account for a large number of control variables and instruments that have been found to explain executive compensation, which in turn improves the efficiency of the parameter estimates.

The study's chosen statistical tool (STATA) is used to analyse the panel dataset. In STATA, the structural modelling is set up as demonstrated above, where there is one equation each for the three incentive components and one equation for the leverage and then a three-stage least squares estimator is applied to run the regression analysis. Before we proceed to the three-stage least squares (3SLS) regression, the next section shows primary data analyses.

5.5 Data analysis

This part provides the analysis of the sampled datasets. It shows the descriptive statistics, correlation matrix and the univariate analyses.

5.5.1 Descriptive statistics

Table (5.3.2) shows the descriptive statistics of the study's main sample and subsamples. The dependent variable, leverage shows a wide variation, which ranges from -0.0712 to 4.69, with an average (standard deviation) of 0.3585 (0.246), which implies that our sample firms display some variation in their leverage. Salary (SAL) ranges from £120,000 to £9,160,000 with an average (standard deviation) of £1,414,000 (759.85), cash bonus (CashB) from £0 to £15,586,000 and shows an average (standard deviation) of £1,105,000 (1204.5), stock options (ESO) from £0.00 to £29,233,000 with an average (standard deviation) of £324,000 (1286.1), whilst LTIPs ranges from £0.00 to £61,547,000 with an average (standard deviation) of £3,024,000 (4190.2). Overall, with the high standard deviation, our compensation components data show a significant variation. Furthermore, for other characteristics: R&D shows this range, -0.3044 to 0.412, with an average (standard deviation) of 0.006 (0.031), tangibility (net PPE) ranges from 0 to 0.935, with an average (standard deviation) of 0.238 (0.227), return on asset (ROA) has an average (standard deviation) of 0.099 (0.181), annual stock return (STKR) an average (standard deviation) of 0.096 (0.512), market-to-book (MKTB) also has an average (standard deviation) of 4.10 (1.411), whilst firm size (Size) and Z-score averages are 9.01 (0.859) and 1.53 (1.22) respectively. Regarding governance variables: executive ownership (E.Owen), non-executive ownership (NonE.Own) and large ownership (Large Own) averages (standard deviation) are 4.7% (0.223), 2.05% (0.127) and 39.3% (18.89) respectively. The reported findings show that our data composition is widely varied.

Table 5.3 2 Descriptive Statistics

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Dependent variables						
Book leverage	1,899	0.3585	0.3581	0.2468	-0.0712	4.6917
Market leverage	1,899	0.2458	0.2401	0.2974	-0.0658	1.0006
Compensation variables						
SAL (£'000)	1,899	1414	1227	759.8	120	9160
CashB (£'000)	1,899	1105	836	1201.5	0	15586
ESO (£'000)	1,899	324	0	1288.1	0	29233
DS (£'000)	1,899	934	263	2142.7	0	35564
PS (£'000)	1,899	2089	1327	3010.0	0	49425
LTIPs (£'000)	1,899	3024	1715	4190.3	0	61547
Total compensation (£'000)	1,899	5868	4144	5471.5	120	63296
Firm characteristics						
R & D	1,887	0.0064	0	0.0308	-0.3044	0.4127
Net PPE	1,820	0.2402	0.1709	0.2283	0	0.9354
ROA	1,871	0.0992	0.0904	0.1818	-3.9170	2.8286
STKR	1,877	0.0603	0.0961	0.5124	-5.4563	6.8998
MKTB	1,894	9.1892	1.4453	77.7421	0.000	15.684
Z-Score	1,899	1.5391	1.4933	1.2246	-13.6644	16.9188
Size	1,829	9.0146	9.0022	0.8598	0	11.5067
Gov. proxy &instruments						
E.Own (%)	1,869	4.78	0.22	0.2233	0	6.063
Non.EOwn (%)	1,843	2.06	0.03	0.1268	0	3.508
Large Own (%)	1,854	39.28	37.64	18.8988	0	85.07
CEO age	1,557	52	52	6.3634	36	73
CFO age	1,438	49	50	5.8161	32	65
Ex.Av. Age	1,402	50	51	5.3114	34	65
DPO	1,852	0.6165	1	0.4893	0	1

This table presents the descriptive statistics for the entire data used for the study. The sample comprises 213 UK FTSE 350 firms over the period 2006 to 2015. Instruments are Ex.Av.Age, STKRV and DPO are included in the first-stage model (incentive model). The variable descriptions are provided in Table 5.3.1.

Table 5.3 3 Correlation Matrix for Independent Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 SAL	1.000															
2 cashB	-0.171	1.000														
3 ESO	-0.048	-0.128	1.000													
4 LTIPs	**-0.495**	-0.234	-0.119	1.000												
5 STKR	-0.077	0.095	0.049	-0.121	1.000											
6 MKTB	-0.083	-0.003	-0.004	0.117	0.003	1.000										
7 ROA	0.002	0.062	-0.002	-0.035	0.197	-0.032	1.000									
8 Net PPE	0.125	-0.156	-0.054	0.056	-0.029	-0.072	0.060	1.000								
9 R&D	0.042	0.057	-0.030	-0.059	0.026	-0.007	0.039	-0.077	1.000							
10 Z-Score	0.051	0.026	-0.007	-0.098	0.096	0.033	**0.599**	0.020	0.056	1.000						
11 Size	-0.319	-0.226	-0.091	**0.530**	-0.054	-0.156	0.039	0.180	-0.042	0.198	1.000					
12 E.Own	0.328	0.012	0.015	-0.135	-0.011	-0.028	0.049	0.002	0.013	-0.012	-0.207	1.000				
13 Large Own	0.326	0.165	0.008	-0.343	-0.032	-0.056	-0.010	0.072	-0.041	0.053	-0.364	**0.440**	1.000			
14 Non Own	0.185	-0.025	-0.051	-0.117	-0.015	-0.017	0.056	0.098	-0.049	0.059	-0.049	-0.028	0.214	1.000		
15 CEO age	-0.003	-0.009	0.003	0.090	0.003	0.109	-0.036	-0.052	0.039	-0.072	0.021	-0.074	0.002	0.036	1	
16 CFO age	0.017	-0.028	-0.062	0.027	0.020	-0.026	0.032	-0.113	0.050	0.026	0.128	0.123	0.040	-0.007	0.315	1

This table presents the correlation matrix for the sample data. The sample and variable definitions are as described in Table 5.3.1.

Table 5.3.3 shows the correlation coefficients of the explanatory variables included in the second stage of the book leverage model. The table reported a highest correlation value of 0.599 (59.9%) between bankruptcy risk (Z-score) and return on asset (ROA). The relatively low correlation among these independent variables is very important for the efficiency of our findings.

The next subsection provides further analysis (univariate) of how the executives' compensation and firm characteristics behave across the different levels of firm leverage. We first conduct this univariate analysis before we move on to discuss the three-stage least squares (3SLS) estimator results.

5.5.2 Univariate analysis

Table (5.4.1) shows univariate mean and standard deviation comparisons of firm- and manager-specific characteristics by leverage quartiles. In order to perform this, we segregate firms into quartiles based on their leverage level and test whether the firm- and manager-related characteristics differ across low leverage (1st quartile) and high leverage (4th quartile). For the compensation components, it shows that the mean cash-based incentive (salary and cash bonus) in low-leverage firms is higher than that in high-leverage firms. In particular, the mean differences for salary and cash bonus are significant at 5% and 1% respectively. This is plausible, because low-leverage firms spend less on interest payment, which in turn will give them a leeway to store enough cash balance and can motivate managers receiving more cash bonus or upward annual salary adjustment than high-leverage ones. Further, executives' stock options in low-leverage firms has a mean value of 6.5% compared to 4.9% for high-leverage firms, which posits that shareholders of highly leveraged firms lower stock options to minimise further risk-taking incentive. Shareholders in high-leverage firms use more LTIPs relative to low-leverage ones, and the mean difference is economically significant at 1% level.

Moreover, the findings on other firm characteristics are largely consistent with most of the extant literature. For instance, it shows that low-leverage firms are normally smaller, have lower tangible assets, higher performance (return on assets and stock return) as well as higher market-to-book ratio than high-leverage firms and they have significant differences in means. It is also observed that low-leverage firms usually have larger R&D spending than the high-leverage ones.

The table further reveals that the executives ownership in low-leverage firms has a mean value of 7.4%, compares to 3% for high-leverage firms, suggesting over 100% higher in mean differences than that of high-leverage ones. The significantly different executives ownership levels seem to be consistent with the managerial entrenchment argument, which suggests that executive managers become entrenched after a specific level of executives ownership, and may choose to have a level of leverage that is lower than the optimal level to prevent further monitoring activities from the debtholders (Florackis and Ozkan, 2009). The analysis also shows that the mean large ownership in low-leverage firms is higher than that in high-leverage firms, and the difference is economically and statistically significant. It tends to imply that large shareholders become cautious of the firm's risk level and may prefer to lower their holdings as the firm's leverage reaches an extreme level. However, the level of non-executives ownership does not seem to differ significantly across both the first and fourth quartiles. Similar findings were also observed for both CEO and CFO age.

In brief, the univariate analysis provides evidence to show how compensation incentives, monitoring mechanism (non-executives ownership, large ownership) and other firm characteristics behave across different leverage levels (1^{st} and 4^{th} quartiles). However, one caveat of this result is that the analysis does not effectively account for other control variables, and that the reported existing relations may be instigated by some unaccounted factors. The next section performs the 3SLS analysis by accounting for the control variables in the regression analyses.

Table 5.4 1 Managerial and Firm Characteristics by Leverage Quartiles

	Quartile 1	Quartile 4	t-test
SAL	0.348	0.326	2.12**
	[0.17]	[0.15]	
CashB	0.211	0.184	3.32***
	[0.13]	[0.11]	
ESO	0.065	0.049	1.81*
	[0.15]	[0.12]	
LTIPs	0.375	0.440	-4.69***
	[0.22]	[0.20]	
MKTB	21.699	10.472	1.60
	[148.30]	[39.00]	
Size	8.662	9.079	-7.24***
	[0.68]	[0.98]	
ROA	0.126	0.080	2.90***
	[0.12]	[0.32]	
STKR	0.106	0.034	2.05**
	[0.48]	[0.56]	
Z-Score	1.459	1.539	-0.84
	[0.96]	[1.81]	
Net PPE	0.215	0.242	-1.80*
	[0.23]	[0.23]	
R & D	0.008	0.003	4.39***
	[0.02]	[0.01]	
E.Own	0.074	0.030	3.46***
	[0.16]	[0.22]	
NonE.Own	0.016	0.023	-0.82
	[0.067]	[0.17]	
Large Own	43.085	37.473	4.48***
	[20.54]	[17.45]	
CEO age	51.438	51.235	0.81
	[7.43]	[6.61]	
CFO age	49.418	49.350	0.15
	[6.11]	[5.62]	

The table above provides univariate mean comparisons of both firm-specific and managers incentives characteristics by leverage (dependent variable) quartiles (normal font) and standard deviation (in square brackets). The t-statistics show the difference of means from the first (1st) to the fourth (4th) quartiles. The column (4) shows t-tests of whether the means of quartiles 1 and 4 differ statistically ($H_{o:}$ *mean* (1) − *mean* (4) = 0; H_1 : *the diff* 6=0). Definitions for all the variables are shown in table 5.3.1. ***, ** and *** indicate** statistical significance at the 10%, 5% and 1% levels, respectively**.**

5.6 Empirical results and discussions – Three-stage least squares (3SLS)

In fact, the univariate regression analysis shows a significant relation between leverage and executives' compensation. However, the specification (univariate) fails to account for several important factors that may affect leverage behaviour. Our chosen system of equations accounts for the additional control variables and estimates them using a 3SLS technique.

As indicated earlier, the estimation follows two important procedures. First, in the first-stage regression analysis, we estimate each compensation component incentive as the dependent variable on a set of control and instrumental variables to obtain the predicted incentive values. In the second-stage regression, our dependent variable is firm book leverage (i.e. unless otherwise stated) regressed on the fitted or predicted incentive value (which is the parameter of interest: LTIPs, stock options and cash bonus), salary and other control variables that are relevant in determining corporate leverage. Our base estimated model is like Coles et al. (2006) and Kini and Williams (2012) but with some modifications. For instance, the present study treats cash bonus as endogenously determined, different from Coles et al. (2006), who included cash-related compensation as a control for managerial risk aversion. Our stated reason is that shareholders consider other factors before awarding executives cash bonuses (Ryan and Wiggins, 2001; Humphery-Jenner et al., 2016) and that failing to accommodate these in the modelling design could biased the estimates. However, we only include salary in the leverage model to represent managerial risk aversion.

More specifically, the presented result in Table (5.4.2) shows four specifications (leverage, LTIPs stock options and cash bonus) and their coefficient estimates of the respective model. Accordingly, our discussion is organised in this order: leverage analysis, control variables and, finally, the pay component regression.

5.6.1 Discussion of financial leverage findings

In Table (5.4.2), the leverage column presents the regression results for our second-stage specification. Specifically, we find that the coefficient on LTIPs (0.3480 t-statistics 7.74) incentive is positive and statistically significant at 1% significance level. A one standard deviation change in LTIPs incentives is, on average, associated with a 34.8% increase in book leverage. In other words, a firm's debt ratio increases with the managerial LTIPs incentive. The result suggests that shareholders tend to use the managerial LTIPs component of compensation to induce executive managers to increase firm idiosyncratic risk by contracting more corporate debt to sponsor all positive net present value projects. Therefore, the effect of LTIPs compensation on the corporate debt increase may be an outcome of shareholders' value-maximisation motives, particularly when managers are risk averse (e.g. Harris and Raviv, 1988; Florackis and Ozkan, 2009). This, in turn, supports the popular view that shareholders in a high-levered firm can expropriate wealth from debtholders (bondholders or other creditors) by inducing managers to increase debt level, which in turn increase the firm's stock price value but decrease bond value (e.g. Jensen and Meckling, 1976). One implication, however, is that such a risk-shifting incentive can lead to agency cost of debt finance, in which shareholders would ultimately bear the full costs (John and John, 1993; Ortiz-Molina, 2007). More specifically, it suggests that, as a firm's leverage ratio goes up, rational lenders, institutional creditors and other debtholders may become wary of possible financial distress or bankruptcy risk (Grossman and Hart, 1982), which in part may influence them to demand a high cost of capital before they lend to such firms, or perhaps they may even enter into a restrictive covenant with the firm on future loan acquisition if the loan agreement is already in place.

On the other hand, the stock options incentive shows an inverse relation with leverage. Thus, the estimated coefficient on share options is -0.5269 (t-statistics -9.06) and it is both economically and statistically significant at 1% conventional level. The finding suggests that, as managers receive more stock option-based incentives, their risk appetite or preference decreases, causing them to lower corporate debt level, which is constant with Hayes et al. (2012) but inconsistent with the fundamental intuition regarding the stock options incentive package (e.g. Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012). Although the coefficient is directly opposite the risk-motivated story of the stock options incentive, the following could constitute a possible explanation of the negative relationship. One reason could be linked to the fact that managers with high-powered stock options may tend to develop a risk-aversion incentive particularly when their stock options value is in the money and may decide to avoid further increase in overall risk profile of the firm, thereby decreasing the corporate debt ratio (Lewellen, 2003, 2006). This raises a serious concern to shareholders whose primary intention is to significantly influence managers to borrow more to invest in all positive net present projects via stock options compensation. This is because, as managers' residual interest reaches the optimal point (thus, once managers share options are in the money), their risk appetite to use more debt finance reduces, which increases the likelihood of managers forgoing some positive investment projects particularly when internally generated funds are insufficient to sponsor such activities. Another alternative explanation of the result could be suggestive of Bebchuk and Fried (2003) and Weisbach's (2007) managerial rent extraction motive, because executive managers often have discretionary power to make adjustments to their share options portfolio (Coles et al., 2006) especially when their firm's stock price takes a tumble and falls below their share options exercised price. Given the monitoring power of debtholders, entrenched managers are less likely to positively respond to the convexity nature of the stock options incentive.

Similarly, we also document a negative relationship between cash compensation and firm financial leverage. To be specific, the coefficient estimate on cash bonus is -0.1719 (t-stats -2.81) and significant at 1% conventional level. This is consistent with the stated hypothesis.

The result can be interpreted to suggest that managers of non-financially constrained (low-leverage) firms tend to receive more cash bonuses, which is consistent with the prior research (e.g. Core and Guay, 1999; Coles et al., 2006). This is plausible, given that managers of low-leverage firms are able to store up substantial cash reserves via high earnings and lower interest payments, which in turn makes it more probable for executives to meet the required accounting performance threshold (e.g. earnings, cash surplus performance measure) set by the shareholders. However, a major implication of the finding is that, by using accounting performance measure, managers may be more inclined to decrease firm debt ratio particularly in a low corporate governance environment.

Overall, it is worth mentioning that the reported coefficient estimate on cash bonus provides a strong support to our hypothesis that more managerial cash bonus partly leads to lower firm leverage ratio. In other words, with more cash bonus compensation, managerial idiosyncratic risk-taking regarding the firm's debt level is significantly reduced, providing further support to our earlier stated inference.

5.6.1.1 Control variables

The results for the control variables in the leverage model are largely consistent with prior findings (Harris and Raviv, 1991; Rajan and Zingales, 1995; Coles et al., 2006; Dang, 2011), with little modification. Specifically, our control proxies include salary, return on assets, firm size, market-to-book, Z-score, annual stock return, net PPE, and R&D expense, and their reported coefficient signs are shown in column (1) of the leverage equation.

First, consistent with the expectation, managerial risk-aversion proxy, salary is negative and statistically significant on leverage. With the coefficient estimates (-0.1225 t-statistics -3.89), it implies that higher salary earners are often risk averse and may tend to hold a low leverage ratio on the firm's balance sheets.

Second, the coefficient estimate on return on assets (-0.1406 t-statistics -1.91) is found to be negatively and significantly related to the book leverage. This is in line with the view that managers of firms with high internal funds (through profits and cash surplus) tend to only use debt finance after they have exhausted their internal funds. It suggests that firms follow a pecking order pattern when faced with financing decisions (see Myers and Majluf, 1984; Flannery and Rangan, 2006).

Third, the estimate on firm size is positive 0.0336 (t-stats 2.08) and significant. It suggests that larger firms are more likely to have a high debt ratio in their books (Rajan and Zingales, 1995; Flannery and Rangan, 2006). This is because such firms often enjoy these characteristics: stable cash flow and more diversified in operations (Hovakimian et al., 2001), and they easily attract the attention of the capital markets (Rajan and Zingales, 1995), which in turn allows them the leeway to borrow more from the debt market.

Fourth, we report that the market-to-book, which proxies for growth opportunity, is positive and significant at 1% conventional level, implying that high-growth firms tend to have a high debt ratio level. This is consistent with Kester (1986) but inconsistent with Myers (1977) and Titman and Wessels (1988). For instance, Myers (1977) vehemently argues that high-growth firms should keep a low leverage ratio to prevent future under-investment problems.

Fifth, as expected, the Z-score shows a positive sign and significant. This seems to suggest that firm's bankruptcy risk and high debt level move in tandem, which implies that a high Z-score increases a firm's financial distress and possible bankruptcy risk (Titman, 1984; Harford et al., 2009).

Sixth, stock return is negatively related to leverage, which suggests that firms experiencing abnormal share price appreciation tend to use stocks to finance investment activities instead of borrowing. This is consistent with the market timing hypothesis (e.g. Lucas and McDonald, 1990; Uysal, 2011). However, with its low significance level, our inference should be taken with this caveat in mind.

Also, net PPE is negative and statistically significant. It shows that firms with large collateral assets are likely to acquire less debt finance, which is inconsistent with prior findings (e.g. Rajan and Zingales, 1995).

Finally, on the R&D investment, we find a negative effect of R&D expenditure on book leverage. This follows a simple argument that, because high R&D firms tend to enjoy greater growth opportunities, they tend to hold low leverage in their books (Uysal, 2011). Another alternative explanation is that, because such R&D firms often have low assets tangibility, a long investment horizon and are largely invested in people and product development, they are less likely to attract the confidence of the debt markets, hence there is a low leverage status for high R&D firms. However, our reported coefficient estimate is insignificant.

5.6.1.2 Discussion of results for LTIPs/Equity determinants

The results reported in Table (5.4.2) column (LTIPs) show the component of LTIP determinants, which includes firm-related characteristics, governance factors and other executives' characteristics.

Specifically, the estimated coefficients on salary (0.0495) and cash bonus (0.0248) are both positive, suggesting a simultaneous usage of cash-based and LTIPs. It further implies that the board of directors jointly utilize cash-based and LTIPs incentives to motivate managers, which is inconsistent with Coles et al.'s (2006) substitution explanation.

In contrast, the coefficient on stock options (-0.0386 t-statistics -8.16) is negative and significant, consistent with substitution effect hypothesis (Coles et al., 2006). The results show that corporate boards of directors simultaneously choose to use these components: LTIPs, stock options and cash bonus incentives.

Further, these firm-related characteristics show a positive correlation on LTIPs incentive: firm size, capital expenditure, fixed intangible, cash flow, stock return and leverage. For instance, the statistically significant coefficient (0.0551) on firm size shows that larger firms use a greater LTIPs component to reward their executives. It is also consistent with the view that, as a firm grows or expands (either organically or inorganically), managerial operational activities become more complex, which can lead to possible agency conflicts of interest. Therefore, to mitigate this possible conflict, the board may tend to use a greater LTIPs component to align both shareholder and manager common interests. Again, it can also be argued that, because larger firms often seek to attract and retain high-quality managerial talents, they are more likely to reward executives generously with LTIPs incentive (Core et al., 1999; Basu et al., 2007; Amoako-Adu et al., 2011). Regarding investment opportunities such as capital expenditure and fixed intangible, we find a positive effect on LTIPs incentive and the estimated coefficients are 0.0912 (t-statistics 3.15) and 0.0883 (t-statistics 2.63) respectively. It supports the argument that shareholders use more LTIPs rewards to control the managerial incentive problem and encourage them to allocate resources into these growth activities (Ryan and Wiggins, 2001; Humphery-Jenner et al., 2016; Chen et al., 2017). Additionally, LTIPs is positively dependant on leverage, which suggests an incentive alignment proposition. It tends to imply that shareholders use equity (LTIPs) to minimise managers' aversion to risk. This finding is inconsistent with Ryan and Wiggins (2001). However, market-to-book and R&D are negatives but lack of statistical significance.

In addition, others including executives ownership, large ownership, executive average age, and dividend pay-out are negatively related to managerial LTIPs awards. To be specific, the coefficient estimates for executives ownership (-0.1109), large ownership (-0.0012), executive age (-0.0002), and dividend pay-out (-0.0130). Thus, executives ownership result is consistent with the shareholders' intention to reduce the managerial entrenchment effect (Ryan and Wiggins, 2001), whilst large ownership implies that the block-owners provide an extra monitoring role on managerial activities, hence less LTIPs incentive is needed to motivate managers (Hartzell and Starks, 2003; Amoako Adu et al., 2011). The non-executives' ownership is positive but lacks statistical significance.

The dividend pay-out and executive average age show a negative sign on LTIPs incentive and are both statistically insignificant. For instance, the finding implies that through LTIPs incentive, risk-averse managers tend to reduce cash hoarding and make appropriate dividend pay-out especially when firms have no investment opportunities (Fenn and Liang (2001; Bates et al., 2009). Also, the reported negative coefficient on executive average age tends to suggest the board's intention to lower LTIPs awards as executives become older, which is consistent with Yermack (1995) but inconsistent with the managerial horizon hypothesis (Kole, 1997; Gibbons and Murphy, 1993).

In fact, it is worth indicating that the introduction of these instruments in our model helps to improve our coefficient estimates. One significant structural model change of this study is that we employ over-identifying restrictions, different from the previous works' just-identifying approach (see Coles et al., 2006). The Sargan-Hansen test of over-identifying restrictions shows that our model is properly specified, and it does not suffer misspecification problem.

5.6.1.3 Discussion of results for the stock options determinants

Column (ESO) of Table (5.4.2) reports stock options results in the first-stage regression analysis. As expected, salary is both significantly and negatively related to stock options, which supports the substitution assumption (Coles et al., 2006; Guay, 1999). The result means that shareholders' upward adjustment of executives salary leaves a cut in stock options rewards. Similarly, supporting the substitution effect, LTIPs and cash bonus estimates all show negative signs with LTIPs statistically significant at 1% levels.

The other firm-related determinants such as R&D, capital expenditure, fixed intangible, leverage, cash flow, and dividend payment dummy all show negative coefficient estimates. In particular, R&D decreases with stock options, which is inconsistent with the prior studies (Humphery-Jenner et al., 2016; Ryan and Wiggins, 2001) but consistent with Bizjak et al. (1993). The highly significant coefficient estimates on capital expenditure (CAPEX) and fixed intangible could imply shareholders' intention to disincentivise managers using the share options reward. Thus, firms with high CAPEX and fixed intangible activity use fewer share options to reward managers. Likewise, firms experiencing high cash flow utilise fewer share options incentives to compensate top executives.

The leverage is negatively related to stock options, implying that shareholders of highly levered firms tend to lower high-powered stock options rewards (Ryan and Wiggins, 2001; Humphery-Jenner et al., 2016;). This can be due to the fact that the extra monitoring role played by debtholders or lenders forcefully induces managers to act in the best interest of the owners, hence there is no added incentive to use a share options incentive (Jensen, 1986; Williamson, 1988). In fact, this issue will be given special attention in the second-stage leverage regression analysis section.

In contrast, firm size, stock return, market-to-book and stock return Volatility are positive and statistically significant except stock return volatility. A simple explanation is that high-growth and large-size firms tend to apply more share options to motivate managers, consistent with prior findings (see e.g. Kole, 1991; Bizjak et al., 1993; Humphery-Jenner et al., 2016). It also suggests that, because high-growth and large firms are often confronted with much bigger agency issues, shareholders of these firms apply more share options to align both shareholders' and agents' common interests.

Among the monitoring proxies, large ownership is negative and significant at 1% confidence level, whilst non-executive ownership is also negative but lacks statistical explanatory power. Collectively, the findings support the monitoring hypothesis (Amoako-Adu et al., 2011; Basu et al., 2007; Mehran, 1995). It tends to suggest that the presence and effective monitoring by large shareholders and outside board of directors help minimise interest divergence among managers–shareholders, leading to a lower share options incentive alignment package. In a similar vein, executives' ownership is negative, which is consistent with the assumption that executives with a high ownership stake require fewer stock options in their compensation package. In other words, shareholders reduce managerial share options awards to prevent a managerial entrenchment incentive (Ryan and Wiggins, 2001).

The coefficient estimates on instruments: executive average age and dividend pay-out are negative with only dividend pay-out that shows statistical significance. Thus, the low usage of share options by high dividend pay-out firms could be attributed to the fact that these unconstrained firms with high available cash flow are likely to motivate managers using cash compensation and also make further pay-out to shareholders (Lambert et al., 1989; Core et al., 1999; Fenn and Liang, 2001).

5.6.1.4 Discussion of results for the cash bonus determinants

Column (CashB) of Table (5.4.2) provides evidence on cash compensation determinants. The coefficient estimates on salary (0.0106), LTIPs (0.0244) are all positive, implying simultaneous determination of the executives' pay package. However, stock options (-0.0060) is negative and significant.

The firm-specific characteristics including firm size, leverage and capital expenditure are all negatively associated with cash bonus. More explicitly, large firms pay less cash bonus to top executives. This could possibly mean that, because larger businesses constantly engage in expansion activities and are often attractive to the debt markets, they are likely to keep high debts (over-leveraged) in their books. Consequently, the firm's regular annual debt payment depletes the free cash flow available, hence there is a lower cash bonus reward.

Similarly, the capital expenditure estimate is -0.0652 and statistically significant, postulating shareholders' intention to use less cash bonus whenever the firm has a huge growth investment opportunity in capital expenditure.

On the other hand, for the other firm-related proxies: fixed intangible, R&D, market-to-book, and cash flow are all positive. In particular, the results on market-to-book, R&D and fixed intangible show shareholders' willingness to motivate managers with cash bonus to spend more on these items, inconsistent with the literature (e.g. Ryan and Wiggins, 2001; Humphery-Jenner et al., 2016). In addition, cash flow shows an intuitive relationship with cash bonus incentive. Thus, the positive coefficient estimates on cash flow (0.2679 t-statistics 6.12) suggests that financially unconstrained firms are likely to reward executives with cash bonus compensation (Guay, 1999).

Furthermore, for the monitoring effectiveness variables large ownership is positive and significant, whilst non-executive directors' ownership is negative but insignificant. For instance, the higher the block ownership the greater the cash bonus, which is inconsistent with a substitute association but consistent with Ryan and Wiggins (2001). This could also possibly suggest that large owners are comfortable to increase their holdings as firm managers generate more cash flow or profits (i.e. to meet accounting-based measure), which, in turn, makes it more likely for them to approve managerial cash incentives. Further, executives ownership is also negative and significant, implying that as managers ownership stake increases shareholders become less concern of alignment problem and tend to lower cash bonus rewards. The results on managerial ownership and outside directors' ownership should be interpreted with care, because the estimates are not significantly related to cash bonus rewards.

The estimates on dividend pay-out and executive average age are positive. For instance, because dividend pay-out firms are financially unconstrained (e.g. resulting from lower leverage), they are likely to reward more cash bonus to managers. Inconsistent with horizon problem, executive average age and cash bonus show an increasing relation. One caveat here is that the coefficient estimate on executive average age is statistically insignificant.

In summary, the simultaneous modelling of managerial compensation incentives and firm financial leverage provide some further new evidence on the determinants of incentive compensation structure. The supplied findings show the statistical and economical relevance of the firm- and manager-specific characteristics in the executive managers' pay determination. Generally, the reported results are largely consistent with prior studies (e.g. Core et al., 1999; Guay, 1999; Ryan and Wiggins, 2001; Adomako-Adu et al., 2011; Humphery-Jenner et al., 2016), although some proxies lack statistical significance in other specifications. The coefficients signs on the selected instruments in the compensation models are generally consistent with our predictions. For instance, dividend pay-out shows a significant explanatory power in the compensation contract design models. Therefore, failure to account for these firm-specific exogenous factors when dealing with compensation incentives and their effect on firm leverage may potentially underestimate the relationship between financial leverage and managerial incentives.

In short, the section reports a strong association between managerial compensation incentives and firm leverage by relying on the expectation that shareholders design appropriate compensation incentives to enhance the quality of managerial financing decisions. More specifically, LTIPs induces more borrowings, whilst share options and cash bonus show a decreasing effect on firm leverage. This presented evidence provides mixed support for the risk-motivated story. In particular, the result shows that the convexity inherent in the stock options incentive is ineffective to reduce managerial risk-related agency problem (Hayes et al., 2012), which is inconsistent with the risk-motivated explanation, whilst the cash bonus finding is consistent with the risk-reduction argument. However, consistent with expectation, shareholders use rather more LTIPs incentive to minimise the managerial risk-related incentive problem. This is interesting, because the Greenbury Report (1995) recommended that the remuneration committee should substitute stock options with LTIPs to prevent managerial excessive risk-taking, implying that with LTIPs managers are able to make efficient leverage decisions.

In fact, before we make an overall conclusion on this issue, we further test whether our key findings are sensitive to other independent factors (thus corporate governance indicators and other executives' characteristics) as well as other alternative specifications.

Table 5.4 2 Leverage Regression Result

	Leverage	LTIPs	ESO	CashB
LTIPs	0.3480***		-0.0247***	0.0244***
	(7.74)		(-4.58)	(5.14)
ESO	-0.5269***	-0.0386***		-0.0060*
	(-9.06)	(-8.16)		(-1.70)
CashB	-0.1719***	0.0248***	-0.0029	
	(-2.81)	(4.22)	(-0.58)	
SAL	-0.1225***	0.0495	-0.0707**	0.0106
	(-3.89)	(1.32)	(-2.32)	(0.40)
ROA	-0.1406*			
	(-1.91)			
Size	0.0336***	0.0551***	0.0551***	-0.0181
	(2.84)	(3.09)	(3.99)	(-1.45)
MKTB	0.0121***	-0.0044*	0.0107***	0.0040**
	(7.41)	(-1.68)	(5.25)	(2.21)
Z-Score	0.0109*			
	(1.64)			
STKR	-0.0042	0.0116	0.0035	
	(-0.40)	(1.13)	(0.40)	
Net PPE	-0.0402*			
	(-1.79)			
R&D	-0.0464	-0.1780	-0.2001*	0.1712
	(-0.31)	(-1.18)	(-1.63)	(1.60)
LEV		0.7393***	-0.6783***	-0.2911***
		(4.70)	(-5.46)	(-2.62)
CAPEX		0.0912***	-0.0408*	-0.0652***
		(3.15)	(-1.82)	(-2.99)
FINTANG		0.0883***	-0.0215	0.0741***
		(2.63)	(-0.83)	(2.83)
STKRV			0.0062	
			(0.83)	
Large Own		-0.0012***	-0.0005**	0.0013***
		(-4.22)	(-2.24)	(5.42)
E. Own		-0.1109**	-0.1154***	-0.0828**
		(-2.44)	(-3.44)	(-2.29)
Non.E.Own		0.0101	-0.0199	-0.0114
		(0.12)	(-0.37)	(-0.17)
Ex.Av. Age		-0.0002	-0.0001	0.0006
		(-0.24)	(-0.02)	(0.74)
CF		0.0124	-0.0341	0.2679***
		(0.23)	(-0.85)	(6.12)
DPO		-0.0130	-0.0295**	0.0364***
		(-0.85)	(-2.58)	(2.94)
Constant	0.6542***	-0.7898***	0.3310***	0.4045***
	(6.71)	(-6.80)	(3.57)	(4.60)
Industry & Year	YES	YES	YES	YES
N	1108	1108	1108	1108
Chi-square	787.88	748.14	153.34	285.66

Simultaneous system of equations (3SLS) regression of leverage and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the leverage (second-stage) model and we report only the results in the second-stage regression. Thus, *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

5.7 Robustness testing

The results presented in Table (5.4.2) leverage column (1), show that there is a link between managerial compensation incentives and the firm's financial debt policy. Primarily, this section tests the sensitivity of the reported findings by applying several other independent factors (e.g. monitoring mechanisms: large ownership, non-executives ownership, as well as other managerial characteristics: executives ownership, CEO age and CFO age) in the specification. Specifically, these independent variables have been shown to have an effect on corporate management policies (see Byrd and Hickman, 1992; Florackis and Ozkan, 2009; Yim, 2013; Pasternack et al., 2017). In addition, the study also applies an alternative specification (ordinary least squares (OLS) to find out if indeed our result is robust to OLS technique.

For the purpose of brevity, this current analysis is restricted to the key explanatory variables: LTIPs, stock options and cash bonus, and the tested independent variables' behaviour on leverage.

5.7.1 Managerial characteristics

Thus, so far in the study, we have largely examined the impacts of managerial financial compensation incentives on leverage level. Apart from the main compensation variables, other managerial characteristics can also influence managerial risk-preference or risk-avoidance decisions and they are worth considering. For instance, some prior studies highlight these factors: executive ownership, executive age and tenure (e.g. Berger, Ofek, and Yermack 1997; Coles et al., 2006; Florackis and Ozkan, 2009; Chava and Purnanandam, 2010; Yim, 2013). Motivated by this, and coupled with our rich datasets, we are able to explicitly account for the following managerial characteristics (executives' ownership as well as CEO and CFO ages) in the leverage model. For the purposes of analysis, we section into sub-groups managerial ownership and governance characteristics, and then other managerial characteristics.

5.7.1.1 Managerial inside ownership

It is suggested that, as executives own more shareholdings, their interests become more aligned with shareholders (Jensen and Meckling, 1976), hence there is less need for shareholders to use more incentive compensation. Taking note of this assertion, it is quite clear that managerial compensation is likely to be affected if executives hold more ownership stakes. We account for this possibility in the second-stage leverage specification.

Firstly, column (1) of Table (5.4.3), shows that the executives' (insiders') ownership coefficient is negative (-0.1279 t-stats -2.93) and statistically significant, implying the effect of managerial entrenchment (Florackis and Ozkan, 2009). The finding tends to support the view that, when managers have large stakes in the firm, they become unwilling to increase the firm's idiosyncratic risks (thus increase leverage ratio). This is because, by increasing leverage, managerial decisions are likely to be monitored and scrutinised by debtholders, which can constrain management power to manage the firm to suit their own interests. Interestingly, the coefficient and the significance on LTIPs remain qualitatively similar across all specifications. Again, the results on share options and cash bonus remain qualitatively the same.

5.7.1.2 Monitoring governance variables

While the influence of these key compensation components is seen to be strong in leverage determination, other firm governance-related factors including block-ownership or concentrated ownership, and non-executive ownership (e.g. Byrd and Hickman, 1992; Mehran, 1995; Florackis and Ozkan, 2009) are likely to indirectly affect the compensation–leverage nexus. In particular, Florackis and Ozkan (2009) argue that the firm's effective external monitoring system affects leverage level. The authors further indicate that, with strong governance practices, firms are able to use fewer managerial incentives to align manager–shareholder resolution, which is consistent with Mehran's (1995) observation.

Moreover, because many large stakeholders are institutional investors, pension funds and other organised agencies, they often have the expertise to strenuously scrutinise the financial position of their invested firms (Ntim et al., 2015) and constantly monitor their corporate activities (Smith, 1996). In contrast, managers of firms operating in a weak corporate governance environment can extract rent from the shareholders and may have the leeway to take decisions including pursuing a low-leverage policy (Bebchuk and Fried, 2003; Weisbach, 2007; Florackis, 2009).

In due recognition of the fact that governance factors are likely to impact firm leverage behaviour but were excluded in our earlier leverage model, like prior research (e.g. Coles et al., 2006; Chava and Purnanandam, 2010), we extend this analysis by including governance proxies in a modified leverage equation. Thus, the inclusion of the monitoring mechanisms in the second-stage leverage model will further aid understanding on the leverage–compensation incentives linkage. Specifically, the results of the extended specifications where we include large (block-shareholders) ownership and non-executives' ownership are presented in Table (5.4.3), column (2).

As shown in column (2) of Table (5.4.3), the additional governance proxies reveal some interesting findings, although our key results still remain quite robust. Specifically, column (2) shows that the coefficient on non-executive ownership is positively related to leverage. This result shows support for leverage increase, implying the fact that managers of well-governed firms are less likely to extract rent or expropriate wealth from shareholders by pursing inefficient leverage policy (e.g. Florackis and Ozkan, 2009). Thus, non-executives ownership is likely to influence firm leverage on average, ceteris paribus. More interestingly, however, the coefficients on LTIPs (equity), share options and cash bonus incentives still remain qualitatively unchanged. It further suggests our results are robust in spite of the extra monitoring role of outside executive directors. In other words, our results are not affected by the substitution effect, because the effective presence of non-executive directors does not change the significance of the key findings. This is reasonable, given the fact that members of the outside executive directors are very knowledgeable, skilful and experienced, so their increased stakes signal that they will cautiously monitor managerial activities including financial leverage policy. However, the low coefficient significance on non-executives ownership calls for this interpretation to be taken with this caveat in mind.

Furthermore, the large ownership proxy is also positive, suggesting that a well-monitored firm forces its managers to increase firm leverage. Similarly, our compensation proxies still remain similar, implying that our findings are still robust to the monitoring role of large stakeholders in reducing agency conflict.

5.7.1.3 Other managerial characteristics

More specifically, Chava and Purnanandam (2010) argue that, in order to fully understand managerial financial risk decision-making, we need to pay special attention to the personal characteristics of the managers that run the firm. Further, the authors contend that the CFO's risk-attitude plays a significant role (even more than that of the CEOs) in explaining finer aspects of a firm's financial decisions. In the face of this revelation, in our robustness testing, we include CEO and CFO age in the leverage model to see the extent to which this proxy affects financial leverage. We start first with the CEO age and then move on to CFO age analysis.

Table (5.4.3), column (3) shows that the coefficient on CEO age (0.0021 t-statistics 2.57) is positive and statistically significant at 5% significance. This implies that older executives (CEOs) are more likely to hold a higher leverage ratio in their firm's books. This could possibly be attributed to the fact that older executives are much more experienced, knowledgeable, skilful and confident, which may influence their high risk-taking decisions including leverage (Yim, 2103). Alternatively, however, the CEO age supportive of leverage may possibly depict an explicit lack of depth in financing because CEOs often concentrate on broad corporate decisions (Chava and Purnanandam, 2010). With this inclusion, the coefficients on LTIPs and stock options remain qualitatively unchanged. However, the cash bonus compensation coefficient is marginally reduced in significance, although statistically significant. This could be explained partly by the fact CEO age supportive of debt ratio increase is likely to decrease cash bonus rewards as firms devote more resources to debt payment.

In column (4), the CFO age coefficient is negative (-0.0003). It suggests that older CFOs are more likely to decrease firm leverage. However, the result is quite unsurprisingly, given the fact that decisions involving more specialised judgement such as debt financing and accrual management are within the CFO's domain. Thus, the CFO acts as a finer point of the firm's financial decisions (Chava and Purnanandam, 2010). One caveat of this result is that the coefficient on CFO age lacks statistical significance.

Collectively, the implication of the reported results on the managerial factors (characteristics) significantly affects firm leverage determination. Whilst the CEO age is positively related, CFO age is negatively associated with leverage. This seems to confirm Chava and Purnanandam's (2010) explanation that CEOs mainly pay special attention to the firm's broad corporate decisions and often delegate the finer aspects of financing decisions to CFOs. Again, although executive managers take into consideration their inside ownership, our story on managerial compensation effects on leverage decisions still remains unchanged.

Taken together, our main reported findings in Table (5.4.2) still remain robust.

In short, the implication of these findings partly suggests that effective corporate governance practices play a role in determining the firm's leverage decision. It also seems to imply that the impact of managerial compensation incentives on corporate leverage, in particular the alignment effect of managerial stock-based incentives and cash bonus, is independent of the firm's corporate governance practices. This means that the presence of external monitoring mechanisms compliments managerial financial decisions. In all, our results still confirm the importance of managerial compensation incentives in determining firm debt capital policy (reported in Table 5.4.2).

Table 5.4 3 Leverage Robustness Test

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
LTIPs	0.2393***	0.2475***	0.1916***	0.2335***
	(4.90)	(5.10)	(3.75)	(4.66)
ESO	-0.6407***	-0.6238***	-0.6018***	-0.6035***
	(-10.88)	(-10.60)	(-9.39)	(-9.68)
CashB	-0.2143***	-0.2304***	-0.1503**	-0.1755***
	(-3.41)	(-3.64)	(-2.36)	(-2.73)
SAL	-0.1363***	-0.1092***	-0.1111***	-0.1129***
	(-4.29)	(-3.30)	(-3.37)	(-3.40)
MKTB	0.0127***	0.0128***	0.0124***	0.0128***
	(7.82)	(8.06)	(7.75)	(7.83)
Size	0.0423***	0.0576***	0.0513***	0.0475***
	(3.58)	(5.13)	(4.32)	(3.97)
ROA	-0.1303*	-0.0965	-0.1996***	-0.1486**
	(-1.78)	(-1.31)	(-2.88)	(-2.05)
STKR	-0.0016	-0.0011	-0.0005	-0.0012
	(-0.23)	(-0.17)	(-0.06)	(-0.15)
Z-Score	0.0082	0.0054	0.0092	0.0073
	(1.26)	(0.82)	(1.32)	(1.09)
Net PPE	-0.0476**	-0.0549**	-0.0556**	-0.0551**
	(-2.12)	(-2.44)	(-2.34)	(-2.31)
R&D	-0.0865	-0.0349	-0.0793	-0.0454
	(-0.58)	(-0.23)	(-0.53)	(-0.30)
E.Own	-0.1279***	-0.1603***	-0.1440***	-0.1508***
	(-2.93)	(-3.41)	(-3.07)	(-3.19)
Non E.Own		0.1196	0.1619**	0.1286
		(1.43)	(1.95)	(1.54)
Large Own		0.0008**	0.0006	0.0007**
		(2.34)	(1.61)	(1.98)
CEO age			0.0021**	
			(2.57)	
CFO age				-0.0003
				(-0.40)
Constant	0.6821***	0.5553***	0.0476	0.5442***
	(6.82)	(5.04)	(0.25)	(4.68)
Industry & Year	YES	YES	YES	YES
N	1108	1108	1107	1106
Chi-square	798.70	808.33	694.56	740.22

Simultaneous system of equations (3SLS) regression of leverage and LTIPs, ESO and CashB results. The predicted sign for the variable of interest are shown in the leverage model and we report only the results in the second-stage regression. Thus, *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

5.7.1.4 Alternative specification (ordinary least squares – OLS approach)

Lastly, we examine the sensitivity of the results using an alternative approach. Throughout the empirical analyses (results in Table 5.4.2), we have used a three-stage least squares (3SLS) technique to explore the causal relationship between managerial compensation incentives and financial leverage decision. We based our analysis on the conventional thinking of simultaneous system of equations, where both leverage and compensation incentives measures are contemporaneous, and jointly determined. We now apply an OLS technique to see if our earlier findings are sensitive to a different specification.

Similar to Coles et al. (2006), our chosen specification allows us to regress leverage on lagged compensation incentives values (i.e. LTIPs, stock options and cash bonus), control variables including industry and year effects and other independent variables (CEO age, executives ownership, non-executives ownership and large ownership). The reported results are based on robust standard errors clustered at the firm level to reduce heterogeneity.

It is worth mentioning that our primary focus is on the key explanatory variables (LTIPs/equity, stock options and cash bonus). The reported results on test (key compensation) variables in columns (1) and (2) of Table (5.4.4) are qualitatively consistent with our previous results reported in Table (5.4.2). More specifically, LTIPs compensation is positive, whilst share options and cash bonus are negatively related to leverage. However, a few exceptions exist. In column (1), the coefficient on LTIPs incentives loses its significance, whilst the share options coefficient is significant at 10% conventional level. Also, cash bonus still remains negative but insignificant. Column (2) shows similar signs but LTIPs, stock options and cash bonus all lose their significance when we include CFO age. The low explanatory power, to some extent, could partly be blamed on the endogeneity presence.

Table 5.4 4 Leverage OLS Alternative Test

	(1) Leverage	(2) Leverage
LTIPs	0.0522	0.0694
	(1.25)	(1.48)
ESO	-0.101*	-0.0258
	(-1.63)	(-0.38)
CashB	-0.0106	-0.0070
	(-0.22)	(-0.13)
SAL	-0.0647*	-0.0651*
	(-1.78)	(-1.77)
ROA	-0.524***	-0.573***
	(-6.09)	(-6.38)
Net PPE	-0.0118	-0.0299
	(-0.43)	(-1.07)
R&D	0.0079	0.0002
	(0.60)	(0.01)
STKR	-0.0034	-0.0052
	(-0.36)	(-0.45)
MKTB	-0.0031***	-0.0025***
	(-4.61)	(-2.77)
Z-Score	0.0192**	0.0235***
	(2.32)	(2.78)
Size	0.0453***	0.0388***
	(3.45)	(2.97)
E. Own	-0.0884*	-0.0589
	(-1.84)	(-1.13)
Non E.Own	0.0943	0.147*
	(1.08)	(1.70)
Large Own	0.0001	-0.0003
	(0.13)	(-0.69)
CEO age	0.0018*	
	(1.84)	
CFO age		0.0007
		(0.59)
Constant	0.543***	0.656***
	(2.69)	(3.03)
Industry & Year	YES	YES
N	1211	1136
R^2	0.245	0.230

The table shows the OLS estimation results of the effects of LTIPs, stock options and cash bonus on leverage. All variable definitions are described in Table 5.3.1. ***, ** and *** indicate** statistical significance at the 10%, 5% and 1% levels, respectively**.**

5.7.1.5 Alternative measure of independent (compensation) variable

This section provides additional results by using alternative measure for independent (LTIPs, stock options and cash bonus) variable. Thus, we measure the independent variable as a natural logarithm of LTIPs, stock options and cash bonus value and utilise OLS technique to estimate leverage model.

Table (5.4.5) shows the OLS results by regressing leverage on lagged natural log of compensation values and other control variables. The coefficient on LTIPs is positive, whilst stock options and cash bonus coefficient is negative with only LTIPs that is statistically significant.

In short, the reported results show similar signs to the earlier findings (Table 5.4.2), however, the estimates: share options and cash bonus are statistically insignificant. The low correlation may partly be explained by the existing endogeneity problem.

Table 5.4 5 Alternative Measure Robustness Test - Log values of LTIPs, ESO &cashB.

	(1) Leverage	(2) Leverage
LTIPs	0.0244***	0.0226**
	(2.81)	(2.45)
ESO	-0.0002	0.0032
	(-0.03)	(0.54)
CashB	-0.0042	-0.0063
	(-0.66)	(-1.00)
SAL	-0.0736**	-0.0674*
	(-2.09)	(-1.84)
ROA	-0.527***	-0.561***
	(-6.26)	(-6.36)
Size	0.0492***	0.0441***
	(3.92)	(3.48)
STKR	-0.0019	-0.0037
	(-0.18)	(-0.33)
Z-Score	0.0194**	0.0272***
	(2.35)	(3.34)
MKTB	-0.0030***	-0.0025***
	(-4.62)	(-3.36)
R&D	-0.0735	-0.114
	(-0.76)	(-1.19)
Net PPE	-0.0141	-0.0185
	(-0.52)	(-0.69)
E. Own	-0.101**	-0.0846
	(-2.03)	(-1.59)
Non-E. Own	0.104	0.132
	(1.25)	(1.63)
Large Own	0.0005	0.0001
	(1.38)	(0.26)
CEO Age	0.0019*	
	(1.92)	
CFO Age		0.0012
		(1.03)
Constant	0.275**	0.350***
	(2.16)	(2.64)
Industry & Year	YES	YES
N	1211	1136
R^2	0.249	0.235

The table shows the OLS estimation results of the effects of LTIPs, stock options and cash bonus on leverage. Here, we use log values of LTIPs, ESO and CashB. All variable definitions are described in Table 5.3.1. ***, ** and *** indicate** statistical significance at the 10%, 5% and 1% levels, respectively**.**

5.7.2 Section conclusion

Overall, this section establishes a statistically and significant relation between managerial compensation incentives and financial leverage by relying on the expectation that shareholders design appropriate compensation incentives to enhance the quality of managerial financing decisions. More specifically, leverage ratio is positively dependent on LTIPs, suggesting shareholders' willingness to use the LTIPs incentive to influence managers to finance projects with debt. In contrast, stock options and cash bonus show a decreasing relationship with firm leverage. Largely, the reported evidence seems to provide mixed support for a risk-motivated story or argument. In particular, the convexity inherent in the stock options incentive is ineffective in reducing managerial risk incentive problem (Hayes et al., 2012; Lewellen, 2006). However, consistent with expectation, shareholders use rather more LTIPs incentive to minimise managerial risk-related incentive problems. This is interesting, because the Greenbury Report (1995) recommended the use of LTIPs in lieu of stock options to minimize managerial excessive risk-taking, suggesting that UK shareholders popular usage of LTIPs influence managers to increase leverage level. The cash bonus finding is consistent with risk-reduction expectations.

5.8.1 Supplementary evidence on deferred or restricted stock compensation

Through their asset substitution hypothesis (risk-shifting problem), Jensen and Meckling (1976) made an early observation that one way to minimise agency cost of debt is to structure executive compensation to include both debt-like (pension and deferred compensation incentives) and equity-like (performance shares) compensation in the same ratio as they appear in the firm capital structure. This means that rewarding managers' compensation leverage (e.g. deferred shares/stock) similar to the firm's leverage ratio induces managers to concentrate on firm value maximisation and not the value of total assets. Consistent with this view, John and John (1993) formulate a theoretical model to predict a positive relation between firm leverage and managers' compensation leverage (such as pensions, deferred stock). In contrast, Sundaram and Yermack (2007) reveal that managers prefer to adopt a more conservative management style aimed to reduce default risk when a large component of their incentives is in the form of restricted stock or pensions. Relatedly, Cassell et al.'s (2012) empirical evidence suggests that managers with large inside debt incentives are likely to reduce the firm's idiosyncratic risk. Taking note of the above discussion, it seems to indicate that the deferred/ restricted stock component may have different effects on managerial risk behaviour. In line with this assertion, we decompose the LTIPs compensation (which is defined as the values of deferred stock plus performance stock) and perform an analysis by including each compensation component – values of restricted stock, performance stock, stock options and cash bonus – in the three-stage least squares (3SLS) estimation model. In other words, we disaggregate LTIPs into deferred and performance stock incentives and apply simultaneous system of equations model. The system design is similar to our earlier approach.

The results of this analysis are presented in Table (5.5.1), where we report only the second-stage leverage regression results in the leverage columns 1, 2, 3 and 4. For instance, column (1) provides results for the base specification, whilst (2), (3) and (4) include other independent variables for robustness purposes. A brief discussion of the results is devoted to the key compensation variables.

First, the presented results show that deferred/restricted stock and leverage are both negatively and significantly related. The coefficients for restricted stock incentive range from -0.2198 to -0.3195 across models (columns) 1, 2,3 and 4, and are all highly statistically significant. The finding tends to imply that an increase in deferred stock (debt-like) incentive influences executive managers to lower firm risk level by lowering leverage ratio. This is consistent with the prior literature (e.g. Sundaram and Yermack, 2007; Anantharaman et al., 2010; Cassell et al., 2012; Freund et al., 2017) but inconsistent with Bryan et al. (2000) and Ortiz-Molina (2004). A possible explanation of this result could be that, because restricted or deferred stock is only vested upon achieving the required performance conditions such as sustaining total shareholders' return for a certain period of time (e.g. three to five years) or sometimes to tie executives to their managed firm for some specified years, such a motivation package induces them to adopt a more conservative management style thereby keeping a low debt ratio in the firm's balance sheet to minimise default risk. In addition, as managers lower the firm's debt as their residual interests in the form of deferred stock compensation increase, debtholders or bondholders' confidence in the firm goes up, and this can ultimately lead to lower costs of borrowing. One of the effective implications of this pay component is that shareholders of high-leverage firms may tend to use more deferred stock to minimise the risk-shifting problem and lower agency cost of debt, thereby reducing the conflicts of interest between shareholder and bondholder (Jensen and Meckling, 1979; John and John, 1993).

Contrary, the performance stock is positive and statistically significant, implying managers' incentive to increase leverage level as their performance stock increases. This is not surprising, given that shareholders want managers to undertake all positive net present value projects and, by rewarding them with more performance stocks, increase their risk appetite to finance growth opportunity investment with debts especially when internal funds are insufficient. One implication of the finding is that bondholders and other creditors may become more sensitive to the firm's borrowings, which in turn can the cause them (debtholders) to demand a higher lending rate (Kabir et al., 2013).

The results on stock options and cash bonus incentives are all negative and qualitatively similar to the earlier findings (see Table 5.5.1). Again, our control variables and other independent variables for robustness purposes all remain qualitatively similar to the earlier reported findings.

In summary, the empirical findings in this section shows that debt-like compensation (i.e. deferred or restricted stock) provides a risk-avoiding incentive for managers. Thus, shareholders use this component to reduce the risk-shifting incentive problem, hence aligning both shareholders' and bondholders' interests. However, the performance stock induces a managerial risk-taking incentive, whilst stock options and cash bonus encourage lower risk-taking, as reported earlier. Clearly, the presented evidence indicates that UK shareholders use a mixture of risk-avoiding and risk-taking incentives to induce managerial risk behaviour.

Table 5.5 1 Leverage and Deferred or Restricted Stock Regression

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
DS	-0.2198***	-0.3195***	-0.3151***	-0.2718***
	(-5.17)	(-7.36)	(-7.26)	(-5.96)
PS	0.2130***	0.1164***	0.1207***	0.1531***
	(6.18)	(3.27)	(3.40)	(4.00)
ESO	-0.6093***	-0.7270***	-0.7121***	-0.6147**
	(-10.58)	(-12.60)	(-12.32)	(-10.16)
CashB	-0.0614	-0.1758***	-0.1791***	-0.0818
	(-0.99)	(-2.78)	(-2.81)	(-1.28)
SAL	-0.0974***	-0.1225***	-0.1053***	-0.1031***
	(-3.12)	(-3.89)	(-3.21)	(-3.16)
MKTB	0.0133***	0.0140***	0.0141***	0.0132***
	(8.22)	(8.68)	(8.73)	(8.25)
Size	0.0694***	0.0724***	0.0728***	0.0691***
	(6.27)	(6.59)	(6.59)	(6.28)
ROA	-0.1025	-0.0618	-0.0436	-0.1906***
	(-1.47)	(-0.89)	(-0.62)	(-2.94)
STKR	-0.0005	-0.0004	-0.0003	0.0005
	(-0.09)	(-0.07)	(-0.05)	(0.07)
Z-Score	0.0081	0.0049	0.0045	0.0115*
	(1.39)	(0.85)	(0.60)	(1.86)
Net PPE	-0.0418**	-0.0538***	-0.0577***	-0.0516**
	(-2.02)	(-2.64)	(-2.83)	(-2.32)
R&D	-0.1588	-0.1929	-0.1577	-0.1763
	(-1.06)	(-1.29)	(-1.05)	(-1.19)
E.Own		-0.2075***	-0.2199***	-0.1787***
		(-4.85)	(-4.72)	(-3.85)
Non E.Own			0.1212	0.1592*
			(1.45)	(1.92)
Large Own			0.0004	0.0002
			(1.15)	(0.59)
CEO age				0.0024***
				(3.10)
Constant	0.3167***	0.4467***	0.3713***	0.2443**
	(3.35)	(3.80)	(3.40)	(2.19)
Industry & Year	YES	YES	YES	YES
N	1108	1108	1108	1107
R^2	0.03	0.02	0.03	0.073

Simultaneous system of equations (3SLS) regression of leverage and DS, PS, ESO and CashB results. The predicted sign of interests: Deferred stock (DS).and performance stock (PS) in the leverage model and we report only the results in the second-stage regression. Thus, *, ** and *** show significance10%, 5% and 1% levels.

5.8.2 Firm leverage and executives' compensation: the role of growth opportunities

The empirical findings shown above (Table 5.4.2) suggest an increasing relationship between LTIPs incentive and firm leverage, while share options and cash bonus show a negative effect on leverage. It is acknowledged in the literature that high-growth firms are difficult to monitor and often tend to have higher information asymmetry than low-growth firms (Myers and Majluf, 1984), which is due to the inherent unpredictability associated with the nature of their growth investment opportunities (Core, 2001; MacLaughlin et al., 1996). In line with this view, Myers (1977) argues that high-growth firms should keep in place higher contracting costs to minimise under-investment and risk-shifting incentive. In other words, high-growth firms should have a decent compensation contract in place to motivate the manager. With this, it is expected that shareholders of high-growth firms should use more (less) stock-based (cash bonus) incentives to compensate their managers.

Furthermore, it is also argued that high-growth firms, compared to low-growth ones, tend to have a high need for external finance (preferably debt) (e.g. Core, 2001) and often tend to keep leverage at a low level to avoid forgoing future growth opportunity. In tune with this argument, it is reasonable to suggest that different levels of firms' growth opportunities may influence leverage–executive compensation linkage. That is, while low-growth firms may choose to reward managers with more cash bonuses and fewer stock incentives, high-growth firms may tend to use more stock incentive and fewer cash bonuses to induce managers operational decisions.

Based on this, we further extend our knowledge on leverage–executive compensation linkage by examining how the relationship is influenced by the firm's growth opportunities.

In fact, before we start to conduct this analysis, we need an appropriate proxy for growth opportunities. Some research studies (e.g. Lewellen et al., 1987) use market-to-book equity, R&D intensity (e.g. Gaver and Gaver, 1995) or market-to-book assets (e.g. Smith and Watts, 1992; Bizjak et al., 1993). Consistent with these studies (Smith and Watts, 1992; Bizjak et al., 1993; Ryan and Wiggins, 2001), we proxy growth opportunities as the market value of equity plus the book value of debt scaled by the book value of assets. More specifically, to measure high and low growth, we split the sample into low-growth firms (those below the median) and high-growth firms (those above the median) to examine if indeed different growth level affects the leverage–compensation relationship. We estimate the newly formulated model using ordinary least squares (OLS), where leverage is regressed on the lagged values of compensation variables and other control variables defined in Table (5.3.1). The reported t-statistics use robust standard errors clustered at the firm level.

The results presented in Table (5.6.1) (low-growth) and (5.6.2) (high-growth), show some interesting findings after controlling for other determinants of leverage. Specifically, in Table (5.6.1) (low-growth firms), cash bonus is negatively and significantly related to leverage. The coefficient estimate is -0.269 (t-statistics -3.68), suggesting that cash-motivated managers at low-growth firms lower firm's leverage ratio. This is plausible, given that managers of low-growth firms tend to have no potential growth opportunities and often tend to have excess cash surplus via lower debt ratio, cash-motivated managers are able to meet their accounting performance measure leading to higher cash bonus rewards. In addition, at low-growth level, the risk-motivated incentives (LTIPs and stock options) induce lower managerial risk-taking appetite (low debt) particularly when the firm has low investment prospects. This is reasonable because managers at low-growth firms can pursue a low-leverage policy as there is no obvious investment opportunity to finance with borrowings, especially when they are compensated with a stock-based incentive. Thus, the reported results (across all models) tend to suggest that both stock-motivated and cash-motivated managers display lower risk-taking incentive or attitude in low-growth firms.

For the control variables, we also observe that salary, net PPE, R&D, market-to-book and Z-score, executive ownership, non-executive ownership, large ownership and CEOs age are all positives, whilst firm size, stock return and return on asset show negative signs on leverage.

Furthermore, the results for high-growth (Table 5.6.2) firms suggest that cash bonus is positively related to firm leverage. With the estimated coefficient of 0.144 (t-statistics 1.98), cash-incentivised managers tend to increase the firm's debt ratio at the high-growth firms. Although, the positive sign on cash bonus is contrary to expectations, a possible interpretation can be that managers of high-growth firms tend to meet their accounting performance measure (profits, cash balance) as they borrow more to finance investment activity. Similarly, share options and LTIPs show a positive and significant effect on leverage, postulating managers' incentive to increase firm risk (via high borrowing) as they receive more stock-based incentive. This is consistent with both alignment hypothesis (Holmstrom, 1979; Jensen and Murphy, 1990) and risk-motivated incentive argument (Coles et al., 2006; Kini and Williams, 2012). The finding on share options shows that the risk-motivated incentive element inherent in share/stock options is limited to managers of high-growth firms.

The control variables including return on asset, tangibility, R&D, Z-score and firm size are positively linked to leverage ratio. However, stock return and market-to-book show negative coefficients.

In summary, this section provides evidence to suggests that a firm's growth opportunity interacts with executive compensation to influence leverage level. The reported findings show that shareholders of high-growth (low-growth) firms award executives more stock-based incentive and cash bonus to encourage (discourage) managerial risk-taking, i.e. increase debt ratio. Interestingly, the share options incentive induces more borrowing in high-growth firms, which is consistent with the risk-motivated incentive argument (Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012). This indicates that the positive association is limited to only high-growth opportunity firms. One surprising finding is that cash-motivated managers increase firm's debt level in high-growth firms, which is inconsistent with risk-reduction hypothesis.

Table 5.6 1 Leverage –Pay Incentives for Low-Growth Firms Regression

	(1) Leverage.	(2) Leverage.	(3) Leverage.	(4) Leverage.
LTIPs	-0.183***	-0.177***	-0.142**	-0.177**
	(-3.23)	(-2.98)	(-2.21)	(-2.55)
ESO	-0.357***	-0.347***	-0.325***	-0.427***
	(-4.79)	(-4.53)	(-4.02)	(-4.68)
CashB	-0.269***	-0.265***	-0.226***	-0.234***
	(-3.68)	(-3.60)	(-2.81)	(-2.90)
SAL	0.030	0.023	0.041	0.027
	(0.69)	(0.51)	(0.75)	(0.50)
ROA	-0.711***	-0.739***	-0.737***	-0.729***
	(-4.44)	(-4.55)	(-4.53)	(-4.42)
Net PPE	0.062	0.061	0.0594	0.047
	(1.46)	(1.42)	(1.35)	(0.91)
R&D	0.019	0.016	0.0243	0.141
	(1.21)	(0.92)	(1.37)	(1.11)
STKR	-0.0081	-0.007	-0.0092	-0.010
	(-0.72)	(-0.64)	(-0.79)	(-0.86)
MKTB	0.154***	0.182***	0.195***	0.209***
	(4.63)	(4.51)	(4.65)	(5.14)
Z-Score	0.045**	0.049**	0.050***	0.024
	(2.43)	(2.54)	(2.61)	(1.16)
Size	0.008	0.009	-0.0027	0.015
	(0.42)	(0.46)	(-0.12)	(0.71)
E. Own		0.021	0.097	0.083
		(0.95)	(1.26)	(1.00)
Non. E.Own			0.212	0.394**
			(1.43)	(2.17)
Large Own			0.001	0.001
			(0.87)	(0.69)
CEO age				0.003*
				(1.90)
Constant	0.375*	0.402*	0.180	0.189
	(1.79)	(1.89)	(0.67)	(0.67)
Industry & Year	YES	YES	YES	YES
N	615	599	586	488
R^2	0.309	0.309	0.323	0.375

The table presents the OLS lagged estimation results for the interaction effects of incentives (LTIPs, ESO and CashB) and low-growth opportunities on leverage. Models 1, 2 3 and 4 include firm fixed effect. The reported t-statistics are based on robust standard errors. All variable definitions are described in Table 5.3.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

Table 5.6 2 Leverage – Pay Incentives for High-Growth Firms Regression

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
LTIPs	0.200***	0.145**	0.160**	0.159**
	(3.28)	(2.24)	(2.28)	(2.18)
ESO	0.156**	0.119*	0.132*	0.130
	(2.14)	(1.63)	(1.69)	(1.43)
CashB	0.144**	0.081	0.093	0.135
	(1.98)	(1.06)	(1.16)	(1.60)
SAL	-0.047	-0.064	-0.048	-0.109**
	(-1.00)	(-1.36)	(-0.97)	(-1.98)
ROA	0.023	-0.003	-0.0053	-0.827***
	(0.23)	(-0.04)	(-0.05)	(-5.38)
Net PPE	0.015	0.026	0.025	0.014
	(0.34)	(0.61)	(0.58)	(0.33)
R&D	-0.334*	-0.011	0.012	-0.162
	(-1.86)	(0.57)	(0.62)	(-0.75)
STKR	-0.037	-0.028	-0.027	0.008
	(-1.18)	(-0.96)	(-0.91)	(0.27)
MKTB	-0.001*	-0.001	-0.001	-0.003***
	(-1.71)	(-1.53)	(-1.53)	(-4.94)
Z-Score	0.007	0.011	0.011	0.014
	(0.71)	(1.10)	(1.11)	(1.18)
Size	0.118***	0.120***	0.124***	0.125***
	(6.69)	(6.85)	(6.93)	(6.43)
E.Own		-0.212***	-0.255***	-0.255***
		(-3.91)	(-3.86)	(-3.46)
Non E.Own			-0.018	0.098
			(-0.14)	(0.73)
Large Own			0.001	0.001
			(1.62)	(1.29)
CEO age				0.001
				(0.86)
Constant	-0.254	-0.135	-0.310	0.187
	(-1.08)	(-0.53)	(-1.09)	(0.65)
Industry & Year	YES	YES	YES	YES
N	638	637	634	529
R^2	0.263	0.274	0.275	0.378

The table presents the OLS lagged estimation results for the interaction effects of incentives (LTIPs, ESO and CashB) and high-growth opportunities on leverage. Models 1, 2 3 and 4 include firm fixed effect. The reported t-statistics are based on robust standard errors. All variable definitions are described in Table 5.3.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

5.8.3 Firm leverage and executives' compensation: the role of corporate governance

As suggested by prior studies, executive managers can easily extract rent from shareholders in poor corporate governance settings (see e.g. Ntim et al., 2016; Weibach, 2007; Bebchuk and Fried, 2003, 2004). In such an environment, managers often have a leeway to pursue policies that suit their own interests including lowering the leverage ratio. For instance, Florackis and Ozkan (2009) document that entrenched managers are more likely to lower firm leverage ratio. Similarly, others including Berkovitch and Israel (1996) and Klock et al. (2004) show that the firm's corporate governance structure significantly affects its capital structure. The literature further argues that the presence of large shareholdings by institutional owners, outside board of directors, is seen to signal the quality of corporate governance (via monitoring) by bondholders and other lenders. In essence, firms with good monitoring mechanisms or governance attributes (e.g. large owners, outside directors' stakes, etc.) in place are likely to affect managerial discretion through pay settings and corporate policies.

In line with the concerns raised, we further extend our knowledge on the leverage-compensation incentives linkage by examining how the relationship is shaped by the effectiveness of the firm's monitoring mechanisms. In fact, finding an appropriate measure to proxy good corporate governance is a major task for the study. However, we are guided by the UK Combined Code of Corporate Governance (2003), Hampel Report (1998) and Cadbury Report (1992), which highlight the important role played by large outside shareholders: using their substantial voting power to influence managers' pay as well as corporate policies, and also having the needed expertise and skills to constructively evaluate managerial decisions (Ntim et al., 2016). As a noisy proxy, the study utilises the shareholdings stake of large shareholders to construct the firm's governance variable, relatively different from the principal component analysis approach employed Florackis and Ozkan (2009). Consistent with the views espoused by the Cadbury (1992) and Hampel (1998) reports and the UK Combined Code of Corporate Governance (2003), we argue strongly that managers of firms with high concentrated ownership (large outside shareholders) are likely to be actively monitored by these owners, thereby forcing managers to act in the best interests of the shareholders. Therefore, in order to provide evidence on the role of corporate monitoring system within the context of leverage and compensation nexus, we split our sample firms into two sub-groups (by arranging the large ownership stakes proxy in ascending order). Those above the median are considered to have effective governance in place, indicated as high-governance (high-monitored) firms, and those below the median are low-governance (low-monitored) ones.

Table (5.7.2), columns (1), (2), (3) and (4) show the OLS regression results for the low-monitored (governed) firms. Largely, the findings suggest a negative relation between leverage and compensation incentives at low-monitored firms. For example, the estimated coefficient on cash bonus (ranges from -0.084 to -0.108) is negative but statistically insignificant. This can be interpreted to suggest that cash-motivated managers operating in a low-monitored environment are likely to hoard more cash surplus, leading to lower leverage and higher cash bonus compensation. This result is very interesting, given that managers operating in poorly monitored firms are more likely to be entrenched and can consequently expropriate wealth from the shareholders by pursuing a low leverage policy. Similarly, managers of high-monitored (governed) firms (see Table 5.7.3) lower the leverage level as they (managers) receive more cash bonus. The observed coefficient estimates range from -0.029 to -0.053, but the coefficient has a low explanatory power. The presented results seem to suggest that cash-motivated executives in both high-monitored and low-monitored firms use debt more cautiously or conservatively in an attempt to meet the required cash bonus performance threshold.

Furthermore, the share options incentive is negative and statistically significant in low-monitored firms, suggesting management's reluctance to increase the leverage ratio when a large component of their incentives package is in the form of share options, ceteris paribus. With the reported parameter estimate (ranges from -0.141 to -0.164), it tends to indicate that managers of poorly (low) monitored firms with a greater share options incentive pursue a low-leverage policy, signalling an entrenchment effect. In the high-monitored firms (Table 5.7.3), the stock options incentive (coefficient -0.146 to -0.167) is still negative and statistically significant. This is quite worrisome to shareholders as they want managers to sponsor corporate activities via more borrowings. The high statistical significance confirms our earlier established negative relationship between stock options and leverage (Table 5.4.2) and that the reported result is not limited to either low- or high-monitored firms.

Moreover, the LTIPs incentive is negative (positive) in low- (high-) monitored firms. In the low- (high-) monitored firms, the estimates range from -0.126 to -0.132 (0.054 to 0.084) and they are all statistically significant. The resultant findings imply that the pressure exerted by well-monitored systems afford managers less opportunity to expropriate wealth from shareholders by pursuing a low-leverage policy. In other words, because debt acquisition is often acknowledged by the market as positive news (e.g. Harris and Raviv, 1990; Stulz, 1990), among others, executive mangers are forced in high-monitored firms via the LTIPs incentive to increase their firm's idiosyncratic risk, hence more borrowing. Another possible explanation could be that, because high-monitored firms enjoy lower borrowing costs, ceteris paribus, LTIPs-incentivised managers become aligned to shareholders' aspirations, thereby contracting more debt to sponsor firm activities. In fact, the opposite is true for poorly (low)- monitored firms, where entrenched managers pursue a low leverage policy as their residual interest in the form of LTIPs increases.

In short, low-monitored firms are likely to be punished by lenders demanding high borrowing rates, which in turn can influence entrenched managers to lower the leverage ratio as they receive more stock and cash-based incentives. Again, the finding is consistent with and complementary to the main results (Table 5.4.2) that LTIPs incentives and the firm's idiosyncratic risk (i.e. leverage) are positively related in high-monitored firms.

5.8.3.1 Other control variables

Largely, the control variables tend to behave differently at each governance level. At low-monitored firms, net PPE, R&D expense, market-to-book and Z-score are negative, with stock return showing a positive sign. In contrast, at high-monitored firms, net PPE, R&D, market-to-book and Z-score are positive, with stock return showing a negative sign. However, return on assets and firm size maintain their effect on leverage in both governance systems. Essentially, the relative effects of the control variables on leverage may partly be attributed to the different governance levels.

In sum, the evidence obtained so far in this section suggests the interaction of corporate governance and managerial compensation incentives in influencing corporate capital structure (leverage). We find that the negative effects of managerial cash bonus and share options components are largely pronounced in a weak corporate governance environment (low-monitored), suggesting an indirect effect of corporate governance practices on firm leverage level. In fact, the supplied results seem to suggest the presence of a managerial entrenchment effect and that such an effect is motivated by managers' risk-aversion, particularly in the low-monitored firms. Moreover, complementary to the main findings (Table 5.4.2), the reported positive effect on LTIPs incentive is partly explained by the effective prevalence of the corporate governance system indicated by high-monitored system. This finding seems to provide support for the incentive alignment argument rather than the risk-motivated story under the high-monitored firms. Again, one should consume this information with low sample observation in mind.

Table 5.7 1 Leverage – Pay Incentives for Low-Governance Firms Regression

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
LTIPs	-0.132**	-0.132*	-0.129*	-0.126**
	(-1.94)	(-1.90)	(-1.87)	(-1.83)
ESO	-0.141*	-0.150	-0.149*	-0.164*
	(-1.63)	(-1.62)	(-1.64)	(-1.81)
CashB	-0.109	-0.115	-0.093	-0.082
	(-1.34)	(-1.39)	(-1.11)	(-0.99)
SAL	-0.107**	-0.097*	-0.096*	-0.073
	(-2.08)	(-1.88)	(-1.87)	(-1.29)
MKTB	-0.002**	-0.002**	-0.001**	-0.002**
	(-2.47)	(-2.41)	(-2.27)	(-2.24)
Size	0.089***	0.093***	0.098***	0.101***
	(5.68)	(5.93)	(6.01)	(6.32)
ROA	-0.039	-0.031	-0.022	0.002
	(-0.24)	(-0.19)	(-0.14)	(0.01)
STKR	-0.006	-0.002	-0.001	0.002
	(-0.40)	(-0.13)	(-0.06)	(0.11)
Z-Score	0.002	-0.001	-0.002	-0.006
	(0.21)	(-0.11)	(-0.16)	(-0.52)
Net PPE	-0.043	-0.039	-0.047	-0.051
	(-1.22)	(-1.11)	(-1.33)	(-1.45)
R & D	-0.163	-0.159	-0.149	-0.153
	(-1.26)	(-1.19)	(-1.15)	(-1.18)
E. Own		0.707***	0.700***	0.689***
		(4.12)	(4.04)	(3.86)
Non E.Own			0.331	0.286
			(1.15)	(0.97)
Large Own				0.002*
				(1.66)
Constant	0.493**	0.413*	0.352	0.176
	(1.97)	(1.64)	(0.44)	(0.60)
Industry & Year effects	YES	YES	YES	YES
N	585	585	581	581
R^2	0.240	0.251	0.25	0.259

The table presents the OLS lagged estimation results for the interaction effects of incentives (LTIPs, ESO and CashB) and low-monitored or governed firms on leverage. Models 1, 2 3 and 4 include firm fixed effect. The reported t-statistics are based on robust standard errors. All variable definitions are described in Table 5.3.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

Table 5.7 2 Leverage–Pay Incentives for High-Governance Firms Regression

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
LTIPs	0.084*	0.076*	0.060	0.054
	(1.75)	(1.63)	(1.20)	(1.05)
ESO	-0.146**	-0.151**	-0.159**	-0.167**
	(-2.22)	(-2.28)	(-2.39)	(-2.48)
CashB	-0.029	-0.034	-0.053	-0.053
	(-0.50)	(-0.59)	(-0.89)	(-0.88)
SAL	-0.031	-0.031	-0.065	-0.065
	(-0.72)	(-0.73)	(-1.56)	(-1.56)
MKTB	0.0017	0.002	0.001	0.001
	(0.25)	(0.25)	(0.19)	(0.18)
Size	0.013	0.013	0.009	0.008
	(0.64)	(0.66)	(0.45)	(0.42)
ROA	-0.316***	-0.314***	-0.319***	-0.316***
	(-4.09)	(-4.07)	(-4.24)	(-4.24)
STKR	-0.016	-0.017	-0.015	-0.015
	(-0.78)	(-0.83)	(-0.67)	(-0.68)
Z-Score	0.042***	0.042***	0.044***	0.044***
	(3.04)	(3.04)	(3.17)	(3.15)
Net PPE	0.095**	0.096**	0.071	0.075
	(2.13)	(2.14)	(1.54)	(1.62)
R & D	-0.499*	-0.488**	-0.344	-0.347*
	(-2.20)	(-2.16)	(-1.62)	(-1.64)
E.Own		-0.022	-0.141***	-0.125**
		(-0.82)	(-3.23)	(-2.53)
Non. E.Own			-0.012	-0.001
			(-0.14)	(-0.01)
Large Own				-0.001
				(-0.74)
Constant	0.601***	0.603***	0.838***	0.905***
	(2.37)	(2.38)	(3.27)	(3.45)
Industry&Year effects	YES	YES	YES	YES
N	665	665	650	650
R^2	0.291	0.293	0.306	0.307

The table presents the OLS lagged estimation results for the interaction effects of incentives (LTIPs, ESO and CashB) and high-monitored or governed firms on leverage. Models 1, 2 3 and 4 include firm fixed effect. The reported t-statistics are based on robust standard errors. All variable definitions are described in Table 5.3.1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

5.9 Chapter overall conclusions

The chapter establishes a strong relation between the level and composition of managerial compensation and financial leverage based on the assumption that shareholders' efficient design of compensation influences the quality of managerial financial leverage decisions. More specifically, leverage ratio is positively dependent on LTIPs, suggesting shareholders' willingness to use LTIPs to influence managers to sponsor corporate activities with more debt. In contrast, stock options and cash bonus show a decreasing relationship with firm leverage. Thus, a stock options incentive discourages managerial risk appetite, which is inconsistent with the risk-motivated explanation, whilst the cash bonus result is consistent with risk reduction expectations (Hayes et al., 2012; Harris and Raviv, 1990). Significantly, the reported evidence seems to provide mixed support for the risk-motivated story. In particular, the convexity inherent in the share/stock options incentive is ineffective for reducing risk-related agency problems between the principal(s) and the agent(s) (Hayes et al., 2012; Lewellen, 2006). Consistent with expectations, shareholders use rather more LTIPs incentive to minimise the managerial risk incentive problem. This is interesting, because the Greenbury Report (1995) recommended that the remuneration committee should substitute stock options with LTIPs to prevent managerial excessive risk-taking. Also, the evidence on cash bonus supports risk reduction hypothesis.

Additionally, the supplementary evidence revealed that shareholders apply more debt-like compensation (i.e. deferred/restricted stock) to induce managers to lower the firm's debt ratio. This is significant, given the fact that deferred stock helps align the incentive of both shareholders and bondholders (debtholders), thereby reducing agency costs of debt (John and John, 1993; Kabir et al., 2013). In essence, the UK shareholders use restricted stock to induce managers to minimise the risk-shifting incentive problem.

Moreover, the chapter's evidence also suggests that the firm's growth opportunity interacts with managerial compensation to affect leverage. The chapter noted that the shareholders of high-growth (low-growth) firms award executives more stock-based incentive (LTIPs and stock options) and cash bonus to encourage (discourage) more risk-taking policy (increase debt ratio). More interestingly, a stock options incentive induces more borrowing for high-growth firms, consistent with the risk-motivated incentive argument (Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012), implying that the risk-motivated feature of stock options to encourage more risk-taking (via borrowings) is limited to only high-growth opportunity firms. One surprising finding is that cash-motivated managers of high-growth firms tend to use more debt to sponsor corporate activities. This could possibly mean that such firm managers are able to generate enough cash flow to satisfy firm's debt obligation as well as their accounting performance threshold in order to receive cash bonus compensation.

Finally, the chapter also shows that the interaction of corporate governance with managerial compensation partly influence the firm's capital structure (leverage). In particular, managers of a poorly (low)- monitored firm lower firm leverage as their incentive packages (LTIPs, stock options and cash bonus) increase, which is symptomatic of the managerial entrenchment effect. However, in high-monitored firms, LTIPs motivate managers to increase the debt ratio, whereas stock options are insensitive to increasing leverage. This indicates that high-monitored firms, which often enjoy lower cost of external finance, induce managers with an LTIPs incentive to afford a higher debt ratio in the capital structure.

Overall, the supplied evidence tends to provide support for incentive alignment hypotheses rather than the radical risk-motivated incentive argument.

Chapter 6

6.0 Summary and Conclusions

6.1 Introduction

In this study, we investigate the interaction among the managerial compensation and risk-taking activities. Specifically, the study examines the association between managerial compensation and investment and/or financial leverage. The underlying reasoning of this research is that shareholders through the board of directors design an efficient compensation scheme that aims to influence managerial risk-taking decisions. This is because the managers' actions and decisions determine the probability distribution of the firm's value, so shareholders via the compensation policy tend to induce managers to make optimal investment and financing decisions.

The thesis has three broad objectives. First, it seeks to examine the association between executives' compensation and investment activities using a sample of UK firms. Prior researchers have hugely concentrated on managerial compensation and research and development and/or capital expenditure (e.g. Coles et al., 2006; Hayes et al., 2012; Kini and Williams, 2012; Chen et al., 2017), acquisitions (see Agrawal and Mandelker, 1987; Croci and Petmezas, 2015; Feitu-Ruiz and Rennboog, 2017) and innovation (e.g. Manso, 2011; Nguyen, 2018). Unlike these prior scholarly studies, the current work provides a complete overview of the firm's investment: research and development, capital expenditure, other fixed assets and, more importantly, fixed intangible activities in a single study. Given the substantial resources firm managers devote to other fixed assets and fixed intangibles, the managerial risk behaviour regarding such activity is unclear. In this respect, we argue that an important gap exists.

Second, the study aims to further examine the extent to which the level of managerial compensation influences investment distortions. Different from Jensen's (1986) over-investment hypothesis, the present study further extends the argument that the level (excess) of management compensation can induce investment distortions (under-investment or over-investment). This view is consistent with the underlying argument of Strobl (2014), who conjectures that shareholders can purposefully design compensation to cause investment distortion. We explore the link between managerial excesses in compensation and the investment distortion probability.

Third, the study also investigates managerial compensation and financial leverage. It is argued that UK firms (management) use debt more conservatively (Rajan and Zingales, 1995; Antoniou et al., 2008). In fact, limited research exists in the UK on how executive compensation influences leverage level. There are a few exceptions (e.g. Florackis and Ozkan, 2009; Kabir et al., 2013); however, unlike this prior work – e.g. Florackis et al. (2009), who relate executive ownership to leverage – the current work utilises comprehensive data on managerial compensation grants and their effect on the firm's observed leverage.

In addition, the thesis further explores the extent to which the firm's growth opportunity influences the relation between executive compensation and leverage nexus. This investigation revolves around the thinking that the leverage–compensation is likely to be affected by the firm's growth prospects. Furthermore, managers of well-monitored or governed firms are likely to have reduced agency cost expenditure because such firms tend to make efficient operational decisions including leverage policy with minimal incentive problem. In line with this view, the study examines how the corporate governance presence impacts the linkage between executive compensation and financial leverage.

The rest of this concluding chapter summarises the main issues of the thesis, draws broad inferences from the key findings, and, finally, points to some unanswered or unresolved issues that need future attention.

6.2 Summary of research findings

This section presents a summary of the study's key findings for the respective empirical chapters. Specifically, we delineate our empirical results into two chapters: investment and leverage.

6.2.1 Managerial compensation and investment activities

Chapter 4 starts our empirical chapters. It presents a detailed analysis and discussion of the relationship between executives' pay incentives and the different types of investment activities by employing a three-stage least squares (3SLS) regression technique. First, the chapter builds on the executive compensation review conducted in Chapter 2 and formulates testable hypotheses (**H1a, H1b and H1c; H2a, H2b and H2c; H3a, H3b and H3c; H4a, H4b and H4c**). Second, it describes the main method employed in examining the causal effect of executives' compensation on the value-critical investment decisions. Again, it discusses the measurement of the key variables and other control variables. It states the empirical model and the chosen estimation method (3SLS). Third, it conducts the empirical tests of the hypotheses and the results are presented and thoroughly discussed. The presented evidence (for hypotheses **H1a–H1c**) suggests that LTIPs (equity) is positively associated with capital expenditure projects. This implies that executives with a large component of LTIPs incentives are more likely to divert corporate funds to sponsor capital expenditure activities, which is consistent with prior work (e.g. Agrawal and Mandelker, 1987; Guay, 1999; Hayes et al., 2012). The chapter also reports that stock options incentives encourage more spending on capital expenditure activities (Croci and Petmezas, 2015), while a cash bonus incentive discourages capital expenditure spending.

Furthermore, the chapter finds that the LTIPs, stock options and cash bonus are all positively related to fixed intangible activities (**hypotheses H2a–H2c).** The finding tends to imply that managers are likely to allocate more corporate resources to fixed intangible when a large component of their incentives is either stock-based or cash-based compensation. This result raises a challenge to the present study because there is no direct evidence on the risk classification of the said activity. In other words, there is no specific investment literature that makes a clear distinction on the risk-related classification of fixed intangible. However, based on the intangible nature of such investment activity, the study predicts it has a high-risk nature, implying that both risk-motivated and risk-avoiding incentives encourage such activity.

Moreover, the chapter provides some interesting findings on the research and development (R&D – hypotheses **H3a–H3c)** expenditure. The evidence shows that the stock-based (LTIPs and stock options) compensation is negatively and significantly related to R&D activity, suggesting that corporate executives are more likely to allocate firm resources away from R&D activity when a stock-based incentive constitutes a large component of their compensation packages. This is contrary to the risk-motivated incentive of stock-based compensation. Cash bonus incentive shows an increasing effect on R&D expense, implying that UK firm managers may tend to invest more on long-term (R&D) activity when a substantial amount of their pay package is the form of this type of incentive.

Finally, on the other fixed assets expenditure evidence (i.e. when we separate other fixed assets expenditure from the capital expenditure – hypotheses **H4a–H4c**), the chapter finds the three compensation components (LTIPs, stock options and cash bonus) to be inversely linked to such activity. It suggests that the UK executives are likely to disinvest in other fixed assets activity as they receive more stock-based and cash bonus incentives.

Chapter 4, section 4.7 further investigates the extent to which managerial excess compensation influences investment distortions. The key underlying aim is to empirically explore if executives' compensation excess is as a result of shareholders' purposeful attempt to encourage investment distortions.

The subsection reviews relevant literature and develops the hypotheses (hypotheses **H5a, H5b and H5c**) to be tested. The chapter describes and estimates the main subsamples to be utilised in the analysis. It also states the empirical model (investment distortion probability model) and discusses the adopted estimation method (probit model) to test the hypotheses.

The subsection establishes that managerial compensation excess induces investment distortions. Specifically, the positive excess compensation (over-compensated) stock-based incentives (LTIPs, stock options) is positively and significantly related to the probability of over-investing in capital expenditure activities. Similarly, a positive excess cash bonus (over-compensated) increases the probability of capital expenditure over-investment. However, under-compensated managers in stock-based and cash bonus (negative excess stock-based and cash bonus) are less likely to cause distortion in capital expenditure activity. One should interpret the under-compensated incentives result with care because the reported coefficients are all insignificant. Further, the chapter also shows that over-compensated LTIPs and cash bonus incentives show a decreased probability of fixed intangible distortion (over-investment), however insignificant, while the over-compensated stock option is significantly associated with a reduced probability of fixed intangible over-investment, implying that rewarding executives with stock options above the optimal level is less likely to induce fixed intangible over-investment. Also, under-compensated stock-based (LTIPs and stock options) managers are unlikely to commit over-investment in fixed intangibles. Finally, it also reports that the over-compensated LTIPs, stock options and cash bonus all show less likelihood of committing over-investment in research and development. However, under-compensated LTIPs, stock options and cash bonus all show an increased R&D over-investment probability, but the coefficients for stock options and cash bonus lack statistical significance.

The findings seem to suggest that shareholders' deviation from the optimal compensation level induces managers to commit investment distortion probability in capital expenditure activity. Thus, over-compensated (LTIPs, stock options and cash bonus) managers are more likely to over-invest in capital expenditure activity. Further, on the intangibles, one major implication of the findings is that the over-compensated incentives (LTIPs, stock options and cash bonus) have a decreased likelihood of committing over-investment in intangibles (fixed intangible and R&D). A possible reason could be that shareholders' intentional deviation from the optimal compensation level to influence managers to cause distortion in intangibles tend to be ineffective. This is unsurprising, given that such activities are seen as risky and that UK managers are unwilling to overly invest in such activity even if they are generously remunerated.

6.2.2 Managerial compensation and financial leverage

Chapter 5 conducts an examination of the effect of managerial compensation on financial leverage. The chapter's main idea centres on the view that shareholders award managers compensation to influence value-critical financial decisions. It reviews the existing material evidence and constructs a main sample and subsamples. It also formulates relevant testable hypotheses and states the empirical model needed to test the hypotheses. The chapter outlines the main estimation method employ to test the stated hypotheses (**H6a–6e**) before undertaking the empirical tests and presenting and discussing the results. The chapter documents a positive relation between LTIPs and leverage. It implies that executives with a higher LTIPs component are likely to borrow more to sponsor corporate activities, consistent with the alignment hypothesis. Again, the chapter disaggregates LTIPs into performance stock and deferred/restricted stock and records that the deferred stock component is negative and significantly related to leverage ratio, signalling the fact that shareholders apply a debt-like pay incentive to influence managers to minimise the risk-shifting incentive problem and possible agency cost of debt, whilst performance stock encourages more debt financing. Furthermore, it shows that stock options and leverage are negatively and significantly linked, which is inconsistent with the risk-motivated incentive argument (Coles et al., 2006; Kini and Williams, 2012). Similarly, the coefficient on cash bonus is negative and significant, postulating that cash-incentivised managers are likely to have a low corporate debt level, supporting risk reduction hypothesis. This is not surprising, given that a manager of a more levered firm needs to meet regular interest payments, which in turn reduces the available cash balance. Maintaining a low leverage level makes it easy for managers to meet the required cash flow balance, thereby enabling them to qualify for a cash bonus incentive.

Moreover, the chapter considers the role of corporate governance within the context of the executive compensation and leverage relation. It rests on the assumption that firm-specific governance characteristics influence managerial compensation to affect the firm’s leverage level. The chapter defines two sub-groups representing low (below median) and high (above median) governance indicators level. It shows that, at low-monitored firms, stock-based and cash bonus compensation are negatively related to leverage. This tends to imply that managers in a low-monitored or governed firm are likely to borrow less when their residual interest in the form of LTIPs, stock options and cash bonus increases. In high-monitored firms, stock options and cash bonus are still negatively related with leverage, although the cash bonus coefficient is insignificant, while LTIPs is positive and significant. The findings show that, as monitoring improves (via increase in large concentrated ownership), LTIPs-incentivised managers tend to become responsive to their LTIPs compensation package and increase the financial leverage level, but managers with higher stock options incentive are still likely to decrease the firm leverage ratio.

The chapter also examines the interaction of managerial compensation and growth opportunities on the firm leverage. The idea is that managers of high-growth firms are often difficult to monitor because managers' actions and decisions are unobservable to the owners. One way shareholders use compensation is to award managers more (less) stock-based (cash bonus) compensation to induce them (managers) to make appropriate financial decisions. Also, high-growth firms can suffer from under-investment problem if managers fail to make efficient leverage decisions (Core, 2001; MacLaughlin et al., 1996). With this, it is expected that executive compensation–leverage association would be influenced by the firm's growth potential level. The chapter describes and constructs the growth opportunity proxy (market-to-book) using high and low sub-groups and employs an OLS method to estimate the two categories. The chapter reports that managers of low-growth firms tend to borrow less when they receive more stock-based (LTIPs and stock options) and cash bonus incentives. At high-growth firms, stock-based incentives and leverage are positively linked to debt level, implying that managers in such firms are more likely to increase the firm's debt ratio as their residual incentives in the form of stocks increase. Thus, stock options positive effect on leverage, supports the risk-motivated incentive argument at only high growth firms. Similarly, cash bonus and leverage are positively related in high-growth firms, suggesting that managers with more cash bonus tend to increase leverage level, which is contrary to the risk reduction argument.

In summary, the main implication of the study findings tends to suggest that UK shareholders do not explicitly or intentionally utilise managerial compensation incentives for risk-taking motivated reasons, but rather for incentive alignment motives. The evidence on managerial compensation and financial leverage interdependence partly explains the assertion that the UK managers' conservative debt behaviour (Rajan and Zingales, 1995; Antoniou et al., 2008) seems to be influenced by the level and structure of their compensation incentives.

6.3 Key conclusions, discussions, and practical and theoretical implications

The study draws four major conclusions from the empirical findings. This subsection discusses these conclusions and their practical and theoretical relevance.

6.3.1 Importance of optimal contracting theory (OCT)

First and foremost, executive compensation incentives appear to be an important and useful tool in influencing managerial corporate decisions. In fact, most of the study's key findings support this conclusion. First, our results show that shareholders offering compensation packages to top executives influence them to make optimal investment decisions. The underlying implication is that, as the quality of managerial investment improves albeit pay incentives, shareholders' value increases. Second, our evidence further suggests that shareholders can intentionally deviate from the optimal level of compensation to induce managerial investment distortions. Third, we also show that executive compensation influences the quality of managerial financing decisions (leverage). Additionally, it is observed that a firm's growth opportunity interacts with compensation incentives to influence managerial leverage decisions. Lastly, the evidence posits the view that managers of high-monitored firms afford higher leverage in their capital structure as they receive more pay incentives.

Furthermore, the reported findings have implications on the theories of managerial compensation: 1) optimal compensation theory (Holmstrom, 1979; Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012; Strobl, 2014; Croci and Petzemas, 2015; Nguyen, 2018), and 2) managerial power hypothesis (Bebchuk and Fried, 2003; 2004; Weisbach, 2007). For instance, the excesses in executive compensation are not as a result of managerial rent extraction, but rather as a result of shareholders' intention to induce managerial investment distortion.

Additionally, the current study's evidence enhances our understanding on the theory of investment. The result seems to imply that the over-compensated (under-compensated) managers are more (less) likely to over-invest in capital expenditure projects over a long period of time. This is contrary to Coles et al.'s (2006) argument that shareholders temporarily deviate from the optimal managerial compensation to alter investment policy. Our finding suggests otherwise, implying the effectiveness of managerial compensation incentives in changing a firm's investment dynamics. In contrast, the reported evidence on intangible investment distortions does not support the excessive managerial compensation hypothesis. It seems to postulate that the over-investment incentive resulting from excessive compensation is limited to capital expenditure activities.

In general, the study's key findings tend to show that the optimal contracting theory provides a potential explanation for the UK datasets.

6.4 Potential limitations of the study and the future research recommendations

Despite the important contributions made by the current study to the relatively scanty UK literature, the following limitations were also observed and therefore the findings should be interpreted with these shortfalls in mind. Specifically, these limitations are presented under three main categories: namely, data and sample limitations, theoretical implications and proxy variables utilised in the analyses.

6.4.1 Data and sample limitations

Even though the data on executives' compensation packages have improved since the implementation of many policy documents (i.e. Greenbury Report, 1995; Hampel Report, 1998; Higgs Report, 2003), some companies, particularly smaller ones, often fall short of providing detailed and relevant information on executives' incentives data (i.e. compensation packages and shareholdings stakes). The research's initial annual report survey reveals that information. Consequently, the study sample was selected based on pre-set criteria. This non-random selection method reveals the inherent sampling bias which is likely to limit the generalisability of the study's findings.

Additionally, our adopted selection procedure (sampling only FTSE 350 firms) resulted in a reduction in the researched firms' size. Notwithstanding this, one advantage of the inherent firm size bias is that it helps to mitigate the survivorship bias which is likely to affect our sample composition. In particular, smaller firms are more likely to be delisted and easily overtaken by the larger ones.

Moreover, the research selected non-financial companies listed on the FTSE 350 index, which further shrank the sample size. The exclusion of financial, utilities and investment firms limits the generalisability of the results. Nevertheless, differences in accounting practices and regulations among financial and non-financial firms make this exclusion an important strategy. For example, it is expected that the firms' executives compensation packages guide their selected policy measures (i.e. risk-taking investment and financial leverage policies). Therefore, such a dichotomy in accounting reporting can inhabit the linkage between risk-taking activities and executives' financial compensation packages. More so, the utilities companies are heavily regulated, which in turn could limit their management operational risk-taking activities.

Finally, limiting our datasets to UK-based companies implies that the interpretation of the findings outside the context of UK publicly listed firms (FTSE 350 index) needs to be done with extreme caution. This is because differences in governance practices as well as the development of the capital market system can affect risk-taking decisions of executive managers.

6.4.2 Limitations of constructs and variables

Another constraint faced by this research is the limited proxy variables utilised in the study analyses, which are based on theoretical and empirical works in constructing and measuring these variables. In terms of the key independent variables (LTIPs, stock options and cash bonus) which were manually collected, they fail to include some incentive plans. For instance, the study discovered that some firms issue a co-investment incentives plan which allows executives to invest part of their incentives into such a scheme. Due to the complication associated with the measurement, this study excluded this component in the long-term incentives plans (LTIPs). This is consistent with previous works (e.g. Coles et al., 2006; Kini and Williams, 2012). In addition, the study also excluded executives' pension plans, which can also provide useful information on the quality of managerial risk-taking activities. The non-inclusion of pension schemes is due to the difficulty in estimating pension values, and therefore creates an avenue for further future study into this issue. Again, it is hoped that the omission of this variable (pension component) would not in any way have material implications for the supplied findings. Moreover, other managerial data including private investments, gender, experience, education, dual role, etc., were unobservable by the chosen model; however, it is hoped this would not affect the study findings. Although this research accounts for a large number of executives' incentives and other related personal characteristics, it is anticipated that the findings and conclusions of this study should be considered with this fact in mind. Also, the estimations of other key dependent variables (e.g. proxy for investment distortions – over- or under-investment) and independent variables (compensation deviation or excess incentives) are all unobservable and need to be estimated. Such proxy variables may not represent the perfect measure of the intended constructs, which can bias the study's findings and its conclusions. Therefore, it is important that this caveat is noted when interpreting the results of the analyses.

In short, while the study acknowledges these limitations, it argues succinctly that the study's inability to find appropriate proxies to quantify these effects would have no serious implications for the research findings. In fact, the data and variable constraints are indifferent to prior studies (e.g. Coles et al., 2006; Kini and Williams, 2012; O'Connor et al., 2013; Eisdorfer et al., 2013; Nguyen, 2018).

6.4.3 Theoretical and empirical delimitation

Another important limitation that should be considered is specifically identifying the theoretical and empirical implications of the study's findings. Generally, the research implicitly assumes that shareholders offer different components of compensation to induce managerial risk-taking activities. In other words, the study's general premise is that the quality of managerial value-critical decisions regarding investment and the concomitant financing options should reflect the effectiveness of managerial compensation schemes in constraining the opportunistic managerial behaviour. Accordingly, it shows the extent to which the level and the different components of executives' compensation influence investment and/or leverage decisions. For example, stock-based (cash-based) compensation increases (decreases) risk-taking policies. This assumption may not be plausible, given that shareholders may apply incentives compensation for different motives. Again, the study's classifications or definition of high- (low-) risk activities would be indifferent to the executive managers. Therefore, the reader should be aware of this fact when analysing the study's findings.

6.5 Areas for future research

The findings of this research provide important evidence to show that managerial financial compensation incentives play a significant role in influencing the efficiency of managerial risk-taking activities (e.g. investment and/or leverage decisions) by using simultaneous equation modelling. However, as indicated above, some other matters exist that are not covered by the current research which we believe have the potential to enhance our understanding on the risk-related behaviour or attitude of managers given compensation incentives. Notably, some of the issues that remain unsettled are highlighted below:

First, one attractive area for future research is to combine both managerial compensation incentives (i.e. secondary data) and primary data (thus, through interviews and questionnaire) to specifically ascertain how managers behave relating to investment and financing decisions. Such an addition will give us direct evidence on managerial behaviour regarding risk-taking decisions.

Another important area for consideration is to look at how executives' pension scheme influences their risk-related decisions. The introduction of the companies' code (2003/2009), for instance, has increased the reportage on executive pension contribution, and relating it to risk-taking activities (e.g. innovative expenditure) will give further fresh impetus on this relatively new stream of research.

Finally, accounting for executives' outside wealth incentive and gender together with compensation packages will contribute to influencing managerial risk behaviour. In tune with this thinking, subsequent research can look at the role of managers' outside wealth, gender and compensation packages on their strategic decisions.

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Appendix 1

Mathematical proof of the anticipated econometric challenges

Endogeneity concern

This appendix provides a detailed mathematical proof of the practical econometric challenges inherent in our dataset which warrants the relevance of our chosen three-stage least square (3SLS) approach. We provide mathematical demonstration of the problem and show the robustness of the selected technique (3SLS) in addressing the such challenge. For illustration purposes, we use investment variable throughout our discussion.

We construct our investment model as follows:

$$I_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad \text{...} \quad (1)$$

Where $\boldsymbol{I_{it}}$, is the firm investment, $\boldsymbol{C_{it}}$managerial compensation incentives (i.e. LTIPs, stock options and cash bonus), $\boldsymbol{X_{it}}$ is firm's observable characteristics based on prior literature (e.g. leverage, growth, firm size, cash flow, sales growth etc.), $\boldsymbol{\varepsilon_{it}}$ **error term, and** and $\boldsymbol{\beta_1}$ is the coefficient of interest.

Practical econometrics challenges

As noted, these econometric issues are prevalent in our data. These include unobserved variables, measurement error, serial correlation and reverse causality could render other technique (e.g. OLS) ineffective. These issues make our prescribed technique (3SLS) theoretically and practically relevant.

More specifically, OLS parameter estimates will suffer from endogeneity bias in the presence of these econometrics issues presented by the data, where one or more explanatory variables are correlated with the error term i.e. E $[C_{it}\varepsilon_{it}] \neq 0$ or E $[X_{it}\varepsilon_{it}] \neq 0$, leading to wrong causal inferences.

To be more specific, we can define $\boldsymbol{\varepsilon_{it}}$ as a composite error term in this general form:

$\varepsilon_{it} = \mu_i + \tau_t + \rho_{\varepsilon_{it}-1} + \cup_{it}$ ……………………………………………………… (1a)

Where μ_i and τ_t indicate unobserved individual and time effects, whiles $\boldsymbol{\rho_{\varepsilon_{it}-1}}$ and $\cup_{it}$ represent serial correlation and white noise error term respectively. This implies that if the explanatory variable(s) are not strictly exogenous the noted econometric bias arises.

A brief overview of the potential bias that are more likely to affect our data as well as the study's results if OLS technique is applied are explained below.

Unobserved heterogeneity

The omitted variable bias may occur when a relevant explanatory variable, assumed to be correlated with the regressors is completely omitted from the model, and, or when such that individual unobserved effects are either industry or firm related characteristics are correlated with both investment and compensation incentives leading to possible econometrics bias often referred to as "unobserved heterogeneity", i.e. E $[C_{it}\mu_i] \neq 0$ or E $[X_{it}\mu_i] \neq 0$.

Let's give mathematical proof of the unobserved heterogeneity bias when OLS estimator is applied to eq. (1).

In a simplified form, we define conditional expectation of firm investment (**I_{it}**), given X' and constant term, where:

X' = (X_{it},C_{it}), β' = ($\beta_1\beta_2$)andε_{it} = ($\mu_i \Upsilon$+ $\cup_{it}$),

thus equation (1) is specified as follows:

$\mathrm{I_{it}} = \beta_1 \mathrm{C_{it}} + \beta_2 \mathrm{X_{it}} + \varepsilon_{it}$ **……………………..………………….. (2)**

Where; **X'** shows firm individual characteristics including intercept term, and managers compensation (**C_{it}**), while **β'** is the coefficients and **μ_i**and$\cup_{it}$are unobserved factor and white noise. Specifically, we write eq (3) as;

$I_{it} = X'\beta' + \varepsilon_{it}$…………………………………..………(3)

Here, we denote OLS estimator for **β'** in equation **(3)** by b_2, given as:

$b_2 = (\sum_{i=1}^{N} X_1 X')^{-1} \sum_{i=1}^{N} X_i\ Y_i$ …………………………………(3)

Substituting eq. (1) into eq. (3) to obtain eq. (4)

$\mathrm{I_{it}} = \beta_1 \mathrm{C_{it}} + \beta_2 \mathrm{X_{it}} + \mu_\gamma + \cup_t$………………………..………… (4)

$b_2 = \beta + (\sum_{i=1}^{N} X_i X_i')^{-1} \sum_{i=1}^{N} X_i\ \mu_\gamma + (\sum_{i=1}^{N} X_i X_i')^{-1} \sum_{i=1}^{N} X_i\ \cup_i$………(5)

Assuming the last term has expectation E [$X_i\ \cup_i$] = 0, allows to show that the probability limit of $b_2$is stated as follows:

Plim$b_2 = \beta + \sum_{xx}^{-1}$ E [$X_i\ \mu_i$]γ ,

where $\gamma \neq 0$ or $\gamma > 0$, hence the parameter estimates by OLS estimator will be biased and inconsistent. However, OLS coefficients will be asymptotically unbiased when E [$X_i\ \mu_i$] = 0.

Measurement error

Measurement error is another case where OLS estimator is likely to be inconsistent when the explanatory variable(s) is measured with error. For example, potential endogeneity bias may occur when the compensation variable is inaccurately measured because of corporate misreporting i.e. E [X_{it} $\cup_{it}$ |C_{it}] ≠ 0. Stating from eq. (1), we provide the step by step proof below:

$I_{it} = \beta_1 X_{it} + \beta_2 C_{it} + \varepsilon_{it}$………………………………………… (1)

We present eq. (1) in a linear model, $y_t = x\beta' + \varepsilon_{it}$ …………... (7)

where I_{it} = y (investment) ; x = explanatory variable including compensation and other exogenous (C_{it}, X_{it}), β' = ($\beta_1 \beta_2$) and ε_{it} = error term

$x_t = Z_t + \cup_t$ ……………………………………………….… …(8)

x_t is the measured explanatory variable with error, Z_t = true value, and $\cup_t$ = measurement error. The linear model shows that the conditional expectation of y_t given x_t and constant term will be biased and inconsistent because of the error measured explanatory variable i.e. E [$x_t \varepsilon_{it}$] > 0, violating the classical linear regression consistency assumption. For instance, in cases where the measurement error shows positive, then the explanatory variable of interest (x_t) will exhibit positive bias ($\cup_t$) whiles the original error (ε_{it}) shows negative bias, thus

E [$x_t \varepsilon_{it}$] < 0 (see equation (9).

$\varepsilon_{it} = \mu_t$- β_2 $\cup_t$ ……………………………………..………...(9)

We show inconsistency of OLS estimator denoting β_2 by b_2

Proof:

$$b_2 = \frac{\sum_{i=1}^{T}(x-\bar{x})(y-\bar{y})}{\sum_{t=1}^{T}(x_t-\bar{x})^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots\ldots(10)$$

Where $\bar{x}$ indicates sample mean of the explanatory variable (x_t), and substituting eq. (7), we obtain;

$$b_2 = \beta_2 + \frac{(1/T)\sum_{i=1}^{T}(x-\bar{x})(\varepsilon_t-\bar{\varepsilon})}{(1/T)\sum_{t=1}^{T}(x_t-\bar{x})^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots(11)$$

Hence, as sample moments get close to the population moments, sample sizes correspondingly increase to infinity.

$$\text{Plim}b_2 = \beta_2 + plim \frac{(1/T)\sum_{i=1}^{T}(x-\bar{x})(\varepsilon_t-\bar{\varepsilon})}{(1/T)\sum_{t=1}^{T}(x_t-\bar{x})^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots(12)$$

From eq.(12), we deriveb$_2$ $= \beta_2 + \frac{E[x_t \varepsilon_t]}{v[x_t]}$, where $E[\varepsilon_t] = 0$, with last term nonzero probability limit .i.e. σ_u^2

$$E[x_t\varepsilon_t] = E[(W_t + u_t)(v_t - \beta_2 U_t)] = -\beta_2\sigma_u^2$$

$$v(x_t) = (w_t + U_t) = \sigma_w^2 + \sigma_u^2$$

$$\text{Plim}b_2 = \beta_2\left(1 - \frac{\sigma_u^2}{\sigma_w^2+\sigma_u^2}\right) \ldots\ldots\ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots\ldots(15)$$

Thereforeb$_2$is asymptotically unbiased in cases where $\sigma_u^2 = 0$. However, with measurement error presence, the coefficient biased estimates may shift towards zero especially if σ_u^2 is positive. Also, the constant term estimates will be biased as well i.e. $\beta_1 = [y_t, - \beta_2 x_t]$

Reverse Causality

Another potential econometric problem on endogeneity concern is reverse causality. This posits two-way impact among the dependent and independent variable. Thus, the conditional expectation of y (investment) given x (compensation) and vice versa.

Investment model is given by:

$I_t = \beta_1 X_t + \beta_2 C_t + \varepsilon_{it}$ ……………………………………………..…………..…..(1),

Where I is the firm investment (dependent variable), C = compensation (endogenous variable), X = exogenous factors, Z_t = valid instruments and Ɛ = error term.

Endogenous equation for compensation

$C_t = I_t + \beta_3 Z_t + \varepsilon_{it}$ …………………………………………………………………(17)

Then, we solve eq. (1) and (17) for C_t and I_t to derive the reduced form.

$C_t = \frac{\beta_1}{1-\beta_2} + \frac{1}{1-\beta_2} z_t + \frac{1}{1-\beta_2} \varepsilon_t$……………………………………..……………......(18)

$I_t = \frac{\beta_1}{1-\beta_2} + \frac{\beta 2}{1-\beta_2} z_t + \frac{1}{1-\beta_2} \varepsilon_t$……………………………………..…………………(19)

$\text{Cov}\,[C_t, \varepsilon_t] = \frac{1}{1-\beta_2}\,\text{cov}\,[z_t, \varepsilon_t] + \frac{1}{1-\beta_2}\,\text{V}\,[\varepsilon_t] = \frac{\sigma^2}{1-\beta_2}$

$\text{V}\,[C_t] = \text{v}\,[\frac{1}{1-\beta_2} z_t + \frac{1}{1-\beta_2} \varepsilon_t] = \frac{1}{(1-\beta_2)^2}\,(\text{V}\,[Z_t]+\sigma^2)$

$Plim\, b_2 = \beta_2 + \frac{\text{Cov}\,[C_t,\ \varepsilon_t]}{\text{v}[C_t]}$

$Plim\, b_2 = \beta_2 + (1-\beta_2)\frac{\sigma^2}{\text{v}[Z_t]+\sigma^2}$

As $0 < \beta_2 < 1$ and $\sigma^2 > 0$, causing OLS estimates biased and inconsistent. In other words, if OLS is applied to the model, the coefficient estimates for β_2 will overestimate the true value of the parameter of interest.

Lastly, the presence of serial correlation in the data may cause endogeneity bias which will render OLS an ineffective estimation technique. This is plausible, where any persistent adjustment in the firm's investment and financing decisions lead to the predetermined explanatory variable (executive compensations), although a time lag may exist between the policy decision time and respond periods. For example, a positive increase in CAPEX, R&D or leverage in year 1 may alter executive compensation incentives in the following year. Hence, E $[\varepsilon_{it}\ \varepsilon_{it-1}] \neq 0$,where the error term ($\boldsymbol{\varepsilon_{it}}$) may be defined as a composite error term which takes the specification as:

$\varepsilon_{it} = \mu_i + \tau_t + \rho_{\varepsilon_{it}-1} + \cup_{it}$ .... (6)

Where, $\boldsymbol{\mu_i}$and $\boldsymbol{\tau_t}$represent unobserved individual and time effects, $\boldsymbol{\rho}$is the serial correlation term and $\cup_{it}$shows the white noise error term.

Resolving endogeneity bias

As indicated, two primary causes of endogeneity bias: a) when the explanatory variable(s) is correlated with the error term;

i.e. E $[X_t \mid \varepsilon_t]$ = cov $[X_{it}\ \varepsilon_{it}] \neq 0$, where the error term is a composite term;

$\varepsilon_{it} = \mu_i + \tau_t + \rho_{\varepsilon_{it}-1} + \cup_{it}$; and b) when there is an issue of reverse causality between the dependent and independent variables.

We apply three-stage least squares (3SLS) to deal with this problem. Two steps involve; first, in the reduced form regression, we regress endogenous regressor, i.e. compensation incentives on all instruments (e.g. including dependent variable, relevant instruments and other exogenous determinants of the endogenous factor) to obtain the predicted values, and finally replacing endogenous variable with the predicted values in the right-hand side as independent variable including other exogenous determinants in the model of interest (original structural model).

Our investment equation is given:

$I_t = \beta_1 C_t + \beta_2 X_t + \varepsilon_{it}$, ……………………………………………………...…. (16),

which can be represented in a linear form:

$I = X'\beta' + \mathcal{E}$, ………………………………………………………………………… (20),

where $X' = (C_t, X_t)$ and β' (β_1, β_2).

Where I_t is the firm investment (dependent variable), C_t = compensation (endogenous variable), X_t = exogenous determinants of firm investment and ε_{it} = error term. In fact, the parameter estimates for compensation (C_t) will be biased and inconsistent when OLS technique is applied because of the violation of strict exogenous condition or assumption, thus, the covariance of the error term and explanatory variable is nonzero (i.e. $C_t\varepsilon_{it}) \neq 0$ or $(X'\varepsilon_{it}) \neq 0$. This implies that the coefficient estimates for compensation (β') from the OLS estimator will be biased because:

$b = \beta' + (X'X)^{-1}X'\mathcal{E}$, E [b] $\neq \beta'$, when the moment condition (X' $\mathcal{E}$) is not equal to zero i.e. $(X'\varepsilon_{it}) \neq 0$.

Therefore, to make the coefficient estimates asymptotically unbiased using instrumental variable estimator we impose further statistical identification, thus, we apply the following moment conditions:

1. Relevant instrument(s) (Z) should be correlated with the regressor (C_t)

   i.e. E ($Z'C_t$) > 0.

2. The instrument (s) (Z) should be uncorrelated with the error term

   E ($Z'\varepsilon_{it}$) = 0.

3. Where (Z) should not be directly related to the dependent variable (I_t)

   i.e. cov [I_t Z | X'] = 0. Specifically, this condition is known as exclusion restriction, which reflects the assumption that (Z) instruments are validly excluded from the original structural or investment model.

Therefore,

$b_{IV} = (Z'\,X')^{-1}Z'I_t = (Z'\,X')^{-1}Z'\,(X'\beta' + \mathcal{E}) = \beta' + (Z'\,X')^{-1}\,Z, \mathcal{E}$

Where Z = valid instruments, X' = explanatory variables $C_tX_{it})\beta'$ (β_1, β_2), $\mathcal{E}$ = error term and I_t = firm investment. Hence, the coefficient estimates (b_{IV}) is unbiased when the covariance of the instruments and error term is equal to zero i.e. (Z, $\mathcal{E}$) = 0. Overall, this approach (instrumental variable technique) is more appropriate for single linear model.

Moreover, the three-stage or three stages least squares (3SLS) is suitable for structural equation model or systems of equation. As described above (3SLS) and relevant to the study application, we employ 3SLS technique.

From the original investment equation (16)

$I_t = \beta_1C_t + \beta_2X_t + \varepsilon_{it}$, ………………………………………….………………….. (16).

For simplicity, we drop the subscripts in equation (16) and to derive

$I = \beta_1C + \gamma_2X + \mathcal{E}$ ……………………………………………………..………....(20)

In the reduced form equation, we derive compensation equation as follows:

$C = \beta_1 I + \gamma_3 X + u$ ……………………………………………………..……..……..…..(21)

We simplify the reduced form using kth explanatory variable in vector notation;

$C_K = Z\pi_K + \mu_K$ ……………………………………………………….……………..(22)

Where $C_K =$ compensation incentives , $Z\pi_K$ = all instruments including dependent variable (investment), exogenous factors of compensation and the relevant instruments, and μ_K = error term.

Applying OLS to equation (22), we obtain the predicted values,

$\hat{C}_k = Z\,(Z'\,Z)^{-1}Z'C_k$.

Where $\hat{C}_k = C_K$ if Z is in a column vector.

In the second stage regression, we apply matrix of explanatory variables are replaced in the K columns of $\ddot{X}$ in the standard model, where $\hat{C}_k$ is seen as matrix of instruments.

$\hat{C} = Z\,(Z'\,Z)^{-1}Z'\;C$

Hence, the parameter estimates in the second stage is given by:

$b_{IV} = (\hat{C}'\,\hat{C}\,)^{-1}\,\hat{C}'\,I$, which can be stated in a three-stage least squares as:

$b_{3SLS} = [X'\,Z\,(Z'\,Z)^{-1}Z'\,X]^{-1}X'Z\,(Z'\,Z')^{-1}Z\,I$

Summary of variables and measures

Variables	Definition	Source/Compustat
Dependent variables for risk-taking activities (Investment, Leverage)		
Investment Variables:		
CAPEX	Capital Expenditure (Gross property, plant and equipment plus other fixed assets expenditure) to total assets.	Compustat
CAPEX2	Other fixed assets expenditure (e.g. Patents acquired from other firms / acquisitions) to total assets	Compustat
R&D expense	Research and Development expense to total assets	Compustat
Fixed intangible	Fixed intangible assets to total assets	Compustat
Financing measures:		
Leverage	Book leverage (short-term debt plus long-term debt) to total assets	Compustat
	Market leverage(Total Debt divided by the (Equity book value + Equity Market value)	Compustat
Independent variables/ Executives compensation (for the respective financial year)		
Salary (SAL)	Total of executives salary (used as control variable for risk aversion) divided by total compensation.	*Annual report*
Cash bonus (CashB)	Total annual cash bonus of executives scaled by total compensation	*Annual report*
Stock options (ESO)	Total share options value (using Black and Scholes, 1973 – per share options is estimated using their method then multiplied by the number of stock options issued to executives). Share options value divided by total compensation.	*Annual report*
Performance stock (PS)	Sum of face value of performance share awards (e.g. stock awarded multiplied by stock price) scaled by total compensation.	*Annual report*
Deferred stock (DS)	Total Face value: deferred stock, deferred annual bonus awards, short-term deferred (e.g. stock awarded multiplied by stock price).	*Annual report*
LTIPs	Total value: performance stock plus deferred stock scaled by total compensation.	*Annual report*
Total compensation	Sum value: salary, cash bonus, stock options value, LTIPs	*Annual report*

Control variables / Firm characteristics		
Firm size	Natural log of total sales as a proxy	*Compustat*
Market-to-book	Total assets – book equity + market equity / total assets	*Compustat*
Tangibility	Net property, plant and equipment / total assets	*Compustat*
Cash flow	Defined as free cash flow scaled by total assets	*Compustat*
Sales growth	Defined as log of the ratio of sales in the current year to the sales in the previous year.	*Compustat*
Stock return	Defined as annual stock return over the fiscal year.	*Bloomberg*
Stock volatility	Standard deviation of daily stock returns (log of stock returns variance)	*Bloomberg*
Return on Assets	EBITDA / Total assets	*Compustat* *Compustat*
Dividend pay-out	An indicator variable of 1 otherwise 0 if firm's makes cash dividend pay-out to shareholders	*Annual report*
Altman's Z-score	[3.3 (EBIT / Total Assets) + 1.0 (Sales / Total Assets) + 1.4 (Retained Profits / Total Assets) + 1.2 (Working Capital / Total Assets)]	*Compustat*
Monitoring mechanisms		
Large Own	Percentage of shares held by large shareholders with at least 3% of the total firm shareholdings	*Annual report*
Non-executives own (%)	Percentage of shares held by non-executives' directors divided by the firm's total common shareholdings.	*Annual report*

Executives Characteristics		
Executives own. (%)	Total annual shareholdings of the three executives (CEO, CFO and Chief operating officer) divided by the firm's total common shareholdings.	*Annual report*
CEOs age	Row values of chief executive officer (CEO) Age - CEO's age)	*Annual report*
CFOs age	Row values of chief financial officer CFO Age - CFO's age	*Annual report*
Executive Average age	Average age of CEO's and CFO's age	*Annual report*
Year effect	Dummies for the years 2006 to 2015 inclusive.	*Compustat*
Industry effect	Dummies for each of the eight main industries.	*Compustat*