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# CORPORATE GOVERNANCE AND GREEN INNOVATION: EVIDENCE FROM CHINESE LISTED COMPANIES

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**Abstract**
This research paper empirically investigates the influence of corporate governance on internal innovation, with a particular focus on green innovation (GI). Drawing from the perspective of internal governance mechanisms, the study examines the effects of equity checks and balances (EB), executive incentives (EI), board size (BS), and board independence (BI) on corporate green innovation. Utilizing unbalanced panel data from Chinese A-share listed companies spanning 2008 to 2022, the analysis employs a two-way fixed effects regression model. The research methodology and variable selection are informed by the frameworks of Nageri and Gunu (2020) and Zhao et al (2023). The empirical results reveal that EB, EI, and BS exert significantly positive effects on GI, whereas BI shows no statistically significant relationship. The originality of this study lies in its comprehensive analysis of how internal governance structures systematically shape green innovation outcomes. By constructing an integrated analytical framework, this study contributes to the theoretical understanding of corporate green innovation drivers. Moreover, the findings offer valuable insights for both policymakers and corporate leaders, particularly under the strategic imperative of "dual carbon" goals, highlighting the importance of optimizing internal governance to strengthen long-term innovation capacity and competitive advantage.
***Keywords:*** *Equity checks and balances, executive incentives, board size, board independence, corporate green innovation*

## 1. INTRODUCTION

Driven by the dual-carbon strategy and the goals of high-quality development, green innovation has emerged as a crucial engine for China's green economic transformation and sustainable growth. In recent years, the continuous advancement of renewable energy technologies has significantly enhanced green total factor productivity (GTFP), alleviated environmental pollution, and improved the efficiency of resource allocation (Li et al., 2021). Furthermore, urban-level green transformation is increasingly reliant on a diversified and open innovation ecosystem, which fosters low-carbon development through multiple pathways, including technological advancement, institutional support, and multi-stakeholder collaboration (Demeulenaere, 2020). Against this backdrop, an in-depth investigation into the driving mechanisms and influencing factors of green innovation, particularly the role of internal corporate governance, holds both theoretical significance and practical relevance. This study contributes to the expansion of the theoretical framework on green innovation (Zhao et al., 2021), underscoring its dual benefits for economic performance and environmental sustainability (Rweyendela & Kombe, 2021). The


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findings highlight the vital role of optimizing internal governance structures in enhancing green innovation among Chinese enterprises (Lei & Zhao, 2024), and also offer practical guidance for policymakers seeking to promote sustainable development and strengthen global competitiveness (Q. Yang et al., 2021).

Amid China's ongoing green transformation, green innovation has become a vital strategic resource for enterprises seeking sustainable competitive advantage. In recent years, scholars have increasingly explored the theoretical links between corporate governance and innovation, gradually recognizing the significant role of governance structures in advancing green innovation. However, most existing studies focus on the direct correlation between governance and green innovation, without reaching a unified conclusion. Moreover, the underlying mechanisms through which corporate governance influences green innovation remain insufficiently examined (Zhang, 2023). While green innovation research has made substantial progress globally, particularly in developed regions, its development in emerging markets remains limited, which restricts the applicability and generalization of existing findings (Bonsu et al., 2024). Currently, the majority of research and implementation efforts related to green innovation are concentrated in developed economies such as those in Europe and North America, whereas developing countries still lag behind (Dang et al., 2025). In particular, there is a notable gap in studies addressing how to cultivate green values at a cultural and spiritual level and translate them effectively into practical organizational actions (J. Wang, 2023).

Starting from the core objective of this study, we propose several research questions that will be further developed into testable hypotheses in Section 2. Specifically, the research questions are as follows:

RQ1: What is the mechanism through which Equity Checks and Balances(EB) influences corporate green innovation activities?

RQ2: How do executive incentives (EI) contribute to the promotion of green innovation?

RQ3: To what extent does board structure affect corporate green innovation outcomes?

The innovation of this study lies in the following aspects. First, it provides a comprehensive investigation into the impact of equity structure, incentive mechanisms, and board characteristics on green innovation using panel data from 2008 to 2022. Second, the study employs rigorous regression techniques and conducts a series of diagnostic tests to ensure robustness. Finally, by adopting a policy-oriented perspective, the study offers valuable insights for the evaluation and potential redesign of regulatory frameworks related to corporate governance and green innovation.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature and presents the research hypotheses. Section 3 outlines the methodology. Section 4 reports the empirical results, followed by a discussion in Section 5. Section 6 concludes the paper.

## 2. THEORETICAL BACKGROUND AND THE HYPOTHESES

### 2.1. Theoretical and empirical insights of ease of doing business

The resource-based theory (RBV) holds that the competitive advantage of an enterprise stems from its internal, scarce, and inimitable resources and capabilities. This theoretical framework is widely


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used to explain how enterprises achieve sustainable development through green innovation (Sabourin, 2020). In green innovation research, RBV not only emphasizes the importance of internal resources of an enterprise but also emphasizes the interactive relationship between the integration of these resources and the governance mechanism. Khanra et al. (2021) systematically sorted out the role of green innovation as a strategic resource in enterprises, and proposed that green supply chain, green product design and corporate social responsibility are the key paths to building green competitive advantages (Khanra et al., 2022). In the corporate governance dimension, Alkaraan et al. (2024) combined RBV with dynamic capability theory to reveal the synergy between corporate governance structure, board capabilities and green strategic investment. They emphasized that whether an enterprise can effectively allocate green resources depends not only on the resources themselves, but also on the absorption and integration capabilities of the governance layer (Alkaraan et al., 2024). Liu et al. (2024) further used machine learning methods to identify the determinants of green innovation and found that key internal resources such as CEO compensation, ESG scores and R&D intensity are highly correlated with green innovation performance, verifying the definition of "strategic scarce resources" in RBV theory (F. Liu et al., 2024).

A large number of empirical studies have shown that corporate governance mechanisms play an important role in promoting corporate green innovation, and that governance mechanisms have a long-term impact on the accumulation of corporate green technology capabilities. Based on data from 3,896 companies in 45 countries, it was found that for every 1% increase in corporate governance, the proportion of green R&D investment increased by approximately 0.77%, indicating that a good governance structure can effectively promote green innovation (Makpotche et al., 2024). Asni and Agustia (2022) believe that the size, independence, and equity concentration of the board of directors significantly improve the level of green innovation, highlighting the key role of governance structure in emerging markets (Asni & Agustia, 2022).

### 2.2. Determining parameters and hypotheses

Green innovation does not occur in isolation. In the context of globalization, transnational value chains and the diffusion of advanced technologies are essential drivers of green innovation (OECD Report, 2019). A variety of external and internal factors influence green innovation, including environmental policies and regulations (Amore & Bennedsen, 2013), regional disparities, capital and technological investments, and market demand (L.R. Rupasinghe et al., 2023).

Corporate governance serves as an important moderating mechanism that enhances the positive effect of green innovation on sustainable development outcomes. Well-structured governance practices can significantly strengthen this relationship (Elkholy et al., 2024). Among governance components, Equity Checks and Balances plays a central role. Moderate equity concentration has been found to improve green innovation performance (Xu et al., 2019), especially under policy uncertainty where balanced ownership can increase firms' resilience and innovation motivation (Yang et al., 2023). Moreover, checks and balances among shareholders can improve green technology investment efficiency and strengthen corporate social responsibility performance


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through the mediating role of green innovation, particularly under conditions of environmental uncertainty. Compared to firms dominated by a single majority shareholder, companies with diversified ownership structures are better equipped to manage cash flow volatility and stimulate green innovation, especially when supported by green finance and intellectual property protections (Wang et al., 2022). This study proposes the H1 :

*H1: Equity Checks and Balances(EB) is positively associated with corporate green innovation (GI).*

As the core of strategic decision-making, executive incentives play a significant role in directing corporate investment toward green innovation. These incentives include both material and non-material forms, with equity-based and salary-based incentives being the most prevalent.

Equity incentives (EI) link executive compensation to firm stock performance, fostering a long-term, ownership-oriented mindset. Executives with equity stakes are more inclined to prioritize sustainable growth and are more willing to undertake long-horizon, high-risk projects such as green innovation (Sun et al., 2023a; J. Wu et al., 2022). Higher equity incentive intensity increases tolerance for innovation failure and cultivates a corporate culture that encourages experimentation in green technologies (Sun et al., 2023b). Equity incentives also enhance corporate governance, financing efficiency, and innovation performance, thereby contributing to improved ESG outcomes(Song Zijun, 2024).

Salary incentives (SI) also significantly promote green innovation. Well-designed compensation structures guide executives to focus more on green strategies, leading to measurable increases in green patent output and R&D investments(Zhao et al., 2025). In addition, salary incentives help mitigate executives' short-termism, enabling greater emphasis on strategic and technological development. This shift supports a transition from superficial "greenwashing" to substantive green innovation (Deng & Chen, 2024). The effect is further amplified in firms undergoing digital transformation (M. Liu et al., 2025). This study proposes the H2 :

*H2a: Equity incentives (EI) are positively associated with corporate green innovation (GI).*

*H2b: Salary incentives (SI) are positively associated with corporate green innovation (GI).*

The board of directors is central to shaping a firm's strategic orientation, and board size, as a structural attribute, has been shown to significantly influence green innovation by affecting resource access, information processing, and decision-making capacity.

Larger boards tend to enhance innovation performance through increased openness and diversity. A greater number of board members facilitates the formation of broader external resource networks, enabling firms to access green knowledge, technologies, and partnerships more effectively, thus improving green R&D and application capabilities (Lu & Wang, 2016a). In addition, board size positively affects green innovation through its role in strengthening internal governance (Asni & Agustia, 2022).

Recent studies also highlight that the digitalization level of a firm can moderate this relationship. Wang and Xie (2023) found that the positive effect of board size on green innovation is more pronounced in highly digitalized firms, where digital tools enhance strategic and innovation-related decision-making (Xie & Wang, 2024). This study proposes the H3 :


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*H3: Board size (BS) is positively associated with corporate green innovation (GI).*

Board independence, as a core metric of governance effectiveness, is expected to influence green innovation by enhancing oversight, improving risk tolerance, and fostering strategic autonomy. However, existing literature presents mixed findings regarding the precise direction and strength of this relationship.

Higher proportions of independent directors are believed to encourage high-risk, high-reward innovation strategies. Independent directors can reduce managerial conservatism by supporting risk-taking, tolerating failure, and helping optimize executive incentive structures, fostering an environment conducive to green innovation(Lu & Wang, 2016b) While many studies affirm a positive impact, other research suggests a more ambiguous or even non-significant relationship. For instance, Valencia (2017), based on Australian public firms, found no statistically significant link between board independence and innovation activity (Valencia, 2018).Given these conflicting findings, further empirical validation is necessary. This study proposes the H4 :

*H4: Board independence (BI) is positively associated with corporate green innovation (GI).*

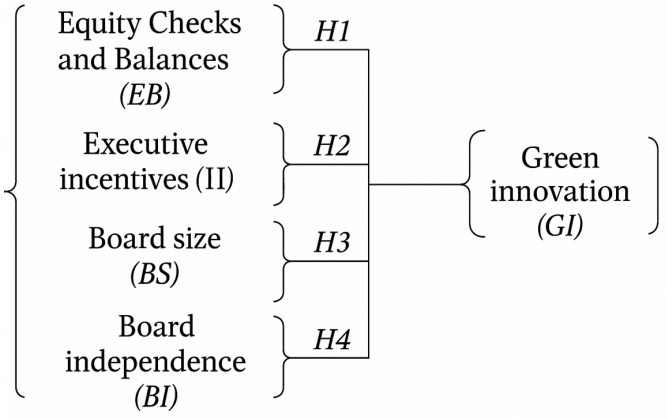
## 3. RESEARCH METHODOLOGY

### 3.1. Data and sample

This study employs panel data and secondary sources to examine the impact of selected corporate governance variables on green innovation among Chinese listed companies. The statistical data are sourced from the authoritative CSMAR database, covering the period from 2008 to 2022, with a total of 36,647 firm-year observations.

To estimate the parameters, this study adopts a Poisson regression model, which is appropriate for count-dependent variables such as the number of green patent applications. In this analytical framework, corporate green innovation (GI) serves as the dependent variable. The key independent variables include equity checks and balances (EB), executive incentives (EI), board size (BS), and board independence (BI).Accordingly, the conceptual framework of the research model is illustrated in Figure 1.

Figure 1. Conceptual proposed model




*Source: Authors' elaboration*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### 3.2. Variables

Following established academic practices, this study uses the sum of the number of green invention patents and green utility model patents granted to a firm in a given year to represent the firm's annual green patent applications, thereby serving as a proxy for green innovation (Liu et al., 2024). To address the issue of data skewness and to enhance model interpretability, the natural logarithm of green patent applications is adopted as the final measure of a firm's green innovation performance, denoted as GI (Chen & Chen, 2021). A higher GI value indicates a higher level of green innovation, while a lower value suggests weaker innovation capability (Liu et al., 2022; Nurul Kabir et al., n.d.; Wu et al., 2024).

Equity checks and balances (EB) are measured as the ratio of the total shareholding percentages of the second to tenth largest shareholders to that of the largest shareholder (Torres et al., 2024). This indicator reflects the degree of power distribution among major shareholders.

Executive incentives (EI) include both equity and salary incentives.Equity incentives are measured by the proportion of company shares awarded to directors, supervisors, and senior executives as part of incentive schemes (Wang, 2023).

Salary incentives (SI) are measured as the natural logarithm of the average annual salary of directors, supervisors, and senior executives, with duplicate entries excluded in cases of concurrent positions (Ding et al., 2020). Since executive compensation typically follows a right-skewed distribution (i.e., most salaries are clustered in a lower range with a few extreme high values), a logarithmic transformation is applied. This transformation compresses the data range, mitigates the impact of outliers, improves model stability, and brings the distribution closer to normality, thereby enhancing the accuracy and interpretability of the regression results (Heller et al., 2014).

Board size (BS) is defined as the total number of members on the board of directors (Coughlan et al., 2023).

Board independence (BI) is measured as the percentage of independent directors relative to the total number of board members(Hou & Xie, 2024).

The selection of control variables in this paper is shown in Table 1.

**Table 1.**Control Variable Table

| Control Variable | Definition | Measurement |
|---|---|---|
| Return on Assets (ROA) | The profitability of a company's assets | Net profit divided by total assets |
| Company size (SIZE) | Asset size | Natural logarithm of total assets at the end of the year |
| Leverage Ratio (LEV) | The ratio of a company's total liabilities to its total assets | Total liabilities divided by total assets |
| Growth | Operating income growth rate | (Current period operating income - Previous period operating income) / Previous period operating income |


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| | | |
|---|---|---|
| Company Age (LNAGE) | The age of the company | The natural logarithm of the difference between the founding year and the IPO year |
| Tang | Asset structure | (net fixed assets + net inventory) / total assets |
| Dual | Chairman and General Manager concurrently | If both positions exist, it is 1; if they do not exist, it is 0 |

*Source: Authors' elaboration*

### 3.3. Model development

Basic regression. The number of green invention patent applications of enterprises meets the Poisson distribution and contains more 0 values. Therefore, this study uses the Poisson counting model with higher fitting accuracy to study the relationship between corporate governance and green innovation (Ding et al., 2024; Xiong et al., 2024), and constructs the following model.

$$Gl_{it} = \exp(\beta_0 + \beta_1 EB_{it} + \beta_2 ei_{it} + \beta_3 si_{it} + \beta_4 BS_{it} + \beta_5 RD_{it} + \gamma_1 roa_{it} + \gamma_2 size_{it} + \gamma_3 lev_{it} + \gamma_4 growth_{it} + \gamma_5 lnage_{it} + \gamma_6 tang_{it} + \gamma_7 dual_{it} + \sum_j lnd_j + \sum_t year_t) + \varepsilon_{it}$$

i represents enterprises or company entities.

t represents time, i.e., years.

$Gl_{it}$: The number of green patent applications submitted by enterprise i in year t (dependent variable).

$EB_{it}$, $ei_{it}$, $si_{it}$, $BS_{it}$, $RD_{it}$: Core explanatory variables.

$\sum_j lnd_j$: Industry fixed effects, controlling for the impact of different industry characteristics.

$\sum_t year_t$: Year fixed effects, controlling for time trend effects, such as policies, economic environment, etc.

$\varepsilon_{it}$: Random disturbance, representing the unexplained error component.

Control variables: $roa_{it}$, $size_{it}$, $lev_{it}$, $growth_{it}$, $lnage_{it}$, $tang_{it}$, $dual_{it}$.

## 4. RESULTS

### 4.1 Data Screening

In order to improve the data quality and reliability of the analysis results, this paper systematically cleans the sample data before the empirical study. First, for missing values, this paper removes the long-term missing enterprise data of key financial indicators (such as debt-to-asset ratio, net profit,


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etc.), and uses the mean of the same industry to reasonably interpolate a small number of missing values. Secondly, in terms of outlier processing, this paper excludes the financial insurance industry, ST/ST*/PT abnormal trading companies, companies with debt-to-asset ratios less than 0 or greater than 1, and financial data before the listing of companies to ensure the comparability and representativeness of the sample. In addition, to further improve the robustness of the data, this paper performs tail shrinking processing on continuous variables at the 1% level. After multiple rounds of screening and cleaning, 36,647 valid annual observations of China's A-share listed companies from 2008 to 2022 were finally retained, providing a solid data foundation for subsequent regression analysis.

**4.2 Baseline Regression**

Table 2 shows the baseline regression results of green innovation (GI) under the Poisson regression model. The results show that equity checks and balances (EB), executive equity incentives (ei), compensation incentives (si) and board size (BS) all have significant positive effects on corporate green innovation, verifying hypotheses H1, H2a, H2b and H3. Among them, the coefficient of the compensation incentive variable is the largest and the most significant, indicating that compensation incentives play the most prominent role in promoting corporate green innovation. In contrast, although board independence (RD) has a potential positive effect in theory, it does not show a significant statistical relationship in this study, and hypothesis H4 is not supported. In terms of control variables, enterprise size, profitability and growth all have a positive impact on green innovation, while enterprise age is negatively correlated, which is in line with the theoretical expectation that green innovation is more likely to occur in emerging enterprises with sufficient resources and strong vitality.

**Table 2:** Baseline Regression

| | (1) GI | (2) GI | (3) GI | (4) GI | (5) GI |
|---|---|---|---|---|---|
| EB | 0.0856*** | | | | |
| | (2.6230) | | | | |
| ei | | 0.2333*** | | | |
| | | (2.5950) | | | |
| si | | | 0.3455*** | | |
| | | | (7.1856) | | |
| BS | | | | 0.0408** | |
| | | | | (2.2097) | |
| RD | | | | | -0.4806 |
| | | | | | (-0.9046) |
| roa | 1.6831*** | 1.5561** | 0.6040 | 1.6239*** | 1.5587*** |
| | (2.7524) | (2.5541) | (0.9967) | (2.6578) | (2.5853) |
| size | 0.9000*** | 0.9141*** | 0.7926*** | 0.8896*** | 0.9051*** |
| | (35.2435) | (33.9757) | (25.8707) | (31.9941) | (34.7831) |


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| | | | | | |
|---|---|---|---|---|---|
| lev | -0.0074 | -0.0062 | -0.0934 | -0.0096 | -0.0356 |
| | (-0.0375) | (-0.0316) | (-0.4738) | (-0.0488) | (-0.1822) |
| growth | 0.0846** | 0.0819** | 0.1039*** | 0.0838** | 0.0831** |
| | (2.5105) | (2.4200) | (3.0958) | (2.5044) | (2.4807) |
| lnage | -0.1485*** | -0.1345*** | -0.1206*** | -0.1557*** | -0.1560*** |
| | (-3.8986) | (-3.4975) | (-3.2522) | (-4.0569) | (-4.1302) |
| tang | 0.0040 | -0.0096 | 0.0544 | -0.0249 | -0.0125 |
| | (0.0181) | (-0.0428) | (0.2488) | (-0.1107) | (-0.0560) |
| dual | 0.2657*** | 0.2486*** | 0.2293*** | 0.2983*** | 0.2866*** |
| | (4.2669) | (3.8358) | (3.7525) | (4.7170) | (4.4159) |
| Ind FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| *Obs* | 36647 | 36647 | 36647 | 36647 | 36647 |

Note: *, **, *** indicate that the test is significant at the 10%, 5%, and 1% statistical levels, respectively.

### 4.3 Robustness Test

In order to verify the robustness of the above benchmark regression results and further enhance the reliability of the research conclusions, this paper continues to conduct robustness tests. This study uses the results of the alternative explanatory variable model for robustness verification.

The classification of green patents in China includes green invention patents and green utility model patents. Compared with utility model patents, invention patents have higher requirements for the novelty, creativity and practicality of technical solutions, and usually better reflect the original innovation capabilities and technological breakthroughs of enterprises in the field of green technology. Therefore, green invention patents are widely regarded as an important indicator for measuring the high-quality green innovation level of enterprises. In order to further test the robustness of the benchmark regression results, this paper uses the number of green invention patents (GI_inn) as an alternative variable for green innovation for regression analysis, and the results are shown in Table 4.4. The regression results show that the coefficient direction and significance level of the core explanatory variables are basically consistent with the benchmark model, which verifies the robustness of the model. Among them, equity checks and balances (EB) are positive and significant at the 10% significance level, and equity incentives (ei) and salary incentives (si) are significantly positive at the 1% level, further supporting the H1, H2a and H2b hypotheses; the board size (BS) also maintains positive significance at the 5% level, verifying H3; and the board independence (RD) has a negative coefficient, but still does not reach the significance standard, and the H4 hypothesis is not supported. In addition, control variables such as profitability (roa), enterprise size (size), growth (growth) and dual positions of senior executives (dual) are still significant in most models, and the direction is consistent. Overall, the results of the


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alternative variable test are highly consistent with the baseline regression, indicating that the empirical results of this paper have good robustness and credibility.

**Table 3** Robust Check Utilizing Green Invention Patents

| | (1) GI_inn | (2) GI_inn | (3) GI_inn | (4) GI_inn | (5) GI_inn |
|---|---|---|---|---|---|
| EB | 0.0728* | | | | |
| | (1.9384) | | | | |
| ei | | 0.3844*** | | | |
| | | (3.3525) | | | |
| si | | | 0.2888*** | | |
| | | | (5.0849) | | |
| BS | | | | 0.0506** | |
| | | | | (2.3992) | |
| RD | | | | | -0.8889 |
| | | | | | (-1.4620) |
| roa | 2.1581*** | 2.0355*** | 1.2520* | 2.1186*** | 2.0274*** |
| | (3.2939) | (3.1253) | (1.9092) | (3.2331) | (3.1336) |
| size | 0.9820*** | 1.0032*** | 0.8933*** | 0.9675*** | 0.9883*** |
| | (32.5089) | (31.5068) | (24.5294) | (30.2391) | (32.5958) |
| lev | -0.1181 | -0.1034 | -0.1979 | -0.1091 | -0.1507 |
| | (-0.5417) | (-0.4801) | (-0.9193) | (-0.5054) | (-0.7001) |
| growth | 0.1537*** | 0.1514*** | 0.1712*** | 0.1519*** | 0.1519*** |
| | (4.4551) | (4.3580) | (4.9522) | (4.4811) | (4.4612) |
| lnage | -0.0744* | -0.0457 | -0.0496 | -0.0821* | -0.0817* |
| | (-1.7057) | (-1.0181) | (-1.1672) | (-1.8456) | (-1.8666) |
| tang | 0.1763 | 0.1708 | 0.2183 | 0.1447 | 0.1648 |
| | (0.6427) | (0.6229) | (0.8090) | (0.5235) | (0.6005) |
| dual | 0.2296*** | 0.1929*** | 0.1979*** | 0.2670*** | 0.2564*** |
| | (3.2234) | (2.6125) | (2.8057) | (3.6687) | (3.4403) |
| Ind FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| *N* | 36647 | 36647 | 36647 | 36647 | 36647 |

Note: *, **, *** indicate that the test is significant at the 10%, 5%, and 1% statistical levels, respectively.

Considering that the COVID-19 pandemic is a sudden external shock event, it may interfere with the resource allocation, R&D investment and innovation strategy of enterprises through multiple channels such as supply chain disruption, market demand fluctuations, and policy intervention, thereby affecting green innovation behavior. In order to eliminate potential non-structural interference factors during the pandemic and enhance the credibility of empirical conclusions, this


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paper shortens the sample time window to before the pandemic, that is, from 2008 to 2019, and conducts a regression analysis on corporate green innovation. The regression results are shown in Table 4.

From the results, in the robustness test of shortening the sample period, the core explanatory variables still show a high degree of significance and directionality consistent with the benchmark regression, indicating that the results of this study have strong robustness and anti-interference ability. Specifically, equity checks and balances (EB) are positively significant at the 10% significance level, equity incentives (ei) and salary incentives (si) are significantly positive at the 5% and 1% levels, respectively, which continue to verify the H1, H2a and H2b hypotheses; the board size (BS) is positively significant at the 5% level in model (4), supporting the H3 hypothesis; while the board independence (RD) is still not significant, and the H4 hypothesis is not supported. In terms of control variables, variables such as corporate profitability (roa), corporate size (size), and growth (growth) all maintain positive significance; corporate age (lnage) is significantly negatively correlated with green innovation; asset tangibility (tang) begins to show positive significance in the regression of this window period, indicating that in the early stage of the epidemic, the allocation of tangible assets may provide certain support for green innovation. In addition, the dual position of senior executives (dual) still maintains a highly significant positive relationship, further confirming its positive role in corporate strategic unification and resource coordination. By shortening the sample time window, we effectively eliminated the interference factors brought about by the COVID-19 pandemic and the macroeconomic fluctuations it caused. The results obtained were basically consistent with the benchmark regression, which once again verified the robustness of the conclusions of this article.

**Table 4:** Robust Check Shorten the Sample Interval

| | (1) GI | (2) GI | (3) GI | (4) GI | (5) GI |
|---|---|---|---|---|---|
| EB | 0.1166*** | | | | |
| | (2.9154) | | | | |
| ei | | 0.2675** | | | |
| | | (2.3524) | | | |
| si | | | 0.4142*** | | |
| | | | (7.3743) | | |
| BS | | | | 0.0445* | |
| | | | | (1.9526) | |
| RD | | | | | -0.4751 |
| | | | | | (-0.6860) |
| roa | 2.9870*** | 2.7821*** | 1.4769** | 2.8638*** | 2.7580*** |
| | (4.4395) | (4.0958) | (2.1936) | (4.0944) | (4.0663) |
| size | 0.9091*** | 0.9276*** | 0.7776*** | 0.8975*** | 0.9169*** |
| | (29.3806) | (28.3082) | (20.8897) | (26.2494) | (28.8268) |
| lev | -0.0852 | -0.1083 | -0.2076 | -0.1087 | -0.1396 |


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| | | | | | |
|---|---|---|---|---|---|
| | (-0.3835) | (-0.4834) | (-0.9168) | (-0.4830) | (-0.6272) |
| growth | 0.0709* | 0.0671* | 0.1007*** | 0.0691* | 0.0689* |
| | (1.9383) | (1.8211) | (2.8458) | (1.9250) | (1.9005) |
| lnage | -0.1174** | -0.0988** | -0.0897** | -0.1232*** | -0.1272*** |
| | (-2.5045) | (-2.0691) | (-1.9919) | (-2.5783) | (-2.7304) |
| tang | 0.5332** | 0.5159** | 0.5713** | 0.4797* | 0.5029* |
| | (2.0935) | (2.0006) | (2.2787) | (1.8385) | (1.9514) |
| dual | 0.2633*** | 0.2482*** | 0.2178*** | 0.3046*** | 0.2908*** |
| | (3.6293) | (3.4004) | (3.0688) | (4.1075) | (3.7944) |
| Ind FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| *N* | 25085 | 25085 | 25085 | 25085 | 25085 |

Note: *, **, *** indicate that the test is significant at the 10%, 5%, and 1% statistical levels, respectively.

## 5. CONCLUSION

This paper conducts a systematic empirical analysis of panel data from China's A-share listed companies from 2008 to 2022, and deeply explores the path and mechanism of the impact of internal governance structure on corporate green innovation. Based on theoretical construction, the study first conducts a benchmark regression analysis of green patent output through the Poisson regression model, and then conducts robustness tests from multiple dimensions, including using green invention patents as alternative variables and shortening the sample time window to eliminate the impact of the new crown epidemic, so as to ensure the validity and stability of the conclusion. The empirical results are highly consistent, indicating that the research hypotheses H1 (equity checks and balances), H2a (equity incentives), H2b (compensation incentives) and H3 (board size) have been fully verified, while H4 (board independence) has not been empirically supported.

Equity checks and balances can effectively alleviate the agency problems caused by the "dominant share" of the controlling shareholder, and promote green technology innovation by promoting multi-party games, improving strategic transparency and resource allocation efficiency; in terms of executive incentive mechanisms, the study found that the marginal effect of compensation incentives is the most significant, indicating that short-term and direct material incentives have a stronger driving effect on green innovation than equity incentives in current corporate practices. This may also be related to the fact that China's capital market is still immature and the overall low shareholding ratio of senior executives, which limits the deep motivation mechanism of equity incentives. The positive effect of board size reflects that a larger board helps to improve the professional diversity and information acquisition ability of the board, which is conducive to enterprises making more rational and forward-looking decisions on green technology investment. However, the independence of the board of directors did not significantly affect green innovation, suggesting that under the current institutional background, the role of the independent director


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system in supervision and green orientation has not been fully exerted, and there is a structural constraint of "form over substance".

In terms of control variables, enterprise scale, profitability and growth continue to show positive and significant effects, indicating that enterprises with better resource endowments and stable operations are more capable of green innovation investment and pressure bearing; enterprise age is significantly negatively correlated with green innovation, confirming that young enterprises are more innovative and risk-taking; in addition, in the robustness test of shortening the sample period, asset tangibility began to show a positive effect, which may indicate that during economic fluctuations, the tangible resource base provides material guarantee for green technology research and development, and the **dual position of senior executives** variable continues to be positive and significant, reflecting that the CEO's concurrent position as chairman helps to improve strategic concentration and execution efficiency, thereby enhancing the driving force of green innovation.

Therefore, on the whole, the research results of this paper not only confirm the important driving role of internal governance mechanisms on green innovation, but also reveal the differences in the roles of different elements in the governance structure in green development.

## 6. Countermeasures and Suggestions

Based on the above empirical research conclusions, this paper proposes the following more targeted and operational policy recommendations:

(1) Optimize the equity structure and promote checks and balances in governance

Listed companies should be encouraged to adopt rules and regulations or articles of association revisions to reasonably set the upper limit of the shareholding ratio of major shareholders to prevent the phenomenon of "one share dominating", and give small and medium shareholders appropriate proposal and voting rights. It is encouraged to introduce more participating shareholders through employee stock ownership plans, industrial fund investment, and diversified allocation of state-owned capital, so as to enhance the multi-game mechanism in corporate governance. At the same time, the governance mechanism of "independent directors + small and medium shareholders linkage" can be used to enhance the review and veto power of the board of directors' supervisory level over green decisions, forming a benign interaction between shareholder structure and green governance.

(2) Improve the incentive mechanism for senior executives and strengthen the green performance orientation

It is recommended that enterprises add a green performance dimension to the performance appraisal system, and include indicators such as the number of green patent applications, the reduction in carbon emission intensity, and the investment amount of energy-saving and emission reduction projects into the core basis for the distribution of senior executives' remuneration and bonuses, so as to promote the effective binding of green responsibility and economic benefits. At the same time, enterprises are encouraged to set up "green equity pools" or "sustainable development option incentive plans" to give senior executives medium- and long-term stock


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appreciation rights or restricted equity tied to successful green projects, so as to increase their attention and sense of responsibility for the company's green strategic goals.

(3) Appropriately expand the size of the board of directors and introduce green technical talents

In response to the problem of the single professional structure of board members, enterprises should appropriately expand the size of the board of directors and introduce independent directors or external consultants with backgrounds in environmental engineering, environmental law, carbon asset management, green finance, etc., to enhance the overall professional judgment of the board of directors on green affairs. A special "ESG committee" or "green strategy group" can be established to review and evaluate green projects. It is recommended that industry associations establish a green director talent pool to support enterprises in selecting green governance talents with cross-border backgrounds.

4) Improve the quality of independent directors' performance and stimulate substantive governance functions

The focus should shift from "structural independence" to "professional independence + responsibility implementation". Regulators can promote the establishment of an independent director's green performance evaluation system to quantify their performance in ESG information disclosure review, green risk identification, green strategy review, etc., and use it as a standard for year-end assessment and re-election. At the same time, green governance training for independent directors should be strengthened, entry barriers and professional qualification mechanisms for green governance should be established, and independent directors should be encouraged to truly play their professional supervision and strategic advisory functions and avoid the role of "rubber stamp".

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