Managerial compensation and fixed intangible assets investment: the role of managerial ownership and firm characteristics

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Abstract

Purpose: This study examines how cash and stock bonus compensations influence top executives to allocate a firm's resources to fixed intangible assets investment and the extent to which this relationship is conditional on executives' ownership, firm growth, internal cash flow and leverage.

Design/method/approach: Using data from 213 non-financial and non-utility UK FTSE 350 firms for the period 2007-2015, generating a total of 1,748 firm-year observations, panel econometric methods are employed to test our model.

Findings: We observe that executives' cash bonus compensation positively impacts fixed intangible assets investment. However, executives' stock bonus compensation has a negative and significant influence on fixed intangible assets. We further observe that executives either cash bonus or stock bonus crucially invest more in fixed intangible assets when the firm has a growth potential. Also, both cash bonus and stock bonus executives in firms with lower internal cash flow spend less on fixed intangible assets. Similar results are also observed for those stock bonus-motivated executives with an increase in fixed intangible assets for low leverage firms but a decrease for high leverage ones.

Originality/value: While this paper builds on the classic Q theory of investment literature, it is the first – to the best of our knowledge – to explore how cash and stock bonus compensations influence top executives to allocate a firm's resources to fixed intangible assets investment and the extent to which this relationship is conditional on executives' ownership, firm growth, internal cash flow and leverage.

Keywords: Managerial compensation, managerial ownership, intangible assets, UK

1. Introduction

In modern corporations, the board of directors, on behalf of shareholders, appoints top executives to manage daily activities of the firm. To safeguard shareholders' value-maximisation interests, the board designs compensation in a way that aligns the interests of executives with those of shareholders (e.g., Balafas and Florackis, 2014; Kaplan and Rauh, 2010; Jensen and Meckling, 1976). Through optimal compensation policy, shareholders (via the board) may influence executives to select risky but positive net present value (NPV) activities. That is, with efficient compensation design, executives may be motivated to increase firm value by selecting appropriate investment and financial policies (Nguyen, 2018; Chen *et al*., 2017; Kini and Williams, 2012; Coles *et al*., 2006). In other words, shareholders can use a combination of compensation incentives (i.e., cash-based bonuses – to encourage risk-avoiding incentive – and stock-based bonuses – to encourage risk-taking incentive) to induce executives' selection of value-critical decisions, particularly those derived from investment and financing policy which determine the probability distribution of firm value (i.e., cash flow and stock returns). For example, shareholders of firms with high growth opportunities may stand to benefit if risk-averse executives can be motivated to embark on value-enhancing risky projects (Guay, 1999). Supporting this view, prior scholarly works have shown how managerial compensation affects investment (i.e., capital expenditure, acquisition activities, research and development) and financial leverage decisions (see Nguyen, 2018; Chen *et al*., 2017; Croci and Petzmas, 2015; Kini and Williams, 2012; Chava and Purnandam, 2010; Xue, 2007; Coles *et al*., 2006), with no material evidence on fixed intangible assets investment. In fact, given the economic importance of fixed intangible assets activity at the national level (Pyo *et al.*, 2012; Borgo *et al.*, 2013; OECD, 2019) and the rate of such investment outperforming physical capital expenditure in this current knowledge-based economy (Lev and Gu, 2016), it becomes an important empirical exercise to find out how shareholders use compensation incentives to induce executives to undertake such growth expansion strategy.

Of course, literature on investment risk-classification suggests that capital expenditure and acquisition activities are less risky compared to research & development (see e.g., May, 1995; Bhagat and Welch, 1995; Kothari *et al*., 2001). On this reasoning, empirical evidence shows that executive stock-based bonus (risk-taking incentive) induces more research & development (i.e., high-risk activity) but less capital expenditure (i.e., low risk activity) while cash-based bonus (risk-

avoiding incentive) encourages more capital expenditure and less research & development (Kini and Williams, 2012; Xue, 2007; Coles *et al*., 2006). Indeed, despite the growing interest in managerial compensation, our understanding on the real implications of the structure of managerial compensation on value-critical investment decisions is far from complete. Thus, in this study, we look at how executives' cash bonus compensation and executives' stock bonus compensation influence top executives to allocate a firm's resources into fixed intangible assets investment. More so, we further seek to understand the extent to which the executives' bonus compensation–fixed intangible assets relation is conditional on executives' ownership, firm growth, internal cash flow and leverage. We perform our analyses by using a panel data of 213 non-financial and non-utility UK FTSE 350 firms for the sample period 2007-2015.

By way of a preview, the evidence obtained in this study shows that executives' cash bonus compensation positively impacts fixed intangible assets investment. This suggests that executives with risk-avoiding incentives may prefer to increase fixed intangible assets activity. This supports the assumption that, because fixed intangible assets are often capitalised in the accounting books (Xue, 2007) and can be used for collateral purposes (Lim *et al*., 2020), risk-averse and utility-maximising executives with incentives heavily weighted on cash bonuses are motivated to invest more in such activity. However, our analysis reveals that executives' stock bonus compensation has a negative and significant influence on fixed intangible assets, which suggests that executives with risk-taking incentives may prefer to spend less on fixed intangible assets investment. Also, we find that both cash bonus and stock bonus executives with higher ownership stakes undertake lower fixed intangible assets spending. We further observe that executives with cash bonus and stock bonus crucially invest more in fixed intangible assets when the firm has a growth potential. This result adds to the evidence that growth-potential firms invest more in fixed intangible assets (Peters and Taylor, 2017). We contend that growth-potential firms use compensation packages to induce managerial investment decisions into fixed intangible assets. Also, we observe that both cash bonus and stock bonus executives in firms with lower internal cash flow spend less on fixed intangible assets. On leverage, our findings show that cash bonus executives in low leverage firms spend more on fixed intangible assets while those in high leverage ones decrease spending in such activity. Similar results are also observed for those stock bonus-motivated executives, with an increase in fixed intangible assets for low leverage firms but a decrease for high leverage ones. This suggests that an executive's incentive to spend more on fixed intangible assets decreases

when the firm has a high debt level. We perform several checks to ascertain the robustness of our results. First, we use both the lagged and residual values of bonus compensation to help minimise the endogeneity problem. Again, to further address the issue of endogeneity and reverse causality, we estimate a simultaneous equations model by using a three-stage least squares (3SLS) technique. Overall, our results remain robust to all these alternative specifications.

We make several contributions to the literature in the following ways. First, we contribute to the literature on corporate investment (e.g., Danso *et al*., 2019; Peters and Taylor, 2017; Dang, 2010) and studies that examine the executive compensation-corporate policy nexus (e.g., Chu *et al*., 2020; Nguyen, 2018; Chen *et al*., 2017; Croci and Petmezas, 2015; Kini and Williams, 2012; Coles *et al*., 2006). Primarily, while this paper adds to the executive bonus compensation literature, it is the first – to the best of our knowledge – to examine how executive bonus compensation induces fixed intangible assets investment and the extent to which executive ownership, firm growth and financial policy matter in this relationship using the UK FTSE 350 firms. Our second contribution stems from the extent to which executive ownership affects the bonus compensation-fixed intangible assets relationship. Here, we demonstrate how cash bonus and stock bonus incentivised executives with higher ownership invest in fixed intangible assets activity. Our third contribution emanates from the role of firm-level characteristics in explaining the bonus compensation-fixed intangible assets linkage. Specifically, we demonstrate that firm growth, cash flow and financial leverage significantly moderate the bonus compensation-fixed intangible assets relation.

The remainder of the article is structured along these lines: section 2 reviews related literature. Section 3 considers data and empirical methods. Section 4 presents and discusses results, and, finally, section 5 concludes.

2.0 Prior literature and hypotheses

2.1. Executive bonus compensation and fixed intangible assets

In the modern corporate set up, the board of directors appoints top executives (management). In an attempt to realise shareholders' expectations, executives make risky policy decisions to achieve the desired results. But, because executives are known to be self-interested and risk-averse (see Xue, 2007; Shleifer and Vishny, 1989; Fama, 1980), they are likely to adopt strategies that suit

their interests. Given that the executives are inherently self-interested and risk-averse, such behavioural imbalances may cause them to select corporate policies including investment that suit their risk preference to the detriment of shareholders. Thus, the resulting risk-related incentive problem of executives may have implications for optimal investment and financing decisions and the ultimate corporate value. For instance, risk-averse and utility-maximising executives may sub-optimally invest in risky intangible activities (i.e., research and development, innovations) because such activity exacerbates the firm's idiosyncratic risk as well as their personal and economic risk exposures (Bhagat and Welch, 1995; Jensen and Meckling, 1976). Anticipating this, the board of directors may efficiently design compensation in a way that it can influence executives' risk appetite or preference to make appropriate investment and financing decisions. In line with this, recent evidence suggests that, compared to cash-based compensation, stock-based compensation is more effective in reducing executives' risk-related incentive problem (Adu-Ameyaw *et al*., 2021; Chen *et al*., 2017; Kini and Williams, 2012; Xue, 2007). More specifically, Xue (2007) shows that, while stock bonus-motivated executives invest more (less) in research & development (externally acquired intangible assets), cash bonus-motivated ones spend more (less) on externally acquired intangible assets (research & development). Chen *et al*. (2017) share similar sentiments when they find an increasing (decreasing) relationship between stock compensation (cash bonus) and research & development. Concentrating on stock-based compensation, Kini and Williams (2012), Hayes *et al*. (2012) and Coles *et al*. (2006) find that executives with stock compensation increase research & development but decrease capital expenditure activities. Additionally, while Nguyen (2018) shows that stock options compensation induces more innovative activities, others including Croci and Petmezas (2015) and Guay (1999) suggest that the convexity feature of stock options (vega) induces managers to increase expenditure on acquisitions activity. Still on a risk-motivated argument, others also contend that executives' compensation influences the firm's leverage levels (e.g., Adu-Ameyaw *et al*., 2021; Coles *et al*., 2006). For instance, Adu-Ameyaw *et al*. (2021) show that stock-motivated executives may increase borrowings but those with a cash bonus decrease the borrowing ratio. Similarly, Kabir *et al*. (2013) broaden the discussion after finding that CEOs' pension benefit and cash bonus compensation decrease bond yield spread while stock options increase cost of debt. Cassell *et al*. (2012) also observe that CEOs with more inside debt compensation (defined as pension benefits and restricted incentives) display lower levels of risk-seeking behaviour, i.e., embark more on investment and financial policies that are less risky.

In a related manner, other prior research looks at the determinants of executive compensation. For instance, Ryan and Wiggins (2001) argue that shareholders of firms with high growth opportunities may use more stock-based and less cash-based compensation to reward executives to influence them to make efficient investment decisions. This outcome is further echoed in the work of Humphery-Jenner *et al*. (2016), which posits that shareholders of growth-potential firms use more stock-based bonus compensation to exploit executive overconfidence incentives. In the same vein, Core *et al*. (1999) also observe similar finding of an increasing relationship between firm growth opportunities and executive compensation. The evidence presented shows that the nature of executive compensation components poses different risk-related incentives to executives and this in turn affects how they make corporate decisions. Primarily, the literature on the risk-motivated story is limited to investment activities (i.e., capital expenditure, acquisition projects, and research & development) and financial policies (e.g., leverage, cash holdings) with no literature on how executive compensation affects fixed intangible assets activity. However, a few exceptions exist with some direct evidence on the determinants of fixed intangible assets investment (e.g., Peters and Taylor, 2017; Arrighetti *et al.*, 2014; Eisfeldt and Papanikolaou, 2013). For instance, Peters and Taylor (2017) show that high growth firms invest more in identifiable (fixed) intangible assets investment while Lim *et al*. (2020) observe that identifiable intangible assets-intensive firms may use more debt financing. Moreover, given the increasing economic importance of fixed intangible assets at the national level, i.e., improving both economic growth and labour productivity growth (Pyo *et al.*, 2012; Borgo *et al.*, 2013; OECD, 2019), and the rate of fixed intangible assets investment outperforming physical capital investment in this knowledge-based economy (Lev and Gu, 2016), it is plausible to examine if indeed shareholders use compensation packages to induce top executives to undertake such expansion strategy. Additionally, the literature on investment-risk classifications posits different risk profiles for different investment types (e.g., Kothari *et al.*, 2001; Bhagat and Welch, 1995). For instance, research & development is seen to be riskier than capital expenditure, externally acquired intangible assets, and other acquisition activities (see Xue, 2007; Kothari *et al.*, 2001; May 1995; Bhagat and Welch, 1995). Others have also noted that the nature of compensation component (cash bonus, stock bonus) possesses different risk-related incentives to executives (Adu-Ameyaw *et al.*, 2021; Chen *et al*., 2017; Croci and Petmezas, 2015; Kini and Williams, 2012; Xue, 2007; Coles *et al*., 2006). More specifically, under the principal-agent framework, Coles *et al. (2006)* report a decreasing relationship between stock bonus and

capital expenditure. Xue (2007) also finds that cash bonus incentives induce more spending on externally acquired intangible assets but those with stock bonus tend to lower such investment activity. The authors argue that because externally acquired intangible assets are capital intensive projects and inherently have low idiosyncratic risk compared to research & development, cash motivated executives may prefer to spend more on such activity as opposed to stock-motivated ones. Moreover, confirming the capital-intensive nature of acquired intangible assets, Lim *et al.* (2020) show that debt markets tend to support firms with more identifiable intangible assets. Accordingly, the capitalisation of acquired intangible assets expenditure may have no direct negative effect on the firm's accounting profit upon which cash bonus compensation is measured. That is, acquired intangible assets have a low risk profile and their direct effect on accounting-based performance measure (profits) is minimal. These characteristics will make a risk-averse and utility maximizing executive whose compensation is heavily weighted on cash-based (i.e., risk-avoiding incentives) to invest more in such activity compared to those with stock-based bonus (risk-taking incentives). That is, we hypothesize that the performance measures (i.e., accounting profit, stock price return) in the executives' compensation packages (i.e., cash bonus, stock bonus) will induce their selection of the acquired (fixed) intangible assets activity. Specifically, we state our first hypothesis as:

H1: Executives with cash bonus (stock bonus) are likely to spend more (less) on fixed intangible assets investment.

2.2. Executive bonus compensation and fixed intangible assets – the role of executive ownership

One key idea is that, through compensation, executives are induced to increase firm value by selecting a value-maximising policy including fixed intangible assets investment (e.g., Xue, 2007; Coles *et al*., 2006). Thus, shareholders' and executives' interests are properly aligned through the compensation scheme. It is argued that executives with larger ownership stakes are likely to be entrenched. These entrenched executives can easily influence the board for higher pay packages (Cheung *et al*., 2005; Weisbach, 2007), and such an inefficient pay design may make it less likely for them to pursue investment policies that suit owners' interests (Gormley and Matsa, 2016; Brick, Palmon and Wald, 2012). For example, Gormley and Matsa (2016) show executives'

incentive to undertake decisions that safeguard their interests when they hold large stakes in the firm, and one way is to invest more in less risky external fixed intangible assets activity. Further studies suggest that, in firms where executives have large stakes, shareholders may use fewer compensation packages (i.e., cash bonus, stock bonus) to align their interests with those executives (Hartzell and Starks, 2003; Ryan and Wiggins, 2001). Given that executive ownership has implication on bonuses design, we expect that ownership levels will modify the effect of cash bonus (stock bonus) on fixed intangible assets activity. In line with this, we formulate our second hypothesis as:

H2: Cash bonus (stock bonus) increasing (decreasing) relationship with fixed intangible assets is likely to be moderated by the executive ownership levels.

2.3. Executive bonus compensation and fixed intangible assets – the role of growth opportunity

The literature presented above suggests that executives' bonus compensation impacts fixed intangible assets investment. However, empirical evidence shows that the boards of directors of firms with high growth potentials may use appropriate compensation incentives to influence managers to embark on optimal investment activities (Ryan and Wiggins, 2001; Guay, 1999). For instance, extant studies (see e.g., Ryan and Wiggins 2001; Core et al., 1999) contend that high growth opportunity firms may use more stock-based incentives but fewer cash-based incentives to incentivise executives to invest in risky investment activities (e.g., research and development). Peters and Taylor (2017) also show that high growth firms invest more in identifiable (fixed) intangible assets investment. Thus, given that cash bonus (stock bonus) induces more (less) fixed intangible assets activity, we expect that a firm with growth opportunity in fixed intangible assets may efficiently use more (less) cash bonus (stock bonus) to influence managerial fixed intangible assets decision. Based on this, we state our third hypothesis as:

H3: The increasing (decreasing) relationship between cash bonus (stock bonus) and fixed intangible assets is likely to be accentuated for growth opportunity firms.

2.4. Executive bonus compensation and fixed intangible assets – the role of internal cash flow

As shown earlier, executive compensation influences managerial investment decisions relating to fixed intangible assets activity. The literature further indicates that risk-averse and utility maximizing executives may have an incentive to underinvest in risky investment activities (i.e., research and development) particularly if the firm's internal cash is inadequate (Makadok, 2003; Myers and Majluf, 1984). Thus, intangibles (i.e., research and development, innovations) are seen as risky and often have a high information asymmetry problem (Borisova and Brown, 2013; Loumioti, 2012; Guariglia, 2008; Xue, 2007), making such activities more susceptible to facing underinvestment if internal cash flow is insufficient. In contrast, firms with greater cash balances are more likely to experience greater agency problems, i.e., overinvestment (Jensen, 1986; Stulz, 1990), which compensation incentives can mitigate (Garvey, 1997). More specifically, Core and Guay (1999) find that cash-constrained firms may prefer to use stock bonus as substitutes for cash bonus compensation. This clearly shows that a firm's cash flow levels are likely to affect how the boards design compensation packages and its ultimate effect on fixed intangible assets activity. That is, shareholders of high (low) cash flow firms are likely to use more (less) cash bonus but those firms may use less (more) stock bonus to incentivise executives. With this, we further hypothesize that the sensitivity of fixed intangible assets investment to executive bonus compensation is likely to be influenced by the firm's internal cash flow. We therefore state our fourth hypothesis below:

H4: Firm's internal cash flow levels will moderate the increasing (decreasing) relationship between cash bonus (stock bonus) and fixed intangible assets investment.

2.5. Executive bonus compensation and fixed intangible assets – the role of leverage

Moreover, studies have shown that, in firms where both managers' and shareholders' interests are aligned, managers may use more debt-financing options to the detriment of bondholders, i.e., risk-shifting incentive problem (e.g., see John and John, 1993). Such interests' alignment (via compensation incentives) causes managers to use more debt to finance projects (see Adu-Ameyaw *et al*., 2021; Coles *et al*., 2006). Also, financial leverage is assumed to mitigate manager-

shareholder conflicts of interest (Jensen, 1986). For instance, Grossman and Hart (1982) and Jensen (1986) argue that managers of high debt firms may be more disciplined and that they may select appropriate policies that suit shareholders' interests. Therefore, if a higher debt level mitigates manager-shareholder conflicts of interest, then shareholders' reliance on compensation incentives to induce managerial investment decisions may not be necessary or lessened. Furthermore, while others suggest that executives' cash bonus (stock bonus) incentives induce lower (higher) borrowing (see Adu-Ameyaw *et al*., 2021; Coles et al., 2006), identifiable (fixed) intangible asset-intensive firms are seen to gain the support of the debt markets (Lim *et al*., 2020). With this, it is plausible that the firm's leverage levels are likely to affect bonus compensation incentives and fixed intangible assets investment. Our final hypothesis is stated below:

H5: The increasing (decreasing) relationship between cash bonus (stock bonus) and fixed intangible assets is likely to be moderated by the firm's debt levels.

3. Method

3.1. Data and variables

The data for this study was obtained from multiple sources. The financial data for the selected firms was obtained from the Amadeus database supplied by Bureau van Dijk, which covers both private and public UK firms. The database's (Amadeus) unique coverage of financial information allows us to select the UK FTSE 350 firms. The executives' compensation and ownership data were manually collected from the firms' annual reports. We then match both the annual financial and compensation and ownership data for 213 non-financial and non-utility UK FTSE 350 firms for the period 2007-2015. In all, a total number of 1,784 unbalanced firm-year observations are used in the regression analyses. All our variables are chosen in line with the extant literature. The dependent variable is fixed intangible assets investment (*FIN*) and it is measured as the ratio of fixed intangible assets to total assets book value (Lim *et al.*, 2020; Peters and Taylor, 2017). Two independent variables are tested in this study. These are cash bonus compensation (*CB*) and stock bonus compensation (*SB*). Consistent with prior work (e.g., Adu-Ameyaw *et al., 2021*; Kabir *et al*., 2013), we measure the cash bonus compensation (*CB*) variable

as annual cash bonus scaled by total sales, whilst the stock bonus compensation *(SB*) variable is measured as the sum values of performance stock and deferred stock scaled by total sales. Also, we account for a number of firm-level controls that are likely to drive an investment activity. These control variables are growth opportunity (*GR*), cash flow (*CF*), firm size (*SZ*), firm performance (*ROA*), annual stock returns (*STR*), cash holding (*CH*), leverage (*LEV*), net working capital (*NWC*), non-executive ownership (*NEO*), large ownership (*LO*), executive ownership (*EO*) and salary (*SAL*) (Nguyen, 2018; Chen *et al.*, 2017; Coles *et al.*, 2006*)*. All variables are winsorised at 1% and 99% levels on either tail to mitigate the effect of outliers. A summary of all the variables used, together with their descriptions, is presented in Table I.

[Table I about here]

3.2. Model specification

Our empirical model to test the relationship between executive bonus compensation and fixed intangible assets investment is stated below

$$FIN_{it} = \alpha + \beta_1 CB_{it-1} + \beta_2 SB_{it-1} + \beta_3 X_{it} + \theta_i + \delta_t + \mu_{it} \quad \text{..... (1)}$$

Specifically, we used a panel data approach and applied fixed effects (FE) regression estimator to the baseline model. Our panel fixed effect choice is influenced by the fact the firm fixed effect could be correlated with the key explanatory variables (*CB* and *SB)*, thereby inducing biased and inconsistent estimates when OLS technique is employed (Wooldridge, 2009, p. 465). This is consistent with prior research (Coles *et al*., 2006; Fosu *et al*., 2016).

In equation (1), *FIN* is the fixed intangible assets investment, while *CB* and *SB* are lagged values of executives' cash bonus compensation and stock bonus compensation, X_{it} (control variables) respectively (Coles et al., 2006), and θ_i , δ_t *and* μ_{it} are composite error term comprising of firm fixed effect and a component assumed to be independent and identically distributed. All variables are defined in Table I. For robustness checks, we also use residual values of bonus compensation and a simultaneous equations modelling (using 3SLS estimator) respectively, to account for possible endogeneity issues (Adu-Ameyaw *et al*., 2021; Coles *et al*., 2006). This further analysis is important because there are studies that suggest that investment also drives a firm's managerial compensation policy (Ryan and Wiggins, 2001; Coles et al., 2006). For instance, it is suggested

that shareholders of capital expenditure-intensive firms use more stock-based compensation to reward executives. Also, while Peters and Taylor (2017) empirically show that high-growth firms invest more in identifiable (fixed) intangible assets investment, other scholars have shown that high-growth firms often tend to use more stock bonus and less cash bonus compensation to reward managers (Guay, 1999; Ryan and Wiggins, 2001). Given this intuitive argument, it is a fact that our assumed direct causation of executives' bonus compensation on fixed intangible assets activity is more complicated than we think. Off course, even though we use lagged values of bonus compensation in our fixed effect - FE estimation (equation 1), it is still possible that other uncontrolled factors might have indirectly caused the reported linkage among executive's bonus compensation and fixed intangible assets activity. With this, we use residual value of bonus compensation (*residualCB, residualSB*) and simultaneous equation model- using 3SLS technique to further analyse our data to see if indeed our already reported results are robust to these specifications. We set up our residual model as follows in equations (2i) and (2ii), and regress lagged cash bonus (CB_{it}) and/or stock bonus (SB_{it}) on their determinants (i.e., controls as defined in Table I) to get predicted values and then subtract these values from the raw cash bonus (*CB*) and stock bonus (*SB*) to obtain residual values for each bonus component, which is then included in the *FIN* equation (i.e., 2iii). Thus, we replace the *CB* and *SB* values with the residual values in the *INT* model.

Residual value of bonus compensation approach

$$CB_{i,t-1} = \alpha + \beta FIN_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(2i)}$$

$$SB_{i,t-1} = \alpha + \beta FIN_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(2ii)}$$

$$FIN_{i,t} = \alpha residualCB_{t-1} + \alpha residualSB_{t-1} + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(2iii)}$$

Also, our simultaneous equations model is presented as follows:

$$CB_{i,t} = \alpha + \beta FIN_{i,t} + \beta IV_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(3i)}$$

$$SB_{i,t} = \alpha + \beta FIN_{i,t} + \beta IV_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(3ii)}$$

$$FIN_{i,t} = \alpha CB_t + \alpha SB_t + \beta X_{i,t} + \varepsilon_{i,t} \quad \text{(3iii)}$$

In the first stage, equations (3i) and (3ii), we include fixed intangible assets *(FIN*), instrumental

variable (*IV)* for each bonus model (CB_{it} – *industry-median cash bonus* – and SB_{it} – industry-median stock bonus) together with other controls. Also, we simultaneously account for each bonus component in the respective first-stage equations (Adu-Ameyaw *et al., 2021*; Coles *et al.,* 2006) where each bonus component CB_{it} and SB_{it} is regressed on the determinants to obtain the predicted values for each bonus component, which are then included in the *INT* equation (3iii).

4. Results and discussion

4.1. Summary statistics and bivariate correlations

In Table II, we present the summary statistics of all the variables used in this study. The average value of fixed intangible assets investment (*FIN*) is 0.26 and it has a standard deviation of 0.21. This variable has a minimum value of 0.00 and a maximum value of 0.88, signifying a fair degree of heterogeneity. Also, the average (standard deviation) values of cash bonus (*CB*) and stock bonus (*SB*) are 0.59 (21.14) and 1.57 (54.54) respectively, showing some degree of variability. The mean values of governance variables, non-executive ownership (NEO), large ownership (*LO*) and executive ownership (*EO*), are 0.02, 39.82 and 0.05, and other controls, growth opportunity (*GR*), cash flow (*CF*), leverage (*LEV*) and salary (*SAL*), are 0.03, 0.14, 0.29 and 1.13.

In Table III, we present the correlation among the variables. Evidence from this table indicates that there is no issue of multicollinearity with any of the main causal variables used in this study. In general, the evidence obtained from the correlation matrix, as well as the descriptive statistics, indicates that our sample does not seem to suffer from any serious issues such as multicollinearity, limited variation or heterogeneity.

[Tables II & III about here]

4.2. The effect of executive bonus compensation on fixed intangible assets investment

In Table IV, we present the empirical results of our baseline regression model of the effect of cash bonus (*CB*) and stock bonus (*SB*) compensations on fixed intangible assets investment (*FIN*). The model is estimated using a Fixed Effect (FE) estimator and our main results are reported in the fully specified models, 2 & 4, while 5 includes both *CB* and *SB* in the regression. Specifically, Model 2 shows that the relationship between cash bonus compensation (*CB*) and fixed intangible

assets investment (F*IN*) is positive and statistically significant at the 1% level. The coefficient estimate for this variable is 0.783 and has a t-statistic of 3.36, suggesting that an increase in cash bonus compensation (*CB*) is associated with higher investment in fixed intangible assets. This finding is consistent with the risk-motivated argument put forward by Xue (2007). It implies that, because fixed intangible assets investment is not expensed in the accounting books (as in the case of research & development) and it is often externally acquired and capitalised (Lim *et al*., 2020; Xue, 2007), risk-averse and utility-maximising managers with their compensation heavily weighted on an accounting-based earnings performance measure are likely to favour such activity when they receive a cash bonus incentive. Thus, based on the risk-related argument, fixed intangible asset activity is inherently less risky compared to research & development and executives with more cash bonus compensation (risk-avoiding incentive) may prefer to invest more in fixed intangible assets. This finding supports our cash bonus hypothesis (H1). However, it is worth pointing out that the low statistical significance reported on *CB* in Model 1 suggests that cash bonus executives consider other economic factors (e.g., growth opportunities) when investing in fixed intangible assets. With regard to stock bonus compensation (*SB*) in Model 4 (fully specified), the coefficient estimate is negative and statistically significant. Specifically, the coefficient is -1.042 (t-statistic -4.65), implying that higher stock bonus (*SB*) compensation leads to lower fixed intangible assets investment which is consistent with our stock bonus hypothesis (H1). This is not surprising because, if fixed intangible assets investment has a low risk profile, then executives with stock bonus compensation (risk-taking incentive) may feel less motivated to increase such investment activity. Again, in Model 5, we include both cash bonus (*CB*) and stock bonus (*SB*) compensation and our results further collaborate what is already reported in models 2 & 4. On the control variables, salary (*SAL*) is negative and significant, suggesting that executives with more salary may lower fixed intangible assets. Cash flow (*CF*), cash holding (*CH*) and net working capital (*NWC*) are negative and significant whilst size (*SZ*), return on assets (*ROA*), stock return (*STR*) and non-executive ownership (*NEO*) are positive and significant.

[Table IV about here]

4.3. Robustness checks

Our reported results in Table V show that both cash bonus (*CB*) and stock bonus (*SB*) compensations differently affect fixed intangible assets investment (*FIN).* Thus, in our analysis so far, we use lagged values of bonus compensation (*CB, SB*) to reduce reverse causality. This section further tests if indeed our results are robust to different econometric specifications, i.e., a residual bonus compensation (incentives) value approach and simultaneous equations model (using a three-stage least squares estimator). First, we re-estimate our model using the residual incentives values. In this method, the lagged value of each compensation bonus variable (i.e., *CB* and *SB*) is first regressed on the determinants (variables are defined in Table I) to obtain the predicted values of cash bonus (*CB*) and stock bonus (*SB*) compensation values, which are then deducted from the actual value to obtain the residual value to be included in the fixed intangible assets (F*IN*) model, like Coles *et al*. (2006). As shown, the residual cash bonus (residual *CB*) sign is still positive, while residual stock bonus compensation (residual *SB)* shows a negative sign, and both results are similar to our hypothesis (H1) results.

In fact, so far, despite our attempt to deal with the endogeneity concern by employing different specifications, the issue of direct causation is still a major issue, as we note there are hypotheses that suggest intangible investment drives a firm's compensation policy (Kini and Williams, 2012; Coles *et al*., 2006; Ryan and Wiggins, 2001). For instance, it is argued that shareholders of a high-growth firm may structure executives' compensation to include more stock bonuses and fewer cash bonuses to encourage executives to engage in more risk-taking activities (Guay, 1999). Again, high-growth firms invest more in identifiable (fixed) intangible assets (Peters and Taylor, 2017), while firms with high cash reserves are likely to compensate executives with more cash bonuses and fewer stock-based bonuses (Core and Guay, 1999). Clearly, these intuitive arguments suggest a more complex relation and that there is no absolute direct causation of executives' compensation on fixed intangible assets investment. To further account for the possibility that fixed intangible assets can be a determinant of executive compensation, we estimate simultaneous equations models in which the jointly determined variables – fixed intangible assets, cash bonus and stock bonus compensations – are simultaneously estimated. In the simultaneous equations model, we first regress each compensation variable (i.e., *CB, SB*) on fixed intangible assets, instruments, and other determinants (defined in Table I) to obtain the predicted values of each bonus compensation

(*CB, SB*) which is then included in the second-stage equation (*FIN* model). Consistent with prior studies, we use contemporaneous values of the cash bonus and/or stock bonus compensation variable instead of lagged values (e.g., Coles *et al*., 2006; Kini and Williams, 2012). Again, the reported results in Table V (simultaneous equations model – 3SLS) show coefficient estimates for both independent variables, *CB* and *SB*, to be qualitatively similar to the hypothesis (H1) results in Table IV. Overall, the 3SLS estimator results suggest that our earlier findings are not plagued by endogeneity problems and that the main results reported in Table IV are robust to an alternative econometric specification.

[Table V about here]

4.4. Executive bonus compensation and fixed intangible assets – the role of executive ownership

Next, we examine whether executive ownership levels affect bonus compensation and fixed intangible assets linkage. To achieve this, we use the percentage of stock ownership held by executives (*EO*) (Adu-Ameyaw *et al*., 2021; Florackis and Ozkan, 2009). Specifically, executives with ownership in the 75th percentile are marked as high stock ownership (EO75), whilst those with ownership at the 25th percentile are marked as low stock ownership (EO25). Accordingly, we use a dummy variable, High (EO75), equal to one (1) for executive stock ownership in the 75th percentile and zero (0) otherwise; and another dummy variable, Low (EO25), equal to one (1) for those executives with ownership stake at the 25th percentile. We interact the dummies (EO75) and (EO25) with the independent variables (cash bonus – *CB x EO75, CB x EO25* – and stock bonus – *SB x EO75, SB x EO25*) and include the interaction terms in our baseline regression model. The results of this are presented in models 1 to 4 of Table VI. We find the coefficient of *CB_EO25* is positive but statistically insignificant, whilst in Model 2 the coefficient on *CB_ EO75* is negative, and it is both economically and statistically significant. This is consistent with our cash bonus hypothesis (H2) suggesting that as cash bonus-motivated executives ownership stakes reach higher level, their appetite for lower risk activity decreases thereby causing them to spend fewer of the firm's resources on fixed intangible assets activity. Another plausible explanation can be that as executive ownership stakes reach higher level, shareholders may use lesser cash bonus incentives to induce executives and this may ultimately lead to lower investment into fixed intangible assets. In models 3 & 4, the coefficient on *SB_ EO25* is positive and significant, implying that stock

bonus-motivated executives with smaller ownership stakes may prefer to increase fixed intangible assets. This is not surprising because at lower ownership level, stock bonus executives risk incentive motivation is likely to be low hence spending more on lower risk activity such as *FIN*. However, in Model 4 the estimate on *SB_ EO75* shows a negative sign, suggesting that those executives with larger ownership stakes may prefer to devote lower resources to fixed intangible assets activity which is inconsistent with the stock bonus hypothesis (H2). It can be explained that larger ownership executives with stock bonus may prefer investing in risky activity and that they see fixed intangible assets less risky, hence lower investment into such activity.

[Table VI about here]

4.5. Executive bonus compensation and fixed intangible assets – the role of growth opportunity

This section examines the interaction effect of growth opportunity and executive bonus compensation on fixed intangible assets investment. We use sales growth (*GR*) as our proxy for investment opportunity and it is measured as log of sales scaled by lagged sales to proxy for growth (e.g., Adu-Ameyaw *et al*., 2021; Peters and Taylor, 2017; Badertscher *et al*.,2013). Thus, we use *GR* firms at the 75th percentile are marked as high growth (GR75), whilst those at the 25th percentile are marked as low growth (GR25). We use a dummy variable, high growth (GR75), equal to one (1) for growth in the 75th percentile and zero (0) otherwise; and another dummy variable, Low (GR25), equal to one (1) for growth in the 25th percentile. We interact the dummies (GR75) and (GR25) with the independent variables (cash bonus – *CB x GR75, CB x GR25* – and stock bonus – *SB x GR75, SB x GR25*) and include the interaction terms in the model. Specifically, the results are presented in models 1 to 4 of Table VII. We find the coefficients of both *CB_GR25* and *CB_ GR75* to be positive and significant, implying that cash-motivated executives of growth-potential firms are likely to support more fixed intangible assets activity. More specifically, the positive estimate on *CB_GR25 (coefficient 1.690 t-statistics 1.88)* suggests that at low growth level, executives with cash bonus incentives may prefer to invest more in *FIN* activity. A reasonable explanation can be that at low growth level, shareholders may still use more cash bonus to reward executives, which ultimately influence them to spend more on low-risk project such as *FIN*. Also, the estimate on *CB_ GR75* is positive *(coefficient 3*.620 t-statistics 5.18) and statistically significant confirming our cash bonus hypothesis (H3). It can be observed that the coefficient

estimate for high growth firms shows a larger effect compared to low-growth ones for those cash bonus. Thus, at high growth level, cash bonus executives spending effects on fixed intangible assets is larger than low-growth ones. This signifies how growth levels influence cash bonus executives to allocate corporate resources to support *FIN* activity. Again, similar positive coefficient estimates are reported for *SB_GR25* and *SB_ GR75* in models 3 & 4. This finding suggests that ceteris paribus, executives of growth-potential firms with stock bonus compensation are likely to spend more on fixed intangible assets investment which is inconsistent with stock bonus hypothesis (H3). A possible explanation is that stock-incentivised executives are influenced to invest more in fixed intangible assets particularly when the firm's growth potentials are associated with fixed intangible activity. In short, our evidence adds a new dimension to the literature on bonus compensation – fixed intangible assets investment by stating that bonus-incentivised managers consider firm's growth potentials when allocating resources to fixed intangible assets investment.

[Table VII about here]

4.6. Executive bonus compensation and fixed intangible assets – the role of internal cash flow

In this section, we explore whether firm's internal cash flow affects bonus compensation – fixed intangible assets investment. Specifically, we measure cash flow (*CF*) as the ratio of cash flow to total assets (defined in Table I) (Coles *et al*., 2006). That is, firms with cash flow level in the 75th percentile are marked as high cash flow (CF75), whilst those at the 25th percentile are marked as low cash flow (CF25). Again, we use a dummy variable to represent high cash flow (CF75), equal to one (1) and zero (0) otherwise; and another dummy variable, low (CF25), equal to one (1) for those cash flow firms at the 25th percentile. We interact the dummies (CF75) and (CF25) with the independent variables (cash bonus – *CB x CF75, CB x CF25* – and stock bonus – *SB x CF75, SB x CF25*) and include them in our *FIN* model. The results are presented in models 1 to 4 of Table VIII. We find that the coefficient of *CB_CF25* (-1.673 t-statistics -4.89) is negative and significant but that of *CB_ CF75* is positive (coefficient 0.699 t-statistics 0.56) but insignificant. This implies that cash bonus executives in firms with a lower cash flow level may spend less on fixed intangible assets which is consistent with the view that cash-constrained firms are unlikely to use more cash bonus to influence executives to invest in fixed intangible assets. This partly supports cash bonus

hypothesis (H4). Also, we find the estimate on *CB_ CF75* to be positive but lacks statistical significance. That is, high cash flow firms are likely to reward executives with more cash bonus which in turn induce them to invest more in fixed intangible assets activity. However, the result should be interpretated with low statistical significance in mind. Also, the coefficient for *SB_CF25 (-2.150 t-statistics -6.80)* is negative and statistically significant, suggesting that stock bonus executives in cash-constrained firms decrease fixed intangible assets investment. This partly supports our stock bonus hypothesis (H4). Thus, cash-constrained firms may use more stock bonus to incentivise executives and this consequently leads to lower fixed intangible assets. However, the coefficient estimates for *SB_ CF75* is also negative but insignificant. Thus, at high cash flow level, stock bonus executives are likely to spend less on fixed intangible assets which is unsurprising given that high cash flow firms may use less stock bonus to affect executive's fixed intangible assets investment decision. One caveat of this result is that the coefficient estimate is statistically insignificant. In short, our findings show that both cash-incentivised and stock-incentivised managers in cash-constrained firms may prefer to invest less in fixed intangible assets projects.

[Table VIII about here]

4.7. Executive bonus compensation and fixed intangible assets – the role of leverage

Finally, we further hypothesize that effect of executive bonus compensation on fixed intangible assets may be affected by the firm's leverage level. To test this, we use the ratio of leverage to total assets as our proxy for the leverage (*LEV*) measure (see Adu-Ameyaw *et al*., 2021; Danso *et al*., 2019; Coles *et al*., 2006). We categorise the firm's leverage at the 75th percentile as high leverage (LEV75) and low (LEV25) at the 25th percentile and we use dummies to represent both high and low leverage: LEV75 is equal to one (1) and zero (0) otherwise and LEV25 is equal to one (1) and zero (0) otherwise. We interact these dummies with the independent variables – cash bonus (*CB* x *LEV25* and *CB* x *LEV75*) and stock bonus (*SB* x *LEV25* and *SB* x *LEV75*) – and then include them in our *FIN* regression model. The regression result is shown in models 1 to 4 of Table IX. Specifically, for cash bonus compensation (Models 1 & 2), we find the coefficient on *CB_LEV25* to be positive and significant but that of *CB_ LEV75* is negative and statistically significant. This implies that executives with cash bonus in a low leverage firm may prefer to

increase fixed intangible assets while those in high leverage ones may prefer to lower such investment. This supports our cash bonus hypothesis (H5). This is not surprising, given that, when a firm has a low leverage level, cash-motivated executives may have the financial flexibility to sponsor fixed intangible assets. That is, low leverage firms are likely to use more cash bonus to induce executives spending on fixed intangible assets. However, high leverage firms may use less cash bonus to reward executives, and this ultimately leads to lower allocation of resources into fixed intangible assets. Again, we find similar coefficient estimates for stock bonus – where *SB_ LEV25* is positive and *SB_ LEV75* shows a negative sign and both are statistically significant. That is, stock bonus executives in low leverage firms support more fixed intangible assets. However, at high leverage level, these executives lower fixed intangible assets. This result supports our stock bonus hypothesis (H5). Overall, our evidence shows that executives with both cash and stock bonuses pay considerable attention to the firm's leverage level when investing in fixed intangible assets.

[Table IX about here]

5. Conclusion

In this study, we provide empirical evidence of a strong causal relation among two important firm characteristics, the structure of executives' bonus compensation and fixed intangible assets investment decisions. We also examine the extent to which this relationship is conditional on executive ownership, firm growth, internal cash flow and leverage. Specifically, we observe that the executives' cash bonus compensation–fixed intangible assets investment relationship is positive and significant across all our models, while executives' stock bonus compensation shows a negative effect on fixed intangible assets. Significantly, the results are robust to all our chosen econometric specifications, including the simultaneous equations model estimate (using three-stage least squares – 3SLS), which accounts for the simultaneous determination of executives' bonus compensation and the fixed intangible assets activity. In terms of theoretical implications, our findings offer important support for the studies that concentrate on risk-related assumptions under the optimal compensation theory (e.g., Croci and Petmezas, 2015; Kini and Williams, 2012; Xue, 2007; Coles *et al*., 2006). In addition, our study offers a new dimension to the literature on investment risk-classification (Bhagat and Welch, 1995; May, 1995; Kothari *et al*., 2001) by

stating that corporate executives find fixed intangible assets activity less risky as compared to research & development. More so, we show that executive ownership and other firm characteristics such as growth opportunity, internal cash flow and financial leverage matter in the bonus compensation–fixed intangible assets investment relation. The practical relevance of our results is that firms with high growth opportunity in fixed intangible assets activity can use more cash bonus compensation (risk-avoiding incentive) to induce corporate executives to invest more in such activity This finding is particularly important given the increasing appetite of firms in this knowledge-based economy to create expansion through fixed intangible assets investment. That is, for firms to increase fixed intangible assets investment, this study suggests that executive cash bonus compensation cannot be ignored.

Notwithstanding these important findings, a few limitations are worth mentioning. The present study is based on a UK dataset (FTSE 350 firms). However, given the fact that UK firms have witnessed many corporate reforms regarding how managerial compensation should be structured (e.g., Greenbury Report, 1995; Conyon *et al*., 2000), it is plausible that the structure of UK managerial compensation schemes may differ from those of other developed and developing countries. Hence, future studies can offer further insight by extending our analysis to both emerging and developed economies.

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Table I: Description of variables

Dependent Variable	**Description**	**Literature**
Fixed intangible assets investment (*FIN*)	Fixed intangible assets scaled by total assets	Lim *et al.*, (2020); Peters and Taylor (2017).
Independent variable		
Cash bonus (*CB*)	Cash bonus compensation scaled by total sales	Kabir *et al*. (2013), Adu-Ameyaw *et al*. (2021)
Stock bonus (*SB*)	Stock bonus compensation scaled by total sales	Kabir *et al*. (2013), Adu-Ameyaw *et al*. (2021).
Control variables		
Growth (*GR*)	Log of $Sales_t$ scaled by lagged $Sales_{t-1}$	Lim *et al*., (2020),
Cash flow (*CF*)	Free cash flow scaled by total assets	Coles *et al.* (2006)
Firm size (SZ)	Natural logarithm of total sales	Coles *et al.* (2006)
Firm performance (*ROA*)	EBITDA scaled by total assets	Lartey *et al.* (2020), Coles *et al.* (2006), Firth *et al.*, (2006)
Annual stock return (*STR*)	Annual stock return	Coles *et al.* (2006)
Cash holdings (*CH*)	Cash and cash equivalents scaled by total assets	Lim *et al.*, (2020), Arslan *et al.*, (2009).
Leverage (*LEV*)	Long-term debt plus short-term debt scaled by total assets	Danso *et al.* (2019), Coles *et al.* (2006), Chava and Purnanandam, (2010)
Net working capital (*NWC*)	Net Working Capital – Cash Equivalents / Total Assets	Lewellen and Lewellen (2016)
Non-Executives' ownership (%) (*NEO*)	Total annual shareholdings of non-executive directors divided by the firm's total common shareholding	Mehran (1995)
Large ownership % (*LO*)	Total shareholdings of large owners (defined as ownership above 3%) scaled by the total number of common shareholdings	Ryan and Wiggins, (2001), Core *et al.* (1999)
Executives' ownership (%) (*EO*)	Total annual shareholdings of the three executives (CEO, CFO and Chief operating officer) divided by the firm's total common shareholdings	Ryan and Wiggins (2001), Core *et al.* (1999)
Salary (*SAL*)	Salary scaled by total sales	Kabir *et al.* (2013), Adu-Ameyaw *et al*. (2021).

The table presents the measures and description of each dependent and independent variable used in this paper

Table II: Descriptive statistics

	Mean	St. Dev.	Min.	Max.	25%	50%	75%	N
FIN	0.26	0.21	0.00	0.88	0.07	0.23	0.42	1503
CB	0.59	21.14	0.00	116.91	0.00	0.00	0.00	1748
SB	1.57	54.54	0.00	357.45	0.00	0.00	0.00	1748
GR	0.03	0.24	-2.84	5.54	-0.01	0.02	0.06	1660
CF	0.14	0.19	-3.91	2.86	0.09	0.13	0.19	1647
SZ	9.02	0.87	0.00	11.51	8.60	8.99	9.47	1675
ROA	0.10	0.19	-3.92	2.83	0.05	0.09	0.14	1712
STR	0.06	0.49	-5.46	2.85	-0.13	0.09	0.30	1675
CH	0.09	0.10	0.00	0.74	0.03	0.06	0.12	1669
LEV	0.29	0.22	0.00	2.71	0.14	0.25	0.38	1606
NWC	0.04	0.20	-0.84	0.88	-0.06	0.02	0.13	1683
NEO	0.02	0.11	0.00	3.51	0.00	0.00	0.00	1697
LO	39.82	18.94	3.00	97.80	25.34	38.17	52.22	1708
EO	0.05	0.22	0.00	6.06	0.00	0.00	0.01	1720
SAL	1.13	38.84	0.00	268.18	0.00	0.00	0.00	1748

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 2007 to 2015. The variable descriptions are provided in Table I above

Table III: Correlation matrix

	FIN	CB	SB	GR	CF	SZ	ROA	STR	CH	LEV	NWC	NEO	LO	EO	SAL
FIN	1.00														
CB	-0.08*	1.00													
SB	-0.09*	1.00*	1.00												
GR	0.01	-0.06	-0.05	1.00											
CF	-0.05	-0.13*	-0.04	0.04	1.00										
SZ	0.05	-0.17*	-0.18*	0.06	0.04	1.00									
ROA	-0.06	-0.01	-0.02	0.05	0.97*	0.03	1.00								
STR	0.04	0.03	0.03	0.04	0.22*	-0.02	0.24*	1.00							
CH	-0.11*	-0.02	0.00	-0.05	0.11*	-0.17*	0.11*	0.00	1.00						
LEV	-0.03	0.12*	0.12*	0.02	-0.37*	-0.28*	-0.39*	-0.11*	-0.17*	1.00					
NWC	-0.06	-0.04	-0.03	0.04	0.02	0.08*	0.05	0.00	-0.52*	-0.11*	1.00				
NEO	-0.10*	-0.00	-0.00	-0.00	-0.09*	-0.03	-0.09*	-0.02	0.06	0.00	-0.01	1.00			
LO	-0.15*	0.01	0.01	-0.00	0.02	-0.27*	-0.01	-0.03	0.16*	-0.02	-0.12*	0.21*	1.00		
EO	-0.14*	-0.00	-0.01	0.03	-0.05	-0.06	-0.06	0.04	0.03	0.00	-0.02	0.56*	0.29*	1.00	
SAL	-0.11*	1.00*	1.00*	-0.07*	-0.12*	-0.18*	-0.02	0.02	-0.02	0.12*	-0.03	-0.00	0.01	-0.01	1.00

This table presents the correlation matrix for the sample data. The sample and variable definitions are as described in Table I. * indicates significance at 1% level.

Table IV: Executive bonus compensation and fixed intangible assets investment

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	FIN	FIN	FIN	FIN	FIN
CB	0.130	0.783***			2.808***
	(1.18)	(3.36)			(9.31)
SB			-0.119**	-1.042***	-2.887***
			(2.14)	(-4.65)	(-9.89)
GR		0.0039		0.0670***	0.0359**
		(0.23)		(3.86)	(2.12)
CF		-0.201***		-0.187***	-0.188***
		(-4.47)		(-4.18)	(-4.38)
SZ		0.100***		0.0622***	0.0808***
		(5.61)		(3.50)	(4.72)
ROA		0.0924**		0.0850**	0.0940***
		(2.52)		(2.33)	(2.70)
STR		0.0057*		0.0039	0.0032
		(1.70)		(1.16)	(0.99)
CH		-0.752***		-0.765***	-0.889***
		(-13.06)		(-13.34)	(-15.75)
LEV		0.0153		0.0273	0.0098
		(0.70)		(1.26)	(0.47)
NWC		-0.278***		-0.298***	-0.398***
		(-6.92)		(-7.37)	(-9.93)
NEO		0.183**		0.159**	0.186***
		(2.43)		(2.13)	(2.60)
LO		-0.0002		-0.0001	-0.0002
		(-0.99)		(-0.42)	(-1.26)
EO		-0.0086		-0.0107	-0.0007
		(-0.20)		(-0.25)	(-0.02)
SAL		-0.701*		-0.449	1.908***
		(-1.71)		(-1.08)	(4.05)
_Cons	0.256***	-0.557***	0.257***	-0.214	-0.365*
	(57.90)	(-3.40)	(58.17)	(-1.31)	(-2.32)
Year Effects	YES	YES	YES	YES	YES
Industry Effects	NO	NO	NO	NO	NO
N	1318	1104	1318	1104	1104
R^2	0.011	0.278	0.014	0.286	0.348

This table shows the FE estimation results of the effects of cash bonus (CB) and stock bonus (SB) on fixed intangible assets investment (FIN). All variable definitions are described in Table I. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table V: Executive bonus compensation and fixed intangible assets investment

	Residual model	Simultaneous Equation Model using 3SLS		
	(Model 1)	**(2ND Stage)**	**(1ST Stage)**	**(1ST Stage)**
	FIN	**FIN**	**CB**	**SB**
Residual CB	2.522***			
	(8.12)			
Residual SB	-2.313***			
	(-7.62)			
CB		27.260***		1.059***
		(5.96)		(22.76)
SB		-11.401***	0.553***	
		(-6.06)	(5.47)	
GR	0.025*	-0.409***	0.024***	0.036***
	(1.67)	(-3.58)	(4.18)	(11.28)
CF	-0.194***	0.247	-0.008	-0.011
	(-4.40)	(1.46)	(-0.58)	(-1.29)
SZ	0.092***	-0.004	0.003	-0.005***
	(5.37)	(-0.23)	(1.47)	(-5.73)
ROA	0.105***	0.023	-0.005	0.002
	(2.94)	(0.14)	(-0.41)	(0.26)
STR	0.004	-0.014	0.001	-0.000
	(1.20)	(-0.87)	(0.42)	(-0.30)
CH	-0.858***	-0.770***	0.060***	-0.039***
	(-14.95)	(-6.72)	(3.39)	(-4.61)
LEV	0.005	-0.103**	0.005	0.008***
	(0.21)	(-1.96)	(1.19)	(3.24)
NWC	-0.367***	-0.248***	0.021***	-0.014***
	(-9.05)	(-4.94)	(2.91)	(-3.87)
NEO	0.192***	-0.402***	0.040**	-0.034***
	(2.65)	(-3.04)	(2.25)	(-3.84)
LO	-0.000	-0.002***	0.001***	-0.001***
	(-0.47)	(-3.81)	(2.72)	(-3.52)
EO	0.000	-0.060	0.009	-0.013***
	(0.00)	(-0.80)	(1.27)	(-3.19)
SAL	1.426***	-5.329***	0.295***	-0.281***
	(2.96)	(-6.31)	(4.47)	(-7.52)

FIN			0.082***	-0.059***
			(3.66)	(-5.91)
IND_CB			-4.315	
			(-0.45)	
IND_SB				12.77***
				(3.50)
Cons	-0.472**	0.639***	-0.068***	0.049***
	(-3.01)	(4.08)	(-3.94)	(5.48)
Year Effects	YES	YES	YES	YES
Industry Effects	YES	YES	YES	YES
N	1104	1104	1104	1104
R^2	0.324	0.324	0.324	0.274

This table shows the regression of F*IN on* residual bonus CB and SB and control variables. The estimates on residualCB and residualSB in Model 1 are our variables of interests. The simultaneous equations regression of intangible assets investment *(INT*) and cash bonus (*CB*) and stock bonus (*SB*) results. The first stage regression is where each endogenous variable: cash bonus *(CB*) and stock bonus (*SB*) is regressed on *FIN*, controls and instruments (industry median_IND_CB, and or IND_SB). The coefficients on the variable of interests: *CB* and *SB* are shown in the *FIN* model. The models included fixed effects in all estimations. The reported t-statistics based on robust standard errors are within parentheses. Variable definitions are described in Table I. *****, ****** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table VI: Executive bonus compensation and fixed intangible asset investment: the role of executive ownership

	(Low)	(High)	(Low)	(High)	(Low & High)
	FIN	FIN	FIN	FIN	FIN
CB	0.745***	0.424*			2.267***
	(3.13)	(1.75)			(6.60)
SB			-1.128***	-1.487***	-2.949***
			(-4.94)	(-6.64)	(-9.96)
GR	0.005	0.007	0.069***	0.065***	0.045***
	(0.27)	(0.42)	(3.97)	(3.87)	(2.67)
CF	-0.200***	-0.204***	-0.184***	-0.186***	-0.190***
	(-4.42)	(-4.57)	(-4.10)	(-4.29)	(-4.50)
SZ	0.100***	0.099***	0.063***	0.056***	0.077***
	(5.60)	(5.63)	(3.54)	(3.23)	(4.52)
ROA	0.090**	0.101***	0.082**	0.098***	0.102***
	(2.46)	(2.80)	(2.25)	(2.78)	(2.98)
STR	0.006*	0.006*	0.004	0.003	0.003
	(1.69)	(1.70)	(1.14)	(1.04)	(0.84)
CH	-0.748***	-0.741***	-0.766***	-0.802***	-0.874***
	(-12.96)	(-13.03)	(-13.34)	(-14.43)	(-15.72)
LEV	0.018	0.025	0.030	0.032	0.025
	(0.80)	(1.15)	(1.39)	(1.52)	(1.20)
NWC	-0.278***	-0.257***	-0.303***	-0.309***	-0.377***
	(-6.92)	(-6.42)	(-7.49)	(-7.91)	(-9.49)
NEO	0.172**	0.195***	0.147**	0.185**	0.188***
	(2.27)	(2.63)	(1.95)	(2.57)	(2.65)
LO	-0.001	-0.001	-0.000	-0.000	-0.001*
	(-0.95)	(-1.33)	(-0.35)	(-1.40)	(-1.70)
EO	-0.011	0.021	-0.014	0.031	0.026
	(-0.26)	(0.47)	(-0.33)	(0.73)	(0.61)
SAL	-0.769*	-0.187	-0.507	-0.721*	2.164***
	(-1.84)	(-0.43)	(-1.22)	(-1.79)	(3.40)
EO25	-0.005		-0.008		-0.005
	(-0.93)		(-1.28)		(-0.85)
EO75		-0.019**		-0.016*	-0.016*
		(-2.20)		(-1.90)	(-1.91)
CB_EO25	0.696				3.741
	(0.82)				(1.53)
CB_EO75		-2.044***			-2.011**
		(-3.69)			(-2.83)
SB_EO25			1.616*		-2.256
			(1.93)		(-0.94)

SB_EO75				-2.306***	-0.413
				(-7.02)	(-0.84)
_Cons	-0.556***	-0.549***	-0.219	-0.139	-0.329*
	(-3.39)	(-3.38)	(-1.34)	(-0.88)	(-2.10)
Year Effects	YES	YES	YES	YES	YES
Industry Effects	NO	NO	NO	NO	NO
N	1104	1104	1104	1104	1104
R^2	0.279	0.299	0.289	0.336	0.377

This table shows the FE estimation results of the moderating role of executive ownership on executive bonus compensation and fixed intangible assets investment (FIN). All variable definitions are described in Table I. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table VII: Executive bonus compensation and fixed Intangible assets investment: the role of growth

	(Low)	(High)	(Low)	(High)	(Low & High)
	FIN	FIN	FIN	FIN	FIN
CB	0.912***	-0.050			2.796***
	(3.83)	(-0.17)			(6.11)
SB			-1.016***	-0.703***	-2.715***
			(-4.51)	(-3.07)	(-8.00)
GR	-0.011	-0.006	0.066***	0.035*	0.002
	(-0.57)	(-0.33)	(3.44)	(1.79)	(0.10)
CF	-0.197***	-0.199***	-0.189***	-0.186***	-0.186***
	(-4.37)	(-4.52)	(-4.22)	(-4.20)	(-4.39)
SZ	0.092***	0.086***	0.067***	0.066***	0.088***
	(5.07)	(4.87)	(3.71)	(3.72)	(4.96)
ROA	0.083**	0.087**	0.077**	0.082**	0.079**
	(2.25)	(2.43)	(2.11)	(2.28)	(2.28)
STR	0.005*	0.004	0.004	0.003	0.003
	(1.63)	(1.32)	(1.31)	(0.85)	(0.90)
CH	-0.766***	-0.766***	-0.763***	-0.774***	-0.871***
	(-13.19)	(-13.59)	(-13.31)	(-13.68)	(-15.56)
LEV	0.014	0.011	0.024	0.011	-0.000
	(0.62)	(0.52)	(1.08)	(0.50)	(-0.00)
NWC	-0.289***	-0.298***	-0.297***	-0.302***	-0.382***
	(-7.11)	(-7.52)	(-7.36)	(-7.56)	(-9.60)
NEO	0.171**	0.155**	0.152**	0.149**	0.158**
	(2.27)	(2.11)	(2.03)	(2.02)	(2.23)
LO	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.89)	(-0.87)	(-0.33)	(-0.37)	(-1.04)
EO	-0.004	-0.017	-0.014	-0.023	-0.014
	(-0.09)	(-0.40)	(-0.32)	(-0.54)	(-0.35)

SAL	-1.339**	-1.160***	-0.453	-0.529	2.670***
	(-2.46)	(-2.81)	(-1.09)	(-1.29)	(3.60)
GR25	-0.009**		-0.007		-0.011**
	(-2.10)		(-1.59)		(-2.33)
CB_GR25	1.690*				-1.871*
	(1.88)				(-1.92)
GR75		0.009*		0.005	0.009*
		(1.74)		(0.95)	(1.89)
CB_GR75		3.620***			-0.298
		(5.18)			(-0.26)
SB_GR25			2.677**		3.586***
			(2.53)		(3.35)
SB_GR75				2.201***	1.324*
				(4.91)	(1.89)
_Cons	-0.476***	-0.427***	-0.256	-0.245	-0.427**
	(-2.86)	(-2.64)	(-1.54)	(-1.51)	(-2.62)
Year Effects	YES	YES	YES	YES	YES
Industry Effects	NO	NO	NO	NO	NO
N	1104	1104	1104	1104	1104
R^2	0.283	0.310	0.291	0.310	0.369

This table shows the FE estimation results of the moderating role of firm growth on executive bonus compensation and fixed intangible assets investment (FIN). All variable definitions are described in Table I. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table VIII: Executive bonus compensation and Fixed intangible assets investment: the role of internal cash flow

	(Low)	(High)	(Low)	(High)	(Low & High)
	FIN	FIN	FIN	FIN	FIN
CB	0.929***	0.778***			2.545***
	(4.00)	(3.33)			(5.69)
SB			-0.614***	-1.043***	-3.543***
			(-2.69)	(-4.65)	(-7.92)
GR	0.005	0.004	0.048***	0.067***	0.051***
	(0.34)	(0.24)	(2.76)	(3.84)	(2.98)
CF	-0.185***	-0.198***	-0.181***	-0.184***	-0.188***
	(-4.09)	(-4.13)	(-4.08)	(-3.85)	(-4.05)
SZ	0.093***	0.101***	0.060***	0.061***	0.070***
	(5.20)	(5.62)	(3.41)	(3.44)	(3.99)
ROA	0.087**	0.092**	0.085**	0.086**	0.104***
	(2.39)	(2.51)	(2.36)	(2.36)	(2.98)
STR	0.005	0.006*	0.004	0.004	0.003
	(1.46)	(1.69)	(1.09)	(1.16)	(0.98)
CH	-0.835***	-0.751***	-0.863***	-0.764***	-0.861***
	(-14.08)	(-13.01)	(-14.92)	(-13.28)	(-15.17)
LEV	0.009	0.016	0.019	0.027	0.017
	(0.44)	(0.71)	(0.89)	(1.25)	(0.82)
NWC	-0.357***	-0.278***	-0.382***	-0.297***	-0.366***
	(-8.32)	(-6.91)	(-9.24)	(-7.36)	(-8.94)
NEO	0.175**	0.180**	0.160**	0.173**	0.203**
	(2.36)	(2.38)	(2.20)	(2.27)	(2.79)
LO	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.86)	(-0.95)	(-0.81)	(-0.40)	(-1.57)
EO	-0.006	-0.008	-0.003	-0.008	0.006
	(-0.15)	(-0.19)	(-0.08)	(-0.20)	(0.16)

SAL	1.097**	-0.701*	0.104	-0.450	-0.144
	(2.01)	(-1.71)	(0.25)	(-1.08)	(-0.21)
CF25	0.004		0.005		0.002
	(0.66)		(0.81)		(0.28)
CB_CF25	-1.673***				2.935***
	(-4.89)				(4.50)
CF75		-0.002		0.001	-0.001
		(-0.34)		(0.17)	(-0.12)
CB_CF75		0.699			0.905
		(0.56)			(0.77)
SB_CF25			-2.150***		-1.902***
			(-6.80)		(-3.10)
SB_CF75				-1.298	-1.733
				(-0.87)	(-1.22)
_Cons	-0.488**	-0.561***	-0.177	-0.206	-0.266
	(-2.95)	(-3.41)	(-1.09)	(-1.26)	(-1.64)
Year Effects	YES	YES	YES	YES	YES
Industry Effects	NO	NO	NO	NO	NO
N	1104	1104	1104	1104	1104
R^2	0.297	0.278	0.321	0.287	0.364

This table shows the FE estimation results of the moderating role of cash flow on executive bonus compensation and fixed intangible assets investment (FIN). All variable definitions are described in Table I. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table IX: Executive bonus compensation and fixed intangible assets investment: the role of leverage

	(Low) FIN	(High) FIN	(Low) FIN	(High) FIN	(Low & High) FIN
CB	0.827***	0.902***			2.696***
	(3.56)	(3.93)			(5.99)
SB			-1.008***	-0.640***	-3.406***
			(-4.52)	(-2.83)	(-7.58)
GR	0.002	0.004	0.065***	0.045***	0.044**
	(0.13)	(0.23)	(3.78)	(2.66)	(2.59)
CF	-0.191***	-0.172***	-0.183***	-0.164***	-0.182***
	(-4.25)	(-3.89)	(-4.10)	(-3.77)	(-4.30)
SZ	0.098***	0.087***	0.063***	0.049***	0.070***
	(5.50)	(4.96)	(3.54)	(2.84)	(3.97)
ROA	0.089**	0.079**	0.087**	0.081**	0.097***
	(2.45)	(2.21)	(2.39)	(2.30)	(2.84)
STR	0.006*	0.004	0.004	0.003	0.003
	(1.73)	(1.27)	(1.22)	(0.87)	(0.95)
CH	-0.759***	-0.836***	-0.774***	-0.860***	-0.873***
	(-13.22)	(-14.27)	(-13.56)	(-15.01)	(-15.56)
LEV	-0.016	0.054**	-0.002	0.065***	0.019
	(-0.66)	(2.30)	(-0.08)	(2.80)	(0.69)
NWC	-0.285***	-0.365***	-0.304***	-0.385***	-0.383***
	(-7.11)	(-8.64)	(-7.58)	(-9.41)	(-9.50)
NEO	0.191**	0.179**	0.170**	0.164**	0.204***
	(2.56)	(2.44)	(2.30)	(2.28)	(2.92)
LO	-0.000	-0.000	-0.000	-0.000	-0.000*
	(-1.08)	(-0.91)	(-0.46)	(-0.84)	(-1.65)
EO	-0.0113	0.0007	-0.026	0.007	-0.009
	(-0.26)	(0.02)	(-0.61)	(0.18)	(-0.23)

SAL	-0.684*	1.216**	-0.473	0.096	0.522
	(-1.68)	(2.28)	(-1.15)	(0.24)	(0.82)
LEV25	-0.019***		-0.025***		-0.026***
	(-3.21)		(-3.70)		(-3.98)
CB_LEV25	2.668**				2.904**
	(2.17)				(2.49)
LEV75		-0.025***		-0.023***	-0.023***
		(-3.41)		(-3.22)	(-3.06)
CB_LEV75		-1.825***			2.056***
		(-5.52)			(3.43)
SB_LEV25			5.267***		5.222***
			(2.99)		(3.14)
SB_LEV75				-2.165***	-1.283**
				(-6.94)	(-2.19)
_Cons	-0.527***	-0.437***	-0.209	-0.083	-0.258
	(-3.20)	(-2.71)	(-1.27)	(-0.52)	(-1.59)
Year Effects	YES	YES	YES	YES	YES
Industry Effects	NO	NO	NO	NO	NO
N	1104	1104	1104	1104	1104
R^2	0.288	0.312	0.298	0.334	0.381

This table shows the FE estimation results of the moderating role of leverage on executive bonus compensation and fixed intangible assets investment (FIN). All variable definitions are described in Table I. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively.