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Growth opportunity and investment policy: The role of managerial incentives

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Based on the neo-classical theory of investment (Tobin's *Q*), this study looks at how growth opportunity drives investment policies and the extent to which this relationship is sensitive to managerial incentives. We use data from 213 non-financial and non-utility UK FTSE 350 firms for the period 2007–2015, generating a total of 1748 firm-year observations. We uncover that growth opportunity firms invest more in fixed intangible assets but less in tangible capital assets activities. We further observe that the growth opportunity-fixed intangible assets' investment is more sensitive to executive compensation incentives. Our results remain robust to alternative econometric models.

JEL CLASSIFICATION
G30, G32, G3

1 | INTRODUCTION

Intangible assets[1] have emerged as a significant theme within the corporate finance and accounting literature (Li et al., 2020; Lim et al., 2020; Manikas et al., 2019; Zhang, 2020). Existing literature suggests that investment in fixed intangible assets (*FIN*) is becoming more and more important to various economies as there is ample evidence to conclude that these assets increase labour productivity, help to increase firms' cash flow (*CF*) and increase their competitiveness and value in the long run (Lim et al., 2020; Martin, 2019; Wu & Lai, 2020). The Organisation for Economic Co-operation and Development (OECD) estimates that *FIN*'s investment is emerging as a neck and neck runner with tangible assets' investment (OECD, 2015). In the United Kingdom, it is estimated that *FIN* form 59% of a firm's total capital, and evidence further suggests that investment in *FIN* has been larger than investment in physical/tangible assets since the early 2000s (Goodridge et al., 2016; Martin, 2019). In light of this, a stream of research demonstrates that firms with a substantial amount of intangible resources have more sustained earnings streams, leading to firm value enhancement and performance (see, e.g., Tahat et al., 2018; Villalonga, 2004). Thus, investment in *FIN* has become an important strategic decision for many firms. As a result of the increasing importance of *FIN*, literature highlights that the empirical tests of the neo-classical theory of investment, which mainly focuses on physical assets, have now shifted towards *FIN* (Peters & Taylor, 2017). While growth opportunities have been shown to drive physical assets' investment (see, e.g., Huang & Paul, 2017; Staglianò & Andrieu, 2017), it is priori unclear how firm growth opportunities may drive the investment in *FIN*. Thus, in this study, we examine the extent to which growth opportunities drive investment in tangible capital assets (*TAN*) and *FIN*. Indeed, the classic *q* theory of investment explains that firm managers should only invest when there is a growth opportunity (i.e., where the market value of the firm's assets is greater than its replacement costs) in the market. Accordingly, growth opportunity is seen as a key element in defining firm's investment behaviour (Hayashi, 1982; Peters & Taylor, 2017; Tobin, 1969). In fact, given the U.K. service-oriented economy and the recent changes in investment patterns (i.e., where corporate firms invest more in intangible assets including human capital, brands, patents, software, distribution channels, databases, franchise, licencing, rights), understanding how firm's experiencing growth opportunities invest in tangible capital and *FIN* investment is essential (Goodridge et al., 2016; Lim et al., 2020; Martin, 2019; Staglianò & Andrieu, 2017). Moreover, despite the growing importance of fixed in *TAN*, researchers have exclusively concentrated on physical or *TAN* when explaining the *q* theory. Thus, we look at how growth opportunity explains firm's investment in *TAN* and *FIN*. Further, we turn to the executive compensation literature (Adu-Ameyaw et al., 2021; Gande & Kalpathy, 2017; Gao & Li, 2015) and examine the extent to which executive reward incentives (i.e., salary [*SAL*], cash bonus [*CB*], stock bonus [*SB*] and executive ownership [*EO*]) matter in the growth opportunity–investment (*TAN* and *FIN*) relation.

To address the above objectives, we use a large sample of data from U.K. FTSE 350 firms and find a significant effect of growth opportunity on investment activities. Specifically, we observe that growth potential firms invest more in *FIN* and less in *TAN*. This evidence supports the recent changing trends in investment whereby *FIN* activity is used to achieve growth expansion strategy (Lim et al., 2020; Martin, 2019). We also observe that growth opportunity–investment (capital expenditure and *FIN*) is more sensitive to executives' compensation incentives. In particular, we find that managers in high growth opportunity firms with a *CB* invest less in both capital expenditure and *FIN* but those with a *SB* spend more on capital expenditure. We conduct several tests to ascertain the robustness of our results. First, we measure growth opportunity by using an alternative proxy. Second, in addition to fixed effects (FEs) estimation, we use a simultaneous equation model (SEM) to address the issue of endogeneity and reverse causality using three stage least squares (3SLS) technique. Indeed, our results remain robust to all these tests and alternative estimations used to analyse the data.

We make primary contributions to the existing literature in the following ways. First, our study provides empirical insight into the importance of growth opportunities in driving investment in capital expenditure and *FIN*. By so doing, we add to the emerging literature that focuses on the relation between firm dynamics and investment activities (see, e.g., Ali et al., 2021; Arrighetti et al., 2014; Contractor et al., 2016; Lim et al., 2020; Naheed et al., 2021). Our second contribution emanates from the role of executive compensation incentives in the growth opportunity–investment relation. While a large number of empirical studies reaffirm the broad importance of executive compensations in driving various corporate decisions (see, e.g., Adu-Ameyaw et al., 2021; Balafas & Florackis, 2014; Croci et al., 2012; Gao & Li, 2015), we are the first, to the best of our knowledge, to empirically test how executive compensations moderate the growth opportunity–*FIN*'s investment relation. Again, our fresh evidence adds to the compensation literature that *CB* incentive is a less powerful incentive tool to influence managerial risk-taking particularly for those high growth potential firms. In all, our study builds on the rich theoretical, as well as empirical, literature that explores the relationship between executive compensation and corporate strategic decisions.

The rest of this paper 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 | RELATED LITERATURE

In a frictionless market, managerial investment decisions should depend on the firm's future growth opportunities (Asker et al., 2015; Fazzari et al., 1988; Hayashi, 1982; Tobin, 1969). According to the neo-classical model, a firm should only invest when its market value capital is more than it costs the firm to accumulate that capital. Thus, proxying Tobin's *Q* as the ratio of the market value of the firm's assets to the book value of those assets, the neo-classical model suggests that it is profitable to invest to expand a firm's capital stock when Tobin's *Q* is greater than one (Asker et al., 2015, 2011; Hayashi, 1982; Peters & Taylor, 2017). This essentially means that no other observable factor should explain a firm's investment behaviour except its growth opportunities (measured as Tobin's *Q*). In other words, in a perfect world, the level of a firm's investment behaviour would be fundamentally defined by its Tobin's *Q*.

Extant empirical research suggests that growth opportunities are major drivers of firms' investment behaviour (see Asker et al., 2015; Gennaioli et al., 2015; Kothari et al., 2015; Peters & Taylor, 2017; Staglianò & Andrieu, 2017). For instance, Kothari et al. (2015) and Gennaioli et al. (2015) show that a firm's growth opportunities are more sensitive to its intended future investment behaviour than to its current investment level. Similarly, Peters and Taylor (2017) find that growth opportunity explains a firm's identifiable intangible investment better than physical capital investment and that the explanatory power is more pronounced in total investment behaviour. In the same vein, Staglianò and Andrieu (2017) further broaden the discussion on firms' growth opportunities by investigating how politically influential firms respond to investment opportunities. Their evidence shows that the sensitivity of growth opportunities to the firm's future investment intentions increases, particularly in an environment where the firm has an influence on government policymaking. In a related manner, Badertscher et al. (2013) also provide evidence to show that the sensitivity of the growth opportunities to capital investment relationship of private firms is associated with the quality of the industry information level. A similar sentiment is shared by Bloom and van Reenen (2007), who contend that the responsiveness of investment-to-investment opportunities is reduced in a more uncertain business environment.

Moreover, others have also provided corroborative evidence on the increasing importance of intangibles at the national level. For example, Pyo et al. (2012) show an increasing relationship between intangible capital and economic growth in the United States, Japan and Korea, while Borgo et al. (2013) indicate that the incremental increase in intangible capital expenditure is associated with labour productivity growth in the U.K. economy. Likewise, it is evident in the literature that intangible assets' investment in OECD countries has become crucial in enhancing productivity growth (OECD, 2019).

Largely, at the firm level, the existing studies that have tested the investment–growth opportunities relationship have usually concentrated on investment as capital expenditure where capital is considered to be property, plant and equipment (PPE). Although these measures may have different conceptual undertones, researchers implicitly assume that the two are perfect substitutes. However, few studies have directly looked at the intangible assets' determinants (e.g., Arrighetti et al., 2014; Corrado et al., 2009; Eisfeldt & Papanikolaou, 2013; Marrocu et al., 2012; Peters & Taylor, 2017). Some researchers argue that firms may increase current spending on intangible assets' investment with the expectation of future gains, suggesting a positive co-movement between current intangible expenditure and future value (Corrado et al., 2009; Eisfeldt & Papanikolaou, 2013; Marrocu et al., 2012; Srivastava et al., 1997). Thus, while Marrocu et al. (2012) and Corrado et al. (2009) find that intangible spending reduces a firm's current *CF* and increases future *CF*, others (see, e.g., Eisfeldt & Papanikolaou, 2013; Lev & Sougiannis, 1996; Srivastava et al., 1997) show that intangibles (research and development [R&D]) increase firms' future profits. More so, Srivastava et al. (1997) and Contractor et al. (2016) show that firms with a strong brand report higher profits and are more valuable, but Eisfeldt and Papanikolaou (2013) suggest that firms with resourceful personnel or workforce are more profitable. In a related manner, Lee et al. (2018) show that firms that have managers with superior ability gain more economic value from their growth opportunities.

A more closely related work to our study is the work of Arrighetti et al. (2014), which specifically argues that the existing heterogeneity among firms influences the investment level (intangible assets activity) after discovering that the size, human capital level, and historical intangible base are key driving forces for intangibles.

Clearly, given the fact that the rate of investment in *FIN* has outperformed physical capital investment in this knowledge-based economy (Borgo et al., 2013; Lev & Gu, 2016) and that the intangible-intensive firms have increased labour productivity growth (Borgo et al., 2013), there is a likelihood that growth opportunity firms may allocate more resources into intangible assets' investment than physical investment to achieve their expansion strategy. Thus, compared to capital expenditure, we predict that there is a strong positive relationship between growth opportunities and *FIN*'s activity.

Moreover, different investment types have different risk levels (Bhagat & Welch, 1995; Kothari et al., 2001; May, 1995). For instance, it has been argued in the literature (see, e.g., Bhagat & Welch, 1995; Kothari et al., 2001) that intangibles (R&D) are riskier than capital expenditure. Given the high-risk profile of intangibles, it is possible that risk-averse executives are likely to reduce the investment in such assets, leading to under-investment problems. Again, while Asker et al. (2011) show that public firms are less responsive to investment opportunities, others (see, e.g., Coles et al., 2006; Kini & Williams, 2012; O'Connor et al., 2013; Xue, 2007) suggest that one way for the shareholders of listed firms to influence managers to respond to valuable growth opportunities is to offer their managers appropriate compensation. A simple implication is that publicly listed firms with high growth opportunity sets are likely to use more compensation incentives to influence managerial investment decisions regarding capital expenditure and *FIN*'s investment. Our study further tests this assumption.

3 | METHOD

3.1 | Data and variables

We obtain annual financial data for 213 non-financial and non-utility U.K. FTSE 350 firms for the period 2007–2015. This financial data for the selected firms were obtained from the Amadeus database supplied by Bureau van Dijk, which covers both private and public U.K. firms. The database's unique coverage of financial information allows us to select the FTSE 350 firms and collect data on *TAN*, *FIN* and other investment related characteristics. The data on executives' compensation and ownership as well as other corporate governance factors 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 firms for the period 2007–2015. In all, a total number of 1748 unbalanced firm-year observations are used in the regression analyses. All our variables are chosen in line with the extant literature (e.g., Lim et al., 2020; Peters & Taylor, 2017; Staglianò & Andrieu, 2017). Our first dependent variable is *TAN*, and it is measured as the ratio of *TAN* to total assets while the second one is *FIN*'s investment, and it is measured as the ratio of *FIN* to total assets book value (Aivazian et al., 2005; Dang, 2011; Lim et al., 2020; Peters & Taylor, 2017). Our main independent variable is growth opportunity (*SGR*), which is measured as the log of sales scaled by lagged sales. This variable is widely used as a measure of investment opportunities (Lim et al., 2020; Staglianò & Andrieu, 2017). An alternative measure of growth opportunity (*MTB*) was used for a robustness check, and it was measured as the market value of the total assets divided by the book value of these assets (Dang, 2011; Lee et al., 2018). Also, we account for a number of firm-level control factors that are likely to drive investment decisions. These control variables are *CF*, firm size (*SZ*), firm performance (*ROA*), annual stock returns (*STR*), leverage (*LEV*), net working capital (*NWC*), non-executive ownership (*NEO*), large ownership (*LO*), *EO*, *SAL*, *CB* and *SB* (Chen et al., 2017; Kini & Williams, 2012; Nguyen, 2018; Peters & Taylor, 2017). Specifically, we measure compensation variables as the ratio of each compensation value divided by total sales (see Adu-Ameyaw et al., 2021; Kabir et al., 2013). 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 1.

3.2 | Model specification

Our main prediction is that firm's investment policy (*INV*) is driven by its growth opportunity. Thus, our broad empirical model to test the

TABLE 1 Description of variables

Dependent variable **(*INV*)**	**Description**	**Literature**
Tangible capital assets investment (*TAN*)	Tangible capital assets scaled by total assets	Lee et al. (2018), Dang (2011)
Fixed intangible assets investment (*FIN*)	Fixed intangible assets scaled by total assets	Lim et al. (2020), Peters and Taylor (2017)
Independent variable		
Growth (*SGR*)	Log of $Sales_t$ scaled by lagged $Sales_{t-1}$	Lim et al. (2020), Staglianò and Andrieu (2017)
Growth (*MTB*)	[Total Assets – Book Equity + Market Equity]/Total assets	Chava and Purnanandam (2010), Dang (2011)
Control variables		
Cash flow (*CF*)	Cash flow scaled by total assets	Coles et al. (2006), Adu-Ameyaw et al. (2021)
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)
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-executive ownership (%) (*NEO*)	Total annual shareholdings of non-executive directors divided by the firms 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)
Executive ownership (%) (*EO*)	Total annual shareholdings of the executives divided by the firm's total common shareholdings.	Ryan and Wiggins (2001), Core et al. (1999)
Salary (*SAL*)	Total salary compensation scaled by total sales	Adu-Ameyaw et al. (2021), Kabir et al. (2013)
Cash bonus (*CB*)	Total cash bonus compensation scaled by total sales.	Adu-Ameyaw et al. (2021), Kabir et al. (2013)
Stock bonus (*SB*)	Total stock bonus compensation scaled by total sales.	Adu-Ameyaw et al. (2021), Kabir et al. (2013)

Note: The table presents the mnemonics and description of each dependent and independent variable used in this paper.

growth opportunity–*INV* relationship is similar to previous works (Eisfeldt & Papanikolaou, 2013; Peters & Taylor, 2017; Staglianò & Andrieu, 2017) with a few modifications. Our modified model is specified below:

$$INV_{it} = \alpha + \beta_1 SGR_{it-1} + \beta_2 Controls_{it} + \theta_i + \delta_t + \mu_{it} \quad (1)$$

In Equation 1, *INV* is the firm's investment, and it is categorised into two types of investment: *TAN* investment and *FIN*'s investment. Specifically, *TAN* is the ratio of *TAN* to total assets while *FIN* is the ratio of *FIN*'s investment to total assets. SGR_{it-1} is the lagged changes in log sales and *Controls* include investment-related determinants and executive's incentives (*SAL*, *CB*, *SB* and shares ownership). Our modified model includes executives' reward incentives because firms with high growth opportunities often apply more incentives packages to induce managerial investment decisions relating to *TAN* and *FIN* (Core et al., 1999; Ryan & Wiggins, 2001). More specifically, our estimated equations (*TAN* and *FIN*) using FEs technique are specified as follows:

$$TAN_{it} = \alpha + \beta_1 SGR_{it-1} + \beta_2 Controls_{it} + \theta_i + \delta_t + \mu_{it} \quad (1a)$$

$$FIN_{it} = \alpha + \beta_1 SGR_{it-1} + \beta_2 Controls_{it} + \theta_i + \delta_t + \mu_{it} \quad (1b)$$

For robustness checks, we use the alternative independent variable measure (*MTB*) and SEM method. Therefore, using another independent variable measure and applying a relatively robust specification technique help to confirm if indeed our main model is free from endogeneity concerns.

4 | RESULTS AND DISCUSSION

4.1 | Summary statistics and bivariate correlations

In Table 2, we present the summary statistics of all the variables used in this study. The average value of *TAN* is 0.395 and has a standard deviation 0.293 while that of *FIN*'s investment is 0.260 with a standard deviation of 0.213. These variables have a minimum value of 0.001 and a maximum value of 0.987 for *TAN* while that of *FIN* is 0.000 and 0.877, signifying a high degree of heterogeneity. Also, the average value of growth opportunity (*SGR*) is 0.028 with a standard deviation of 0.236. The minimum and maximum values of this variable are −2.836 and 5.543, respectively, signifying a fair degree of heterogeneity. The mean value of our alternative measure of growth opportunity (*MTB*) is 4.661, with a standard deviation of 1.947. Also, the average values (standard deviation) of executive compensation are *SAL* 1.126 (38.841), *CB* 0.592 (21.144), *SB* 1.570 (54.538) while executive ownership % (*EO%*) 0.048 (0.218), large ownership % (*LO%*) is 39.815 (18.946) and non-executive ownership % (*NEO%*) 0.019 (0.105).

In Table 3, we present the correlation among the variables. Evidence from this table shows a strong positive estimate of 0.97 among return on assets (*ROA*) and *CF*, suggesting earnings as a key determinant of firm's *CF*. As such, this shows there is no issue of multicollinearity with any of the 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.

4.2 | The effect of growth opportunity (*SGR*) on *INV*

In Table 4, we present the empirical results of our baseline regression model of the effect of growth opportunities (*SGR*) on *INV*, that is, *TAN* and *FIN*. We adopt FEs estimation method in testing our models, and the results are based on the fully specified Models 2 and 4, while Models 5 and 6 show the results of an alternative independent variable measure for robustness purposes. Specifically, Model 2 shows a negative and significant effect of growth opportunities (*SGR*) on *TAN* after controlling conventional variables in the fully specified model. Our variable of interest (*SGR*) shows a coefficient estimate of −0.0135, suggesting that an increase in *SGR* is associated with lower investment in *TAN*. That is, growth opportunity firms are less likely to spend more on capital expenditure activities, which is inconsistent with prior studies (e.g., Kothari et al., 2015; Staglianò & Andrieu, 2017). A plausible explanation can be attributed to the recent changing investment trend where firms allocate huge resources to *FIN* (Goodridge et al., 2016; Martin, 2019). However, Model 4 shows a positive and significant coefficient estimate of SGR (0.0237) on *FIN*. This finding supports the assertion that managers of growth opportunity firms are likely to invest more in *FIN*'s activity, confirming recent changing in investment pattern where growth firms spend more on *FIN*. This is consistent with prior research which suggest strong explanatory power of growth opportunity on *FIN*'s investment behaviour (Eisfeldt & Papanikolaou, 2013; Peters & Taylor, 2017). Our result for the alternative independent variable measure (*MTB*) qualitatively shows similar coefficient signs although the estimates missed out on their significance.

TABLE 2 Summary statistics

	(1) Mean	SD	Min.	Max.	25%	50%	75%	*N*
TAN	0.395	0.293	0.001	0.987	0.146	0.316	0.610	1728
FIN	0.260	0.213	0.000	0.877	0.073	0.230	0.423	1503
SGR	0.028	0.236	−2.836	5.543	−0.007	0.025	0.061	1660
MTB	4.661	1.947	0.000	8.138	1.079	1.523	2.352	1746
CF	0.144	0.190	−3.913	2.856	0.086	0.132	0.185	1647
SZ	9.019	0.870	0.000	11.507	8.596	8.989	9.474	1675
ROA	0.098	0.187	−3.917	2.829	0.048	0.089	0.141	1712
STR	0.055	0.494	−5.456	2.851	−0.135	0.093	0.296	1675
LEV	0.288	0.220	0.000	2.708	0.143	0.250	0.381	1606
NWC	0.041	0.198	−0.841	0.877	−0.058	0.020	0.128	1683
NEO%	0.019	0.105	0.000	3.509	0.000	0.000	0.002	1697
LO%	39.815	18.936	3.000	97.800	25.345	38.170	52.215	1708
EO%	0.048	0.218	0.000	6.064	0.001	0.002	0.010	1720
SAL	1.126	38.841	0.000	268.180	0.000	0.001	0.003	1748
CB	0.592	21.144	0.000	116.921	0.000	0.001	0.002	1748
SB	1.570	54.538	0.000	357.450	0.000	0.001	0.003	1748
N	1748							

Note: The table presents the summary statistics of all the variables used in our analysis. Variable definitions are provided in Table 1.

TABLE 3 Correlation matrix

	(1) TAN	FIN	SGR	MTB	CF	SZ	ROA	STR	LEV	NWC	NEO	LO	EO	SAL	CB	SB
TAN	1.00															
FIN	−.62*	1.00														
SGR	−.03	.01	1.00													
MTB	−.05	−.08*	−.01	1.00												
CF	−.06	−.05	.04	.02	1.00											
SZ	−.11*	.05	.06	−.20*	.04	1.00										
ROA	−.06	−.06	.05	.01	.97*	.03	1.00									
STR	−.03	.04	.04	.02	.22*	−.02	.24*	1.00								
LEV	.35*	−.03	.02	.02	−.37*	−.28*	−.39*	−.11*	1.00							
NWC	−.24*	−.06	.04	−.01	.02	.08*	.05	.00	−.11*	1.00						
NEO	.05	−.10*	−.00	.02	−.09*	−.03	−.09*	−.02	.00	−.01	1.00					
LO	.06	−.15*	−.00	−.02	.02	−.27*	−.01	−.03	−.02	−.12*	.21*	1.00				
EO	.05	−.14*	.03	−.00	−.05	−.06	−.06	.04	.00	−.02	.56*	.29*	1.00			
SAL	.05	−.11*	−.07*	−.00	−.12*	−.18*	−.02	.02	.12*	−.03	−.00	.01	−.01	1.00		
CB	.05	−.08*	−.06	−.00	−.13*	−.17*	−.01	.03	.12*	−.04	−.00	.01	−.00	1.00*	1.00	
SB	.05	−.09*	−.05	−.00	−.04	−.18*	−.02	.03	.12*	−.03	−.00	.01	−.01	1.00*	1.00*	1.00

Note: The table provides the correlation coefficient between the variables. All variables are described in Table 1.
*Indicates significance at 1%.

TABLE 4 Growth opportunity and investment policy

	Main measure			Alternative measure		
	(Model 1) TAN	(Model 2) TAN	(Model 3) FIN	(Model 4) FIN	(Model 5) TAN	(Model 6) FIN
SGR	−0.0327*** (−4.00)	−0.0135* (−1.65)	0.0517*** (4.84)	0.0237** (1.93)		
MTB					−0.0018 (−1.54)	0.0032 (1.35)
CF		0.0545 (1.52)		−0.213*** (−4.32)	0.0460 (1.28)	−0.205*** (−4.15)
SZ		−0.0455*** (−3.24)		0.0933*** (4.91)	−0.0486*** (−3.51)	0.103*** (5.57)
ROA		−0.0640* (−1.85)		0.0716* (1.81)	−0.0624* (−1.80)	0.0729* (1.82)
STR		−0.0039 (−1.23)		0.0056 (1.51)	−0.0045 (−1.44)	0.0074** (1.99)
LEV		−0.0148 (−0.80)		0.0108 (0.46)	−0.0162 (−0.88)	0.0217 (0.91)
NWC		0.189*** (9.31)		0.151*** (6.10)	0.185*** (9.14)	0.162*** (6.54)
NEO		−0.0558 (−0.83)		0.160** (1.96)	−0.0181 (−0.28)	0.0707 (0.92)
LO		−0.0001 (−0.65)		−0.0001 (−0.48)	−0.0001 (−0.81)	−0.0001 (−0.31)
EO		0.0028 (0.07)		−0.0006 (−0.01)	0.0198 (0.48)	−0.0337 (−0.72)
SAL		0.381*** (2.81)		−0.334 (−0.73)	0.370*** (2.75)	−0.457 (−1.14)
CB		0.0173 (0.36)		0.710 (1.52)	0.0202 (0.42)	0.790** (2.13)
SB		−0.0702 (−1.48)		−1.412*** (−3.22)	−0.0713 (−1.51)	−1.477*** (−3.66)
_Cons	0.386*** (88.79)	0.790*** (6.18)	0.255*** (58.47)	−0.579*** (−3.34)	0.833*** (6.60)	−0.665*** (−3.95)
Year effect	YES	YES	YES	YES	YES	YES
Firm effect	YES	YES	YES	YES	YES	YES
N	1454	1215	1313	1103	1220	1108
R^2	0.018	0.124	0.031	0.153	0.122	0.152

Note: This table shows the FE estimation results of the effects of growth opportunity (SGR) on investment dynamics (TAN and FIN) and include year and firm effects. All variable definitions are described in Table 1.
*Indicates statistical significance at the 10% level.
**Indicates statistical significance at the 5% level.
***Indicates statistical significance at the 1% level.

4.3 | Robustness checks

Our results presented in Table 4 show that growth opportunity (*SGR*) strongly drives *INV*. In this section, we use different econometric specification to further test if indeed our results are free from endogeneity concerns. For instance, it has been argued that high growth firm managers make better investment choice especially when they face no financial constraints (Lee et al., 2018). Again, the nature of a firm's growth opportunity is determined by the type of its investment activities, suggesting a simultaneous determination of investment and growth opportunity. It has also been suggested that high growth opportunity firms often use compensation incentives to induce managerial risk-taking activities (e.g., Coles et al., 2006; Guay, 1999; Kini & Williams, 2012; Ryan & Wiggins, 2001). In line with this, Ryan and Wiggins (2001) suggest that high growth opportunity firms should use less cash-based incentives but more *SB* compensation to incentivise managers to make optimal investment decisions. Clearly, this evidence shows that the relation between growth opportunity and *INV* is more

TABLE 5 Growth opportunity and investment policy—Simultaneous equations model (using 3SLS)

	(2nd stage) TAN	(1st stage) SGR	(2nd stage) FIN	(1st stage) SGR
SGR	−0.780** (−2.20)		2.033*** (3.17)	
CF	0.273 (1.53)	−0.195 (−1.38)	0.415 (1.27)	−0.192 (−1.39)
SZ	0.0459*** (3.38)	0.0199* (1.75)	−0.0553* (−2.21)	0.0229** (2.06)
ROA	0.0104 (0.05)	0.324** (2.42)	−0.751* (−2.03)	0.347** (2.59)
STR	0.0057 (0.33)	0.0174 (1.34)	−0.0333 (−1.05)	0.0170 (1.31)
LEV	0.248*** (5.30)	0.0154 (0.33)	0.0208 (0.24)	0.0089 (0.19)
NWC	−0.337*** (−8.52)		−0.0441 (−0.60)	
NEO	0.555*** (3.43)	0.509*** (5.02)	−1.239*** (−4.19)	0.543*** (4.81)
LO	0.0004 (0.83)	0.0005 (1.29)	−0.00123 (−1.50)	0.0005 (1.35)
EO	0.176* (1.98)	0.232*** (4.06)	−0.551*** (−3.38)	0.244*** (4.05)
SAL	2.959*** (4.75)	0.337 (0.63)	−1.319 (−1.15)	0.490 (0.97)
CB	−0.379 (−0.22)	2.691** (2.62)	−4.792 (−1.52)	2.527** (2.46)
SB	−1.498 (−1.13)	−1.704** (−2.22)	2.106 (0.87)	−1.468* (−1.81)
TAN		−0.0279 (−0.33)		−0.0358 (−0.50)
FIN		0.321*** (5.33)		0.367*** (3.28)
Ind_ROA		0.606** (1.99)		0.180 (0.60)
Cons	−0.344** (−2.56)	−0.375*** (−3.23)	0.924*** (3.73)	−0.374** (−2.92)
Year & industry	YES	YES	YES	YES
N	1259	1259	1259	

Note: This table shows the results of simultaneous equations regression of investment (*TAN* and *FIN*) on growth opportunity (SGR) using three-stage least squares technique. In the first stage regression, we regress SGR on *INV* (*TAN*, *FIN*), control variables and the instrument (industry median performance_ROA). The coefficients on the variable of interest—*SGR*, and it is statistically significant in the 2nd stage model. The models included fixed effects (year and industry) in all estimations. The reported *t* statistics based on robust standard errors are within parentheses. Variable definitions are described in Table 1.

*Indicates statistical significance at the 10% level.

**Indicates statistical significance at the 5% level.

***Indicates statistical significance at the 1% level.

complex than we initially assumed. To further ensure that our observed results (i.e., Table 4 results) are not spurious and that a firm's *INV* is directly driven by its growth opportunity, we estimate SEM using 3SLS method. Our adopted approach is similar to prior works (see, e.g., Coles et al., 2006; Lee et al., 2018). Specifically, the SEM is stated as follows:

TAN

$$SGR_{i,t} = \alpha + \beta INV_{i,t} + \beta IV_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \tag{2i}$$

$$TAN_{i,t} = \alpha + \beta a SGR_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \tag{2ii}$$

FIN investment

$$SGR_{i,t} = \alpha + \beta INV_{i,t} + \beta IV_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (3i)$$

$$FIN_{i,t} = \alpha + \beta aSGR_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (3ii)$$

The first stage Equations 2i and 3ii include investment activities (*INV*: *TAN* and *FIN*), instrumental variable (*IV*) (i.e., industry-median performance variable, *ROA*) together with other controls. Our selection of industry *ROA* is in line with the suggestion that managers with superior ability (proxied by firm earnings) are able to identify better investment opportunities (Lee et al., 2018). Thus, we argue that growth opportunity firms with superior managerial ability are likely to make efficient investment decisions. More so, our chosen instrument, industry median performance proxy, is not directly related to a firm's investment decision. Thus, our first-stage growth opportunity (*SGR*) model is like that of Lee et al. (2018) with few modifications, that is, inclusion of instrument variable and other controls. We apply 3SLS method to simultaneously estimate our structural equations where the first-stage equation—SGR_{it}—is regressed on the determinants to obtain the predicted values (αSGR_t), which are then included in the respective equations (*TAN* and *FIN*). The results of this analysis are reported in Table 5. Still, we observe in *TAN* model that *SGR* is negative and significant while positive sign is reported in *FIN model*. Overall, our chosen specifications and alternative independent variable measure results continue to show how *INV* (i.e., *TAN*'s and *FIN*'s investment) is more sensitive to the firm's growth opportunities.

4.4 | Growth opportunity and *INV*—The role of managerial compensation

The evidence presented above suggests that a firms' investment policies are more sensitive to their growth opportunities. That is, because these firms gain their value by undertaking investment activities (i.e., *TAN* and *FIN*) which may not already be in place, controlling agency problems through monitoring managers may be difficult. The agency model predicts that growth potential firms can effectively mitigate the monitoring problems by efficiently designing compensation incentives to influence managerial decisions (see Guay, 1999; Ryan & Wiggins, 2001). For instance, Ryan and Wiggins (2001) contend that high growth opportunity firms should use less cash-based incentives but more *SB* compensation to incentivise executives to make optimal investment decisions. Furthermore, more recent evidence suggests that the nature of managerial compensation incentives influences their selection of investment activities (see Coles et al., 2006; Croci & Petmezas, 2015; Kini & Williams, 2012; Xue, 2007). Thus, based on risk-motivated incentive argument, these studies have shown that stock-motivated managers invest more in intangible activities while those cash-based ones spend more on physical capital expenditure (e.g., Coles et al., 2006; Kini & Williams, 2012; Xue, 2007). The authors argue that some investment activities are more risky (intangibles) than others (e.g., physical capital assets expenditure), and by using appropriate compensation, managers are influenced to make efficient investment decisions. Given the different risk profile among physical capital expenditure and intangibles, a firm with high growth opportunities in capital intensive projects and or intangible-intensive activities may need to design appropriate compensation packages to encourage maximal participation in its future investment opportunities. Again, a risk-averse manager in a high growth intangible-intensive firm is more likely to forgo such risky intangible activity (Borisova & Brown, 2013; Loumioti, 2012), resulting in a possible underinvestment problem. One way for shareholders to minimise the managerial incentive problem is to offer managers appropriate pay packages to influence them to make efficient investment decisions, particularly when the firm has a high growth opportunity (Coles et al., 2006; Ryan & Wiggins, 2001). Thus, managers are less likely to miss out on valued growth opportunities in risky investment activities if they are incentivised properly.

In this section, we examine the interaction effect of growth opportunity and executive compensation on investment activities, that is, *TAN* and *FIN*. We follow existing studies (e.g., Adu-Ameyaw et al., 2021; Kabir et al., 2013) and measure our compensation variables, *SAL*, *CB* and *SB*, as the ratio of each compensation value to total sales. Thus, the ratio of each compensation component value (*SAL*, *CB* and *SB*) is interacted with the growth opportunity variable (*SGR*) which is then included in our FE investment (*TAN* and *FIN*) model.

The results of this analysis are presented in Table 6 (i.e., FE Models 1 to 6). Specifically, in Models 1 and 5, our FE regression results reveal that the estimated coefficient on the interaction term ($SGR \times SAL$) is positive, suggesting that executives of growth opportunity firms with a larger *SAL* pay component are likely to increase both *TAN* and *FIN* activities. One caveat of the results, however, is that the estimates lack statistical significance. This is unsurprising because *SAL* forms the base pay upon which other bonus compensation largely depends and that executives may feel less motivated to take extra risk by spending more on investments (*TAN* and *FIN*) as their *SAL* goes up. Also, in Models 2 and 6, we observe that the interaction term for $SGR \times CB$ is negative and statistically significant. Specifically, in Model 2, the estimate on $SGR \times CB$ is -0.3061 (*t* statistics -2.79) implying that *CB*-motivated executives in high growth opportunity firms are more likely to spend less on *TAN*. A similar finding is also observed in Model 6 (*FIN*) where the estimate is -1.965 (*t* statistics -2.97), postulating that *CB* executives in high growth opportunities prefer to lower investment in *FIN*. Thus, the reported findings suggest that, ceteris paribus, executives of growth-opportunity firms with a substantial *CB* component are likely to disinvest in both *TAN* and *FIN*. A plausible explanation is that, as executives receive more *CB* compensation in growth firms, their incentives to expand by embarking on risky investment opportunities through *TAN* and *FIN* activities decrease, leading to lower allocation of resources into these activities. This confirms the assumption that *CB* is a less powerful incentive package to influence risk-averse executives to embark on risk-taking activities (Chen et al., 2017; Coles et al., 2006; Xue, 2007). An alternative explanation is that, because shareholders of high growth firms use less managerial *CB* (i.e., these firms need cash to sponsor their growth activities), this

TABLE 6 Growth opportunity and investment policy—The role of managerial incentives

	(Model 1) TAN	(Model 2) TAN	(Model 3) TAN	(Model 4) TAN	(Model 5) FIN	(Model 6) FIN	(Model 7) FIN	(Model 8) FIN
SGR	−0.0143* (−1.65)	−0.0066 (−0.77)	−0.0214** (−2.50)	−0.0156* (−1.77)	0.0218* (1.73)	0.0279** (2.27)	0.0273** (2.22)	0.0343** (2.54)
CF	0.0497 (1.25)	0.0994** (2.54)	0.0581* (1.63)	0.0543 (1.51)	−0.214*** (−4.32)	−0.214*** (−4.35)	−0.216*** (−4.38)	−0.214*** (−4.33)
SZ	−0.0445*** (−3.07)	−0.0529*** (−3.71)	−0.0445*** (−3.19)	−0.0455*** (−3.24)	0.0940*** (4.94)	0.0913*** (4.82)	0.0918*** (4.84)	0.0933*** (4.91)
ROA	−0.0636* (−1.84)	−0.0645* (−1.87)	−0.0630* (−1.83)	−0.0657* (−1.89)	0.0716* (1.81)	0.0796** (2.01)	0.0799** (2.02)	0.0763** (1.93)
STR	−0.0039 (−1.24)	−0.0036 (−1.13)	−0.0042 (−1.32)	−0.0040 (−1.27)	0.0056 (1.51)	0.0056 (1.53)	0.0058 (1.57)	0.0059 (1.62)
LEV	−0.0139 (−0.74)	−0.0210 (−1.13)	−0.0075 (−0.40)	−0.0153 (−0.83)	0.0106 (0.45)	0.0134 (0.57)	0.0112 (0.48)	0.0127 (0.54)
NWC	0.188*** (9.24)	0.201*** (9.72)	0.177*** (8.57)	0.189*** (9.32)	0.151*** (6.10)	0.160*** (6.45)	0.159*** (6.41)	0.151*** (6.11)
NEO	−0.0549 (−0.81)	−0.0646 (−0.96)	−0.0574 (−0.85)	−0.0601 (−0.89)	0.160** (1.96)	0.169** (2.07)	0.173** (2.12)	0.177** (2.15)
LO	−0.0001 (−0.66)	−0.0001 (−0.61)	−0.0001 (−0.53)	−0.0001 (−0.67)	−0.0001 (−0.48)	−0.0001 (−0.63)	−0.0001 (−0.59)	−0.0001 (−0.45)
EO	0.0027 (0.07)	0.0008 (0.02)	0.0064 (0.16)	0.0058 (0.14)	−0.0023 (−0.05)	−0.0024 (−0.05)	−0.0081 (−0.17)	−0.0095 (−0.20)
SAL	0.384*** (2.82)	0.367*** (2.72)	0.395*** (2.93)	0.381*** (2.81)	−0.324 (−0.71)	0.581 (1.05)	0.553 (0.99)	−0.377 (−0.82)
CB	0.0208 (0.41)	−0.0206 (−0.41)	0.0389 (0.80)	0.0182 (0.37)	0.847* (1.67)	−1.419* (−1.66)	−1.352 (−1.53)	0.789* (1.68)
SB	−0.0720 (−1.50)	−0.0518 (−1.09)	−0.0606 (−1.28)	−0.0704 (−1.49)	−1.417*** (−3.23)	−1.679*** (−3.77)	−1.584*** (−3.59)	−1.421*** (−3.25)
SGR × SAL	0.0388 (0.27)				0.330 (0.71)			
SGR × CB		−0.306*** (−2.79)				−1.965*** (−2.97)		
SGR × SB			0.570*** (3.08)				−2.056*** (−2.74)	
SGR × EO				0.0393 (0.65)				−0.130* (−1.85)
Cons	0.782*** (5.94)	0.855*** (6.60)	0.779*** (6.11)	0.791*** (6.18)	−0.586*** (−3.37)	−0.559** (−3.23)	−0.563** (−3.25)	−0.580*** (−3.34)
Year effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm effect	YES	YES	YES	YES	YES	YES	YES	YES
N	1215	1215	1215	1215	1103	1103	1103	1103
R^2	0.124	0.130	0.132	0.124	0.154	0.162	0.160	0.157

Note: This table shows the FE estimation results of the moderating role of managerial incentives on investment policy (*TAN* and *FIN*)–growth opportunity (*SGR*) relationship and our model includes both year and firm effects. All variable definitions are described in Table 1.
*Indicates statistical significance at the 10% level.
**Indicates statistical significance at the 5% level.
***Indicates statistical significance at the 1% level.

leads to lower managerial incentive to increase firm's investment activities in *TAN* and *FIN*. Furthermore, on the stock bonus interaction term (*SGR* × *SB*) in Model 3 (*TAN*), we find a strong positive coefficient estimate of 0.570 (*t* statistics 3.08), implying that executives of growth potential firms with more *SB* compensation are likely to spend more on *TAN* (Croci & Petmezas, 2015). In Model 7 (*FIN*), however, the estimate on *SGR* × *SB* (coefficient −2.056, *t* statistics −2.74) is negative and statistically significant, suggesting that stock-motivated executives in growth potential firms are likely to decrease *FIN* investment as they receive more *SB*. This finding is contrary to the prediction that shareholders of growth opportunity firms should use more stock-based compensation to influence managers to undertake more risk-taking activities (e.g., Coles et al., 2006; Kini & Williams, 2012). The implication of this finding is that fixed intangible-intensive growth firms should make less use of *SB*s to incentivise executives. In short, our evidence indicates that managerial pay incentives play an important role in influencing managers of growth firms to make efficient investment decisions.

4.5 | Growth opportunity and *INV*—The role of EO

As shown in Section 4.5, growth opportunity firms use more pay incentives to influence managerial investment decisions relating to *TAN*'s and *FIN*'s activities. Relatedly, the literature further shows that, in firms where executives own large stakes, shareholders may use fewer pay incentives to induce managerial decisions (Hartzell & Starks, 2003; Ryan & Wiggins, 2001). Contrarily, others also contend that executives with *LO* holdings can easily extract wealth from shareholders by pursuing policies that suit their own interests (Brick et al., 2012; Gormley & Matsa, 2016; Weisbach, 2007). For instance, Gormley and Matsa (2016) observe that executives often have an incentive to play it safe when they hold large holdings in their firm, and one way they can do that is to spend less on risk-taking activities (Bhagat & Welch, 1995; Kothari et al., 2001). Due to the high (low) information asymmetry associated with intangibles' (*TAN*) investment and the risky nature of these activities (Bhagat & Welch, 1995; Loumioti, 2012; May, 1995; Nguyen, 2018; Ryan & Wiggins, 2001), it is possible that managerial decisions regarding both *TAN*'s and *FIN*'s investment are likely to be affected if managers have large holdings. With this, we further hypothesise that the sensitivity of *INV* to a firm's growth is likely to be affected by *EO* stakes.

Specifically, we measure the *EO* variable as the percentage of stock ownership held by the executive (defined in Table 1) (Florackis & Ozkan, 2009; Ryan & Wiggins, 2001). We interact the *EO* variable with the independent variable (*SGR* × *EO*) and include it in our FE–FE regression model. The regression result is shown in Models 4 and 8 of Table 6. In Model 4, we find the coefficient of *SGR* × *EO* is positive but lacks statistical significance, implying that executives in high growth firms with LO holdings may reluctantly increase *TAN* investment. Also, Model 8 shows an estimate on *SGR* × *EO* to be negative and significant. This suggests that *LO* executives in growth opportunity firms may prefer to spend less on *FIN*'s investment. This is not surprising, given that executives' opportunism increases as their undiversified shareholdings go up, and they become less willing to allocate more resources into relatively risky investment activity. This evidence is likely to be suggestive of the executives' risk preference effect (Gormley & Matsa, 2016).

5 | CONCLUSION

In this study, we examine the relationship between growth opportunity and *INV* using a sample of U.K. firms. Evidence obtained indicates that growth opportunity drives *INV* relating to *TAN* and *FIN*. Specifically, we find that high growth opportunity firms invest more in *FIN* but less in *TAN*, indicating the changing investment dynamics in recent times. Our evidence confirms the recent rate of investment in *FIN*'s investment outperforming physical or *TAN* spending in this knowledge-based economy (Borgo et al., 2013; Lev & Gu, 2016). Further, we also report strong evidence that executive compensation incentives moderate the growth opportunity–*INV* relationship. In particular, *CB*-incentivised managers in high growth firms invest less in *TAN* and *FIN*, but those *SB* executives spend more on *TAN* but less on *FIN*. The overall evidence obtained indicates that growth opportunities and executive compensation incentives are imperative to the investment decisions of firms. Our results remain robust even after dealing with possible endogeneity issues. We hope that this study stimulates further empirical investigation. For instance, a more significant insight could be gained by using a fresh dataset that compares both public and private firms' investment in such activity in pre and post COVID-19 periods. Also, it could be interesting to replicate this study from the perspective of multiple countries to see how varied institutional environments affect the tested relationships.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTE

[1] Intangible assets are those non-monetary assets without physical substance, like software, patents, brands, licences and franchise rights, copyrights, customer-related activities and distribution networks, which are often backed by contractual or legal rights (Financial Accounting Standards Board—FASB under SFAS 141R; Lim et al., 2020; Loumioti, 2012).

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