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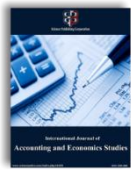

The Impact of Chair-CEO Duality on R&D Investment in Firms Led by Highly Educated CEOs

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Abstract

This study investigates the impact of Chair–CEO duality on R&D investment intensity in firms managed by highly educated CEOs using a dataset of 877 firm-year observations from companies listed on the Shanghai and Shenzhen Stock Exchanges between 2015 and 2020. Employing Hausman–Taylor estimations to address potential endogeneity, the results reveal that Chair–CEO duality has a significantly positive effect on R&D investment in such firms. In the context of highly educated CEOs, the concentration of authority does not appear to lead to self-serving or inefficient behaviors but rather to more purposeful investments in innovation. Moreover, the results highlight the differences in how CEOs approach R&D decisions based on the type of postgraduate degree they hold. These findings offer important insights into how leadership education and governance structures jointly influence firms' strategic-innovation outcomes.

Keywords: *Corporate Governance; Research and Development Investment R&D; Chair-CEO Duality; Higher Education; China.*

1. Introduction

In knowledge-driven economies and industries characterized by intense competition and rapid technological change (Abdoh & Liu, 2021; Choi et al., 2015), firms' capacity to innovate is a decisive factor for sustaining competitive advantage and long-term performance (Al-Dubai, 2025b, 2025a; Barker & Mueller, 2002; Hill & Snell, 1988; Mohanram et al., 2025). Research and development (R&D) investments are the primary mechanism through which firms generate technological advancements, develop new products, improve operational processes, and maintain a sustainable competitive edge in dynamic markets (Al-Dubai, 2025a; Azzam, 2022). However, R&D is inherently uncertain, costly, and subject to managerial discretion (Chambers et al., 2003). Consequently, the strategic orientation of firm leaders plays a central role in determining the scale and persistence of investments (Hambrick & Mason, 1984).

The educational background of the chief executive officer (CEO) is critical in shaping strategic decision-making. Upper echelons theory posits that executives' values, experiences, and knowledge bases influence their interpretation of strategic issues and subsequent actions (Hambrick & Mason, 1984). Empirical evidence indicates that higher educational attainment is associated with a greater propensity to invest in innovation because of enhanced cognitive abilities, a broader strategic vision, and openness to novel ideas (Datta & Guthrie, 1994; Farag & Mallin, 2018; Harymawan et al., 2020). Highly educated CEOs are more likely to recognize long-term benefits from R&D investments, even when short-term returns are uncertain (Yong-hai, 2010).

However, the translation of such strategic preferences into actual investment decisions is mediated by corporate governance structures. One structural element of particular importance is the Chair–CEO duality, where the CEO also serves as the chair of the board (Zhang et al., 2023). This governance arrangement consolidates decision-making authority, potentially facilitating faster and more coherent strategic action (Chen et al., 2022; Gallego-Álvarez & Pucheta-Martínez, 2022). From a stewardship theory perspective, duality may enhance the capacity of a highly educated CEO to implement ambitious, innovation-oriented strategies without encountering excessive procedural delays or internal resistance (Donaldson & Davis, 1991).

Conversely, agency theory warns that Chair–CEO duality can reduce the board's monitoring effectiveness, increasing the likelihood of managerial opportunism and inefficient resource allocation (Jensen & Meckling, 1976; Liedong & Rajwani, 2022). Even well-educated executives may overcommit to R&D projects that align with their personal vision or prestige rather than with shareholder value (Liedong & Rajwani, 2022). This theoretical tension suggests that the effect of CEO education on R&D intensity may vary significantly depending on whether the CEO holds the position of board chair.

Despite the theoretical importance of this interaction, empirical studies directly examining the role of Chair–CEO duality in firms led by highly educated CEOs remain scarce, particularly in emerging markets such as China. Understanding this relationship is critical for both scholars and practitioners, as it informs debates on optimal governance structures for fostering innovation while safeguarding shareholders' interests. Accordingly, this study addresses the following research question:

What is the impact of Chair–CEO duality on R&D investment intensity in firms managed by highly educated CEOs?

This study analyzes 877 firm-year observations from companies with highly educated leadership listed on the Shanghai and Shenzhen Stock Exchanges between 2015 and 2020. To mitigate potential endogeneity concerns, I employ the instrumental variable approach proposed by Hausman and Taylor (1981), following prior research.

The results reveal that the Chair–CEO duality exerts a significantly positive effect on R&D investment intensity. This aligns with stewardship theory, which posits that concentrated leadership authority enhances the CEO's capacity to pursue long-term strategies. Highly educated CEOs, with their superior cognitive abilities, analytical skills, and openness to innovation, are more likely to appreciate the strategic value of R&D investments. When they also hold the chair position, organizational barriers, board resistance, and procedural delays are minimized, allowing for a more decisive resource allocation for innovation. Thus, the interplay between educational attainment and leadership authority generates a synergistic effect that promotes investment in high-risk, but strategically critical, R&D initiatives.

The remainder of this paper is organized as follows: The next section reviews the relevant literature and develops the main hypothesis. The next section outlines the dataset, variables, and estimation strategy. The subsequent section presents the empirical results and discussion. The theoretical contributions and practical implications of this study are elaborated. This study concludes by summarizing the key findings, acknowledging the limitations, and suggesting directions for future research.

2. Literature Review and Hypotheses Development

2.1. CEO education and strategic innovation

The educational attainment of a CEO has been identified as a central factor in shaping strategic decision-making processes, particularly in domains that require long-term investment and high uncertainty, such as R&D (Abdoh & Liu, 2021; Al-Dubai, 2025a; Choi et al., 2015). Upper Echelons Theory argues that executives' cognitive frames, functional experiences, and intellectual capacities significantly influence their interpretation of situations and choice of strategic action (Datta & Guthrie, 1994).

Urquhart and Zhang (2022) argued that individuals can obtain four levels of education at university, among which the Master of Business Administration (MBA) represents a stage focused on managerial training and applied knowledge, whereas the Doctor of Philosophy (PhD) reflects a stage of advanced technical expertise. These different educational levels equip graduates with varying degrees of scientific thinking, cognitive awareness, and personal qualities. Each stage provides a unique set of skills and knowledge that differentiates its holders. Accordingly, it is unrealistic to expect identical performance, thinking, or knowledge from an individual with an MBA compared to one with a PhD. Nevertheless, prior studies have confirmed that both levels of higher education contribute positively to CEO performance, particularly in areas such as innovation and sustainability, which, in turn, enhance overall organizational performance (Urquhart & Zhang, 2022). Higher education strengthens a CEO's ability to process complex information, engage in sophisticated analytical reasoning, and make evidence-based decisions (Yong-hai, 2010). These capabilities are crucial in R&D-intensive industries, where decision-making often involves balancing uncertain short-term costs with potentially transformative and long-term benefits.

Empirical research supports the assertion that CEOs with advanced education are more likely to support innovation through R&D investment. They tend to view R&D not as an expense but as a strategic asset necessary for sustaining competitive advantages in volatile markets (Farag & Mallin, 2018; Harymawan et al., 2020). Furthermore, education enhances a firm's absorptive capacity, defined as its ability to identify, assimilate, and exploit new external knowledge (Heyden et al., 2017). This is critical in innovation-focused strategies, where the early recognition of emerging technological opportunities can be decisive for market leadership.

However, the influence of CEO education on R&D commitment is complex and nuanced. Some studies report a consistently positive link (Lin et al., 2011), while others report mixed or insignificant results (Barker & Mueller, 2002; Daellenbach et al., 1999). A CEO's academic specialization is a key moderating factor: those with science and engineering backgrounds typically demonstrate stronger support for R&D than those with business or law degrees (Barker & Mueller, 2002).

Barker and Mueller (2002) concluded that the type of higher education attained by a CEO, rather than the level of education, may be more important in predicting R&D expenditures. Their results showed that while the number of business degrees held by CEOs had no significant effect, the number of legal degrees had a negative and significant effect, and the number of technical degrees (science and engineering) had a positive and significant effect on R&D expenditure. These findings can be interpreted through the lens of CEOs' ability to analyze and manage the risks associated with R&D decisions and their capacity to estimate future benefits. Unlike CEOs with business or legal backgrounds, those with technical training tend to perceive R&D as a value-generating investment. Technical and engineering degrees often foster a problem-solving mindset, familiarity with scientific principles, and openness to technological opportunities. Moreover, because R&D spending is inherently risky, uncertain, and long-term (Al-Dubai, 2025a), CEOs with technical degrees are generally more inclined to assess technological risks and view uncertainty as manageable. In contrast, CEOs with business degrees are typically trained to evaluate investments using financial metrics such as net present value (NPV) or return on investment (ROI), which may encourage risk-averse behavior and lead them to abandon risky projects even when they have a positive NPV (Abdel-Khalik, 2014).

These findings underscore that while higher education generally equips leaders with valuable skills, its specific impact on R&D decisions depends on disciplinary orientation, organizational context, and governance arrangements.

2.2. Chair–CEO duality: concept and debates

Chair–CEO duality refers to a governance structure in which the chief executive officer also serves as the board of directors' chairperson (Yu, 2023; Zhang et al., 2023). The CEO's primary role is to manage the organization's day-to-day operations and implement strategic initiatives, whereas the board chair leads the board in providing oversight, approving strategies, and ensuring accountability to shareholders (Zhang et al., 2023). When both roles are combined, decision-making power is highly centralized, granting the CEO significant influence over operational execution and governance.

This structural arrangement has been the focus of sustained academic and policy debates because of its potential benefits and risks (Liedong & Rajwani, 2022; Yu, 2023; Zhang et al., 2023). According to agency theory (Jensen & Meckling, 1976), Chair–CEO duality can undermine board independence, weaken monitoring mechanisms, and exacerbate agency problems by allowing the CEO to pursue personal objectives at the expense of shareholders (Liedong & Rajwani, 2022). Concentrated leadership may also increase information asymmetry, reduce voluntary disclosure, and heighten corporate risk exposure (Gallego-Álvarez & Pucheta-Martínez, 2022). Regulatory bodies such as the UK Corporate Governance Code have expressed concerns that powerful dual-role CEOs may act opportunistically, especially in high-stakes investment decisions such as R&D (Gallego-Álvarez & Pucheta-Martínez, 2022).

In contrast, stewardship theory (Donaldson & Davis, 1991) presents a more favorable view, suggesting that duality unifies command, eliminates ambiguity in strategic direction, and accelerates decision-making (Yu, 2023; Zhang et al., 2023). A CEO with board chair authority can align management and board objectives more effectively, ensuring the consistent pursuit of long-term strategies, including innovative projects. In dynamic or resource-constrained environments, such centralized leadership may be essential for rapid adaptation and strategic execution (Chen et al., 2022).

Resource dependency theory offers a contingency perspective, proposing that the optimality of Chair–CEO duality depends on contextual factors such as industry complexity and resource scarcity. In high-complexity sectors, which often coincide with high R&D intensity, strong centralized leadership may provide a competitive advantage by enabling decisive allocation of resources and swift responses to technological change (Jayaraman et al., 2022).

2.3. Integrating CEO education, duality, and R&D investment intensity

The interaction between CEO education and governance structure is a critical, but underexplored, determinant of R&D investment intensity. Highly educated CEOs possess the cognitive capacity, technical understanding, and strategic vision to appreciate the long-term benefits of innovation and navigate the uncertainties associated with R&D investment (Farag & Mallin, 2018). However, the extent to which they can act on this understanding depends on their organizational capabilities.

When a highly educated CEO also occupies the chair position, they gain substantial autonomy to direct resources toward R&D without the delays or compromises that might arise from an independent chair exercising rigorous oversight (Zhang et al., 2023). In such cases, stewardship theory suggests that unified leadership may amplify the positive effect of CEO education on R&D commitment by enabling faster decision-making, reducing internal conflicts, and maintaining strategic consistency (Chen et al., 2022; Yu, 2023).

However, agency theory cautions that autonomy can create risks. The absence of robust board oversight may allow overconfidence, personal biases, and hubris to influence strategic investment decisions (Liedong & Rajwani, 2022). Overinvestment in R&D without adequate governance checks could misalign resources with a firm's actual capacity to commercialize innovations.

Therefore, Chair–CEO duality in the hands of a highly educated CEO represents a double-edged governance arrangement (Finkelstein & D'Aveni, 1994). It has the potential to enhance innovation by leveraging the CEO's expertise and decisiveness, but it can also expose the firm to governance risks that undermine investment efficiency.

Upper Echelons Theory posits that CEOs' backgrounds, education, and experience shape how they interpret problems and make strategic decisions (Hambrick & Mason, 1984). Doctoral studies often instill scholarly values, such as theoretical depth, methodological rigor, and intellectual exploration. This orientation may foster innovation, but typically in abstract, long-term, or quality-focused directions rather than immediate commercialization. Some research suggests that executives with PhDs act more moderately and are less prone to risk-taking than their non-PhD counterparts (Berger et al., 2014). Other studies confirm the limited or absent influence of PhD-educated CEOs in various contexts. For example, King et al. (2016) found no significant effect of CEOs with PhDs on the performance of the banks they managed, a result consistent with Berger et al. (2014), who showed that when the board structure shifted toward more executive members, portfolio risk decreased.

In contrast, s-level education—particularly the MBA—tends to emphasize applied problem-solving, managerial decision-making, and market-oriented strategies (Baruch et al., 2005). Bhagat et al. (2010) found that newly appointed CEOs with an MBA achieved higher short-term operational performance compared to their predecessors. Similarly, Beber and Fabbri (2012) reported that MBA-trained CEOs were often overconfident and more risk-tolerant, engaging in speculative behavior in forex markets. These CEOs are also more inclined to pursue aggressive corporate strategies (King et al., 2016). This practical, market-oriented training aligns more directly with commercial R&D investment.

Taken together, these differences suggest that when combined with the authority provided by CEO duality, CEOs with PhDs may underutilize their expertise and exercise restraint in expanding the R&D budgets. In contrast, CEOs with master's degrees are more likely to channel company resources toward applied, investment-focused innovation. This theoretical tension justifies the need to empirically test whether Chair–CEO duality strengthens, weakens, or has no significant effect on the relationship between higher education and R&D investment intensity. Consequently, based on the preceding arguments, the hypothesis can be refined as follows:

Chair–CEO duality positively impacts R&D investment intensity in firms managed by highly educated CEOs.

3. Methodology

This study leverages the dataset compiled by Wang et al. (2023), which comprises 153 firms with highly educated CEOs listed on the Shanghai and Shenzhen Stock Exchanges over the period 2015–2020, yielding 877 firm-year observations (unbalanced). The sample was restricted to industries with substantial R&D activities, such as electronics manufacturing, pharmaceuticals, and other high-innovation sectors. These industries are particularly relevant for analyzing R&D investment dynamics because they are frequently positioned at the forefront of technological advancements and innovation-driven growth. By focusing on these sectors, this study ensures that the analysis is situated in a context in which R&D constitutes a key driver of competitive advantage and long-term sustainability.

To test the hypothesis regarding the effect of Chair–CEO duality on R&D intensity in firms managed by highly educated CEOs, the following baseline model is specified:

$$RD = \alpha_0 + \beta_1(duality)_{it} + \beta_2(ceoage)_{it} + \beta_3(stateowned)_{it} + \beta_4(Fsize)_{it} + \beta_5(Leverage)_{it} + \beta_6(Sector\ dummies)_{it} + \mu_i + \varepsilon_{it}$$

The dependent variable, R&D investment intensity (RD), is measured as the ratio of R&D expenditure to operating income, multiplied by 100. The key independent variable is Chair–CEO duality (duality), coded as 1 when the CEO simultaneously serves as the board chair in a firm led by a highly educated CEO and 0 otherwise. The control variables include CEO age (ceoage), measured in years; state ownership (stateowned), coded as 1 if the firm is state-owned and 0 otherwise; firm size (FSize), measured as the natural logarithm of total assets; leverage (Leverage), defined as the ratio of total liabilities to total assets; and sector dummies (Industry dummies), classified according to the 2012 industry guidelines of the China Securities Regulatory Commission.

China provides a particularly significant setting for this analysis, given its position as the world's second-largest economy and its rapidly evolving corporate governance landscape. Its institutional environment, characterized by a distinctive combination of state influence and market-oriented dynamics, offers a rich context for examining how CEO characteristics and governance structures jointly shape firms'

innovation strategies. By focusing on Chinese firms, this study contributes to the understanding of the drivers of R&D investment in emerging markets, offering insights that may also extend to economies undergoing similar transitional phases.

4. Results and Discussion

4.1. Descriptive statistics

Table 1 presents the results of the descriptive analysis. The findings indicate that most sample firms do not exhibit Chair–CEO duality. Specifically, 361 companies (41%) had a CEO who also served as the Chairman of the Board, whereas 516 companies (59%) had separate individuals in these roles. This proportion is higher than that in other Asian nations. For instance, Sundarasen et al. (2016) found that only 12.44% of Malaysian companies have a Chair-CEO duality. While Chair–CEO duality can enhance executive power and decision-making authority, its impact on organizational outcomes remains a matter of debate (Mubeen et al., 2021).

In terms of R&D, the overall mean for the sample was 7.73%, with a standard deviation of 6.22%. The minimum R&D investment was 1.01%, and the maximum was 38.8%, reflecting considerable variation in firms' commitment to innovation in China. Notably, firms with Chair-CEO duality reported, on average, 1.03% higher R&D investments than those without Chair–CEO duality. These results differ from those of Harymawan et al. (2020), who reported lower R&D investment levels for Indonesian firms. However, they align closely with Wang et al. (2023), who studied Chinese firms and found similar patterns in their R&D investments.

Table 1: Descriptive Statistics of the Continuous Variables

	All Sample					Chair–CEO Duality					No Chair–CEO Duality				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
duality	877	0.41	0.49	0	1										
RD	877	7.73	6.22	1.01	38.8	361	8.34	6.46	1.01	38.8	516	7.31	6.02	1.01	38.8
ceoage	877	50.76	5.67	33	66	361	52.35	5.37	34	66	516	49.66	5.62	33	62
stateowned	877	0.22	0.42	0	1	361	0.11	0.31	0	1	516	0.31	0.46	0	1
Fsize	877	22.23	1.13	20.31	25.97	361	22.18	1.30	20.31	25.97	516	22.27	0.99	20.49	25.76
Leverage	877	0.37	0.16	0.05	0.78	361	0.37	0.18	0.05	0.78	516	0.37	0.16	0.06	0.78

Note: RD = Research and Development investment intensity, CEOage = CEO age, stateowned = State ownership, Fsize = Firm's size, Leverage = Firm's Leverage.

4.2. Correlation analysis

Table 2 displays the pairwise correlation coefficients between R&D investment intensity (RD), Chair-CEO duality (duality), and control variables. The findings reveal a statistically significant positive correlation between R&D investment intensity and Chair-CEO duality ($p < 0.01$). In contrast, R&D investment intensity is negatively correlated with state ownership (stateowned), firm size (Fsize), and firm leverage (Leverage), validating their inclusion as control variables in the analytical framework. Additionally, the absence of high correlations among the independent variables and the low Variance Inflation Factor (VIF) values—all below 2—confirms that multicollinearity is not a concern, ensuring the reliability of the regression analysis. These findings underscore the importance of CEO characteristics and corporate governance in shaping R&D investment decisions, while the control variables account for firm-specific factors that may influence these outcomes.

Table 2: Pairwise Correlation Coefficients Matrix

	RD	duality	ceoage	stateowned	Fsize	Leverage	VIF	1/VIF
RD	1							
duality	0.0810***	1					1.15	0.871553
ceoage	-0.0240	0.2336***	1				1.10	0.910240
stateowned	-0.0575*	-0.2337***	0.1030***	1			1.18	0.849384
Fsize	-0.1900***	-0.0384	0.1169***	0.2502***	1		150	0.668370
Leverage	-0.2704***	0.0176	0.0641*	0.2476***	0.5582***	1	1.49	0.670776
Mean VIF							1.28	

* p<0.10, ** p<0.05, *** p<0.01.

RD = Research and Development investment intensity, duality = Chair-CEO duality, ceoage = CEO age, stateowned = State ownership, Fsize = Firm's size, Leverage = Firm's Leverage.

4.3. Regression analysis

Table 3 presents the results of the Hausman specification test, the Modified Wald test, the Wooldridge test, and the Hausman–Taylor estimations. The Hausman test results confirm that the fixed-effects model is appropriate across all specifications. The Modified Wald test consistently indicates the presence of heteroskedasticity, highlighting the necessity of applying robust standard errors to ensure reliable estimation. Furthermore, the Wooldridge test reveals significant autocorrelation in all models, reinforcing the importance of addressing serial correlations in this analysis.

To address potential endogeneity concerns, this study follows prior research (Al-Dubai, 2025c, 2025b; Alotaibi & Al-Dubai, 2024; Arora & Gaur, 2022) by employing the instrumental variable approach proposed by Hausman and Taylor (1981) and using the xthtaylor estimator in Stata. This method allows for the treatment of both time-varying and time-invariant endogenous regressors, thereby enhancing the robustness of the estimation (Beaudry & Larivière, 2016). The Hausman and Taylor technique is widely recognized in empirical research for generating consistent estimates when explanatory variables are correlated with unobserved effects, and its application has expanded

across both linear and nonlinear models (Hausman, 2019). In line with the best practices recommended by previous studies (Arora & Gaur, 2022), the key variable of interest (Chair-CEO duality) was modeled as endogenous.

The results of Model 1 in Table 3 indicate that the Chair–CEO duality exerts a significantly positive influence on R&D investment in firms led by highly educated CEOs ($\beta = 1.560$, $p < 0.00$). This finding provides meaningful insights into the interplay between leadership education and governance structures in shaping strategic innovation outcomes.

From a stewardship theory perspective, this result is consistent with the view that concentrated leadership authority can enhance visionary CEOs' ability to pursue long-term strategies (Donaldson & Davis, 1991). Highly educated CEOs, with their greater cognitive capacity, analytical skills, and openness to innovation (Dahlin et al., 2005; Hambrick & Mason, 1984), are more likely to recognize the long-term strategic importance of R&D. When such leaders simultaneously occupy the chair position, they encounter fewer organizational barriers, board resistance, or procedural delays, enabling them to allocate resources decisively for innovation. This synergy between education and authority fosters an environment in which risky but strategically important R&D projects can thrive.

The findings also complement the empirical evidence suggesting that CEO education enhances firms' innovative orientation (Farag & Mallin, 2018; Harymawan et al., 2020). The positive role of Chair–CEO duality indicates that governance structures that empower rather than constrain highly educated executives can amplify this effect. In other words, while education equips CEOs with the vision to recognize innovation opportunities, Chair–CEO duality provides the structural autonomy necessary to translate this vision into tangible investments.

Table 3: Hausman-Taylor Estimations (R&D Models)

	Model (1)	Model (2)	Model (3)
TVexogenous			
ceoage	0.252***	0.283***	0.266***
Fsize	-0.979***	-1.075***	-0.994***
Leverage	-0.710	-0.460	-0.736
TVendogenous			
duality	1.560***		
PhdDual		0.558	
MasterDual			1.279***
TIexogenous			
stateowned	-0.321	-0.795	-0.353
Sector Dummies	Included	Included	Included
_cons	17.45***	18.68***	17.28***
sigma_u	5.7804282	5.7846371	5.826808
sigma_e	2.0314993	2.0442148	2.0348406
rho	.89006521	.88898191	.8913014
Wald chi2	93.95	84.08	90.56
Prob > chi2	0.0000	0.0002	0.0001
Number of obs	877	877	877
Number of groups	153	153	153
Hausman's specification test			
chi2	31.94	34.10	32.83
Prob>chi2	0.0000	0.0000	0.0000
	FE Model	FE Model	FE Model
Modified Wald test for groupwise heteroskedasticity			
chi2	9.6e+32	3.4e+30	1.1e+33
Prob>chi2	0.0000	0.0000	0.0000
	Hetero	Hetero	Hetero
Wooldridge test for autocorrelation in panel data			
F(1, 146)	17.922	17.824	18.008
Prob > F	0.0000	0.0000	0.0000
	Auto.	Auto.	Auto.

*p < 0.1, **p < 0.05, ***p < 0.01.

TV refers to time varying; TI refers to time invariant.

RD = Research and Development investment intensity, duality = Chair-CEO duality, ceoage = CEO age, stateowned = State ownership, Fsize = Firm's size, Leverage = Firm's Leverage.

This outcome challenges the agency theory critique of Chair–CEO duality, which emphasizes the risks of reduced board oversight and managerial entrenchment (Finkelstein & D'Aveni, 1994; Jensen & Meckling, 1976). In the context of highly educated CEOs, the concentration of authority does not appear to lead to self-serving or inefficient behaviors but rather to more purposeful investments in innovation. One possible explanation is that advanced education reduces the likelihood of opportunistic decision-making by enhancing awareness of long-term firm value creation and stakeholder considerations. Thus, in firms led by highly educated CEOs, the agency costs typically associated with dual leadership may be mitigated.

However, these results should be interpreted with caution. However, this positive association may not be generalizable across all firms or institutional environments. For instance, in contexts where corporate governance is weak or where CEOs' educational backgrounds do not align with technological or strategic competencies, Chair–CEO duality could still result in overinvestment or misallocation of resources. Moreover, this study highlights the importance of contextualizing governance effects: the impact of Chair–CEO duality is not uniform but is contingent upon the attributes of firm leadership, such as educational attainment.

The supplementary analysis distinguishing between PhD-and Master '" s-educated CEOs under duality provides a deeper understanding of the role of education in shaping innovation outcomes. Two dummy variables were created to capture these differences. The first variable, PhdDual, was coded as 1 if the CEO simultaneously held a dual position (Chair–CEO duality) and possessed a PhD, and 0 otherwise. Its effect was tested using Model 2. The second variable, MasterDual, was coded as 1 if the CEO held the dual position and had either a master's degree (MSc or MBA/EMBA), and 0 otherwise. This effect was examined in Model 3. Interestingly, the findings of Model 2 reveal that Chair–CEO duality combined with PhD education (PhdDual) does not significantly influence R&D investment, whereas Chair–CEO duality with Master's education (MasterDual) is positively significant at the 1% level.

This divergence may be explained by the different orientations and incentives associated with PhD versus Master's education. PhD-educated executives often adopt a highly academic and research-oriented perspective, which may predispose them to theoretical exploration and long-term intellectual pursuits rather than the immediate commercialization of R&D outcomes. When combined with the concentrated

authority of Chair–CEO duality, this orientation may not translate into concrete increases in R&D investment intensity, possibly because of a greater focus on the quality rather than the quantity of innovation.

In contrast, Master "" s-educated CEOs typically receive more applied and managerial training, emphasizing strategy execution, risk management, and business-oriented decision-making (Wiersema & Bantel, 1992). When coupled with Chair–CEO duality, such training appears to empower CEOs to actively channel resources into R&D to secure a competitive advantage. This strong positive significance suggests that Master "' 's-educated CEOs may balance their ambition for innovation with the pragmatism required to justify and sustain investments.

These results are generally consistent with Upper Echelons Theory, which suggests that CEOs' educational level, cultural background, and professional experience are key determinants of how they approach management problems and strategic decisions (Hambrick & Mason, 1984), including those related to R&D. Moreover, they highlight the differences in how CEOs approach R&D decisions based on the type of postgraduate degree they hold. Urquhart and Zhang (2022) emphasized that different levels of university education provide individuals with varying degrees of scientific thinking, cognitive awareness, and personal qualities, as each stage equips its holder with a distinct set of skills and knowledge. Accordingly, it is unrealistic to expect the same level of performance, perspective, or knowledge from two CEOs with advanced education when one holds an MBA and the other a PhD.

In this context, the findings of this study suggest that Chair–CEO duality amplifies these educational differences. For CEOs with MBAs, the duality position enhances their ability to translate applied managerial training into decisive R&D investments, as their education emphasizes problem solving, market-oriented strategies, and resource allocation (Baruch et al., 2005). Duality minimizes board resistance and procedural delays (Yu, 2023; Zhang et al., 2023), allowing CEOs to pursue more aggressive, innovation-driven agendas (King et al., 2016). In contrast, PhD-holding CEOs, while possessing greater technical expertise and intellectual rigor, often take a more cautious and long-term perspective toward R&D. Even with the authority granted by duality, they may be less inclined to pursue aggressive budget expansions for R&D, as their orientation emphasizes depth, quality, and risk moderation, rather than rapid commercialization. Thus, duality empowers MBA-trained CEOs to act on their innovation-oriented managerial logic, while its effect on PhD-trained CEOs remains limited, reflecting their inherently different cognitive and strategic orientations.

Overall, the findings suggest that combining leadership education with concentrated authority can catalyze innovations. For policymakers and boards, this underscores the need to consider executive qualifications when evaluating Chair–CEO duality as a governance arrangement. Instead of adopting a one-size-fits-all stance against Chair–CEO duality, governance codes may benefit from a nuanced perspective that accounts for the role of CEO human capital in shaping innovation outcomes.

5. Theoretical Contributions

This study makes several important contributions to the corporate governance and innovation literature. First, it advances the debate on Chair–CEO duality by demonstrating that its effects are not universally detrimental, as often suggested by agency theory (Finkelstein & D'Aveni, 1994; Jensen & Meckling, 1976). However, the findings show that in the presence of highly educated CEOs, Chair–CEO duality can serve as a governance mechanism that enhances innovation-related investments. This contextualization contributes to the emerging body of research emphasizing the contingent nature of governance mechanisms (Donaldson & Davis, 1991; Hill & Snell, 1988).

Second, the results extend the upper echelons perspective (Hambrick & Mason, 1984) by illustrating how a CEO's educational background interacts with governance structures to shape firm outcomes. Education equips leaders with the vision and analytical tools to appreciate the strategic value of R&D, but it is the governance configuration — specifically, the concentration of power under Chair–CEO duality — that enables these leaders to act upon their insights. This integration of human capital attributes and governance arrangements offers a more nuanced understanding of the influence of executive characteristics on strategic decision-making.

Finally, the findings contribute to the innovation literature by identifying the governance conditions under which R&D investments are more likely to be supported by the board. While prior research highlights the importance of CEO characteristics for innovation (Al-Dubai, 2025a, 2025b; Dahlin et al., 2005; Harymawan et al., 2020), this study shows that the structural authority provided by the Chair–CEO duality is an essential factor. Thus, innovation outcomes emerge not only from managerial traits or governance arrangements in isolation but also from their interactions.

6. Practical Implications

These results have important implications for practitioners and policymakers. For boards of directors, the findings suggest that blanket opposition to Chair–CEO duality may be misguided. Instead, governance decisions should consider the qualifications of the firm's leadership. In firms led by highly educated CEOs, Chair–CEO duality can serve as a mechanism to unlock greater innovation potential, allowing them to pursue long-term strategies with fewer constraints.

For shareholders and investors, this study highlights the value of considering CEO education when assessing governance risks. While Chair–CEO duality is often perceived as increasing agency costs, this study shows that in firms with highly educated executives, Chair–CEO duality may signal a stronger commitment to innovation and long-term value creation.

Finally, for policymakers and regulators, the findings underscore the importance of tailoring governance codes to reflect contextual realities. Uniform prescriptions against Chair–CEO duality may limit firms' flexibility in designing governance arrangements that align with their leadership capabilities and strategic needs. A more nuanced regulatory approach that evaluates the interplay between executive qualifications and governance structures may promote accountability and innovation.

7. Conclusion

This study investigates the impact of Chair–CEO duality on firms' R&D investment intensity under the leadership of highly educated CEOs. The analysis is based on 877 firm-year observations of companies listed on the Shanghai and Shenzhen Stock Exchanges between 2015 and 2020. To test this hypothesis, this study employs the instrumental variable approach proposed by Hausman and Taylor (1981), which is particularly suitable for addressing potential endogeneity issues in panel data. This methodological choice enhances the robustness and reliability of the findings.

The results demonstrate that the Chair–CEO duality has a significantly positive effect on R&D investment intensity. These findings are consistent with stewardship theory, which argues that concentrated leadership authority strengthens a CEO's ability to pursue long-term

strategic objectives. Highly educated CEOs, who generally possess greater cognitive capacity, analytical skills, and openness to innovation, are more inclined to recognize the strategic importance of R&D investments. When such CEOs also occupy the chair position, they face fewer organizational constraints, less board resistance, and fewer procedural delays than other CEOs do. This enables firms to allocate resources more decisively for innovation. Thus, the combination of educational attainment and leadership authority creates a synergy that facilitates investment in high-risk, but strategically valuable, R&D projects. Moreover, the results underscore that CEOs' approaches to R&D decisions vary according to the type of postgraduate degree they hold.

Nonetheless, the findings of this study should be interpreted with caution when applied to other contexts and sectors. The analysis specifically focused on firms led by highly educated CEOs, without considering the quality or specialization of their education. Moreover, while the study accounted for certain CEO characteristics, such as age, it did not examine other important attributes, including gender, prior industry experience, nationality, and additional factors that prior research has shown to influence firm outcomes. Moreover, as this study concentrated on firms in an emerging economy such as China, future research should re-examine these variables in both developing and developed economies. Further studies should consider additional factors that may influence the strength of this relationship, particularly governance systems implemented within firms to mitigate the risks of duality. Finally, this study highlights the importance of including other governance variables as control factors to achieve greater balance; however, this was constrained by the lack of available data in the dataset on which this study relied.

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