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Does green marketing improve corporate performance?

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ABSTRACT

This paper examines the relationship between green marketing, board characteristics, and corporate performance, with 13,864 Chinese listed companies as the research observation subject. It centers on the influence of green marketing on the performance of corporations, as well as the moderating influence of board characteristics. The findings reveal the following: first, green marketing serves to enhance corporate performance; second, the independent composition of the board of directors exerts a positive moderating influence; third, the combination of the roles of chairman and general manager exerts a negative moderating influence, impeding the positive effects of green marketing on corporate performance; and finally, the gender diversity of the board of directors plays a beneficial moderating role.

1. Introduction

Based on the current ecosystem environment that is constantly being destroyed, people all over the world are worried about the ecological environment in the process of consumption, and when choosing and buying products, they prefer safe, pollution-free and ecologically beneficial products, and the awareness of protecting the ecological environment has already appeared in all parts of the world. Secondly, the enhancement of environmental awareness around the world, also reflected in people's consumption process, in the consumption process, health, pollution-free, pollution-free, return to the primitive has become the pursuit of the public, consumers in the process of choosing products will be more favourable to products with green environmental protection mark. In general, the needs of consumers determine the producers in the production, processing, transport and sales process are integrated into the green concept. It is showed that the global and Chinese green marketing markets shall reach the substantial figures of $331.942 billion and $92.977 billion, respectively, by the year 2022. Green marketing entails the promotion of products and services by incorporating environmental considerations or raising environmental consciousness. Companies engaged in green marketing are responsible for making informed decisions throughout the entire life cycle of their offerings, encompassing processes such as production, packaging, and distribution. It is a sequence of ethically accountable actions that businesses can undertake. Within this framework, green marketing entails the adoption of environmentally-friendly practices by producers, including the recycling of water, the utilization of renewable energy sources, and the reduction of carbon dioxide emissions.

Marketing department, as one of the core functions of an organization, is also facing the same opportunities and challenges due to green development, and green marketing has emerged in this context (Ahmed et al., 2022). Green marketing is a marketing strategy in which a company actively adopts environmentally friendly measures in the production, promotion, and distribution of its products or

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services in order to satisfy consumers' demands for environmental protection. Green marketing originated in the early 1970s when environmental issues first began to receive widespread notice. Businesses now need to rethink their procedures and take into account their effects on the environment as a result of the current environmental movement. A few pioneering businesses started to promote ecologically friendly goods and messaging in response to rising consumer awareness. The fundamental aim of green marketing resides in fulfilling the discerning consumer's longing for ecological preservation by offering products and services that align with stringent environmental benchmarks. Simultaneously, it endeavors to heighten the enterprise's competitive edge while mitigating any deleterious repercussions on the natural world. In the late 1980s, the phrase "green marketing" was formally coined, and it soon gained popularity as a marketing tactic. Green marketing in its early phases was concerned mainly with eco labeling and emphasizing the environmental benefits of products. Green marketing (green brand knowledge, environmental knowledge, environmental attitude) has a positive effect on purchase intention (Patwary et al., 2022). Green entrepreneurship in general helps to improve corporate performance, and the green entrepreneurial behaviors of firms in better institutional environments are more effective in improving corporate performance than firms in poor institutional environments. Some scholars split green entrepreneurship into green innovation, green procurement, green production, green management and green marketing, and variances manifest in the impact of diverse facets of green entrepreneurship upon corporate performance. Among them, green innovation promotes environmental performance by reducing negative ecological impacts on the firm through waste reduction and cost reduction (Ogiemwonyi et al., 2023). The act of procurement exerts a notably positive influence on overall corporate performance, particularly in the realm of ecologically-conscious production and green management have a better effect on better performing companies, while green marketing has no significant effect on corporate performance (Zhu, 2018).

Board characteristics refer to the individual traits and compositional structure of board members, such as board size, board independence, and board diversity. Board characteristics encompass the array of qualities and attributes possessed by a company's board, facilitating the effective and successful pursuit or fulfillment of the diverse interests of numerous stakeholders (Augustine & Juliet, 2022). Board members as a whole affect corporate decisions and performance more than ordinary employees. Currently, corporate boards are generally studied in terms of two dimensions: homogeneity and heterogeneity. The homogeneity dimension focuses on the similarity among board members. Board members with higher homogeneity have higher similarity in terms of background, experience, gender, and culture. Communication among homogeneous board members is smoother and decision-making is easier to reach consensus. In simple, less risky environments, homogeneity characteristics lead to smoother and more efficient communication among team members, thus improving corporate performance. The heterogeneity dimension focuses on the differences among board members. Heterogeneous board members differ significantly in terms of background, experience, skills, and perspectives. Heterogeneous board members can bring diverse perspectives and ways of thinking to promote innovation and decision-making quality. Research shows that the degree of executive team homogeneity is positively related to the degree of group polarization; the higher the degree of homogeneity, the more open the communication among members, the smoother the communication, and the smaller the deviation of group polarization (Guan et al., 2018). The augmentation of female directors, the inclusion of interlocking directors, and the presence of political affiliations within the board of directors all yield positive ramifications for corporate performance (Ginglinger & Raskopf, 2023; Luong et al., 2023). Companies with female directors avoid excessive risk-taking and manage existing risks, ultimately improving company performance (Nadeem et al., 2019). Furthermore, the augmentation of female directors specifically enhances corporate performance within the realm of environmental, social, and governance (ESG) considerations (Huang & Li, 2024). Distinct board characteristics exert varying impacts on corporate performance. The higher the percentage of executives with a marketing background, the better the firm's short-term performance (Du et al., 2024). Notably, an escalation in the frequency of board meetings fosters corporate performance, while a high level of board education significantly bolsters it. Conversely, the fulfillment of corporate social responsibility weakens this effect. Additionally, the proportion of independent directors exhibits a negative albeit insignificant influence on corporate performance (Yao & Yan, 2022). Firm performance declines in companies with military independent directors (Li & Rainville, 2021). In the realm of state-owned enterprises, board diversity emerges as a catalyst for fostering high-quality enterprise development. Specifically, the inclusion of diverse board members in terms of age and gender exhibits a positive influence on the attainment of such high-quality development. However, it is noteworthy that educational diversity within the board exerts a contrary effect. It is important to highlight that the impact of board diversity on high-quality enterprise development in state-owned enterprises operates indirectly, mediated by the internal control mechanisms in place (Li, 2022). The strategic approach chosen by the board of directors directly affects the firm's competitive position and ultimately its performance (Whitler & Puto, 2020). Green marketing responds to the strategic requirements of the firm (Gao et al., 2022). There is a close relationship with board member characteristics. Upon synthesizing the existing body of literature, it becomes evident that the predominant focus of current research centers around studying the direct mechanism between board characteristics and corporate performance and the impact of green marketing on corporate performance, but there are still the following shortcomings: (1) Green marketing reflects the strategic performance of the enterprise and is closely linked to the board of directors' decision-making, but there are fewer studies on the relationship between green marketing, board characteristics and corporate performance, especially the micro-level empirical Research. (2) The role of board characteristics has not been explored. (3) Different dimensions of board characteristics have different effects on corporate performance. To address the above research shortcomings, this paper focuses on green marketing and takes board characteristics as moderating variables, and from the micro level, delves into the intricate workings of three distinct dimensions of board characteristics, namely board independence, the dual role of chairman and general manager, and gender diversity within the board of directors. By directing attention towards these aspects, it offers a fresh vantage point for comprehending the intricate interplay between green marketing and corporate performance. By analyzing the available data, it provides a scientific basis and reference for companies and policy makers. The findings can serve as guidance for companies to better leverage board characteristics to promote green marketing practices.

2. Theoretical analysis and hypotheses development

Drawing upon the tenets of the natural resource base view theory, the attainment of competitive advantage that invariably augments firm performance hinges upon the possession of heterogeneous resources that are both ecologically constrained and opportune, whilst also embodying qualities of value, uniqueness, and substitutability (Hart & Dowell, 2011). Green marketing is a marketing strategy that aims to promote and sell environmentally friendly products, practices and policies (Tzanidis et al., 2024). According to stakeholder theory, green marketing can fulfill the growing consumer demand for environmental protection and sustainability. By meeting consumers' expectations and values, firms can increase consumer loyalty and satisfaction, which in turn increases their market share and revenue. Green marketing, as a strategic marketing approach, kindles the impetus for companies to engage in technological and product innovation, thereby birthing a new breed of environmentally conscious products and services. Through incessant innovation, enterprises can effectively differentiate their offerings from those of their competitors, thereby bolstering product competitiveness and market share (Andersén, 2021). Notably, eco-product innovation exerts a positive influence on economic performance, with the impact of eco-process innovation on economic performance being partially mediated by eco-product innovation (De Oliveira Brasil et al., 2016). At the same time, green exploitative activities are the application of current processes, abilities, and environmental knowledge to enhance existing green processes, products and services, and can also successfully achieve environmental performance (Jabeen et al., 2024). However, it is noteworthy that green marketing alone does not wield a significant impact on product greening. Rather, when coupled with the implementation of eco-labeling policies, it incentivizes retailers to invest in heightened marketing efforts, consequently yielding greater economic profitability, enhanced product greening, and overall societal welfare (Xue et al., 2023). By emphasizing the value proposition of environmental protection and sustainability, companies can develop their own green brand image and build brand equity related to environmental protection. These brand assets can increase consumers' trust and willingness to purchase corporate products, thus contributing to the growth of corporate performance (Rahman et al., 2023).

Therefore, this paper concludes that.

H1. *Green marketing enhances corporate performance*.

Within the realm of principal-agent theory, a profound conflict of interest arises between the principal and the agent. Herein, the principal seeks to maximize shareholder profits, whilst the agent endeavors to advance their own self-interests. An inherent information asymmetry further compounds the issue, wherein the agent may exploit their superior knowledge, thereby detrimentally affecting the principal and giving rise to a principal-agent problem (Squires & Elnahla, 2020). The board of directors of a company consists of inside directors and outside independent directors. Internal directors are usually members of the company's senior management, who have their own interests and goals and are more inclined to support the decisions of the senior management. Independent directors, on the other hand, are more independent and objective compared to inside directors; they do not directly benefit from the company and are more concerned with the long-term interests of the company and the rights of shareholders (Chindasombatcharoen et al., 2023). In green marketing, companies need to adopt a series of environmental protection measures and strategies, which will reverberate throughout the company's operational and fiscal landscape. Augmenting the independence of the board of directors entails an elevation in the proportion of autonomous directors comprising said board, who have more power and influence to monitor and evaluate the company's decision-making and implementation in green marketing. Independent directors can provide more objective opinions and suggestions to help companies develop and implement more effective green marketing strategies and reduce potential agency problems.

Therefore, this paper argues that.

H2. *The presence of independent directors improves the contribution of green marketing to corporate performance*.

The combination of a chairman and a managing director means that decision-making and executive power are concentrated in the same person, leading to over centralization of power and information asymmetry (Bansal & Thenmozhi, 2021). Holding a dual post as vice president or director is more likely to lead to public companies being questioned (Huang et al., 2023). However, in green marketing, the support of the company's overall resources and capabilities is needed, and the resource dependence theory suggests that the higher the company's dependence on external resources, the higher the need for internal control. Therefore, holding both positions of chairman and general manager may negatively affect the decision-making and implementation of green marketing in the company and reduce corporate performance.

H3. *The concurrent position of chairman and general manager inhibits the promotion of green marketing on corporate performance*.

Furthermore, gender diversity denotes the proportion of female members occupying positions within the board of directors. Social identity theory theorizes that diverse boards provide different perspectives and experiences, promoting innovation and quality of decision-making (Arun et al., 2015). Board members of different genders differ in personal traits, thinking patterns, and perspectives, especially in terms of risk preferences in corporate strategic decisions (Zhang et al., 2024). First, women are more environmentally friendly and have a stronger environmental philosophy. Women are more inclusive and more likely to recognize environmental risks, and therefore tend to protect nature. Second, females want to address stakeholders to avoid environmental risks will be more proactive in promoting green marketing (Wang et al., 2024). This is because green marketing is a key way for firms to balance environmental and economic benefits and avoid environmental risks to stakeholders. Third, executives of different genders differ in their professional skills, thinking perspectives, and information sources, thus enriching the information of the firms so that they can issue reasonable and appropriate marketing decisions. As a fourth facet, when compared to their male counterparts, female participation engenders a plethora of distinct resources and diverse knowledge. Moreover, it evokes a heightened sense of responsibility towards societal welfare, along with the capacity to provide non-financial guidance at the decision-making level (Fan et al., 2024). In green marketing, a gender-diverse board of directors may have a broader perspective, be able to better understand and satisfy the needs of gender-diverse consumers, and formulate unique green marketing strategies to enhance corporate performance and competitiveness in the marketplace.

H4. *Gender diversity can promote green performance on corporate performance.*

3. Data, variables, and methodology

3.1. Data

To conduct this study, we have meticulously selected Chinese listed companies spanning the period from 2011 to 2020, serving as our initial sample. The primary data has been sourced from the China Industrial Enterprises database and the CSMAR database, while relevant annual reports have been procured from the official websites of the Shenzhen Stock Exchange and the Shanghai Stock Exchange. To avoid interference with anomalous data, the samples of ST and *ST firms during the sample period, the samples of delisted firms during the sample period, and the samples with missing main variables are excluded. Finally, 13,864 sample observations are obtained.

3.2. Variables

3.2.1. Independent variable

Green marketing (*Greenm*) is measured by the proportion of the sewage charges collected by enterprises and their advertising expenses. The imposition of pollution charges serves as a financial consequence for entities discharging pollutants, based on the type, quantity, and concentration of pollutants released. These charges effectively represent the economic cost of an enterprise's environmental pollution activities. Consequently, the amount of pollution charges levied directly reflects a company's investment and stance towards environmental protection. Advertising expenses, on the other hand, constitute a significant component of a firm's marketing strategy, representing the financial allocation for market promotion and product promotion. By comparing pollution charges with advertising expenses, one can discern the balance and choice an enterprise makes between environmental investment and marketing investment. Furthermore, by calculating the ratio between pollution charges and advertising expenses, a quantitative analysis can be conducted to assess the extent of an enterprise's commitment to green marketing. A higher ratio indicates a greater investment in environmental protection compared to marketing, thereby reflecting a higher level of green marketing practices within the enterprise. The analysis of China's industrial enterprise database reveals that some enterprises are exempted from sewage charges due to "policy exemptions", and thus their sewage charges are 0. In order to clearly show the level of green marketing of enterprises, this paper only selects enterprises with sewage charges greater than 0 for the study.

3.2.2. Dependent variables

Return on assets (*ROA*) assesses the relative efficiency of a business's output and gives a visual depiction of a corporation's capacity to use its assets to produce value; a higher ROA value often indicates that a firm can make greater use of its assets and achieve more profitability. So, this paper selects the ROA of listed companies as a measure of their corporate performance.

3.2.3. Control variables

The selection of control variables in this paper is based on the premise of giving full consideration to the research themes of green marketing and corporate performance, and selecting variables such as asset size (*lnscale*), corporate leverage (*lev*), operating income growth ratio (*growth*), years on the market (*Conyear*), Asset structure (*Ast*), Equity Concentration (*Top*), Current Ratio (*Wac*) and cash flow rate from operating activities (*cfo*).

3.2.4. Moderating variables

This article endeavors to scrutinize the profound influence of board characteristics on corporate performance, with a specific focus on three pivotal moderating variables: board independence, the amalgamation of dual chairmanship and managing director status, and the dimension of board gender diversity. Board independence refers to the degree of autonomy a board possesses in operating the company without reliance on external parties. The position of "Chairperson and Chief Executive Officer (CEO) concurrently" denotes an individual assuming both leadership roles of the board chairperson and the company's general manager. Gender diversity on boards signifies a balanced representation of both male and female members, reflecting the gender ratio within the organization's workforce. The extent of board independence is aptly reflected by the ratio of independent directors to the overall board composition, denoted as "Bod". The presence or absence of dual roles, encompassing both chairman and general manager responsibilities, is encompassed in the variable "Dual", taking the value of 1 when applicable and 0 when not. Lastly, the ratio of female board members to the total board membership, referred to as "gen", provides a valuable measure of the board's gender diversity. Further elucidation and precise definitions of these variables can be found in Table 1.

3.3. Model construction

The model set in this study is as follows:

$$ROA_{i,t} = a_0 + a_1 Greenm_{i,t} + a_2 Control_{i,t} + industry_i + year_t + \varepsilon_{i,t} \tag{1}$$

$$ROA_{i,t} = a_0 + a_1 Greenm_{i,t} + a_2 Bod_{i,t} + a_3 Greenm_{i,t}{}^{*}Bod_{i,t} + a_4 Control_{i,t} + industry_i + year_t + \varepsilon_{i,t} \tag{2}$$

$$ROA_{i,t} = a_0 + a_1 Greenm_{i,t} + a_2 dual_{i,t} + a_3 Greenm_{i,t}{}^{*}dual_{i,t} + a_4 Control_{i,t} + industry_i + year_t + \varepsilon_{i,t} \tag{3}$$

$$ROA_{i,t} = a_0 + a_1 Greenm_{i,t} + a_2 Gen_{i,t} + a_3 Greenm_{i,t}{}^{*}Gen_{i,t} + a_4 Control_{i,t} + industry_i + year_t + \varepsilon_{i,t} \tag{4}$$

Model 1 is a benchmark regression to quantify the role of green marketing in influencing firm performance. Model 2-4 examines the interaction of three board features, including board independence, dual office holders, and gender diversity, with green marketing to determine their moderating impacts. Where ROA represents corporate performance and Greenm represents the level of corporate green marketing. Bod is board independence and dual is two positions on the board and gen is the gender ratio on the board. The interaction term represents its moderating effect. In addition to this, the paper controls for industry and year effects.

4. Empirical analysis

4.1. Descriptive statistics

Table 2 unveils the results of statistical characterization pertaining to the key variables. Notably, there exists a significant disparity between the maximum and minimum values of corporate performance, suggesting substantial variation amongst our enterprises. The mean value of green marketing stands at 0.304, accompanied by a standard deviation of 0.758. This signifies enterprises exhibit higher values of green marketing, emphasizing the implementation of environmentally conscious marketing strategies throughout their developmental trajectory. The statistical findings pertaining to board independence reveal a more equitable distribution of independent directors among listed companies in China.

4.2. Baseline regression

Employing the model constructed above, we delve into the quantitative impact of green marketing upon corporate performance, with the estimated results presented in Table 3. Column (1) showcases the regression outcomes in the absence of control variables, while column (2) presents the regression results incorporating these control variables. All statistical inferences are based on clustering-adjusted standard errors of individual and year cross-multiplication. The coefficient on green marketing is significantly positive. This suggests that green marketing promotes corporate performance to some extent after removing possible confounding factors. H1 is tested. Specific analyses are as follows: green marketing can help enterprises expand market share. With the enhancement of environmental awareness, more and more consumers tend to buy environmentally friendly products, and green marketing can convey the enterprise's environmental protection concept and commitment to consumers. By promoting the enterprise's environmental protection measures and sustainable development initiatives, the company can attract more environmentally aware consumers, thus expanding its market share; green marketing can enhance corporate image and brand value. Consumers, driven by an escalating concern for environmental preservation and sustainable development, exhibit a heightened inclination to opt for companies and brands that demonstrate a resolute commitment to environmental consciousness. Through the implementation of green marketing,

Table 1
Variable definition.

variable	sign	Meaning and algorithm
Corporate performance	ROA	Net Profit/Total Assets × 100%
Green marketing	Greenm	The proportion of the sewage fee levied by the enterprise to the advertising cost of the enterprise
Board of directors independence	Bod	Independent directors/the total number of board members
Chairman and General ManagerWhether concurrently	Dual	1 for concurrent appointment, 0 for non-concurrent appointment
Board of directors Gender diversity	gen	Ratio of the number of female directors to the total number of directors on the board
Asset size	lnscale	Assets at the end of the year are expressed in natural logarithms
Corporate leverage	lev	Total Liabilities/Total Assets
Operating income Growth ratio	growth	(Amount of operating income for the current year - Amount of operating income for the same period of the previous year)/Amount of operating income for the same period of the previous year
Business Activities Cash flow ratio	cfo	Net cash flows from operating activities/income from operations
Age	Conyear	Year of observation minus year of listing plus 1 to take logarithms
Asset structure	Ast	Ratio of fixed assets to total assets
Equity Concentration	Top	Shareholding ratio of the largest shareholder
Liquidity ratio (Wac)	Wac	Liquid Assets/Liquid Liabilities

Table 2
Descriptive statistical analysis.

Variables	N	mean	std	min	max
ROA	13864	0.038	0.073	−0.285	0.235
Greenm	13864	0.304	0.758	0.000	9.417
Bod	13864	0.365	0.057	0.321	0.778
dual	13864	0.296	0.442	0.000	1.000
gen	13864	0.151	0.125	0.000	0.800
lnscale	13864	21.329	1.221	19.006	25.123
LEV	13864	0.373	0.179	0.063	0.720
growth	13864	0.164	0.322	−0.481	1.741
Conyear	13864	2.066	0.746	0.672	3.390
cfo	13864	0.092	0.157	−3.758	1.804
Ast	13864	0.403	0.208	0.043	0.846
Top	13864	0.407	0.154	0.111	0.790
Wac	13864	2.113	2.292	0.295	13.376

Table 3
Baseline regression of model 1.

Variables	(1) ROA	(2) ROA
Greenm	0.331*** (5.157)	0.296*** (3.981)
ln*scale*		-0.430*** (-8.206)
LEV		0.607*** (6.912)
growth		-0.463 (-0.291)
Conyear		-12.422 (-0.105)
cfo		0.137** (2.158)
Ast		0.176*** (3.294)
Top		0.007 (0.082)
Wac		-0.384 (-0.193)
Con	2.331*** (14.212)	3.939*** (10.345)
Ind	Yes	Yes
Year	Yes	Yes
N	13864	13864
Chi^2	836.273	1376.105
Adj.R^2	0.339	0.284

enterprises can establish an environmentally friendly image, enhance consumer recognition and goodwill towards the enterprise, thus enhancing the brand value of the enterprise. In addition, green marketing can also reduce the operating costs of enterprises. By curbing resource consumption and limiting environmental pollution, enterprises can simultaneously reduce production costs while enhancing the efficacy of resource utilization. Concurrently, through the adoption of green marketing initiatives, enterprises can effectively promote their environmentally responsible endeavors and obtain government support and preferential policies, further reducing the enterprise's operating costs. Therefore, green marketing can promote corporate performance to a certain extent. Therefore, enterprises should actively formulate green marketing strategies so as to achieve a win-win situation in terms of sustainable development and economic benefits.

Table 4
Regression results for model 2.

Variables	(1) ROA	(2) ROA
Greenm	0.260** (2.402)	0.304*** (2.857)
Bod	0.015*** (2.607)	0.100*** (2.733)
Greenm*Bod		0.173* (1.682)
Control	Yes	Yes
Con	2.440*** (9.203)	3.095*** (11.311)
Ind	Yes	Yes
Year	Yes	Yes
N	13864	13864
Chi^2	1549.220	2030.693
Adj.R^2	0.232	0.250

4.3. Mechanism analysis

Table 4 presents a comprehensive analysis of how board independence influences the correlation between green marketing and corporate performance. The interaction term coefficient (Greenm*Bod) in the sample stands at 0.173, which passes the significance level test of $p = 0.1$. From the data of the whole sample of this paper, this finding underscores the substantial positive moderating effect of board independence on the relationship between green marketing and corporate performance, thereby corroborating the veracity of H2. The presence of an independent board of directors facilitates the provision of impartial and unbiased insights and recommendations. An independent board of directors can provide objective and neutral opinions and recommendations, strengthen supervision and control, and enhance corporate reputation and trust, thus promoting the effective implementation of green marketing and providing support for corporate performance growth. In green marketing decision-making, independent board members can assess the potential risks and opportunities of green marketing from a holistic perspective without being influenced by the company's management. This helps to avoid possible conflicts of interest and bias in green marketing decision-making, thereby increasing the effectiveness of green marketing, which in turn strengthens the contribution of green marketing to corporate performance.

Table 5 elucidates the impact of the simultaneous occupancy of the positions of chairman and general manager on the relationship between green marketing and corporate performance.

The interaction term coefficient (Greenm*dual) in the sample is -0.210, successfully surpassing the significance level threshold of $p < 0.01$. The comprehensive data analysis conducted in this study affirms the significant negative moderating effect of the aforementioned dual positions on the relationship between green marketing and corporate performance, thereby corroborating the validity of H3. The concurrent positions of chairman and general manager imply to some extent the limited ability of the company's management. As the duties and requirements of the two positions are different, holding them at the same time may lead to management's dispersal of efforts and inability to fully utilize their professional abilities and experience. This lack of management ability will affect the strategic decision-making and execution ability of the company, weakening the strategic effect of green marketing, and thus weakening the promotion of green marketing on corporate performance.

Table 6 presents a comprehensive analysis of how board gender diversity influences the connection between green marketing and corporate performance. The interaction term coefficient (Greenm*Gen) in the sample stands at 0.003, successfully surpassing the significance level threshold of $p < 0.1$. This empirical evidence, derived from the comprehensive dataset employed in this study, substantiates the significant positive moderating effect of board gender diversity on the relationship between green marketing and corporate performance. In essence, board gender diversity serves to foster and amplify the positive impact of green marketing on corporate performance, thereby affirming the validity of H4. Gender-diverse teams can bring different perspectives and experiences, which can contribute to corporate innovation. In the field of green marketing, such diversified thinking can promote enterprises to develop more innovative and unique green products and services, thus improving their market competitiveness.

4.4. Endogeneity

Green marketing enhances corporate performance, but increased corporate performance may also give additional finances and resources for research and development, as well as the application of environmentally friendly technologies and procedures, all of which boost corporate green marketing. In terms of innovation and technical growth, increased corporate performance promotes the use of corporate green marketing by generating more environmentally friendly goods and manufacturing methods. To overcome this endogeneity resulting from reverse causality, this paper first introduces the green marketing lag as an instrumental variable. Specifically, this paper introduces green marketing lags of three periods as instrumental variables. The final regression results in Table 7 show that the regression coefficient of green marketing on corporate performance is still significantly positive, indicating that the current baseline regression is robust.

Second, this paper uses the mean green marketing (MG) of other firms in the same industry as another instrumental variable. Firms within the same industry are in roughly the same macro environment, and the marketing performance of other firms affects the marketing level of this firm. The instrumental variable 2SLS method is used for endogeneity test, and the test results are detailed in Table 8. From a statistical standpoint, it is worth noting that MG (market growth) exhibits a significant correlation with Greenm (green marketing), boasting a correlation coefficient of 0.479. The F statistic exceeds the empirical value, thereby negating any concerns

Table 5
Regression results for model 3.

Variables	(1) ROA	(2) ROA
Greenm	0.102*** (3.419)	0.103*** (3.588)
dual	-0.164*** (-3.974)	-0.241*** (-5.216)
*Greenm*dual*		-0.210*** (-4.933)
Control	Yes	Yes
Con	-0.346*** (-13.058)	-0.479*** (-20.334)
Ind	Yes	Yes
Year	Yes	Yes
N	13864	13864
Chi^2	1824.850	1939.432
Adj.R^2	0.288	0.171

Table 6
Regression results for model 4.

Variables	(1) ROA	(2) ROA
Greenm	0.092*** (3.021)	0.105*** (3.603)
Gen	0.019*** (2.733)	0.017*** (2.642)
*Greenm*Gen*		0.003* (1.721)
Control	Yes	Yes
Con	3.053*** (14.659)	4.206*** (16.001)
Ind	Yes	Yes
Year	Yes	Yes
N	13864	13864
Chi^2	1327.025	1009.933
$Adj.R^2$	0.157	0.204

Table 7
Endogeneity test of IV1.

Variables	(1) ROA	(2) ROA
Greenm		0.399*** (3.158)
L3. *Greenm*	1.064*** (8.773)	
Control	Yes	Yes
Ind	Yes	Yes
Year	Yes	Yes
Cons	0.034 (0.629)	-0.426*** (-9.203)
LM	80.780*** (0.000)	
Wald F	243.393 (18.270)	
Adj.R^2	0.262	0.244

Table 8
Endogeneity test of IV2.

Variables	(1) Greenm	(2) ROA
IV	0.479*** (5.330)	
Greenm		0.399*** (4.002)
Control	Yes	Yes
Ind	Yes	Yes
Year	Yes	Yes
F	74.025	
Hansen (P)		1.273 (0.176)
N	13864	13864
Adj.R^2	0.119	0.165

pertaining to weak instrumental variables; Hansen statistic P-value is larger than 0.1, and this instrumental variable passes the test of exogeneity test. Overall, it shows that the regression coefficients remain significant and there is no change in direction.

4.5. Heterogeneity analysis

To comprehensively explore the influence of various enterprise types on the efficacy of green marketing in driving corporate performance improvement, this study segregates the sample into two distinct categories: state-owned (SOEs) and non-state-owned (Non-SOEs), based on enterprise ownership. Each subsample is then subjected to regression analysis. The findings of Table 9 indicate that the performance increase following the deployment of green marketing is more substantial in Non-SOEs. This might be because Non-SOEs are more flexible in decision-making and operations, allowing them to implement green marketing strategies and measures more quickly. They can respond more swiftly to market needs and changes, as well as tailor their products and services to satisfy customer environmental preferences. In market competitiveness, Non-SOEs place a greater emphasis on company image and brand value. These businesses often focus on brand creation, and green marketing may assist them in developing an ecologically responsible image while also increasing customer familiarity and goodwill. Green marketing allows Non-SOEs to build stronger relationships with customers while also increasing market share and sales. Non-SOEs are frequently not monopolies and experience greater competition than SOEs, particularly in areas where customers are more concerned about environmental problems. Consumers in these industries are more likely to purchase environmentally friendly items and firms. Non-SOEs can acquire a competitive edge in the market by employing green marketing, which meets customers' demands for environmental protection. The results of the above heterogeneity analysis can provide guidance for corporate performance improvement by developing targeted green marketing strategies.

Table 9
Heterogeneity test.

Variables	(1) SOEROA	(2) Non-SOE ROA
Greenm	0.176*** (3.114)	0.402*** (3.955)
Control	Yes	Yes
Con	-0.399*** (-12.317)	-0.513*** (-17.418)
Ind	Yes	Yes
Year	Yes	Yes
N	5098	8766
$Adj.R^2$	0.240	0.191

5. Conclusion

The improvement of corporate performance cannot be separated from the formulation of marketing and other strategies. In the context of low-carbon development, many enterprises have changed their marketing strategies to green marketing, so what role does green marketing play in influencing corporate performance, and does it positively promote or negatively inhibit. This study uses a sample of Chinese listed companies to scrutinize the profound influence of green marketing on corporate performance.

Considering that board characteristics are directly related to corporate strategy formulation, this paper embeds three types of board characteristics to investigate their moderating effects on the relationship between green marketing and corporate performance. The findings unearth the following key insights: Firstly, green marketing exerts a significantly transformative impact on corporate performance, bolstering its overall efficacy. Secondly, board independence amplifies the positive influence of green marketing on corporate performance, accentuating its prowess. Thirdly, the simultaneous occupancy of the positions of chairman and general manager substantially hampers the positive impact of green marketing on corporate performance, impeding its potential. Lastly, board gender diversity emerges as a powerful force, wielding a significant positive moderating effect on the intricate relationship between green marketing and corporate performance. To make the findings more robust, this paper uses the lag period and the green marketing level of the rest of the firms in the same industry as two instrumental variables to address the endogeneity issue, and the baseline findings remain unchanged. In the future, the impact of green marketing on firm performance can be further explored in terms of the differences between different industries and market environments. In addition, the interaction between green marketing and other corporate strategies (innovation strategy, internationalization strategy) could be investigated.

Pursuant to the findings of this study, it is recommended that corporate management incorporate green marketing into their long-term strategic planning and augment investments in green product development, market promotion, and brand-building initiatives. The selection and appointment of board members should prioritize independence and gender balance to foster a diversified and effective board composition. Clarifying the role division between the chairman and the general manager, as well as their respective responsibilities, is essential to ensure effective checks and balances in the decision-making process. Furthermore, policy makers can devise a range of policies and measures, such as tax incentives and financial support, to encourage enterprises to actively implement green marketing strategies. Legislative or regulatory measures should be strengthened to oversee and guide corporate boards, promoting optimized board structures that enhance independence and diversity. In making investment decisions, stakeholders should consider a company's green marketing strategy and board composition as criteria for assessing its long-term value and sustainability.

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