



Research article

Applications of linear regression models in exploring the relationship between media attention, economic policy uncertainty and corporate green innovation

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Abstract: The media plays a dual role of “supervision” and “collusion” in governance mechanisms. This study investigates the impact of media attention and economic policy uncertainty on green innovation by analyzing A-share industrial listed enterprises data between 2011 and 2020. The results show that media attention can effectively promote green innovation and that this impact is significantly heterogeneous. Media attention significantly affects green innovation in non-state-owned enterprises and manufacturing companies positively, but it is insignificant for state-owned enterprises and mining and energy supply industries. Moreover, the results indicate that external economic policy uncertainty can lead enterprises to take early measures to hedge risks, thereby positively regulating the promotion effect of media attention on green innovation during economic fluctuations. Finally, media attention can promote green innovation by increasing environmental regulation intensity, reducing corporate financing constraints, and enhancing corporate social responsibility. Therefore, paying full attention to the media as an institutional subject outside of laws and regulations, gradually forming a pressure-driven mechanism for corporate green innovation, and reducing information opacity, is a pivotal way to promote enterprises’ green innovation.

Keywords: media attention; green innovation; economic policy uncertainty; industrial enterprises

Mathematics Subject Classification: 62P20, 62P25, 90A19, 90A80

1. Introduction

The growth trajectory of China's economy, which has traditionally depended on resource-intensive, environmentally damaging and high-emission industries, has aggravated the challenges associated with resource constraints and environmental sustainability for achieving sustainable economic development. Under the traditional development mode, many critical environmental issues, such as high pollution levels in the air, land desertification, and climate change, have been triggered because of excessive resource consumption and production factors' inefficient utilization [1,2]. The statistics reveal that all Chinese cities' air quality standard compliance rate was only 56.9%, and the concentrations of PM₁₀ and NO₂ were still rising compared to 2020 in 2021. Additionally, the trend of climate change has not yet been alleviated. For example, the Chinese average temperature in 2021 was 10.53°C, the highest since 1951. Addressing the growing environmental crisis, the Chinese government significantly emphasizes promoting innovation through science and technology self-improvement, especially when establishing a market-driven green technology innovation system.

Innovative green technologies are widely acknowledged as an essential component in driving both economic expansion and responsible environmental management. It is a shared goal of nations and societies, but also a practical necessity for enhancing corporate green competitiveness [3,4]. Distinguished from general innovation activities, green innovation emphasizes the effective integration of green sustainability and innovation. This requires that enterprises combine economic effects with environmental protection, and resource consumption, resource allocation efficiency, positive externalities and spillovers of knowledge and pollution emissions to the natural environment need to be contained at reasonable levels [5,6]. Green innovation has positive externalities from reducing environmental pollution and resource conservation, as well as spillover effects of innovation itself. Green innovation has a dual externality of "spillover effects" and "external environmental costs." Motivating corporations to boost green innovation as well as to participate in environmental governance is a key to internalizing externalities. Media's environmental governance function in public supervision is also gaining increasing attention from scholars, as their governance role and the pressure effect of media attention simultaneously influence the green innovation efforts of enterprises [7]. Media coverage of enterprises' environmental image can directly or indirectly shape the attitudes and behaviors of consumers and investors, influencing the economic performance of enterprises and, consequently, their green innovation behavior [8]. Moreover, media attention towards green innovation can elevate enterprises' awareness and sensitivity to environmental issues, thus boosting their R&D and application of green technologies. Therefore, how to leverage media attention to advance corporate green innovation has emerged as an urgent issue to be debated by scholars and government departments.

So, how does media attention affect green innovation, and does such an effect exist heterogeneously across property attributes and industry types? What is the function of economic policy uncertainty in influencing green innovation through media attention? Furthermore, how does media attention affect the state of green innovation? Few scholars have conducted insightful analyses of media attention affecting green innovation. This survey examines the impact of media attention on green innovation and the moderating effect of economic policy uncertainty, along with mechanistic features of government environmental regulation, financing constraints and corporate social

responsibility, by analyzing A-share industrial listed enterprises data between 2011 and 2020.

The following components constitute both the significance of this research and its contribution to the field. First, while the role of media attention as an informal environmental regulation for regional environmental protection and pollution control has been widely recognized, the impact of media attention on green innovation has not been fully investigated in current research. The effects of media attention on different corporate innovation behaviors are further clarified on the basis of exploring whether corporate green innovation behaviors change under media attention pressures. Furthermore, the inner mechanism of corporate green innovation performance driven by external institutional legitimacy pressure is reviewed again through the lens of media attention, refining existing research in the field. Second, according to the available research, media attention on green innovation is considered from the triple perspective of government environmental regulation, financing constraints and corporate social responsibility, which is beneficial to further investigate the specific avenues of media attention in influencing the green development process [9,10]. In conclusion, taking into consideration the influence that the media has on green innovation in the context of the unpredictability of economic policy, this study enriches the boundary conditions of green innovation performance and offers a new framework for re-examining the regulatory environment and the regulatory intensity of green innovation in order to shed light on the scientific formulation of relevant policies.

2. Literature review

2.1. Research on media attention

Institutional economics theory reveals that social opinion is considered as an informal institutional environment and social normative mechanism. The media, as an independent watchdog, exposes corporate misconduct and strongly promotes and praises corporate social responsibility, which is an essential driver of corporate social responsibility development. In mature market countries where the media is constitutionally protected, media environmental governance functions have been a focus earlier [11,12]. Given that public opinion guiding and supervision functions can be fully utilized, two major hypotheses have been formed about the media attention effect. The first is the adequate supervision hypothesis. Considering information asymmetry, corporations prefer not to disclose all information truthfully and may not fully fulfill environmental responsibilities, engaging in environmentally damaging production behavior.

Regarding social information dissemination and opinion orientation, news media can increase the exposure of corporate environmental governance issues through publicity [13]. It helps regulatory authorities and investors effectively supervise enterprises and increases the probability of discovering corporate environmental governance issues, thereby curbing managers' environmental opportunistic behavior and forcing effective environmental governance. The second is the market pressure hypothesis. Through information and published commentary transmission, the media can change the information environment of the capital market, and affect stock price fluctuations, thereby changing the market pricing of capital. Since a corporation's operations are closely related to management career development and stock incentives, negative media coverage can create significant pressure on corporate managers [14]. For example, some scholars verified the impact of media coverage indices on emerging stock markets and corporate ESG (environmental, social and governance) through the US capital market [15]. Therefore, managers will take corresponding actions to meet market expectations,

improve corporate image, and adapt to the economic environment and policy restrictions [16,17].

Another group of academicians believes that media cannot honestly play a role in supervising corporate environmental governance and innovative investment. For example, the motivation for media to proactively monitor corporate environmental governance issues is mainly to gain a good social reputation and associated benefits. Under disseminating information, the information released by the media may have certain biases based on their interests, which may be derived from the need for media competition. Besides, not all media are independent and objective. Apart from being interfered by their interests, they may also report biased information under pressure from the government. In areas or countries where collusion between government and enterprises is more serious, the media may become a tool for controlling public opinion of government enterprises [18]. The national legal protection of press freedom is essential to reduce media rent-seeking and government intervention, improve media credibility, and bring media oversight to bear on the corporations' green development. Excessive media supervision can also bring market pressure on corporate managers, exacerbate short-sighted behavior, and induce corporate managers to focus more on short-term performance rather than innovative long-term investment [19]. Some research also indicates that media attention has little influence on corporate green behavior. To meet market expectations, corporations may package their image through project idleness and scientific research fraud rather than substantially investing in green innovation [20].

2.2. Research on green innovation

Green innovation is a technological innovation activity emphasizing environmental friendliness, clean energy, ecological protection, and combating climate change [21]. Extant literature has primarily focused on the green innovation concept and defined green innovation [22,23]. The state, social media, and enterprises are increasingly concerned about green innovation and trying to materialize sustainable development by implementing green innovation because of the seriousness of ecological and environmental damage. Green innovation has progressively emerged as a critical avenue toward sustainable development in China [1,3,24]. Research can be divided into several aspects. First, there is research on green innovation meaning. The concept of green innovation emerged in the 20th century, first proposed by Fussler and James, referring to developing products and technological improvements that can bring economic benefits and significantly reduce negative environmental impacts [25]. The theory of technology innovation management believes that green innovation is an essential aspect of technological innovation and a key factor for enterprises to solve environmental damages. Green innovation has the potential to offer not only commercial worth but also new products and technologies that substantially decrease the negative effects on the environment, which is the fundamental driving power for green development. Second, there is research on the measurement of green innovation. Scholars debate the measurement of green innovation, yet it encompasses three main aspects. The first is to build a system of indicators using composite indicators to measure. However, it is difficult to identify accurate indicators to determine green innovation, resulting in a considerable variation in green innovation levels measured by different indicator systems, thus reducing the reliability of measurement results. Also, environmental pollution indicators such as industrial waste are introduced as desired and undesired outputs of innovation based on innovation outputs to measure green innovation. However, some scholars suggest that the two types of indicators are not effectively related to each other because of the lack of correlation between environmental pollution and R&D innovation,

which makes it challenging to characterize the contents of green innovation. Thus, adopting the innovation output approach to designate green innovation lacks rigor. Third, some scholars use green patents to measure green innovation, which is currently the most commonly used measurement method. Compared with the first method, the advantage of directly using the green patent is that it can reflect the level of green innovation output. However, its difficulty lies in how to define the meaning of green patents. Although some scholars have attempted to clarify the concept and meaning of green patents, a unified and clear definition has not yet been formed, while the more common practice is to give the corresponding technical classification number of green patents.

Finally, there is the study of its factors. Besides the classic spillover effects, green innovation generates external effects by reducing or lowering external environmental costs. This “dual externality effect” renders the research on green innovation implementation drivers and implementation effect influencing factors more significant. Research on the dynamics of green innovation includes three main categories: technology-driven, market-driven and environmental regulation-driven. Scholars have mainly conducted investigations in terms of both the internal environment and external constraints. Among them, managers’ environmental awareness, corporate performance, and corporate social responsibility are internal environment, while environmental regulation, financing constraints, government subsidies, and foreign direct investment are external constraints.

In summary, existing research has provided a solid foundation to analyze the intrinsic mechanism deeply. However, current research still has some limitations. For example, while the role of media attention as an informal environmental regulation for regional environmental protection and pollution control has been widely recognized, the influence of media attention on green innovation has not been thoroughly investigated in terms of a microscopic view. The nexus between media attention and corporate green innovation needs to be strengthened.

Compared with previous studies, the following marginal innovations are possible: Firstly, on the basis of exploring whether firms’ green innovation behavior changes under the pressure of media attention, the impact of media attention on different firms’ innovation behavior is further clarified, and the intrinsic mechanism of firms’ green innovation performance driven by external institutional legitimacy pressure is re-examined from the perspective of media attention, refining the current field of research. In addition, based on previous scholars’ research ideas, the mechanism of media attention’s influence on corporate green innovation is explored from the triple perspective of government environmental regulation, corporate financing constraints and corporate social responsibility, which is conducive to further analysis of the specific paths of media attention networks in influencing the process of green development. Finally, the impact of media attention on corporate green innovation under economic policy fluctuations is considered, which enriches the boundary conditions of corporate green technological innovation performance and provides a new framework for re-examining the regulatory environment and regulatory intensity of corporate green innovation, with a view to providing insights for the scientific formulation of relevant policies.

3. Mechanisms and hypotheses

3.1. The impact of media attention on corporate green innovation

The role of media attention is to supervise corporations through information transmission, thus conveying legitimacy pressure to corporate managers and forcing them to make strategic adjustments

and management reforms [26]. First, media attention has a focusing effect. In reality, various hot events are constantly occurring, leading to a dispersion of government and public attention, making it difficult to focus on a particular event. However, the focusing effect of media attention can collect public opinion quickly, publish information and guide society's focus. Continued attention and reporting on corporate green initiatives help strengthen the innovative drive towards corporate green innovation, attract stakeholder attention and optimize corporate green innovation and performance based on stakeholder pressure and signaling mechanisms [27]. Second, media attention has a reputation effect. Adverse environmental events and corporate pollution issues reported in the media harm corporate reputation. Positive media coverage can enhance a corporate reputation and give an advantage in the competitive market [28]. Third, media attention has a strong signaling effect on investors. Media attention can change the behavior of corporate managers by influencing the capital market. Media attention tremendously impacts investors' perceptions, information dissemination, and reconstruction in the capital market [29]. By exerting influence on the capital market, media attention can pressure managers, causing them to change their behavior and increase green innovation, thereby fulfilling the function of corporate environmental governance. Consequently, the following hypothesis is put forward for consideration:

H1: Media attention can increase corporate green innovation.

3.2. The impact of media attention on corporate green innovation under economic policy uncertainty

As a vital tool for the government to regulate the market, economic policy has unpredictability and opacity in its formulation process. Enterprise risk preferences and profit-seeking mechanisms are closely related to the uncertainty of economic policies. Faced with adverse changes and increased risks in the external environment, enterprises may hedge external risks and avoid possible adverse effects [30–32]. On the one hand, actively assuming social responsibilities can help reduce enterprise risks. Therefore, enterprises tend to increase green innovation investment, establish a green and environmental corporate image, help enterprises obtain relationship assets and scarce competitive resources, and thus improve the ability of both enterprise management and risk avoidance. To cope with the pressure caused by external environmental uncertainty, enterprises actively counteract the negative impact of economic uncertainty from the external environment and seek new opportunities. Enterprises can release positive environmental protection and green innovation signals, and they can avoid the negative impact on enterprises caused by changes in environmental regulation due to economic fluctuations if they strengthen green environmental protection investment and improve the performance of green innovation [33–35]. Therefore, economic policy uncertainty can strengthen the motivation for corporate green innovation under media attention through legitimacy mechanisms and signaling mechanisms and produce substantial beneficial regulation impacts through the interaction of media attention and corporate environmental innovation. As such, this study proposes research hypothesis H2:

H2: Economic policy uncertainty positively moderates the impact of media attention on corporate green innovation.

3.3. The influence mechanisms of media attention on green innovation

After the previous review of the mechanisms, combined with the existing research literature, it is

clear that there are multiple dimensions of the influence mechanism of media attention on corporate green innovation, including both external and internal dimensions. In terms of focus effect and investor behavior effect, environmental regulation and capital market financing constraints are the key factors that constitute the influence mechanism of media attention on corporate green innovation. In contrast, the reputation effect of media attention makes corporate social responsibility another critical factor for media attention to influence corporate green innovation.

First, media attention can help to improve government environmental regulation. For a long time, the promotion tournament model, which selects officials based on GDP as the core element, has played a vital role in China's economic development [1,36,37]. Meanwhile, the ecological environment has the attribute of a public good. Without adequate regulation, enterprises lack the motivation to boost the ecological environment. For enterprises, asymmetry is observed between the costs associated with participation in environmental governance and its benefits. All the subjects share the benefits of environmental governance by enterprises in economic activities, but the enterprises bear the costs of environmental governance [38]. The assessment of the performance of municipal administrations has recently started to incorporate environmental sustainability as a metric. Public opinion monitoring by the news media plays a vital role in promoting local government environmental pollution control and has a significant impact on the reputation of local government officials' performance, and a better media reputation will give government officials extra points in promotion tournaments. Therefore, media attention can force local governments to improve environmental pollution control. Second, media attention can reduce financing constraints. Media attention is a communication bridge between enterprises and investors. Through information transmission and comment publication, media can guide public opinion and assist businesses in lowering the costs associated with disseminating information, which will ultimately help reduce the information gap between external investors and internal businesses. The social responsibility information disclosed by listed enterprises can be effectively transformed into helpful information for investor decision-making, avoiding the interruption of the information transmission chain and enabling investors to adjust their decisions based on the information disclosed easily. Lastly, media attention can help improve corporate social responsibility. As the public is more likely to believe the content of media reports, media coverage of listed enterprises is a vital factor affecting enterprises' reputation and intangible value. A better media reputation will give the enterprise a competitive advantage. Because of this, the degree to which an organization is transparent corresponds directly to the amount of attention it receives from the media, meaning that the enterprise must enhance its sense of social responsibility, increase investment in green innovation, fulfill its environmental protection obligations, and gain the understanding and support of investors and other stakeholders, thereby maintaining a good image in the public eye. As such, this study proposes research hypothesis H3:

H3a: Media attention can enhance government environmental regulations and improve the level of green innovation in enterprises.

H3b: Media attention can improve green innovation by reducing financing constraints.

H3c: Media attention can enhance corporate social responsibility and improve the level of green innovation in enterprises.

Influence mechanism is shown in Figure 1:

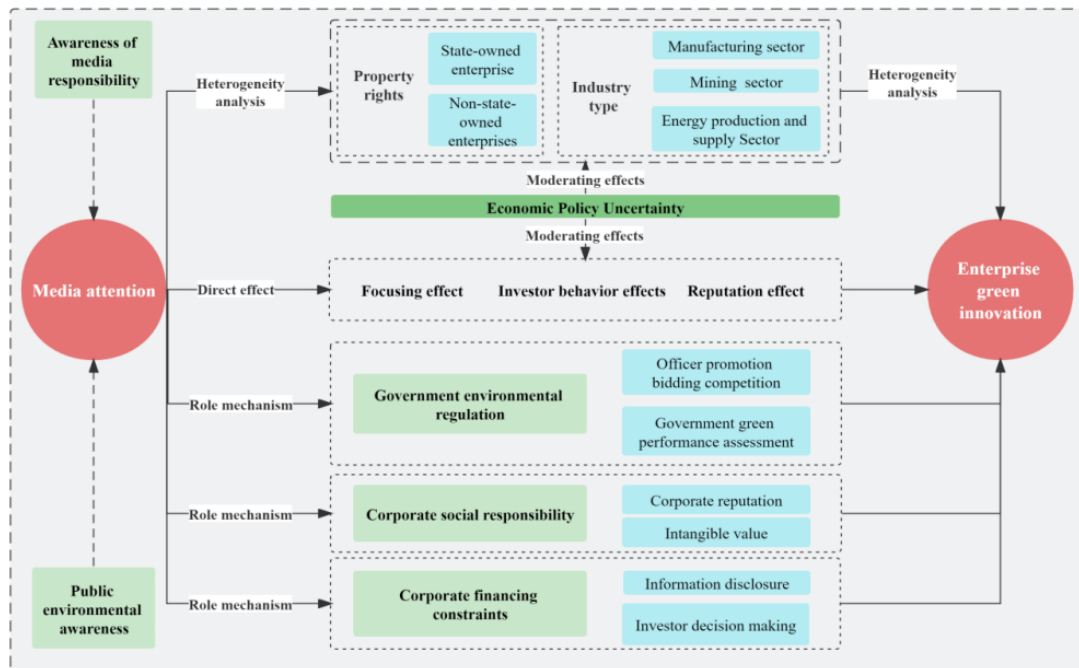


Figure 1. Influence mechanism graph.

4. Study design

4.1. Model setting

The dual fixed effects model is able to control for individual fixed effects and time fixed effects separately, thus eliminating the effects of individual characteristics and time trends on the estimation results and improving the accuracy of the model. Taking the time fixed effect as an example, we can prove the principle of the model from the following derivation process. We assume that

$$y_{it} = \beta_i x_{it} + a_i + u_{it}, \quad t = 1, 2 \dots T. \quad (1)$$

Now, for each i , average this equation over time. We get

$$\bar{y}_i = \beta_i \bar{x}_i + a_i + \bar{u}_i, \quad t = 1, 2 \dots T, \quad (2)$$

where $\bar{y}_i = T^{-1} \sum_{t=1}^T y_{it}$. Then, we subtract (2) from (1) for each t , and we get

$$y_{it} - \bar{y}_i = \beta_i (x_{it} - \bar{x}_i) + u_{it} - \bar{u}_i, \quad t = 1, 2 \dots T, \quad (3)$$

or

$$\dot{y}_{it} = \beta_i \dot{x}_{it} + \dot{u}_{it}, \quad t = 1, 2 \dots T. \quad (4)$$

where \dot{y}_{it} is an abbreviation for the $y_{it} - \bar{y}_i$. The important thing about Eq (4) is that the unobserved effect, a_i , has disappeared. This suggests that we should estimate (4) by pooled ordinary least squares (OLS).

This study investigates the impact of media attention on green innovation. Following available studies and combined with H1, a two-way fixed effects model is developed [39]. The model is

constructed as follows:

$$EI_{it} = \delta + \partial_1 Media_{it} + \beta_i X_{it} + v_t + u_i + \varepsilon_{it} \quad (5)$$

where EI represents green innovation. $Media$ represents media attention. X_{it} a set of control variables, including book-to-market ratio (bm), debt-to-equity ratio (lev), current ratio (cf), asset turnover ratio (ato), return on equity (roe), management revenue ratio (mf) and enterprise listing age (age). v_t represents time fixed effects, u_i represents regional fixed effects and ε_{it} represents the random error term.

To test H2 that economic policy uncertainty positively moderates the impact of media attention on corporate green innovation, this study set the following model. The specific model is constructed as follows, where Epu is economic policy uncertainty:

$$EI_{it} = \delta + \partial_1 Media_{it} + \partial_2 Media_{it} \times Epu_{it} + \partial_3 Epu_{it} + \beta_i X_{it} + v_t + u_i + \varepsilon_{it} \quad (6)$$

4.2. Variable description

4.2.1. Dependent variable

Green innovation (EI). Green innovation input and output are two main ways to measure corporate green innovation [40]. The input perspective mainly refers to the resources invested by the enterprise for green innovation, while the output perspective mainly measures the number of green patents and products achieved through green innovation. Since listed enterprises currently do not disclose data on their green products or services, this study follows the output method, which analyzes the degree of creativity in green technology in public companies based on green inventions. Compared with the number of patent grants, it is less affected by time limitations and external environmental factors and can better reflect corporate green innovation in a given year. By referring to the IPC codes in the “Green List of International Patent Classification” issued by WIPO in 2010, the number of green patents applied for and granted by enterprises each year was matched with the enterprise level patent types retrieved from SIPO. Since the innovation of patents (in descending order, invention patents, utility model patents and design patents) this study adopts the number of green invention patents independently obtained by industrial enterprises in the same year as a proxy variable for green innovation. First, matched the patents of the listed enterprises on the Shanghai and Shenzhen stock exchanges in China. To avoid the effects due to missing data and abnormal situations, some treatments were made to the original data samples: (1) excluding data from the financial industry to avoid the effects of different profit models and accounting treatments of such industries on the conclusions; (2) excluding enterprises starting with ST, *ST and PT; (3) excluding samples with missing data; (4) excluding extreme data. Finally, 2037 industrial enterprises were selected as the research subjects. The total amount of green patent applications was then logarithmically transformed and increased by one to serve as the dependent variable.

4.2.2. Core explanatory variables

Media attention to an event is usually measured by the number of news events related to that event in media coverage. Thus, measuring the number of news stories the media covers has become a meaningful measure of media attention [41].

Media attention varies widely, so different coverage content and reporting tendencies demonstrate significant differences in their impact on recipients. Currently, the measurement of media attention is mainly divided into online and newspaper media. This study uses the number of times a company is searched on the web as a measure of media attention. The method of measuring the intensity of media attention based on media coverage has been accepted by scholars in different countries and regions [42,43]. Compared with paper-based newspaper reports, the coverage of online media reports is broader. Therefore, this study utilizes the Internet news search engine to retrieve the number of news reports of the corporations concerned as a measure of media intent, which is obtained from China Research Data Service Platform (CNRDS) [44]. Another way is to consider the media coverage of newspapers as a media attention (Media-news) source, whose precision of measurement is related to representative media selection. Changing trends of media attention is captured in Figure 2.

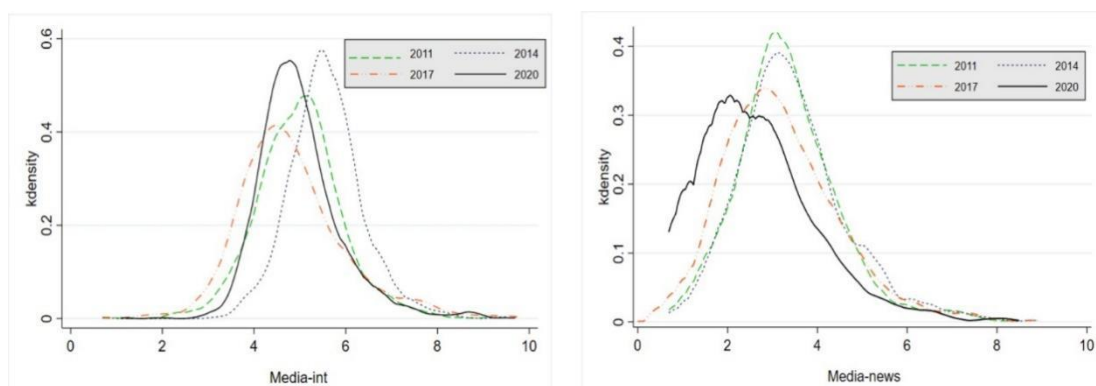


Figure 2. Media attention kernel density graph.

Visualization of trends in variables is done using kernel density estimation functions. Kernel density analysis can accurately describe the data distribution and show the data distribution by drawing probability density curves, which can visually show the data concentration, dispersion, anomalies, etc. It has a very good visualization effect for data exploration and analysis. Kernel density estimation (KDE), a non-parametric method for estimating the probability density function. $x_1, x_2 \dots x_n$ are n sample points of independent identical distribution. The he probability density function is f , and $K(\cdot)$ is the kernel function. The kernel density function is derived as follows:

Firstly, we assume that

$$f(x) = \lim_{h \rightarrow 0} \frac{F(x+h) - F(x-h)}{2h} \quad (7)$$

Replacing the distribution function with the empirical distribution function above, the numerator of the above equation is the number of points that fall in the interval $[x-h, x+h]$, and we can write the estimate of $f(x)$ as

$$\hat{f}_h(x) = \frac{1}{2h} \frac{\#x_i \in [x-h, x+h]}{N} = \frac{1}{2Nh} \sum_{i=1}^N 1(x-h \leq x_i \leq x+h) = \frac{1}{Nh} \sum_{i=1}^N \frac{1}{2} \cdot 1\left(\frac{|x-x_i|}{h} \leq 1\right). \quad (8)$$

We assume that

$$K_0(t) = \frac{1}{2} \cdot 1(t < 1). \quad (9)$$

Then the estimating equation can be written as

$$\hat{f}_h(x) = \frac{1}{nh} \sum_{i=1}^n K_0\left(\frac{x-x_i}{h}\right). \quad (10)$$

Then the integral of the density function can be written as

$$\int \widehat{f(x)} dx = \frac{1}{nh} \sum_{i=1}^n \int K_0\left(\frac{x-x_i}{h}\right) dx = \frac{1}{N} \sum_{i=1}^N \int K_0(t) dt = \int K_0(t) dt. \quad (11)$$

In addition functions can be extended to multiple dimensions as

$$\hat{f}_h(x) = \frac{1}{nh^d} \sum_{i=1}^N \sum_{i=1}^N K\left(\frac{x-x_i}{h}\right). \quad (12)$$

The left side represents the media attention measured by online media, while the right is the media attention measured by newspaper reports. The concentration of online media attention can be witnessed to be higher than that of newspaper media, and the crest of online media attention is increasing, whereas the crest of newspaper media attention is generally decreasing. This indicates that the variability of the intensity of attention by online media is gradually expanding for enterprises that use different media, while the variability of the intensity of attention by newspaper media is gradually decreasing for different enterprises. This study uses online media attention for empirical analysis, and newspaper media attention is replaced as an explanatory variable in the robustness check.

4.2.3. Moderating and mechanism variables

Countries worldwide increased their market intervention to avoid further economic crises after the global financial crisis in 2008. Economic policy stimulus is persistent in China, undergoing an economic structural transformation. These economic intervention policies expose enterprises to more significant uncertainty. According to the South China Morning Post (SCMP), compiling an index of China's economic policy uncertainty is now a more common method [45]. This approach is measured by measuring the weight of the words "China," "economy," "uncertainty" and "policy." According to Figure 3, China's economic policy uncertainty rose from 0.82 to 1.79 in 2008 in response to the economic crisis and then began to decline; after 2018, influenced by the trade war between China and the United States, China's economic policy uncertainty rose sharply, from 4.60 to 7.92, and declined in 2020. Overall, China's economic policy uncertainty index is on an upward trend.

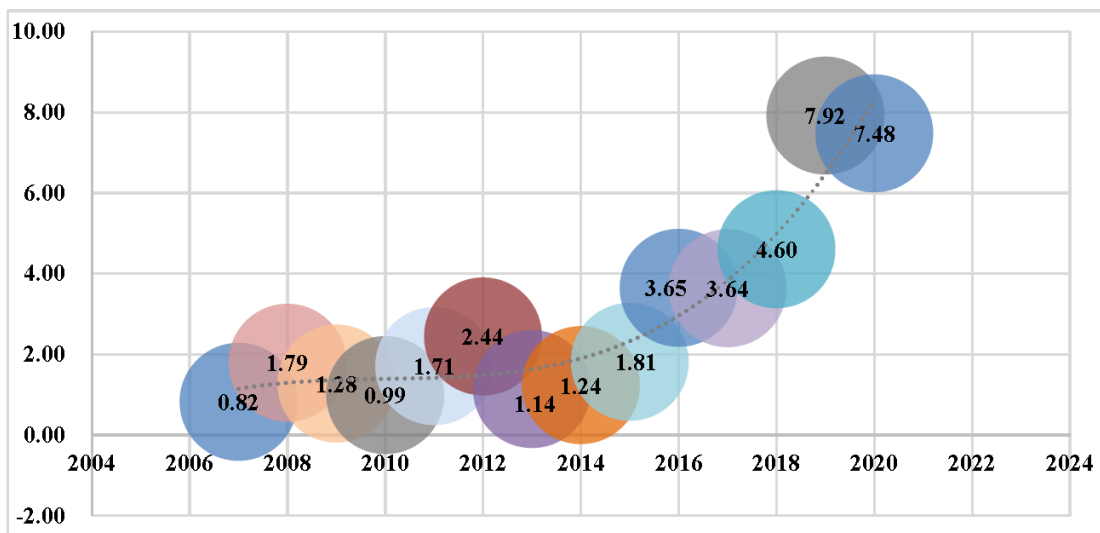


Figure 3. Economic policy uncertainty index.

Government environmental governance is a complex system project. The government work report, as the annual work plan of a region, is both a direct reflection of the importance attached to the ecological environment and a strong reflection of the environmental management efforts [46,47]. At the annual “Two Sessions” meetings held by governments at all levels in China, the work achievements of the previous year and the work plan for the future are reported to congress. The report embodies various social demands and consensus and plays a decisive guiding role in the government’s work for the year. The prevalence of buzzwords related to “environmental protection” in local government work reports is compared in this research to the production worth of the local manufacturing sector in order to provide a characterization of the level of environmental legislation that is implemented by local governments. Taking into consideration the fact that the government work report is traditionally distributed at the start of the year, this effectively avoids the problem of reverse causality between the report and social and economic activities [20,45]. To comprehensively reflect the level of government environmental regulation, the text statistical analysis includes 15 keywords in three aspects: environmental factors, governance objectives, and governance objects. The specific vocabulary selection is shown in Table 1.

Table 1. Dimensions of government environmental regulation indicators.

Dimension	Selected Vocabulary	Quantity
Environmental Factors	Ecological, Air	2
Governance Objectives	Environmental Protection, Environmental, Green, Low Carbon, Emission Reduction	5
Governance Targets	PM10, PM2.5, Chemical Oxygen Demand, Emissions, Pollution, Energy Consumption, Sulfur Dioxide, Carbon Dioxide	8

Financing constraints: It is not possible to infer in a straightforward manner from accessible statistics the financial restrictions that businesses are under. The qualitative classification of financing constraints is the basis of corporate financial indicators. Related indicators based on various corporate

indicators, such as the KZ index, WW index, SA index, etc., are constructed. Considering that the KZ and WW indexes are constructed using some endogenous variables, this study chooses the more exogenous SA index to measure corporate financing constraints [48]. The calculation method is as follows:

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age \quad (13)$$

Where SA refers to the financing constraint, $Size$ is the natural logarithm of the corporate assets, and Age is how long the enterprise has been listed. The unit of $Size$ is Yuan and the unit of Age is year. A negative SA index that has a more considerable numerical value indicates that the enterprise is facing a greater degree of difficulty in obtaining financing.

For corporate social responsibility, available literature usually adopts ESG evaluation to represent corporate social responsibility. ESG evaluation system is a corporate evaluation criterion to evaluate corporate contribution in boosting sustainable economic development and fulfilling social responsibility. Given that the Chinese securities market lacks an evaluation system for corporate ESG responsibility fulfillment, the ESG score data published by third-party rating agencies are employed as an objective evaluation of corporate social responsibility indicators. Of these, the ESG scores published by the Hexun website are derived from a broader range of initial information sources, including the overall scores of corporate ESC disclosure and the detailed public treatment of the original ESC performance of companies in different dimensions. Therefore, we use the corporate social responsibility-related data of Chinese A-share listed companies published by the Hexun website since 2010 to measure the social responsibility of sample companies.

4.2.4. Control variables

To minimize omitted variables, various factors affecting green innovation are controlled to enhance empirical reliability following existing studies, and some control variables are introduced. Book-to-market ratio (bm) represents the shareholders' equity divided by the market capitalization of the company; debt-to-equity ratio (lev) represents total liabilities divided by total net assets; current ratio (cf) represents the ratio of current assets to current liabilities of the enterprise; asset turnover ratio (ato) represents total sales revenue divided by average total assets; return on equity (roe) represents net income divided by average net assets; management revenue ratio (mf) represents administrative expenses divided by total operating revenues; enterprise listing age (age) indicates the number of years the company has been listed.

4.3. Data source

In order to investigate the effect that media attention has on environmentally friendly innovation, this research relies heavily on the observational data of listed industrial enterprises of China A-shares from 2011 to 2020. The green patent data and the financial information of all enterprises are sourced from the CSMAR database and ESP database. Ultimately, data from 2,037 industrial enterprises listed on A-shares and 13,846 observation samples are obtained.

5. Empirical analysis

5.1. Correlation analysis

Given the potential bias arising from the relationships among variables, this study conducts a correlation analysis of all research variables before performing empirical tests. The correlations between variables are assessed using the variance inflation factor (Table 2) and the Pearson test (Figure 2).

Table 2. Descriptive statistics.

Variable	Mean	Std.Dev.	Min	Max
<i>EI</i>	0.179	0.527	0.000	5.521
<i>Media-int</i>	5.118	0.995	0.693	9.802
<i>Media-news</i>	3.183	1.292	0.000	9.274
<i>Epu</i>	1.329	0.670	0.593	2.720
<i>Sa</i>	4.737	1.490	0.466	13.991
<i>Er</i>	0.348	0.131	0.029	1.239
<i>Esg</i>	2.999	0.749	-4.605	4.520
<i>bm</i>	0.904	0.939	0.015	20.965
<i>lev</i>	0.401	0.197	0.008	2.123
<i>cf</i>	0.049	0.071	-1.938	0.664
<i>ato</i>	0.652	0.424	0.006	7.871
<i>roe</i>	0.047	0.572	-60.153	2.379
<i>mf</i>	0.095	0.110	0.002	7.284
<i>age</i>	2.104	0.727	0.693	3.434

Figure 4 and Table 3 show that the values of the variance inflation factor (VIF) for all of the variables investigated for this article fall somewhere in the range of 1.06 to 1.63. Furthermore, the majority of the correlation coefficients between variables are lower than 0.6, which indicates that there is not a significant issue with multicollinearity.

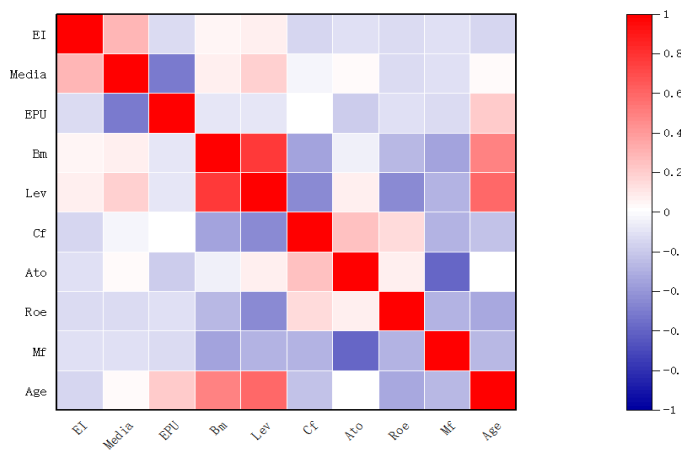


Figure 4. Correlation hotspot graph.

Table 3. Covariance test results.

	Media-int	EPU	Bm	Lev	Cf	Ato	Roe	Mf	Age
VIF	0.89	0.90	0.69	0.61	0.91	0.86	0.86	0.94	0.78
1/VIF	1.12	1.12	1.44	1.63	1.10	1.16	1.16	1.06	1.29

5.2. Baseline regression results and discussion

Table 4. Baseline regression results.

Variables	(1)	(2)	(3)	(4)
<i>Media-int</i>	0.011** (0.005)	0.010* (0.005)	0.011** (0.005)	0.010* (0.005)
<i>Media-int*Epu</i>		0.013*** (0.001)		0.013*** (0.001)
<i>Epu</i>		0.019*** (0.003)		0.012*** (0.004)
<i>bm</i>			0.006 (0.006)	0.005 (0.006)
<i>lev</i>			0.055* (0.033)	0.054 (0.033)
<i>cf</i>			-0.002 (0.054)	-0.007 (0.053)
<i>ato</i>			-0.051*** (0.016)	-0.045*** (0.016)
<i>roe</i>			-0.002 (0.006)	-0.002 (0.006)
<i>mf</i>			-0.032 (0.033)	-0.033 (0.033)
<i>age</i>			-0.002 (0.017)	0.021 (0.017)
Constant	0.059** (0.030)	0.031 (0.032)	0.077** (0.039)	0.028 (0.038)
Observations	13,846	13,846	13,846	13,846
Year effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses indicate standard errors.

Table 4 implies that media attention positively affects green innovation, whether control variables are included or not, which implies that media attention reinforces sustainable corporate development and has a potential incentive effect on green innovation orientation [8,49]. Also, it can promote enterprises to better cater to external stakeholders' green environmental orientations, transform innovation processes, and enhance the green attributes of products and services, achieving sustainable

development based on green innovation. The increased public environmental concern can make policymakers pay more attention to environmental protection, introduce more targeted pollution control policies, and strengthen the restraint on enterprises. It also has a significant impact on investors' choices, motivating them to invest more resources in companies that meet environmental standards and social responsibility, and driving the transition to sustainable development goals.

In addition, economic policy uncertainty can positively moderate the promotion effect of media attention on green innovation. Policy volatility forms an essential ingredient of uncertainty in China's economic development, as government departments frequently introduce economic reform policies during the structural transition of the economy. Such frequent adjustments in economic policies have induced elevated economic policy uncertainty and brought about a non-negligible impact on the decision-making behavior of enterprises at the micro level. It is mainly manifested that enterprises' risk perception of policy fluctuations and sensitivity to the external policy environment will increase accordingly as the policy uncertainty level increases. Seeking long-term development stability, and hedging corporate business risks from policy fluctuations by strengthening green innovation systems seems to be a rational choice. Therefore, economic policy uncertainty can positively moderate the promotion effect of media attention on green innovation, enabling enterprises to respond more actively to the external policy environment under dynamic complexity. Thus, H1 and H2 are supported by empirical results.

5.3. Heterogeneity analysis

To explore the impact of property attributes and industry characteristics, this study conducts a classification investigation of full samples and incorporates considerations of economic policy uncertainty on green innovation. The bubble chart in Figure 5 can initially reflect the significant differences in the impact of media attention on green innovation generated by different types of property rights as well as the nature of the industry.

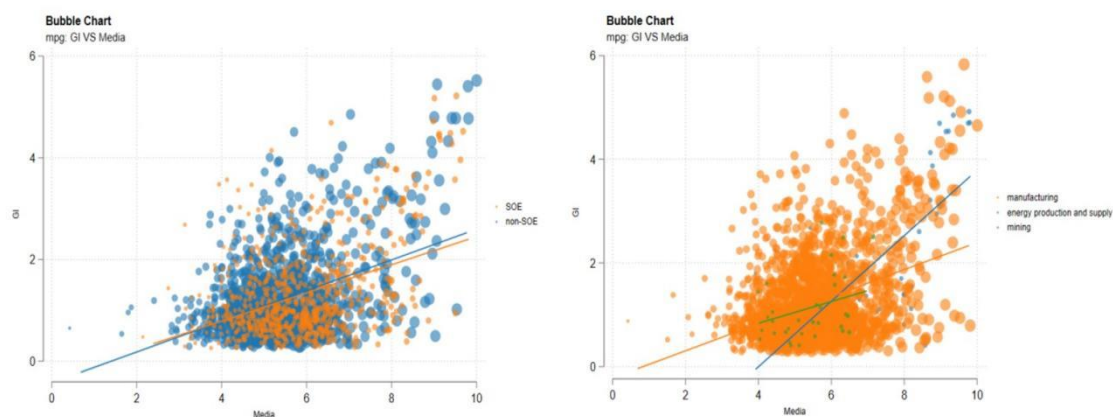


Figure 5. Bubble chart of property rights and industry characteristics heterogeneity.

5.3.1. Property rights heterogeneity results and discussion

The findings of this study classify companies into one of two categories based on the attributes

of property rights: state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs) (see Table 5). According to the findings in Table 5, the effect of media attention on environmentally friendly innovation is insignificant in SOEs but it has significantly contributed to green innovation in non-SOEs. One potential explanation is that the different objectives of enterprise operations cause the above results. SOEs, in contrast to non-SOEs, serve as leaders in regional economic development and are entrusted with the functions of serving society, implementing macro policies, and regulating socio-economic development. SOEs' green innovation is more motivated by proactive social responsibility than by local environmental regulations, which makes the impact of media attention on their operation strategies insignificant.

Table 5. property rights heterogeneity results.

Variables	SOEs	SOEs	non-SOEs	non-SOEs
	(1)	(2)	(3)	(4)
<i>Media-int</i>	0.008 (0.006)	0.008 (0.006)	0.029*** (0.011)	0.022** (0.011)
<i>Media-int</i> × <i>Epu</i>		0.011*** (0.002)		0.015*** (0.002)
<i>Epu</i>		0.014** (0.006)		-0.008 (0.009)
Constant	0.085** (0.042)	0.039 (0.041)	-0.370*** (0.124)	-0.348*** (0.118)
Control	YES	YES	YES	YES
Individual effect	YES	YES	YES	YES
Time effect	YES	YES	YES	YES
Observations	9,699	9,699	4,147	4,147

Moreover, variations in the magnitude of government subsidies and the pros and cons of information resources exist between the two types of enterprises. SOEs, with closer ties to the government are better able to enjoy R&D subsidies and access to the latest economic information. Green innovation typically includes higher technological obstacles and a more significant commitment of resources, and innovation activities conducted by businesses are distinguished by long-term cycles, elevated hazards, and a high probability of failure. As a result, green innovation in non-SOEs is subject to a greater risk of bankruptcy and operational pressure. It relies on continuous investment from external resources, with financial and policy support playing an essential role in the innovation process of non-SOEs [50,51]. Therefore, non-SOEs will adopt more aggressive coping strategies to avoid the negative impact of adverse media coverage on enterprises. According to the information in Columns (2) and (4) of Table 5, the mitigating impact of economic policy unpredictability is more pronounced for non-SOEs. Compared to non-SOE companies, state-owned enterprises (SOEs) are less vulnerable to the unpredictability of economic policy because of the inherent political connections they have with the government as a result of their special ownership character. Non-SOEs, however, will proactively undertake specific social responsibilities and develop an excellent social image to gain government support and recognition, thereby positively moderating the effect of media attention on green innovation.

5.3.2. Heterogeneity of industry nature

Based on the 2020 Chinese Classification of National Economic Industries (GBT4754), this study classifies all samples into three categories: mining, manufacturing, and energy production and supply. Table 6 indicates that Media attention can significantly promote green innovation in manufacturing enterprises but is not significant in the mining and energy production and supply industries. Moreover, the impact of economic policy uncertainty shows apparent heterogeneity, with only media attention in the manufacturing industry having a positive effect on green innovation, while being insignificant in the mining and energy production and supply industries.

Table 6. Industry characteristics heterogeneity results.

Variables	Manufacturing	Manufacturing	Mining	Mining	Energy production and supply	Energy production and supply
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Media-int</i>	0.011* (0.006)	0.009 (0.006)	0.007 (0.031)	0.002 (0.031)	0.007 (0.052)	0.007 (0.052)
<i>Media-int*Epu</i>		0.014*** (0.001)		0.009 (0.006)		0.002 (0.012)
<i>Epu</i>		0.011** (0.005)		-0.003 (0.025)		0.122*** (0.038)
Constant	0.076* (0.039)	0.028 (0.038)	0.151 (0.264)	0.165 (0.257)	1.155* (0.602)	0.932 (0.597)
Control	YES	YES	YES	YES	YES	YES
Individual fixed	YES	YES	YES	YES	YES	YES
Time fixed	YES	YES	YES	YES	YES	YES
Observations	13,088	13,088	435	435	323	323

According to the “White Paper 2022 on China’s High-end Manufacturing Listed Enterprises” released by the China Listed Companies Association on December 26, 2022, it is known that as of December 10, 2022, the number of listed enterprises in China’s A-share manufacturing industry accounted for 65.5% of all A-shares. Among them, the number of listed enterprises in the high-end manufacturing industry has increased rapidly, the revenue and profitability levels have strengthened, and the added value of products has increased. As the revenue grows, the R&D investment of manufacturing enterprises increases significantly, the proportion of R&D personnel keeps increasing and R&D investment maintains a high level, supplying a stable basis for the environmentally friendly transformation and innovative development of businesses. Moreover, to cope with the ever-changing global economic environment, the Chinese government has implemented macroeconomic policies such as “Industry 4.0” and “supply-side reform” and continuously promoted industrial and technological change and optimization and upgrading with intelligent manufacturing as the main direction, making manufacturing enterprises more significantly stimulated by R&D innovation. Therefore, media attention can more significantly influence the green innovation of manufacturing

enterprises, while economic policy uncertainty also positively and significantly contributes to media attention and green innovation in manufacturing. The mining industry and energy production and supply industry are suffering from a large proportion of capacity withdrawal, weak development of successive replacement industries. In particular, the Chinese mining industry is lagging in infrastructure development, facing real difficulties such as ecological restoration and environmental management debts, and reduced attractiveness to highly qualified personnel. The overlap of many factors makes the media attention fails to influence the green innovation of these enterprises more significantly.

Moreover, the mining and energy supply industries are mainly SOEs in the research sample selected for this study, while non-SOEs occupy a higher proportion of the manufacturing industry enterprises. Then, it becomes a rational choice for non-SOEs to choose to upgrade their production technology to achieve green innovation in order to build a green image government for adequate policy and financial support. The findings of this research are consistent with the analysis obtained from the section on property rights heterogeneity that came before it. In particular, the effect of media attention on businesses that are not owned by the state is substantially more significant than on businesses that are owned by the state, and the mitigating effect of economic policy instability is more apparent.

5.4. Robustness and endogeneity check results and discussion

This study employs multiple methods to conduct a robustness check [24]. The results of the different robustness tests are shown in Table 7.

Table 7. Robustness and endogeneity check results.

Variables	(1)	(2)	(3)	(4)	(5)
<i>Media-int</i>	0.015** (0.007)		0.009* (0.006)	0.011* (0.006)	0.193*** (0.013)
<i>Media-news</i>		0.009* (0.005)			
Constant	0.134*** (0.050)	0.104*** (0.033)	0.064 (0.040)	0.059 (0.042)	-0.793 (0.064)
Control	YES	YES	YES	YES	YES
Individual effect	YES	YES	YES	YES	YES
Time effect	YES	YES	YES	YES	YES
Observations	13,846	13,846	12,510	11797	11581
R-squared	0.012	0.014	0.015	0.016	0.081
Kleibergen-Paaprk					1623.518
LMstatistic					[0.000]
Kleibergen-Paaprk					7749.405
WaldFstatistic					{16.38}

To begin, the value of the dependent variable is altered. The dependent variable is re-estimated after having its value substituted with the number of green utility model patents acquired by mentioned organizations in the same year (see column (1) of Table 7). Secondly, the independent variable is

changed. The measurement method for the explanatory variable is changed by using newspaper media coverage of media reports in the CNRDS database as a proxy variable for media attention. The media attention of listed enterprises is manually collected and calculated. The newspaper coverage included significant financial newspapers. Media attention is then recalculated. Third, the length of time that was investigated was altered. In light of the significant influence that COVID-19 has had on industry, society, and business development, to eliminate the potential impact of COVID-19 on results, this study excludes the data from 2020 and only selects the samples from 2011 to 2019 for re-estimation (see column (3) of Table 7). Fourth, the sample size is changed. Since the development levels of different areas in China vary, especially between municipalities directly under the central government, to prevent the influence of regional development level differences, this research excludes the data from the four municipalities directly administered by the federal government. These municipalities are Beijing, Tianjin, Shanghai, and Chongqing (see column (4) of Table 7). Table 7 reveals that coefficients of the media attention show no significant differences in significance level or sign compared to the baseline regression results, demonstrating the results' robustness.

Moreover, considering the potential endogeneity problem in the empirical results, this study used the first lag of media attention as an instrumental variable and conducted regression again using the two-stage least squares method (see column (5) of Table 8). All the different test results confirm the validity of the instrumental variable, and the final results are similar to baseline regression results, further demonstrating the results' robustness.

5.5. Influence mechanism results and discussion

To further investigate the mechanism of media attention on green innovation, three mechanism variables, environmental regulation, financing constraints, and corporate social responsibility, were employed.

Government environmental regulation can positively contribute to green innovation. Green innovation is facilitated by government environmental regulation policies that significantly affect enterprises [13,46]. The Porter Hypothesis and the Pollution Sanctuary Theory suggest that when faced with environmental regulations, enterprises can either achieve environmental compliance through technological innovation or avoid local environmental regulations by relocating. Before the hypothesis of Porter was suggested, the conventional wisdom among academics was that environmental legislation would lead to an increase in the expense of production as well as the pressure placed on businesses, which would be deleterious to technological advancement later. However, Porter argues that environmental legislation will compel businesses to engage in environmentally friendly innovation in order to boost their level of competitiveness, offset the additional cost generated by environmental regulation, form an innovation compensation effect and effectively enhance green innovation. Although recent research suggests that different environmental regulations have different impacts on green innovation and that there may be a non-linear relationship between environmental regulations and green innovation, this does not negate the fact that there is a relationship between the two. On the other hand, environmental legislation can significantly contribute to the degree of environmentally friendly innovation.

Moreover, there is an organic and close connection between S&T and finance as the driving force and blood of the modern economy. R&D investment is an essential material basis for enterprises to carry out green innovation activities [52–54]. The acquisition and use of financial capital play an

important role in promoting the technological innovation of enterprises. With the rapid development of S&T enterprises, capital scarcity has been a significant concern worldwide, while financing has been a critical factor in enterprise development due to its high risk and high return characteristics. The reduction in financial constraints may lead to further damage to the environment by neglecting environmental and social responsibility as capital chases high short-term returns. Particularly in the area of green technologies, due to their long-term investment return cycle and high-risk nature, financial institutions may disinvest in the short term, thereby reducing their investment in and support for green technologies. The theory of financing constraint points out that enterprises will put high costs in seeking financing, quickly making them fall into the dilemma of lack of capital. By reducing the financing constraint, enterprises can provide strong support for the capital required for production and operation, which can stimulate innovation and produce numerous technological achievements through capital promotion. By generating value pockets through innovation, enterprises can attract financial capital to enter the field of science and technology, digest the accumulated excess capital, transform scientific and technological achievements into commercial value, create new demand, and further stimulate the momentum of green innovation in enterprises. Finally, CSR contains both economic and social attributes and can create integrated and shared values covering economic, social, and environmental aspects for economic stakeholders (shareholders, employees, suppliers, consumers, etc.) and social stakeholders (social organizations, communities, cluster environment, government, natural environment, etc.). CSR is an essential strategy for developing enterprises and can strengthen the green innovation orientation of enterprises under media attention [55]. CSR enhancement enables sustainable innovation in terms of business model and process innovation, which in turn strengthens corporate green innovation performance and forms a green innovation effect of internal strategic response under external policy incentives.

According to existing research, this study establishes a model based on Eq (1) as follows:

$$Med_{it} = \delta + a_1 De_{it} + \beta_i X_{it} + \varepsilon_{it} \quad (14)$$

Med_{it} designates government environmental regulation, financing constraints, and corporate social responsibility. a_1 is the coefficient to be estimated, and the other parameters are the same as in Eq (1).

Column (2) of Table 8 indicates that media attention can substantially contribute to promoting government environmental regulation. Media attention has a focusing effect, which can attract public attention through intensive reporting in a short period and urge the government to respond to adverse environmental reports. In addition, the media possesses an amplification effect whereby, in the age of information, the speed of internet transmission of news is extremely rapid, thus “forcing” local governments to enhance their governance efforts concerning environmental issues. Column (3) of Table 8 indicates that media attention can effectively alleviate corporate financing constraints. According to communication theory, news media possesses the agenda-setting function, which means that media influences the public’s attention and evaluation of the importance of a particular issue through the transmission of information. In the highly digitized era of the Internet’s widespread use, the information environment of the capital market has become even more complex and volatile, and investors are facing time and information acquisition limitations. News media is not only an intangible regulatory force but can also enable governments and citizens to quickly understand the level of local corporate green development and environmental governance efforts through reporting on corporate production behavior. To avoid damaging their reputation, companies actively establish a positive image, using public opinion monitoring and signal transmission to meet investors’ expectations, easing

corporate financing constraints [4,56]. Column (4) of Table 8 demonstrates that media attention can enhance corporate social responsibility. The increase in media attention strengthens the transparency of the information environment and further reduces information asymmetry. The media's external monitoring function can improve corporations' commitment to assuming public social and environmental responsibilities, thereby promoting green innovation performance through stakeholder value reciprocity mechanisms.

Table 8. Influence mechanism results.

Variables	(1)	(2)	(3)	(4)
	EI	Er	Sa	Csr
<i>Media-int</i>	0.011** (0.005)	0.005*** (0.002)	0.094*** (0.006)	0.039*** (0.010)
<i>bm</i>	0.006 (0.006)	0.007*** (0.002)	0.207*** (0.007)	-0.007 (0.012)
<i>lev</i>	0.055* (0.033)	-0.039*** (0.011)	0.794*** (0.039)	-0.881*** (0.066)
<i>cf</i>	-0.002 (0.054)	0.030* (0.017)	0.037 (0.063)	0.794*** (0.105)
<i>ato</i>	-0.051*** (0.016)	0.006 (0.005)	-0.248*** (0.019)	0.287*** (0.030)
<i>roe</i>	-0.002 (0.006)	0.003 (0.002)	0.061*** (0.006)	0.147*** (0.011)
<i>mf</i>	-0.032 (0.033)	0.011 (0.011)	-0.525*** (0.039)	-0.468*** (0.072)
<i>age</i>	-0.002 (0.017)	-0.027*** (0.005)	0.177*** (0.020)	0.048 (0.032)
Constant	0.077** (0.039)	0.386*** (0.012)	3.095*** (0.045)	3.112*** (0.073)
Observations	13,846	13,846	13,846	13,288
Individual effect	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes

6. Conclusions and policy implications

6.1. Conclusions

This research applies theoretical and empirical approaches to investigate the effect that media attention and economic policy instability have had on green innovation in A-share industrial traded companies from 2011 to 2020 using data collected from those companies. Heterogeneity analysis is also conducted from the perspectives of property attributes and industry rights and characteristics. Moreover, the specific influence mechanism of media attention on corporate green innovation is explored through government environmental regulation, financing constraints and corporate social responsibility. The following findings show that media attention can effectively promote green innovation. Media attention reinforces the incentive effect on corporate green innovation and promotes

better catering to the green orientation of external stakeholders. At the same time, media attention has a significant heterogeneous impact on corporate green innovation due to differences in corporate business objectives and the nature of the industry, with a more substantial impact on non-SOEs and manufacturing enterprises. Economic policy uncertainty can positively moderate the promoting effect of media attention on corporate green innovation. Lastly, media attention will promote corporate green innovation through increasing government environmental regulation intensity, reducing corporate financing constraints, and enhancing corporate social responsibility.

6.2. Policy recommendations

The media's role as an external regulatory subject overseeing green innovation and environmental governance should be given adequate attention. As an external regulatory entity, the media exerts external legitimate pressure and signal mechanisms, which can effectively guide and promote green enterprise innovation. It is crucial to actively utilize the media to increase public participation in environmental protection, foster a good public opinion atmosphere, promptly disseminate negative environmental information through news reports and exert social public opinion pressure to encourage enterprises to innovate, reduce pollution emissions and improve resource utilization efficiency. For example, increase the exposure of corporate green development through the media. Provide more support and recognition for corporate green innovation by increasing the public's awareness and understanding of corporate green innovation.

The news media needs to gradually develop pressure-driven mechanisms to reinforce the legitimacy of media regulation on state-owned enterprises, in addition to non-state-owned enterprises. Improve the objectivity and impartiality of media attention. Through objective reporting on green technologies, green production, and green supply chains implemented by SOEs, the actual status and effectiveness of their development should be revealed and evaluated. In addition, we should rely more on the legitimacy of regulation and signaling mechanisms under market incentives to achieve the level of green innovation in enterprises such as mining and energy supply and give full play to the role of the news media in urging enterprises to invest in environmental pollution control.

While economic policy uncertainty positively influences media attention to firms' innovation investment, excessive economic policy volatility can also cause increased pressure on firms to transform and upgrade to green, which may inhibit their capital investment activities. Therefore, government environmental regulatory and policy-making authorities need to develop region-oriented environmental policies to smooth economic fluctuations and enhance firms' innovation capacity in a timely and local context. Policymakers should fully leverage the supervisory role of the news media in local government environmental pollution governance and ensure complete information disclosure on the entire process of local government's decision-making, investment and performance evaluation in environmental governance. By exercising media supervision, it is possible to strengthen the supervision of enterprise CSR information disclosure and environmental governance issues, reduce information opacity, ease corporate financing constraints and "force" enterprises to establish a positive social image, thereby promoting enterprises toward green development.

6.3. Research limitations

Despite the fact that this study has attempted to be as exhaustive as possible in its examination of

the effect of media attention and economic policy instability on the corporate green innovation under investigation, there are still some shortcomings. This investigation focuses solely on publicly traded companies; consequently, it does not cover a significant proportion of small and medium-sized businesses; as a result, there is a pressing need to broaden the sample in order to conduct a study that is sufficiently comprehensive. Next, this research examines the influence of the media on green innovation but only in the context of governmental environmental legislation, financial limitations and the accountability of corporations to their communities. There may be additional aspects that have an impact, such as the revelation of environmental information, the educational qualities of senior executives, and political relationships. These aspects should all be thoroughly investigated.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors declare no conflict of interest.

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