

Equity Incentives and Corporate Green Innovation: Mechanisms and Institutional Contingencies

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Abstract. Against the backdrop of escalating global environmental degradation and resource scarcity, green innovation has emerged as a cornerstone of corporate sustainable development. Beyond reducing energy consumption and enhancing resource utilization efficiency, it strengthens competitive advantage and long-term profitability. Governments worldwide have implemented stringent environmental protection policies, with China's "dual carbon" goals accelerating industrial green transformation and compelling enterprises to assume greater environmental stewardship. By aligning senior executives' interests with corporate long-term value, equity incentives mitigate principal-agent conflicts, a mechanism particularly congruent with green innovation's inherent characteristics of high investment intensity, long gestation periods, and strong positive externalities. Based on empirical analysis of Chinese A-share listed companies from 2010 to 2023, this study demonstrates that equity incentives significantly enhance enterprises' green innovation capabilities, with pronounced effects on energy efficiency improvement and waste emission reduction. The findings offer empirical insights for corporate decision-makers and policymakers.

Keywords: Equity Incentives, Green Innovation, State-Owned Enterprises, Principal-Agent Theory.

1. Introduction

1.1. Research Background

Intensifying global warming, ecosystem degradation, and depletion of non-renewable resources constitute critical development challenges for contemporary society, with environmental governance and sustainable development emerging as a global consensus. According to the Global Energy and Carbon Emissions Status Report released by the International Energy Agency, global carbon dioxide emissions reached a record high of 3.68 billion tons in 2023, with the industrial sector accounting for over 65% of total emissions. Concurrently, pressing environmental dilemmas—including plastic pollution and industrial solid waste management—have underscored the ecological limitations of conventional development paradigms. Green innovation, as a pivotal pathway for reconciling economic growth with environmental preservation, enables enterprises to transcend resource constraints and attain sustainable development. Through technological innovation, product upgrading, and management optimization, green innovation reduces energy consumption and pollution emissions while cultivating differentiated competitive advantages, thereby achieving synergistic improvements in environmental and economic performance.

From a policy perspective, the global environmental regulatory framework is undergoing continuous refinement. China's "carbon peaking and carbon neutrality" goals mark a new phase in industrial green transformation, integrating mandatory regulations with incentive-based policies. The 14th Five-Year Plan for Industrial Green Development, issued in 2022, mandates that by 2025, energy consumption per unit of added value for industrial enterprises above designated size must decrease by 13.5% compared to 2020 levels, with carbon dioxide emissions per unit of industrial added value reduced by 18%. Such policy imperatives have compelled key sectors—including energy, manufacturing, and transportation—to expedite green innovation initiatives. At the market level, growing consumer preference for green products and investor focus on environmental responsibility evidenced by expanding ESG investment scale have further

driven corporate green transformation. For instance, China's new energy vehicle market penetration exceeded 30% in 2023, validating the market potential of green products and the trajectory of industrial upgrading.

The alignment between corporate internal governance mechanisms and green innovation has become a focal point in academic research and practical exploration. Green innovation exhibits high investment intensity, prolonged return cycles, and strong positive externalities, with its value realization contingent on enterprises' long-term strategic orientation and sustained resource commitment. Within the modern corporate governance structure—characterized by the separation of ownership and management—principal-agent conflicts between shareholders and executives may incentivize managers to prioritize short-term financial performance while evading the risks and costs of green innovation, resulting in "innovation myopia." As a core governance instrument for mitigating principal-agent problems and aligning managerial interests with long-term corporate value, equity incentives link the interests of senior executives, core employees, and enterprises' sustainable development objectives through profit-sharing mechanisms. This provides a viable solution to address under-incentivization of green innovation initiatives. Empirically, corporate practices—such as Tesla and BYD's use of equity incentive plans to drive new energy technology R&D and green product iteration—have substantiated the synergistic interplay between equity incentives and green innovation strategies. Systematically investigating the impact mechanisms, heterogeneous effects, and boundary conditions of equity incentives on corporate green innovation not only addresses the compatibility challenge between corporate governance and innovation strategies amid green transformation but also offers theoretical insights and empirical guidance for policymakers optimizing green development incentive frameworks, thereby yielding substantial practical significance.

1.2. Research Significance

1.2.1. Theoretical Significance

This study first advances research on the relationship between equity incentives and corporate innovation. Existing literature predominantly examines the aggregate impact of equity incentives on corporate technological innovation, yet research specifically addressing green innovation—a distinct category integrating "technological" and "environmental attributes"—remains underexplored. Green innovation, characterized by strong externalities and policy dependence, differs inherently from conventional technological innovation. By deconstructing the mechanisms through which equity incentives influence green innovation, this study provides domain-specific empirical evidence for understanding the innovation effects of equity incentives, thereby expanding the research boundary at the intersection of corporate governance and innovation management.

Second, this study deepens theoretical understanding of green innovation determinants. Existing research primarily investigates green innovation drivers from macro-level or micro-level perspectives, with insufficient attention to equity incentives within internal governance. Grounded in principle-agent theory, incentive theory, and green innovation theory, this study constructs a framework of "equity incentives–interest alignment–green innovation," elucidating micro-pathways through which corporate governance affects green innovation and bridging the gap between "external drivers" and "internal governance" in existing literature.

Finally, this study offers a novel perspective for heterogeneous research on green innovation between state-owned enterprises and non-SOEs. Existing literature presents conflicting findings regarding ownership type and green innovation. This study integrates equity incentives and ownership nature into a unified analytical framework, examining heterogeneous impacts of equity incentives on green innovation across ownership types and their mechanisms. This contributes to understanding interactive effects between property rights systems and corporate governance, enriching theoretical research on corporate green innovation within the Chinese institutional context.

1.2.2. Practical Significance

For enterprises, this study provides practical implications for designing robust incentive mechanisms and enhancing green innovation capabilities. Firms can optimize equity incentive plans by incorporating environmental performance metrics—such as green patent outputs and carbon emission intensity—to align the interests of management and core employees with long-term green development objectives, mitigate short-termism, and stimulate sustained engagement in green innovation initiatives. For state-owned enterprises, equity incentive mechanisms can translate policy imperatives into intrinsic innovation motivation, enabling them to leverage resource endowments and policy adaptability to enhance green innovation efficiency. For non-SOEs, equity incentives can compensate for policy incentive gaps, thereby improving the sustainability and stability of green innovation investments.

For policymakers, this study offers evidence-based insights for refining green development incentive policies and accelerating industrial green transformation. Governments can encourage enterprises to implement equity incentive plans linked to green innovation outcomes through policy instruments such as tax incentives and targeted subsidies, fostering a dual-driving mechanism of "policy guidance + market incentives." Additionally, tailored policy support systems should be developed based on heterogeneous green innovation characteristics across ownership structures—for instance, strengthening environmental performance assessment criteria in SOE equity incentives and increasing financial subsidies and financing support for non-SOE green innovation—to achieve precise allocation of policy resources.

For capital markets, this study assists investors and market participants in evaluating enterprise value and advancing green financial systems. The findings reveal a significant positive correlation between equity incentives and corporate green innovation, guiding investors to prioritize green-oriented clauses in enterprises' equity incentive plans and integrate green innovation capabilities into investment decision-making frameworks. This incentivizes enterprises to enhance commitment to environmental responsibility and sustainable development. Furthermore, the results inform regulatory authorities in improving ESG information disclosure standards for listed companies, enhancing transparency and standardization of corporate green innovation performance and facilitating diffusion of sustainable investment practices.

1.3. Research Methods

1.3.1. Empirical Analysis Method

This study employs Chinese A-share listed companies spanning 2010–2023 as the research sample, with data on equity incentives, green patents, corporate financial characteristics, and other relevant variables sourced from the China Stock Market & Accounting Research Database, Wind Database, and China National Research Data Service Platform. During data processing, samples of ST/*ST enterprises, financial and insurance firms, and those with severe variable missingness are excluded. Additionally, 1% winsorization is applied to mitigate the influence of outliers, resulting in a balanced panel dataset containing 43,096 observations. Using Stata 17.0 software, descriptive statistical analysis is conducted to characterize variable distributions, while Pearson correlation analysis preliminarily examines inter-variable relationships. A multiple linear regression model is constructed to test the benchmark impact of equity incentives on green innovation. Further heterogeneity tests stratified by ownership type, robustness checks including explanatory variable replacement, sample scope reduction, and instrumental variable methods, and endogeneity treatments via lagged instrumental variables are implemented to systematically validate the reliability and generalizability of the research findings.

1.3.2. Literature Review Method

This study systematically combs domestic and foreign literature in the fields of equity incentives, green innovation, and corporate governance through databases such as CNKI, Web of Science, and Elsevier. Regarding equity incentive research, the focus is on sorting out their impact

mechanisms on corporate innovation, performance, and risk-taking. For green innovation research, attention is centered on driving factors including external environmental regulation, internal governance structures and economic consequences. In terms of theoretical foundations, the core viewpoints and application scenarios of principal-agent theory, incentive theory, human capital theory, and green innovation theory are reviewed in detail. By summarizing, synthesizing, and commenting on existing literature, the progress and gaps in current research are clarified, providing a solid literary foundation for the construction of the theoretical framework, the formulation of research hypotheses, and the design of the research methodology in this paper.

1.3.3. Normative Research Method

This study employs normative research methods to define core concepts, clarifying the connotation, dimensions, and measurement criteria of equity incentives and green innovation. Grounded in principle-agent theory, incentive theory, human capital theory, and green innovation theory, a theoretical analytical framework is constructed to elucidate the mechanisms through which equity incentives impact corporate green innovation. Through logical deduction, this study analyzes the internal pathways—including interest alignment, risk-taking, and long-term orientation mechanisms—via which equity incentives influence green innovation. Integrating the institutional characteristics of China's property rights system, research hypotheses are proposed regarding the heterogeneous effects of equity incentives on green innovation across enterprises with different ownership structures, thereby providing rigorous logical guidance and theoretical foundation for subsequent empirical analysis.

2. Theoretical Foundation

Principal-Agent Theory: This theoretical framework addresses the inherent goal divergence between shareholders and managers. Equity incentives mitigate such conflicts through three interrelated mechanisms: interest alignment via residual claim rights, enhanced monitoring capabilities through ownership stakes, and improved information symmetry. By aligning managerial incentives with long-term firm value maximization, this theory provides a foundational rationale for why equity-based compensation can stimulate green innovation investments characterized by extended payback periods.

Incentive Theory: Grounded in Maslow's hierarchy of needs, equity incentives facilitate a psychological transition from "employee" to "owner" identity among core personnel. This transformation satisfies self-actualization and achievement needs, thereby enhancing intrinsic motivation for green innovation activities. The theory posits that such psychological ownership drives proactive engagement in environmental initiatives beyond contractual obligations.

Human Capital Theory: This perspective suggests that equity incentives create a relational contract binding employee human capital development to enterprise performance. By linking personal wealth accumulation to firm value, equity-based compensation motivates core employees to invest in specialized skills and knowledge relevant to green technologies, thereby enhancing the productivity and efficiency of corporate green innovation systems.

Green Innovation Theory: This framework advocates for the integration of ecological value creation into the innovation process, emphasizing the need to internalize environmental externalities through technological and organizational change. It provides evaluative criteria for assessing how equity incentives can align profit-seeking behavior with sustainable development goals, offering a theoretical lens to examine the normative dimensions of corporate green innovation strategies.

3. Research Hypotheses and Research Design

3.1. Research Hypotheses

H1: Equity incentives exert a significantly positive impact on corporate green innovation. This relationship is mediated through three mechanisms: aligning managers' long-term interests with corporate sustainability goals, integrating green performance metrics into incentive contracts, and enhancing organizational risk-taking capacity to pursue innovation with extended payback horizons.

H2: The positive effect of equity incentives on green innovation is more pronounced in state-owned enterprises than in non-SOEs. SOEs' unique institutional attributes—including stronger policy mandates for environmental stewardship, superior resource access, and governance stability—amplify the effectiveness of equity-based incentives in driving green innovation investments.

3.2. Sample Selection and Data Sources

The sample comprises Chinese A-share listed companies spanning 2010–2023. Data processing procedures include excluding ST/*ST firms, financial/insurance enterprises, and observations with critical missing data; minorizing continuous variables at the 1% level to mitigate the influence of outliers; and constructing a balanced panel dataset with 43,096 firm-year observations. Primary data sources include the China Stock Market & Accounting Research Database, Wind Database, and China National Research Data Service Platform.

3.3. Variable Definition and Model Construction

3.3.1. Variables

Explanatory Variable: Equity Incentives – Measured as the ratio of granted stock options and restricted stock to total share capital, reflecting the intensity of equity-based compensation.

Dependent Variable: Green Innovation – Natural logarithm of total green patent applications plus one, capturing the quantity of corporate green innovation output.

Control Variables: Firm size measured by natural logarithm of total assets, financial leverage measured by total liabilities to total assets, return on assets measured by net profit to total assets, cash flow ratio measured by operating cash flow to total assets, inventory ratio measured by inventory to total assets, largest shareholder ownership measured by percentage of shares held by the largest shareholder, firm age measured by years since establishment, and ownership balance measured by ratio of the second to the tenth largest shareholders' ownership to the largest shareholder's ownership.

3.3.2. Benchmark Regression Model

$$\ln RD_{it} = \alpha_0 + \alpha_1 GQ_{it} + \alpha_2 CONTROL_{it} + \delta_t + \gamma_t + \varepsilon_{it}$$

Where: $\ln RD_{it}$ denotes the green innovation level of firm i in year t ;

GQ_{it} represents the equity incentive intensity of firm i in year t ;

$CONTROL_{it}$ denotes a set of control variables;

δ_t represents year fixed effects;

γ_t denotes industry fixed effects;

ε_{it} is the random error term.

Table 1. Variable Definition Table

Variable	Abbreviation	Definition	Source
Equity Incentive	GQ	Ratio of the actual number of stock options or restricted stocks granted in the equity incentive plan to the total share capital	CSMAR
Green Innovation	lnRD	Ln(Total number of green patent applications + 1)	CSMAR
Firm Size	Size	ln(Total Assets)	CSMAR
Leverage	Lev	Total Liabilities/Total Assets	CSMAR
Return on Assets	ROA	Return on Total AssetsROAB	CSMAR
Cash Flow Ratio	Cashflow	Net Cash Flow from Operating Activities divided by Total Assets	CSMAR
Inventory Ratio	INV	Ratio of Net Inventory to Total Assets	CSMAR
First Largest Shareholder Ownership	Top1	Number of Shares Held by the Largest Shareholder/Total Shares	CSMAR
Firm Age	FirmAge	ln(Current Year-Establishment Year+1)	CSMAR
Equity Balance	Balance1	Ratio of the Second Largest Shareholder's Ownership to the First Largest Shareholder's Ownership	CSMAR

4. Empirical Results

4.1. Descriptive Statistics

Key findings: (1) The explanatory variable GQ exhibits a mean value of 0.003 and standard deviation of 0.01, indicating generally low but heterogeneously distributed equity incentive intensity across the sample firms; (2) The dependent variable lnRD presents a mean of 0.851 and standard deviation of 1.189, suggesting substantial variability in corporate green innovation output; (3) All control variables demonstrate approximate normal distributions, consistent with the statistical properties typically observed in listed company datasets.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
GQ	43096	0.00	0.01	0.00	0.33
lnRD	43096	0.85	1.19	0.00	7.38
Size	43096	22.19	1.34	15.58	28.70
Size	43096	22.19	1.34	15.58	28.70
Lev	43096	0.41	0.21	0.01	1.96
ROA	43096	0.04	0.08	-1.86	1.29
Cashflow	43096	0.05	0.08	-0.74	0.88
INV	43096	0.14	0.13	0.00	0.94
Top1	43096	0.34	0.15	0.00	0.90
FirmAge	43096	2.92	0.36	0.00	4.19
Balance1	43096	0.37	0.29	0.00	1.00
INV	43096	0.14	0.13	0.00	0.94

4.2. Correlation Analysis

Pearson correlation analysis reveals a statistically significant positive correlation between GQ and lnRD at the 1% significance level ($r = 0.055$). All pairwise correlation coefficients among variables are below 0.5, suggesting the absence of severe multicollinearity issues in the regression model.

Table 3. Correlation Analysis

	GQ	lnRD	Size	Lev	ROA	Cashflow	INV	Top1	FirmAge	Balance
GQ	1									
lnRD	0.055* **	1								
Size	- 0.024* **	0.453* **	1							
Lev	- 0.015* **	0.206* **	0.490* **	1						
ROA	0.042* **	-0.004	-0.006	- 0.369* **	1					
Cashflow	0.004	0.018* **	0.079* **	- 0.153* **	0.397* **	1				
INV	- 0.012* **	- 0.076* **	0.112* **	0.291* **	- 0.059* **	- 0.199* **	1			
Top1	- 0.066* **	0.030* **	0.181* **	0.029* **	0.145* **	0.095* **	0.042* **	1		
FirmAge	- 0.030* **	0.061* **	0.189* **	0.186* **	- 0.123* **	0.030* **	0.052* **	- 0.109* **	1	
Balance	0.035* **	0.002	- 0.073* **	- 0.089* **	-0.005	-0.008	- 0.085* **	- 0.596* **	- 0.012* *	1

Note: "****", "***", and "*" denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.3. Benchmark Regression

Model 1 (baseline model with only GQ): The coefficient of GQ is 4.17685 ($p < 0.01$), indicating a statistically significant positive association between equity incentives and corporate green innovation.

Model 2 (full model with control variables): The coefficient of GQ remains 4.02401 ($p < 0.01$), confirming the robustness of the positive impact after accounting for firm-level characteristics. Hypothesis H1 is therefore supported.

Table 4. Baseline Regression

	(1) lnRD	(2) lnRD
GQ	4.17685*** (7.43)	4.02401*** (8.25)
Size		0.44895*** (103.02)
Lev		0.15513*** (5.16)
ROA		0.18516** (2.53)
Cashflow		-0.35541*** (-5.08)
INV		-0.51166*** (-10.84)
Top1		-0.19870*** (-4.88)
FirmAge		-0.09656*** (-6.27)
Balance1		-0.09491*** (-4.64)
Ind	Yes	Yes
Year	Yes	Yes
-cons	0.84056*** (152.58)	-8.71853*** (-87.26)
N	43096	43096
R2	0.139	0.357

Note: "****", "***", and "**" denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.4. Heterogeneity Analysis

Non-SOEs: The coefficient of GQ is 3.18561 ($p < 0.01$).

SOEs: The coefficient of GQ is 11.91687 ($p < 0.01$). These results indicate that the positive impact of equity incentives on green innovation is significantly stronger in SOEs than in non-SOEs, thereby supporting Hypothesis H2.

Table 5. Heterogeneity Analysis

	Non-SOEs	SOEs
	lnRD	lnRD
GQ	3.18561*** (6.39)	11.91687*** (8.22)
Size	0.38541*** (67.08)	0.49388*** (66.51)
Lev	0.27506*** (7.61)	-0.03268 (-0.60)
ROA	0.25508*** (3.20)	0.42298** (2.56)
Cashflow	-0.28613*** (-3.53)	-0.42962*** (-3.29)
INV	-0.46227*** (-7.80)	-0.55280*** (-7.15)
Top1	-0.48217*** (-9.79)	-0.11432 (-1.54)
FirmAge	-0.10293*** (-5.81)	-0.14571*** (-4.69)
Balance1	-0.14439*** (-6.01)	-0.06637* (-1.74)
Ind	Yes	Yes
Year	Yes	Yes
_cons	-7.22868*** (-55.21)	-9.60131*** (-52.71)
N	28090	15006
R2	0.288	0.443

Note: "****", "***", and "*" denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.5. Robustness Tests and Endogeneity Treatment

Dependent Variable Replacement: When using $\ln(\text{total green patent grants} + 1)$ as the alternative dependent variable, the coefficient of GQ is 2.73119 ($p < 0.01$), which remains consistent with the benchmark regression results.

Sample Size Reduction: After excluding the 2019–2021 pandemic period data, the coefficient of GQ is 4.25613 ($p < 0.01$), further confirming the robustness of the baseline findings.

Table 6. Robustness Analysis

	Replaced Dependent Variable Lnrd	Reduced Sample Size lnRD
GQ	2.73119*** (6.32)	4.25613*** (7.36)
Size	0.37619*** (97.37)	0.41393*** (83.42)
Lev	0.16523*** (6.20)	0.13334*** (3.93)
ROA	-0.02785 (-0.43)	0.30589*** (3.46)
Cashflow	-0.25503*** (-4.11)	-0.37583*** (-4.83)
INV	-0.46895*** (-11.21)	-0.45199*** (-8.60)
Top1	-0.13910*** (-3.85)	-0.21477*** (-4.70)
FirmAge	-0.08232*** (-6.03)	-0.09081*** (-5.32)
Balance1	-0.07382*** (-4.07)	-0.08790*** (-3.81)
Ind	Yes	Yes
Year	Yes	Yes
-cons	-7.33368*** (-82.79)	-8.03165*** (-70.91)
N	43096	31662
R2	0.348	0.332

Note: "****", "***", and "**" denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Instrumental Variable Method: Employing the lagged GQ as the instrumental variable, the two-stage least squares (2SLS) estimation yields the following results: (1) First stage regression: The coefficient of L.GQ is 0.25204 ($p < 0.01$), indicating a statistically significant positive correlation with the endogenous variable GQ; (2) Second stage regression: The coefficient of GQ is 14.18408 ($p < 0.01$). The model passes both the LM test (valid instrument relevance) and Wald test (no weak instrument issue), confirming that endogeneity concerns have been effectively mitigated.

Table 7. Endogeneity Test

	(1) GQ	(2) lnRD
L.GQ	0.25204*** (51.08)	
GQ		14.18408*** (6.96)
Size	-0.00020*** (-4.27)	0.46687*** (95.75)
Lev	0.00196*** (6.08)	0.09075*** (2.68)
ROA	0.00913*** (11.71)	0.05748 (0.68)
Cashflow	-0.00135* (-1.76)	-0.41140*** (-5.16)
INV	-0.00091* (-1.82)	-0.53069*** (-10.18)
Top1	-0.00256*** (-5.88)	-0.17087*** (-3.72)
FirmAge	-0.00151*** (-8.75)	-0.10326*** (-5.61)
Balance1	-0.00021 (-0.98)	-0.10158*** (-4.48)
Ind	Yes	Yes
Year	Yes	Yes
_cons	0.00939*** (8.24)	-9.54296*** (-79.09)
N	36899	36899
R ²	0.101	0.358
LM statistic		2436.618*** 2605.926 [16.38]

Note: "****", "***", and "*" denote statistical significance at the 1%, 5%, and 10% levels, respectively

5. Conclusions and Recommendations

Against the backdrop of global environmental degradation, resource scarcity, and China’s “dual carbon” strategy, green innovation has emerged as a critical driver of corporate sustainable development, compelling firms to assume greater environmental stewardship. This study empirically investigates the impact of equity incentives on corporate green innovation using a sample of Chinese A-share listed companies from 2010 to 2023. Employing a comprehensive empirical framework that includes descriptive statistics, correlation analysis, benchmark regression, heterogeneity tests, and robustness checks including dependent variable replacement, sample size reduction, and instrumental variable estimation, the findings consistently indicate that equity incentives exert a significantly positive effect on corporate green innovation. Specifically, equity incentives align the long-term interests of executives and core employees with those of the firm, mitigate principal-agent conflicts, and encourage increased investment in green technology R&D and environmental improvement initiatives—thereby enhancing green innovation performance, particularly in terms of energy efficiency optimization and waste emission reduction.

Heterogeneity analysis further reveals that this promotional effect is more pronounced in state-owned enterprises than in non-SOEs. This divergence arises from SOEs’ stronger exposure to policy pressures and social responsibilities: equity incentives effectively translate external policy mandates

into internal innovation motivation. Additionally, SOEs' advantages in accessing government resources including environmental subsidies, stable governance structures, and inherent emphasis on long-term strategic goals amplify the effectiveness of equity incentives in fostering green innovation. In contrast, non-SOEs lack direct policy-driven incentives for such alignment, resulting in a weaker correlation between equity incentives and green innovation.

Based on these findings, targeted recommendations are proposed for multiple stakeholders. Enterprises should design evidence-based equity incentive schemes integrated with explicit green innovation metrics including green patent outputs, carbon emission reduction targets, aligning employees' personal interests closely with the firm's long-term sustainable development objectives. This alignment will motivate management and core technical personnel to actively engage in green innovation, balancing environmental performance with market competitiveness while responding to societal environmental demands. For policymakers, efforts should focus on integrating environmental performance assessments into SOEs' equity incentive frameworks and introducing targeted policy supports—such as tax incentives and special subsidies—to lower the cost of green innovation. These measures will facilitate the harmonious development of economic growth and environmental protection, advancing national sustainable development strategies. For capital markets, investors and market participants should incorporate corporate green innovation capabilities and equity incentive implementation into their valuation models. This will improve the green financial system, promote sustainable investment practices, and incentivize more enterprises to proactively adapt to green development trends.

Collectively, this study contributes to the literature by elucidating the mechanism through which equity incentives drive green innovation, particularly highlighting the heterogeneous effects across enterprise ownership types. The proposed recommendations aim to construct a synergistic ecosystem where equity incentives effectively catalyze corporate green transformation, providing empirical and practical insights for advancing the global green transition and China's "dual carbon" goals.

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