Assessing Institutional Investor Attention's Impact on Corporate Innovation: A Computational Analysis of Dual Incentives

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Abstract. Utilising investor data from Shenzhen Stock Exchange's "Interactive Easy" platform and listed company data, this paper constructs an institutional investor attention index to explore its impact on corporate innovation investment. Results demonstrate that increased institutional investor attention significantly boosts corporate innovation investment through equity and compensation incentives, with executive compensation incentives playing a pivotal mediating role. This effect is more pronounced in non-state-owned enterprises than in state-owned ones. The findings suggest external institutional investor attention enhances corporate governance, advocating for regulatory efforts to broaden information exchange channels for investors and encourage listed companies to engage in enterprise research.

Keywords: Institutional investor attention, Enterprise innovation investment, Equity incentive, Compensation incentive, Mediating effect.

1 Introduction

Innovation serves as the cornerstone for national economic advancement and a prerequisite for businesses to sustain and evolve in competitive markets. In the context of global economic globalization and regional integration, it is imperative for enterprises to innovate and strengthen their competitive edge for continued operation. Research highlights that companies investing significantly in innovation exhibit enhanced market value and share, fostering long-term growth [1][24]. Nonetheless, the traditional enterprise structure and management often deter innovation investment due to the high uncertainty of innovation outcomes and potential short-termism in management decisions, exacerbating shareholder-management conflicts. Numerous studies have indicated that shareholder characteristics, corporate ownership structure, and management incentive schemes critically influence innovation performance[15].

Institutional investors, as key stakeholders in listed companies, focus on long-term enterprise value and seek stable returns, thereby playing a crucial role in advocating for corporate innovation investment [21]. Previous research confirms that external investor

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engagement with listed companies can mitigate inefficient investment levels [2], enhance stock returns, improve stock market liquidity[4], encourage equity incentive schemes[7], boost innovation efficiency [11], and influence corporate strategy [13]. While existing literature from the behavioural finance perspective enriches understanding of investor attention's impact, the specific influence on innovation investment requires further exploration. This study questions the effect of institutional investor attention on corporate innovation investment and the roles of equity and compensation incentives within this dynamic. Should the efficacy of these incentives be validated, it also seeks to examine their interaction effects.

Focusing on China's Shenzhen Stock Exchange listed companies and leveraging "Investor Relations" data from the "Interactive Trading" platform, this paper constructs an "Institutional Investor Attention" index to examine its impact on corporate innovation investment. The research highlights the pivotal role of institutional investor attention in fostering corporate innovation investment, presenting new empirical evidence. It also contributes to the theoretical understanding of the relationship between institutional investors and corporate governance mechanisms, exploring the dynamics between various incentive mechanisms. This exploration sheds light on their capacity to boost innovation investment and sustain long-term enterprise growth, confirming the essential influence of institutional investors in corporate governance.

2 Literature Review

2.1 Institutional Investor Attention and Corporate Innovation Investment

The relationship between institutional investor attention and corporate innovation investment is articulated through three primary perspectives. The first posits that institutional ownership catalyses corporate innovation investment[25], while the second perspective contends there is no significant effect of institutional investment holdings on innovation investment.The third delineates a nuanced view where the impact of different types of institutional investors' shareholdings on innovation diverges. Specifically, securities investment funds, driven by performance disclosure pressures, focus on short-term returns, potentially divesting from companies whose performance dips temporarily due to R&D activities [19].Given the backdrop of information asymmetry and principal-agent conflicts, the nexus between investors' attention and corporate innovation decisions unveils a complex interaction. Institutional investors, through economies of scale in information acquisition and governance scope, can mitigate information asymmetry, enforce oversight, and thus, spur corporate innovation. This role is pivotal in overcoming managerial short-sightedness and fostering innovation through tolerance and knowledge spillover mechanisms[12][20].

H1: Enhanced attention from institutional investors is associated with an increase in corporate innovation investment.

2.2 Institutional Investors' Attention, Equity Incentives, and Corporate Innovation Investment

Literature delineates the institutional investors, by virtue of their shareholding, partake actively in corporate governance, thereby influencing the magnitude and direction of equity incentives within firms. Such investors, armed with professional acumen, are positioned to evaluate the suitability of a company's equity incentive plans[27]. This evaluative process affects the implementation of equity incentives across different corporate forms, encouraging alignment between managerial and shareholder interests towards fostering innovation [16][22]. Nonetheless, the relationship between equity incentives and innovation investment is nuanced, spanning from positive impacts to potential adverse effects or an inverted U-shaped correlation[23].

The "Convergence of Interests Hypothesis" underscores the alignment of executives' personal interests with the firm's long-term objectives via share allocations. This alignment diminishes opportunistic, short-sighted actions and minimizes conflicts with shareholders, thereby favoring strategic investments in R&D. Evidence suggests that robust equity incentives for executives correlate with a heightened propensity for risk-taking and innovation investment, a necessity underscored by institutional investors for long-term corporate progress[18].

H2: Executive equity incentives mediate the influence of institutional investors' attention on corporate innovation investment.

2.3 Institutional Investor Attention, Salary Incentives, and Corporate Innovation Investment

The attention of institutional investors also profoundly impacts the compensation structures of corporate executives. In the United States, mutual foundations actively engaging in corporate governance advocate for a higher proportion of performance-linked compensation in executive remuneration packages[17]. While institutional investors may favor an increase in both performance-linked and fixed compensation components, in China, a significant positive correlation has been observed between institutional shareholding and executive fixed compensation and equity incentives[6]. This correlation suggests that institutional investors positively affect executive compensation contracts, with compensation incentives acting as a buffer against the risk aversion tendencies of executives, particularly in the context of innovation failures[26].

H3: Executive salary incentives influence the impact of institutional investor attention on corporate innovation, playing a crucial role in shaping innovation investment behaviors and decisions.

3 Research Design

3.1 Sample Selection and Data Sources

This study focuses on A-share listed companies on the Shenzhen Stock Exchange to examine the impact of institutional investor attention on corporate innovation, utilizing

data from 2014 to 2019. The selection is driven by the need for a precise measure of investor attention and the availability of relevant data. Exclusions were made for financial companies, ST and *ST companies due to their operational instability and potential for significant business changes, and companies with incomplete data sets. After these considerations, the final sample comprised 5,932 companies. Financial data, excluding that from the "Interactive Easy" platform, were sourced from the CSMAR Database.

3.2 Variable Selection

Dependent Variable: The study adopts the ratio of R&D investment to operating income as the measure of innovation input[14]. This encompasses both capitalized and expensed R&D expenditures.

Independent Variable: Institutional investor attention, the core variable, is measured innovatively. Traditional indirect methods, such as trading volume and news reports, lack directness. This research constructs a measure using the log of the number of field and telephone interviews conducted by institutional investors, as recorded on the Shenzhen Stock Exchange's "Interactive Easy" platform[3].

Mediating Variables: Salary incentives and equity incentives serve as mediators. Salary incentives are quantified by the log of the total annual salary of a company's executives, whereas equity incentives are measured by the log of one plus the cumulative shareholding ratio of company executives.

Control Variables: To elucidate the factors influencing R&D investment and innovation outcomes, the study controls for a range of variables: Return on Total Assets, Corporate Free Cash Flow, Debt-to-Asset Ratio, Proportion of Independent Directors, Shareholding Ratio of Top Ten Shareholders, Separation of Duties, Tobin's Q, Total Asset Turnover, and Company Size. The study also incorporates year and industry dummy variables to account for temporal and sectoral effects.

The definitions and specific description of variables are shown in Table 1:

Table 1. Variable Definitions and Description.

Type of variable	Variable meaning	Variable name	Variable explanation
Explained variable	Investment in research and development	*R & D*	R&D expenditure/operating income
Explanatory variable	Institutional investor attention	*INSTIFRE*	The natural logarithm of the number of times the company is surveyed by institutional investors
Mediating variable	Equity incentive degree	*MSH*	Take the logarithm of the cumulative total number of shares held by executives
	Executive compensation incentives	*LNPAY*	The logarithm of total executive compensation
Controlled variable	Return on total assets	*ROA*	Corporate EBIT divided by total assets

Free cash flow to the firm	*FCF*	Company free cash flow divided by total assets
Debt to asset ratio	*LEV*	The ratio of total liabilities to total assets
The proportion of independent directors	*IND*	The ratio of independent directors to directors in the company
Shareholding ratio of top ten shareholders	*TOP*10	The sum of the shareholding ratios of the top ten shareholders
Separation of duties	*DUL*	If the chairman and the general manager are held by different persons, take 1, otherwise take 0
Tobin's Q value	*Tobin Q*	The ratio of company's market value to book value
Total assets turnover ratio	*TAT*	Operating income divided by total asset balance
Enterprise size	*SIZE*	The natural logarithm of the company's total assets
Year	*Year*	Year virtual variable
Industry	*Ind*	Industry virtual variables

3.3 Empirical Model

Employing financial data from the sample companies spanning 2014 to 2019, this study adopts a sequential testing approach for mediation effects to investigate the potential mediating role of equity incentives in the relationship between institutional investor attention and corporate innovation investment.

Test of Overall Effect Model Construction: To assess the overarching influence of institutional investor attention on corporate innovation, a two-way fixed-effects panel model is constructed as follows:

$$R\&D_{it} = \alpha_0 + \alpha_1 INSTIFRE_{it} + \sum control_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (1)$$

Among them, i represents the company, t represents the year, ε represents the random interference item, $R\&D$ represents the investment in research and development, and $INSTIFRE$ represents the attention of institutional investors.

Chain Multiple Mediation Effect Model: In line with Hypothesis 2 and Hypothesis 3, this study posits that institutional investor attention fosters corporate innovation by enhancing both equity and compensation incentives. Acknowledging the interplay between compensation and equity incentive mechanisms, and proposing that enhancements in salary incentives subsequently boost equity investment, a chain multiple mediation effect model is employed. This model scrutinises the mediating pathways through which institutional investor attention influences corporate innovation investment[9]. The envisaged pathway is depicted in Figure 1.

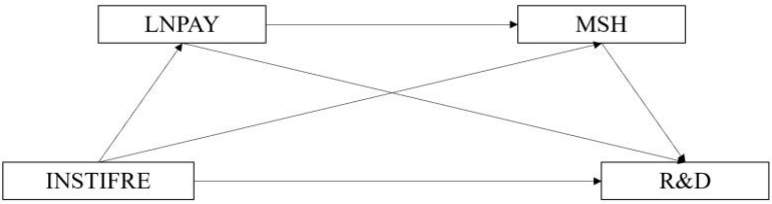

Fig. 1. Institutional Investors and the Chain Mediation Model on Corporate Innovation.

The chain-type multiple mediation effect model is established as follows[8]:

$$INPAY_{it} = \beta_0 + \beta_1 INSTIFREit + \sum control_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (2)$$

$$MSH_{it} = \gamma_0 + \gamma_1 INSTIFREit + \gamma_2 INMPAY_{it} + \sum control_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (3)$$

$$R\&D_{it} = \eta_0 + \eta_1 INSTIFRE_{it} + \eta_2 INMPAY_{it} + \eta_3 MSH_{it} + \sum control_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (4)$$

Herein, *MSR* signifies executive equity incentives, *INSTIFRE* denotes institutional investor attention, $R\&D$ represents corporate innovation investment, and $INMPAY$ indicates executive compensation incentives, with other parameters as defined in equation (1). Equations (2)-(4) constitute a system of multiple equations, where equation (2) assesses the influence of institutional investor attention on executive compensation incentives, equation (3) evaluates the effect of executive compensation incentives on executive equity incentives while accounting for institutional investor attention, and equation (4) investigates the impact of executive equity incentives on corporate innovation investment, considering both institutional investor attention and executive compensation incentives.

Within this chain multiple mediation effect model, mediation effects are categorized into independent and chain mediation effects. The independent mediation effect is delineated as follows: an increase in institutional investor attention leads to an uptick in executive compensation incentive intensity, subsequently enhancing corporate innovation investment. This pathway, alongside the direct influence of increased institutional investor attention on corporate equity incentives culminating in augmented corporate innovation investment, is termed as independent mediation effects 1 and 2, respectively, quantified by $\beta_1\eta_2$ and $\gamma_1\eta_3$. Conversely, the chain mediation effect unfolds as an increase in institutional investor attention boosts executive compensation incentive intensity, which in turn elevates corporate equity incentives, ultimately amplifying corporate innovation investment, with its magnitude $\beta_1\gamma_2\eta_3$.

Mediation Effect Test Method: Traditionally, mediation effect testing has relied on a sequential approach, where each model equation is estimated individually, and the presence of a mediation effect is determined based on the significance of regression coefficients. This method, however, has been critiqued for its limitations. To enhance the precision of the findings, this study adopts the methodology proposed by Dong et al. (2020)[5]. Initially, a two-way fixed-effects panel model is employed to estimate

models (2)-(4), facilitating a preliminary mediation effect analysis based on the estimation outcomes. Subsequently, the analysis is extended to system estimation for models (2)-(4), employing the Bootstrap technique to evaluate the product of coefficients associated with the mediation effects.

4 Empirical Results and Analysis

4.1 Descriptive Statistics and Correlation of Main Variables

The descriptive statistics for the primary variables are presented in Table 2. From the data, it is observed that the average attention from institutional investors stands at 1.2, equating to an average of two surveys per listed company, with a peak frequency of 110 surveys. This variation highlights significant differences in institutional investor attention across companies. The mean value for innovation investment is 5.379, with a range from 0 to 72.75, reflecting the diversity in innovation spending across firms. Equity incentives exhibit an average value of 13.859, with a considerable spread between the highest and lowest values (21.299), indicating varied levels of equity incentive implementation among companies. Similarly, the average value for compensation incentives is 15.077, with values ranging from 12.124 to 18.267, demonstrating substantial differences in compensation and incentive mechanisms across different enterprises.

Table 2. Descriptive statistical results for the main variables

Variable	Mean	Median	SD	Minimum	Maximum
R & D	5.379	4.020	5.367	0.000	72.750
MSH	13.859	16.114	6.160	0.000	21.299
LNPAY	15.07 7	15.030	0.751	12.124	18.276
INSTIFRE	1.200	1.099	1.001	0.000	4.710
ROA	0.057	0.047	0.046	-0.019	0.547
FCF	0.008	0.020	0.110	-1.109	0.603
LEV	0.380	0.371	0.180	0.009	0.979
IND	0.378	0.364	0.055	0.000	0.750
*TOP*10	58.203	59.095	13.706	8.975	95.094
DUL	1.651	.0200	0.477	1.000	2.000
Tobin Q	2.270	1.847	1.548	0.153	31.400
TAT	0.615	0.526	0.484	0.041	11.345
SIZE	22.095	21.999	1.075	19.410	27.149

4.2 Benchmark Regression Results

The benchmark regression analysis, detailed in Table 3, investigates the effect of institutional investor attention on innovation investment through equity incentives. Model

(1) results, after controlling for other variables, reveal a coefficient for institutional investor attention of 0.447, statistically significant at the 1% level. This finding corroborates the hypothesis (H1) that institutional investor attention positively impacts corporate innovation investment. Equation (2), incorporating corporate executive compensation incentives as a mediating variable, shows that institutional investor attention significantly enhances executive compensation incentives, also at the 1% level. In Equation (3), with corporate executive equity incentives as the dependent variable, both executive compensation incentives and institutional investor attention are significant at the 1% level, with coefficients of 0.448 and 0.723, respectively. This demonstrates that both executive compensation incentives and institutional investor attention effectively increase executive equity incentives, with institutional investor attention exerting a stronger influence on corporate equity incentives than executive compensation. Equation (4)'s results, using corporate innovation investment as the dependent variable and controlling for other factors, indicate that corporate equity incentives, executive compensation incentives, and institutional investor attention—all have significant positive effects at the 1% level, with coefficients of 0.025, 1.052, and 0.332, respectively. This underscores that institutional investor attention, executive compensation incentives, and equity incentives collectively bolster corporate innovation investment. The empirical evidence from columns (2)-(4) suggests that institutional investor attention facilitates corporate innovation investment through dual mediating channels: enhancing executive compensation and equity incentives. This is further affirmed by a Bootstrap test to ascertain the significant presence of these mediation channels.

Table 3. Two-way result test

Variable	(1) *R & D*	(2) *INPAY*	(3) *MSH*	(4) *R & D*
MSH	-	-	-	0.025** (2.52)
LNPAY	-	-	0.448*** (3.60)	1.052*** (11.32)
INSTIFRE	0.447*** (7.18)	0.091*** (10.54)	0.723*** (8.68)	0.332*** (5.31)
ROA	-9.519*** (-6.78)	1.947*** (9.96)	14.351*** (7.64)	-11.941*** (-8.49)
FCF	0.47 (0.92)	0.157** (2.2)	0.243 (0.36)	0.297 (0.59)
LEV	-5.819*** (-13.89)	-0.285*** (-4.89)	-1.756*** (-3.16)	-5.472*** (-13.18)
IND	0.890 (0.86)	-0.400*** (-2.78)	-3.465** (-2.52)	1.401 (1.37)
*TOP*10	-0.011*** (-2.64)	-0.001 (-1.39)	-0.031*** (-5.55)	-0.010** (-2.27)
DUL	-0.344*** (-2.85)	-0.019 (-1.13)	-2.691*** (-16.84)	-0.258** (-2.11)
Tobin Q	0.727*** (16.37)	0.030*** (4.86)	-0.380*** (-6.44)	0.704*** (15.95)

TAT	-1.749***	0.127***	-1.315***	-1.851***
	(-12.72)	(6.62)	(-7.19)	(-13.51)
SIZE	0.157**	0.382***	-0.241**	-0.243***
	(2.22)	(38.73)	(-2.29)	(-3.09)
Year	control	control	control	control
Ind	control	control	control	control
sample capacity	5932	5932	5932	5932
adjust R^2	0.388	0.394	0.184	0.402

Note: ***, **, * indicate that they passed the 1%, 5%, and 10% significance tests, respectively, and the values in parentheses below the coefficients are robust standard errors

Table 4 outlines the Bootstrap test results for the chained multiple mediation effects. The confidence intervals for all mediating effect estimates exclude 0, affirming the significant presence of both independent mediation effects and the chain mediation effect. This demonstrates that institutional investor attention not only enhances corporate innovation investment through two distinct intermediary channels—increasing executive compensation incentives and boosting corporate equity incentives—but also via a sequential mediation pathway of "increased executive compensation incentives → increased corporate equity incentives". Therefore, the executive compensation incentive mechanism exhibits both an independent and a chain mediation effect, corroborating Hypotheses H2 and H3. Moreover, the magnitude of mediation effects reveals the most pronounced impact arises from the increase in executive compensation incentives, followed by the independent mediation effect of executive equity incentives, and lastly, the chained mediation effect through executive equity incentives.

Table 4. Bootstrap's mediating effect test results

Type of mediation effect	Mediation effect value	95% confidence interval	Number of samples
Overall mediation effect	0.118	[0.086,0.151]	5000
Independent mediation effect 1	0.080	[0.052,0.109]	5000
Independent mediation effect 2	0.036	[0.021,0.053]	5000
Chain mediation effect	0.002	[0.010,0.003]	5000

4.3 Heterogeneity Test

To delve into the possibility of corporate nature heterogeneity in the impact of institutional investor attention on corporate innovation investment, this study categorizes the sample into two subsets: state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs), conducting separate analyses for each. Table 5 presents the outcomes of how institutional investor attention affects innovation investment across these different corporate entities. The findings reveal that institutional investor attention positively influences innovation investment in both SOEs and non-SOEs, with the estimated coefficients being significantly positive at the 1% level. Notably, this effect is

more marked within non-state-owned enterprises, suggesting a differential impact based on corporate ownership nature.

Table 5. Estimated Results: Impact of Institutional Investor Attention on Innovation Investment by Enterprise Type

Variable	State-owned enterprise	Non-state-owned enterprise
	R & D	*R & D*
INSTIFRE	0.442*** (2.79)	0.451*** (6.61)
ROA	-13.754*** (-3.23)	-9.315*** (-6.23)
FCF	0.829 (0.55)	0.440 (0.82)
LEV	-7.775*** (-6.65)	-5.674*** (-12.60)
IND	-3.397 (-1.22)	1.938* (1.72)
*TOP*10	-0.043*** (-3.81)	-0.004 (-0.88)
DUL	0.340 (0.72)	-0.471*** (-3.76)
Tobin Q	1.179*** (7.40)	0.622*** (12.95)
TAT	-1.812*** (-4.70)	-1.751*** (-11.87)
SIZE	0.549*** (2.88)	0.036 (0.43)
Year	control	control
Ind	control	control
sample capacity	1032	4900
adjust R^2	0.457	0.387

Note: ***, **, * indicate that they passed the 1%, 5%, and 10% significance tests, respectively, and the values in parentheses below the coefficients are robust standard errors

Table 6. Estimated Results: Chained Multiple Mediation Effects in State-Owned vs. Non-State-Owned Enterprises

Variable	State-owned enterprise			Non-state-owned enterprise		
	INPAY	*MSH*	*R & D*	*INPAY*	*MSH*	*R & D*
MSH	-	-	0.042 (1.58)	-	-	0.022* (1.92)
LNPAY	-	1.739*** (5.55)	0.360 (1.37)	-	0.526*** (4.05)	1.170*** (11.54)

INSTIFRE	0.121*** (6.13)	0.340* (1.73)	0.376** (2.32)	0.089*** (9.30)	0.605*** (6.94)	0.333*** (4.88)
ROA	2.282*** (4.30)	23.883*** (4.58)	-15.742*** (-3.63)	1.859*** (8.87)	8.070*** (4.24)	-11.685*** (-7.85)
FCF	0.371** (1.98)	0.685 (0.37)	0.639 (0.42)	0.083 (1.09)	-0.135 (-0.20)	0.345 (0.65)
LEV	-0.537*** (-3.69)	-0.749 (-0.52)	-7.511*** (-6.39)	-0.268*** (-4.25)	-1.163** (-2.04)	-5.332*** (-11.98)
IND	-0.764** (-2.21)	-12.669*** (-3.75)	-2.535 (-0.90)	-0.440*** (-2.78)	-2.577* (-1.81)	2.513** (2.26)
*TOP*10	-0.001 (-0.79)	-0.121*** (-8.76)	-0.038*** (-3.20)	-0.000 (-0.35)	-0.027*** (-4.59)	-0.003 (-0.7)
DUL	-0.090 (-1.55)	-2.622*** (-4.61)	0.488 (1.03)	-0.031* (-1.79)	-2.001*** (-12.62)	-0.391*** (-3.11)
Tobin Q	0.017 (0.87)	0.517*** (2.68)	1.150*** (7.20)	0.028*** (4.21)	-0.399*** (-6.55)	0.597*** (12.53)
TAT	0.070 (1.46)	-1.604*** (-3.42)	-1.775*** (-4.58)	0.122*** (5.90)	-1.028*** (-5.49)	-1.873*** (-12.79)
SIZE	0.380*** (15.99)	1.058*** (4.07)	0.340 (1.57)	0.359*** (31.19)	0.073 (0.64)	-0.390*** (-4.40)
Year	control	control	control	control	control	control
Ind	control	control	control	control	control	control
sample capacity	1032	1032	1032	4900	4900	4900
adjust R^2	0.530	0.388	0.460	0.362	0.145	0.404

Note: ***, **, * indicate that they passed the 1%, 5%, and 10% significance tests, respectively, and the values in parentheses below the coefficients are robust standard errors

Table 6 presents the estimation results from a two-way fixed-effect model for both state-owned and non-state-owned enterprises. The findings for non-state-owned enterprises align in sign and significance with those detailed in Table 3, indicating consistency across different analyses. However, for state-owned enterprises, the influence of institutional investor attention on corporate equity incentives, as well as the impact of compensation and equity incentives on innovation investment, is not statistically significant. This suggests that institutional investor attention does not effectively enhance equity incentives within state-owned enterprises, and the effectiveness of compensation and equity incentives in fostering innovation investment within such entities remains inconclusive.

Furthermore, this study conducted separate tests on industry heterogeneity, firm age heterogeneity, and management heterogeneity. The analysis of industry heterogeneity

revealed that institutional investor attention has a significant promoting effect on innovation investment in manufacturing, public utilities, mining, information technology services, and leasing industries. However, the promoting effect of institutional investor attention on innovation investment in traditional industries with higher maturity levels such as agriculture, real estate, construction, transportation, and retail was not evident. After analyzing firm age heterogeneity, it was found that institutional investor attention has a promoting effect on innovation investment in firms aged 5-14 years, 15-24 years, and 25-34 years, with a stronger effect observed for innovation investment in new firms compared to those with longer existence. The estimated coefficient of institutional investor attention for firms aged 35-45 years was not significant, indicating that the promoting effect of institutional investor attention on innovation investment in firms with longer existence is not evident. Following the analysis of management heterogeneity, it was observed that institutional investor attention promotes innovation investment in firms regardless of whether the CEO and chairman are the same person. However, the promoting effect of institutional investor attention on innovation investment in firms where the CEO and chairman are not the same person was more pronounced. The detailed results of empirical tests are not presented here.

Table 7 elaborates on the Bootstrap test results for mediation effects within state-owned and non-state-owned enterprises. The confidence intervals for all mediation effect estimates exclude 0, substantiating the significant presence of both independent mediation effects and the chained mediation effect. This demonstrates that, in both enterprise types, institutional investor attention boosts corporate innovation investment not only through two distinct intermediary channels—enhancing executive compensation and equity incentives—but also via a sequential mediation pathway of 'increased executive compensation incentives leading to heightened corporate equity incentives'. Notably, this mediation effect is more pronounced in non-state-owned enterprises.

Table 7. Bootstrap Test Outcomes for Mediation Effects in State-Owned vs. Non-State-Owned Enterprises

Type of mediation effect	State-owned enterprise		Non-state-owned enterprise	
	Mediation effect value	95% confidence interval	Mediation effect value	95% confidence interval
Overall mediation effect	0.168	[0.095,0.260]	0.0934	[0.058,0.130]
Independent mediation effect 1	0.132	[0.072,0.205]	0.0652	[0.035,0.099]
Independent mediation effect 2	0.026	[0.002,0.062]	0.0268	[0.011,0.043]
Chain mediation effect	0.011	[0.003,0.022]	0.0013	[0.0004,0.0026]

4.4 Robustness Test

To verify the empirical results' robustness, this study conducts two robustness tests. Initially, the mediating effect is reassessed with innovation investment redefined as the

proportion of R&D investment to total enterprise assets. Subsequent to this adjustment, Bootstrap test results for the mediation effects affirm that both independent and chained mediation effects remain significant, with the influence of executive compensation incentives emerging as the most pronounced. Secondly, the robustness of mediation effect significance is tested through varying the number of samples drawn. The Bootstrap method, which involves random sample selection for testing mediation effects, may yield varying outcomes based on the number of draws. Testing with 10,000, 20,000, and 5,000 samples respectively, confirms the robustness and significance of all mediation effects, thereby reinforcing the study's conclusions.

5 Conclusion

This study harnesses data from the Shenzhen Stock Exchange's "Interactive Easy" platform to craft indicators of institutional investor attention, analyzing its impact on corporate innovation investment from 2014 to 2019 via a mediation effect model. Findings illuminate that institutional investor attention significantly propels corporate innovation investment. This enhancement occurs through direct channels—augmenting executive compensation and equity incentives—and a sequential mediation process, where elevated executive compensation incentives lead to increased equity incentives. Notably, the effect of compensation incentives stands out for its significance, enriching the discourse on the interplay between institutional investor attention and executive incentives in fostering corporate innovation investment.

The insights derived from this research delineate several strategic implications. At the outset, listed companies are urged to adopt an open stance towards external investor research and fortify investor relations, tapping into institutional investor attention for long-term value creation. Additionally, recognizing the critical role of equity and compensation incentives becomes imperative, with schemes designed to spur executives towards higher risk-taking for innovation investment, laying the groundwork for sustained growth. Equally, institutional investors should intensify their focus on corporate engagements and research, advocating for effective equity incentive plans and innovation investments as a pathway to secure stable, long-term yields. For investors, targeting firms that garner significant institutional attention could mitigate the risks tied to information asymmetry. Moreover, regulators are called upon to appreciate the positive impacts of institutional investor research and informational exchanges on corporate innovation and development. Expanding the avenues for information discovery and communication for external, particularly seasoned and professional, investors, while guiding listed companies to more dynamically engage with external investors, is paramount. A welcoming and proactive attitude towards external oversight and research is essential for fostering an ecosystem conducive to innovation and long-term corporate prosperity.

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References

1. Babina, T., et al. Artificial intelligence, firm growth, and product innovation. Journal of Financial Economics, 151, 103745 (2024).
2. Cen, W., Li, S., & Tong, N. The Impact of Investor Attention on Stock Returns and Risk: An Empirical Study Based on Shenzhen Stock Exchange's "Interactive Easy" Platform Data. Securities Market Herald, (7), 40-47 (2014).
3. Cen, W., Tong, N., & Guo, Q. Institutional Investor Attention and Corporate Inefficient Investment: An Empirical Study Based on Data from Shenzhen Stock Exchange's "Interactive Easy" Platform. Securities Market Herald, (10), 36-44 (2017).
4. Chen, Q., Ma, L., & Yi, Z. Analyst Coverage and Corporate's Innovation Performance: The Logic of China. Nankai Business Review, 20(3), 15-27 (2017).
5. Dong, J., Feng, T., & Li, J. Impact of Inter-provincial Factor Misallocation on Quality of Economic Development in China: Based on the Chain Multiple Mediation Effect Model. Finance and Trade Research, 31(05), 1-12+51 (2020).
6. Li, C., Cai, Q., & Chen, J. Can Institutional Investors Improve Listed Companies' Executive Compensation Incentives? Securities Market Herald, (1), 31-36+68 (2012).
7. Liu, J., & Cai, W. The Influence of Investor Field Research on the Enterprise Strategy Adjustment. International Business, (5), 141-156 (2020).
8. Liu, S., & Ling, W. Multiple Mediation Models and Their Applications. Psychological Science, 32(2), 433-435+407 (2009).
9. Wen, Z., & Ye, B. Analyses of Mediating Effects: The Development of Methods and Models. Advances in Psychological Science, 22(5), 731-745 (2014).
10. Xu, Z., & Shi, X. Can Executive Stock Ownership Incentives Promote R&D Investment?—A Mediating View of Executive Risk-Taking. Financial Communication, 845(09), 41-45 (2020).
11. Zhang, P., Peng, F., & Hao, D. The Attention of Institutional Investors and the Innovation Performance of Listed Companies———Evidence from the Shenzhen Stock Exchange's "Easy Interaction" Platform. Journal of Capital University of Economics and Business, 22(4), 103-112 (2020).
12. Zhang, Q., & Wang, M. The Influencing Mechanism of Institutional Investors on Enterprise Innovation—Evidence from Listed Companies in the SME and GEM. Science and Technology Progress and Policy, 36(13), 1-10 (2019).
13. Zhong, F., & Wang, M. Could Institutional Investors' Corporate Site Visit Improve the Implementation of Equity Incentive Plans? Modern Finance and Economics-Journal of Tianjin University of Finance and Economics, 40(6), 99-113 (2020).
14. Zhu, F. Executive Compensation Incentives, Available Slack and R&D Investment: Also a Discussion of Situational Impact of TMT Stability. Science of Science and Management of S.& T., 39(9), 120-136 (2018).
15. Aghion, P., Van Reenen, J., & Zingales, L. Innovation and Institutional Ownership. American Economic Review, 103(1), 277-304 (2013).
16. Barker, V.L., & Mueller, G.C. CEO Characteristics and Firm R&D Spending. Management Science, 48(6), 782-801 (2002).

17. Fong, E. Relative CEO Underpayment and CEO Behaviour Towards R&D Spending. Journal of Management Studies, 47(6), 1095-1122 (2010).
18. Holthausen, R.W., Larcker, D.F., & Sloan, R.G. Business Unit Innovation and the Structure of Executive Compensation. Journal of Accounting and Economics, 19(2–3), 279-313 (2004).
19. Huang, T., et al. R&D information quality and stock returns. Journal of Financial Markets, 57, 100599 (2022).
20. Jensen, M.C., & Meckling, W.H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. Journal of Financial Economics, 3(4), 305-360 (1976).
21. Jin, C., et al. Institutional investor ESG activism and corporate green innovation against climate change: Exploring differences between digital and non-digital firms. Technological Forecasting and Social Change, 200, 123129 (2024).
22. Lerner, J., & Wulf, J. Innovation and Incentives: Evidence from Corporate R&D. The Review of Economics and Statistics, 89(4), 634-644 (2007).
23. Li, Z., et al. Exploring the relationship between takeover market and enterprise innovation: The mediating role of internal governance. Journal of Innovation & Knowledge, 7(3), 100205 (2022).
24. Morris, M.H., Kuratko, D.F., & Covin, J.G. Corporate Entrepreneurship & Innovation. Cengage Learning (2010).
25. Samila, S., M. Simeth, and D. Wehrheim. Institutional ownership and the nature of corporate innovation. SSRN Electronic Journal, (2021).
26. Shang, Y., J. Xu, and J. Li. The impact of executive compensation incentive on corporate innovation capability: Evidence from agro-based companies in China. PLoS One, 18(9), e0291517 (2023).
27. Smith, M.P. Shareholder Activism by Institutional Investors: Evidence from CalPERS. The Journal of Finance, 51(1), 227-252 (1996).