Exploring the Multidimensional Perspective of Retail Investors’ Attention: The Mediating Influence of Corporate Governance and Information Disclosure on Corporate Environmental Performance in China

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Abstract: In the dynamically evolving global environment, enterprises grapple with an intricate web of social, environmental, and technological changes that demand heightened environmental efficiency and sustainability-oriented strategies. This study investigated the influence of retail investor attention on corporate environmental performance as well as the roles of corporate governance and information disclosure quality in Chinese publicly traded companies from 2008 to 2019. The empirical evidence reveals a positive association between retail investors’ attention and corporate environmental performance. The quality of corporate governance significantly affects environmental performance, while information disclosure quality exhibits a negative correlation. The study’s findings provide valuable insights for policymakers looking to improve corporate environmental efficiency. They suggest incorporating retail investor attention as a strategy for Chinese publicly traded firms to enhance their environmental performance. Overall, this study highlights the importance of corporate governance practices, information disclosure quality, and retail investor attention in achieving optimal environmental performance.

Keywords: retail investor attention; corporate governance quality; corporate environmental performance

1. Introduction

The capacity of a CEO to maintain a company’s environmental efficiency is essential for the firm’s profitability. Strong attention from retail investors highlights the significance of motivating management to pursue the organization’s objectives and the value employees bring to attaining these goals. It is widely acknowledged that successful organizations depend on high-quality decision-making, and corporate environmental efficiency directly influences organizational success [1,2]. Moreover, it is commonly presumed that the extent of governance practices and information disclosure by retail investors is primarily driven by the company’s sustainability impact. Efficient conduct facilitates the fulfillment of stakeholder expectations, thus bolstering environmental effectiveness.

The area of managerial compensation schemes is a well-established field of research within the current literature on corporate environmental sustainability. This study proposes using retail investor structures as a tool to mitigate potential agency risks associated with corporate activities. This is particularly relevant for high-tech firms seeking to foster innovative efficiency and enhance corporate environmental performance in countries like China, which are wrestling with substantial agency conflicts. Companies that attract a higher level of retail investor attention tend to exhibit a reduced level of potential risk. When businesses act responsibly, they are more likely to generate superior returns for their shareholders. Therefore, they must conscientiously address environmental, societal, and other stakeholder concerns. These responsibilities include safeguarding legitimate rights,
adhering to business ethics, conserving resources, and protecting worker interests [3]. Retail investors are gaining increasing prominence in financial markets [4], and exploring the influence of their attention on corporate environmental performance presents a captivating research focus. Existing literature offers ample evidence of accumulating agency conflicts, uncertainties, and long-term earnings concerns related to emerging technologies. As modern economies such as China strive for technological leadership in the global market, numerous national policies have been implemented to promote scientific and technical advancements. These policies aim to transition the corporate sector from leapfrogging growth towards self-sufficiency in new technology. Consequently, recent research has concentrated on retail investors’ attention and corporate information quality, as well as their impact on the corporate environment. The emphasis is shifting from increasing exploitative activities towards prioritizing quality innovation [5,6].

Retail investor awareness seems to significantly shape a firm’s sustainability impact, with environmental management practices playing a key role in bolstering a company’s competitive edge and core competitiveness. Investors have increasingly considered both financial and nonfinancial factors in their comprehensive organizational assessments [7]. Among these non-financial and intangible factors, corporate environmental performance has emerged as the most crucial element. As demonstrated in prior research [5,6], corporate social and environmental efficiency has become vital in evaluating companies, making the identification of factors driving corporate environmental efficiency essential for a complete understanding of a firm’s capabilities. Previous studies indicate that stakeholders significantly influence a company’s environmental performance [8]. Retail investor attention is likely to boost corporate innovation by enhancing corporate governance through external monitoring, thereby reducing agency costs. Heightened investor attention fosters greater corporate information transparency, enabling investors to gain a more comprehensive understanding of organizations, encompassing both current performance and future growth prospects [9]. Retail investor attention typically improves information transparency, reduces information asymmetry, and, ultimately, elevates a firm’s information environment [10]. When information asymmetry is reduced, management may be better equipped to align stakeholders’ interests when allocating resources to environmental initiatives, as demonstrated in previous research [11]. Consequently, retail investors can assume a managerial role in promoting corporate environmental efficiency through the information quality mechanism. Furthermore, some studies have found that stakeholders can contribute to strengthening environmental corporate governance [12]. With enhanced corporate governance, top managers are more inclined to address environmental concerns raised by investors and curb opportunistic behavior, in accordance with agency theory. Thus, we propose that corporate governance can serve as a moderating factor, enhancing the positive impact of retail investor awareness on corporate social and environmental efficiency.

Customers and external stakeholders, including environmental non-governmental organizations, employees, and the local community, tend to favor sustainable business practices [13,14]. However, managers might perceive that implementing green management demands substantial additional time and resources, diverting their attention from other operational responsibilities and resulting in stakeholders prioritizing green initiatives over managerial concerns [15]. The goal of this research is to explore the influence of retail investor attention on corporate sustainability. This is achieved by examining the impact of retail investor attention, corporate governance, and information disclosure quality on the environmental performance of organizations.

Previous research has primarily concentrated on asset pricing and announcement effects [16,17], and it is recognized that investor attention is limited [18,19]. Due to the high costs associated with gathering and processing stock data, retail investors cannot access all available information [20]. However, when they take an interest in a company, they can acquire more knowledge about it [17]. Retail investors’ efforts to obtain and analyze information can exert considerable pressure on companies to improve their information-sharing
quality [21,22]. This is because retail investors have emerged as an increasingly influential force in financial markets, capable of significantly impacting a company’s performance and reputation. Studies by [23,24] have demonstrated that corporate disclosure quality facilitates the effectiveness of firm-investor information exchanges.

Several research studies have sought to explore the effects of retail investors on the market and, subsequently, on a firm’s overall performance [25]. It has been observed that retail investors significantly influence market sentiment, which, in turn, sets the financial market’s tone through price movements and changes in trading activities [26]. Other studies have noted that factors associated with the internal governance and external environments of enterprises impact corporate environmental performance [27,28]. Retail investor attention is likely to considerably affect corporate environmental performance by influencing overall investment decisions, as retail investors tend to invest in organizations that prioritize social responsibility and sustainability. The surge in consumer environmental concerns has prompted an increasing number of organizations to proactively enhance their environmental performance. Both corporate culture and governance play a vital role in improving decision-making processes for better environmental performance [28]. The existing literature in the area of corporate environmental performance often examines corporate governance mechanisms from the perspective of internal governance. These studies are approached from a variety of perspectives, including board independence [29] and board diversity [30,31]. External monitoring often focuses on analyst coverage [32] and institutional investors [33]. These studies, however, have not examined the role of retail investors in corporate environmental performance.

Corporate governance is monitored both internally and externally to ensure businesses operate ethically, legally, and effectively. These two types of monitoring both play efficient roles. Internal monitoring is conducted within the organization and is focused on improving the company’s performance and ensuring compliance with internal policies and procedures. Key internal monitors include the board of directors and employees. External monitoring involves parties outside the organization scrutinizing the company’s activities. External monitors have a broader focus, including legal compliance and societal impact. Key external monitors include shareholders, investors, external auditors, and analysts. In essence, while internal monitoring ensures compliance with internal standards and strives for operational effectiveness, external monitoring focuses on broader impacts, including legal compliance and social responsibility. Both are necessary for effective corporate governance. The current literature primarily concentrates on the link between the internal monitoring function of board directors and corporate social responsibility, largely overlooking the impact of external monitoring, particularly the influence of retail investor attention. Investors, due to their unique position and interests, could exert distinctive pressures and incentives that might have varying effects on the environmental performance of firms compared to other monitoring entities. According to the agency theory, individual investors analyze and interpret relevant business information about corporations through social media, thereby suppressing the motivation of corporate management to conceal the real situation within the company. The negative information about the company is more likely to be detected and disseminated, making it difficult to hide. Consequently, the opportunistic behavior of management will be restrained to some extent. As of the end of 2022, given the unique national conditions in China’s capital market, where the number of individual investors exceeds 200 million, exploring the behavior of individual investors holds more practical significance.

The theory of information asymmetry suggests that there is a discrepancy in the information available to internal and external parties in a corporation. Concurrently, signaling theory points out that investors, who are at an informational disadvantage, find it more challenging to obtain private information within a company. Manetti and Bellucci (2016) dissected the role of social media from the perspective of voluntary information disclosure and found that public opinion supervision on social media could prompt listed companies to increase the probability of disclosing voluntary performance forecasts [34]. It
is evident that individual investors’ information demands on social platforms can accelerate information dissemination, reducing the problem of information asymmetry caused by delayed information acquisition. The information transmission mechanism can affect corporate environmental performance in the following two ways:

On the one hand, the improvement of information interaction efficiency can effectively convey investors’ environmental demands to corporate management, thereby supervising corporate environmental behavior through signaling effects. Corporate compliance with environmental behavior is not only a response to investor demands but also an essential manifestation of the company actively coping with external pressure to enhance environmental adaptability. Specifically, corporate managers will actively transmit positive signals of environmental activities to meet compliance requirements, fulfilling the demands of investors, the government, and consumers for corporate environmental performance. This information exchange process can provide positive incentives for management’s environmental decisions, thereby improving the company’s willingness and commitment to sustainable development transformation and effectively enhancing environmental performance. On the other hand, social media aids in enhancing investors’ capabilities to interpret information, effectively mitigating the information asymmetry between companies and investors. In the new media age, characterized by the profound integration of digital technology and the real economy, social media has broadened the information exchange channels between investors and listed companies. The advent of social media allows investors to acquire more incremental information about corporate operations and provides them with more efficient tools for interpreting that information. Corporate management’s environmental practices can be more easily perceived by investors, thereby intensifying the visibility and impact of management’s environmental activities. This can subsequently increase investor interest in and support for such activities, highlighting the powerful role social media can play in shaping investor perceptions and corporate behavior.

This paper contributes to several strands of the literature. First, this research contributes to enriching the theoretical studies related to the environmental behaviors of companies. Based on agency theory, information asymmetry theory, and corporate social responsibility theory, this paper explores whether individual investors have a monitoring effect from the perspective of corporate environmental behavior. Most scholars elaborate on the motivation for businesses to adopt green behaviors from the perspective of corporate social responsibility [35]. From the viewpoint of resource acquisition, some studies have found that a company’s environmental protection behaviors can bring certain resources to the company by improving stakeholder relationships [36]. However, there has yet to be any research focused on the relationship between individual shareholder voice and corporate environmental performance. This enriches the related studies on the factors influencing the environmental performance of companies and the realization of their targets. By examining this relationship, this study deepens the body of knowledge on the factors influencing the environmental performance of companies and how they achieve their targets, thereby providing a new perspective to the existing research landscape.

Second, this research broadens the relevant studies on the supervisory effects of individual investors. The paper constructs an effective model and uses empirical analysis to separately test the impacts and mechanisms of individual investors’ concerns on corporate environmental performance. Meanwhile, through mechanism analysis, it elucidates the rationality of external supervision mechanisms generated by investors’ attention. Most studies focus on the capital market reactions caused by investor attention, such as the impact on stock returns and market risk [16,17,37]. Fewer studies conduct in-depth empirical analysis and theoretical explanations of the decision-making behaviors of listed companies triggered by investor attention [38]. Most of the literature on retail investors’ participation in corporate governance deals with aspects such as information disclosure, executive compensation, and corporate investment efficiency [39–41]. The theoretical analysis framework of individual investors’ governance effect is constructed, providing theoretical
support for individual investors to enter the supervision system of socialism with Chinese characteristics.

Third, this research broadens the related studies on external corporate governance mechanisms. Individual investors are important stakeholders of a company, and their attention and the resulting supervision can help alleviate the conflict of interest between management and stakeholders, optimizing the sustainable development objectives of the company. Previous literature, based on the governance effect of individual investors through social media, mostly unfolds from the perspectives of capital markets and corporate social responsibility [42,43]. To the best of the researcher’s knowledge, the implications of corporate governance quality and retail investor attention on overall corporate environmental performance have not been examined. This research focusing on the external monitoring role of retail investor attention aims to fill this existing gap, which is crucial for understanding the importance of retail investor attention and corporate governance quality in corporate environmental performance. The purpose of this study is to resolve the problem, that is, to mitigate the conflict of interest among various equity holders, to propose solutions, to obtain policy implications and practical suggestions, and finally to improve external corporate governance mechanisms, ultimately facilitating the long-term, high-quality development of the company.

This research study has analyzed the effectiveness of retail investors’ attention in promoting sustainable business practices. However, the study does not consider the impact of retail investors’ leadership roles on business operations. Moreover, numerous studies highlight China’s resource disparity, and few government policies have been implemented to promote corporate management careers in the country. The findings suggest that environmental equality in the upper echelons fosters exploratory growth. Policymakers should thoughtfully design a portfolio of executive incentives that efficiently manage effort, apprehension, and overoptimism to encourage long-term corporate growth. The dynamic value should emphasize corporate environmental efficiency and rationality in allocating corporate capital, and the managerial motivation group serves as a crucial tool for internal resource allocation that should not be overlooked [44]. The primary focus of this research study revolves around the following research questions:

- **RQ1:** Is there a link between retail investor attention (LnR) and company environmental performance?
- **RQ2:** Is there a link between retail investor attention, corporate governance, quality access to information, and corporate environmental performance (CEP)?

### 2. Literature Review and Theoretical Foundation

#### 2.1. Theoretical Foundation

This study investigates the influence of retail investor attention, corporate governance quality, and information disclosure quality on corporate environmental performance. Drawing on institutional theory, it explains how social behavior is directed by individuals or corporations through the establishment of routines essential for environmental sustainability. In organizational studies, institutional theory addresses the deeper, more resilient social structures that underpin such behavior. Ref. [45] contend that the theory accounts for how norms, rules, structures, routines, and schemes become established as guidelines for social behavior. Building on institutional and agency theories, this study develops a research model. It posits a positive association between retail investor attention and CEP, with empirical evidence supporting this claim. Information asymmetry theory posits that better information environments reduce information asymmetry between firms and investors. Empirical findings reveal that retail investor attention contributes to a better information environment, which, in turn, reduces information asymmetry and has a positive impact on CEP. The study also takes into account the pecking order theory proposed by Frank and Goyal [46]. According to this theory, firms should minimize negative signals by financing their resources internally and resorting to risky equity only as a last resort if external financing is needed. In conclusion, this research underscores the significance of
retail investor attention, corporate governance quality, and information disclosure quality in shaping corporate environmental performance. Institutional and agency theories offer a robust theoretical framework to comprehend these relations. Furthermore, information asymmetry theory illuminates the role of an improved information environment in retail investors’ supervision of corporate environmental behavior.

2.2. Corporate Environmental Performance

The current literature on corporate environmental performance is mainly divided into two categories: the influencing factors of corporate environmental performance and the economic consequences of corporate environmental performance. At present, a large volume of literature has discussed the influencing factors of corporate environmental performance. Scholars mainly research the motivations for enterprises to engage in green behaviors from the perspective of corporate social responsibility. On the one hand, they discuss the motivations for enterprises to participate in environmental protection activities, mainly based on shareholder value theory. By improving relationships with stakeholders, enterprises can enhance their resource acquisition capabilities and increase credibility, which aids the company in obtaining related resources [35]. On the other hand, scholars have studied the factors that influence enterprises’ choices of environmental protection strategies. The market environment and legal system affect enterprises’ strategic choices. A good legal system environment leads enterprises to pay more attention to long-term benefits [47]. At the same time, a good market environment also has a positive impact on the environmental performance of enterprises. In addition to external influencing factors, scholars have also studied the relationship between internal characteristics of enterprises and environmental performance [48].

Previous literature mainly explored the influencing factors of corporate environmental behaviors from the perspective of the institutional environment and stakeholders. This study contributes to enriching the relevant theoretical research on corporate environmental behaviors. By exploring the relationship between retail investor attention and corporate environmental performance, this study further enriches relevant research on the factors influencing corporate environmental performance and the achievement of its objectives.

To test the economic consequences of environmental performance, prior research has explored the significance of corporate environmental initiatives concerning long-term value and organizational growth potential [44,49]. These analyses demonstrate that corporate environmental actions can yield improved economic benefits and enhanced environmental performance for companies [50]. Additionally, there is a strong and positive association between other non-financial outcome measures and corporate performance, including improved organizational commitment and system implementation success. Numerous studies have found a positive correlation between corporate environmental performance and market performance as well as profits [51,52]. It has been assessed that enhanced corporate environmental performance leads to lower organizational debt financing costs when a company’s investment in corporate environmental performance is below optimal levels. This underlines the importance of corporate environmental performance in driving positive financial and non-financial outcomes for businesses. The findings from these studies suggest that while implementing effective environmental measures may necessitate additional resources and effort, they can ultimately boost overall profitability and competitive advantage for organizations in the long run [12]. This section reviews the existing literature examining the impact of retail investor attention, corporate governance, and information disclosure quality on the environmental performance of organizations. CSR theory provides a framework for understanding the relationship between retail investor attention and corporate environmental performance. Retail investor attention drives companies to adopt and improve CSR practices, particularly concerning environmental performance. In turn, these practices lead to improved financial performance and long-term value creation, benefiting the organization, its stakeholders, and the environment. By synthesizing these
various factors, the review aims to provide a comprehensive understanding of how they collectively contribute to shaping corporate environmental performance.

2.3. Retail Investor Attention

Individual investors are one of the most important participants in the financial market. Due to their limited attention resources, the demand for evaluating the value of listed companies results in the allocation of attention. This behavior of information demand affects aspects such as the fluctuation of asset prices in the capital market. Literature related to investor attention mainly revolves around the information value generated by investors’ proactive search for information. Most research focuses on the impact of the attention allocation of individual investors on the capital market, which is mainly reflected in its influence on asset prices and the timing of information disclosure. Numerous studies have investigated the impact of investor attention on asset price changes [37,53]. Investors find that handling multiple events is challenging, as the emergence of external news catches their attention, making them slower to respond to news related to specific companies. This has a significant impact on the company’s stock prices and trading volume [54], thereby reducing the predictability of its returns [55,56]. Investor attention also has a certain influence on the timing of disclosure decisions by the management. According to domestic and foreign research, there are several reasons why companies carry out selective disclosure: (1) They offset the impact of previously disclosed negative news by releasing good news in advance. When investors have already expected bad news from companies in a certain industry, the company releasing the bad news will receive relatively less attention [57,58]. (2) Companies will disclose good news for their own benefit and receive more market attention than their competitors [59].

In the digital age, individual investors acquire and exchange information through social media. Current literature mainly explores the potential corporate governance function of individual investors based on social media from the perspectives of information disclosure, earnings management, and so forth [60]. With the development of technology, online social media has gradually become an important means of information communication [61]. It not only conveys crucial information but also significantly influences investors’ decisions, thereby profusely altering the development of companies [60]. Internet social media is not merely a channel for information dissemination but also possesses significant influence, such as changing the behavior of capital market participants and attracting the attention of government departments [60–62]. Past research mostly discusses the governance function of listed companies as viewed by individual investors through social media from the perspective of agency problems. However, they lack discussions concerning the specific environmental governance behaviors or related mechanisms of companies that are influenced by the attention of individual investors. This paper first explores the supervisory effect of individual investors on social media from the perspective of corporate environmental performance, thereby enriching the study of the supervisory role of individual investor attention.

Furthermore, the majority of studies suggest a positive correlation between environmental actions and business financial performance, as these activities strengthen the relationship between stakeholders and firms [63]. However, some argue that environmental conservation and business value maximization are mutually exclusive objectives [64]. This research also explores the link between investors’ interest in green initiatives and corporate environmental performance. Prior studies have demonstrated that investor attention can impact green bond returns and volatility [65], and have investigated investors’ perceptions of environmental disclosure quality. The findings of this study can be employed to illustrate corporate environmental effectiveness [51].

Managers may be hesitant to allocate resources to environmental initiatives due to the significant managerial effort required, despite the potential long-term benefits for the company’s core competencies. By accessing stock information on social networking websites, retail investors can gain a better understanding of a company, making them
more tolerant of short-term managerial missteps, which is crucial for environmental efforts. Reduced information asymmetry enables managers to recognize retail investors’ demand for corporate environmental initiatives [52,66]. Moreover, retail investors may play a critical role in evaluating and supporting a company’s ambitious growth plans. However, the absence of reliable assurance from shareholders can heighten managers’ anxiety, potentially hampering the research and innovation processes. While environmental initiatives demand significant effort and resources, retail investors’ increased understanding and support can play a vital role in driving these efforts. By reducing information asymmetry and fostering a supportive environment, managers can better align their strategies with investors’ expectations and the long-term interests of the company.

Boards of directors (BoDs) have been found to significantly influence information disclosure, operational efficiency, and corporate governance. In particular, BoDs play a crucial role in supporting corporations, and their contributions are often seen as vital to corporate environmental performance. However, it has been observed that when an organization has a large BoD, there may be a greater likelihood of “free-riding” among board members. Additionally, the benefits of a large BoD could be offset by increased organizational costs due to more complex decision-making and communication processes [67]. As a result, it can be inferred that having a large BoD might lead to reduced overall effectiveness in decision-making and operational efficiency. This, in turn, can cause organizations to become indifferent toward corporate environmental performance, making them less inclined to disclose relevant information [68]. Therefore, it is essential to strike a balance in board size to maintain effective decision-making while fostering a focus on environmental performance and information disclosure.

Numerous research studies have highlighted the positive effects of retail investor attention on enhancing the overall performance of organizations [69,70]. Specifically, it has been observed that retail investor attention fosters increased corporate innovation by improving the overall level of corporate governance. This is primarily achieved through external monitoring to minimize agency costs. Several studies have demonstrated that incentive schemes remain an effective solution for reducing agency risk associated with efficiency and corporate environmental actions [71,72]. An effective governance system significantly reduces the agency problem associated with corporate environmental innovation. In recent decades, various changes have been implemented, particularly in China and emerging economies, to improve the governance structure of modern environmental performance and promote efficiency [73]. Environmental measures necessitate that managers direct their full attention to environmental issues. Consequently, supervisors who prefer stability may allocate limited resources to environmental operations that are not closely monitored. However, when retail investors are attentive to their managerial role through information awareness and engagement, managers are more likely to participate in value-generating activities, including environmental initiatives, which can enhance a company’s core competitiveness. Hypothesis 1 is illustrated in Figure 1.

**H1:** Retail investor attention is linked to a company’s environmental performance in a positive way.

Agency conflicts arise when managers are typically rewarded based on their outcomes rather than their efforts. These conflicts can occur because some managers’ efforts toward a firm’s long-term strategy, particularly environmental efficiency, may not be immediately reflected in the company’s performance. Strong governance can help reduce agency costs. By improving corporate governance and increasing retail investor attention, managers may come to understand that corporate environmental performance is a crucial aspect of evaluating their competencies. Retail investor attention can help align the interests of investors and managers by enhancing corporate governance quality, which ultimately improves the company’s environmental performance. Recent studies have shown that site visits by institutional investors contribute to better corporate governance. The importance of strong governance in promoting business innovation, especially exploration and novelty-seeking, cannot be overstated. Moreover, research has demonstrated that retail investor
attention to information disclosure quality plays a significant role in environmental innovation, aligning with improvements in governance. When individual investors pay closer attention to a company and process information more quickly, it becomes more difficult for unethical behavior to go unnoticed. This form of monitoring, which relies on retail investors' attention, can be achieved by strengthening company governance and reducing agency conflicts between management and investors. Hypothesis 2 is illustrated in Figure 2, highlighting the vital role of retail investor attention in promoting environmentally responsible corporate behavior through improved governance.

**Figure 1.** The direct retail investor attention influence on corporate environmental efficiency.

**H2:** The relation between retail investor attention and corporate environmental performance can be mediated by corporate governance quality.

**Figure 2.** The mediating impact of corporate governance quality on corporate environmental performance.

In Chinese listed companies, a prominent feature of ownership is the presence of a single large shareholder. It has been observed that having a single shareholding structure allows for easy control over the listed company [63]. This structure is also known as “tunneling” due to the lack of internal balance, and the controlling shareholders tend to take high stakes. Furthermore, controlling shareholders can easily access confidential and inside information [64]. Due to a lack of incentives and cost limitations, marginalized shareholders are unable to pressure the company to disclose more information. Consequently, the controlling shareholders’ motivation to reveal social responsibility information may not be strong, which is not favorable for enhancing corporate information transparency. Investors can broaden a company’s perspective by seeking out environmental efficiency and high-quality information. A study found that retail investors on social media are more likely to pay attention to and obtain relevant information about the companies in which they are interested [44]. Managers may enhance disclosure quality in response to increased retail investor attention to alleviate information asymmetry problems, which could boost
market reactions and liquidity. Retail investors can acquire new knowledge about corporate environmental challenges, and management can address the information asymmetry issue by validating the environmental demands of retail investors. This highlights the importance of retail investor attention in fostering transparency and driving environmentally responsible behavior in corporations.

The primary goal of companies fully disclosing social responsibility information is to protect investors’ interests. This advances information exchange between businesses and society, mitigating information asymmetry and increasing corporate transparency [74]. Comprehensive information disclosure on social responsibility enables investors to make thorough and effective evaluations of the risk factors and conditions of listed enterprises, allowing them to make informed decisions. This can ultimately enhance the efficiency and transparency of capital markets. When a listed company publicly and honestly discloses its social responsibility information, the market perceives the organization as diligent, trustworthy, honest, and legally compliant in conducting business. Moreover, such organizations contribute to integrating social responsibility into management, operations, decision-making, and strategies, yielding non-financial benefits.

State-owned enterprises (SOEs) serve as a critical pillar of the Chinese economy, carrying social, political, and economic responsibilities [65]. These unique characteristics of SOEs oblige them to adopt enhanced social responsibility measures, increasing the likelihood of social responsibility information disclosure. This information exchange between companies and retail investors helps align stakeholders’ and managers’ interests on environmental matters, as illustrated in Figure 3.

**H3:** The relationship between retail investor attention and business environmental performance can be mediated by information disclosure quality.

![Figure 3](image_url)

**Figure 3.** The information disclosure quality on corporate environmental performance.

### 3. Method

#### 3.1. Measurement of Variables

This study utilizes Chinese listed firms as samples to investigate the relationship between retail investor attention and corporate environmental performance. Additionally, the study examines the impact of these relationships on corporate environmental efficiency. Several factors, including retail investor attention (LnR), corporate governance, and information accessibility, are required to invest more in improving environmental performance. There are two distinct views on corporate social responsibility (CSR) activities, as outlined by [75], which closely align with the first two perspectives on CSR investment. The first view, referred to as the “environmental responsibility importance view”, asserts that firms should prioritize investments that benefit society, even if they decrease shareholder value. Investors who adopt this perspective place greater emphasis on promoting social and environmental responsibility than maximizing shareholder wealth. Consequently, these investors are more proactive in monitoring the environmental conduct of businesses.
The second perspective, referred to as the “environmental performance return view”, is based on the idea that firms should engage in socially responsible activities only when they lead to increased shareholder value. Consequently, investors who subscribe to this view believe that environmentally responsible firms generate higher returns compared to those that are environmentally irresponsible. The existing literature indicates a positive correlation between environmental and social performance disclosures and their influence on investor valuations and investment judgments. However, these studies do not explore the possibility that the impact of environmental performance information may vary according to investors’ judgments, which are based on individual perspectives related to corporate environmental performance.

This study presents a comprehensive analysis of the existing literature on retail investor attention and corporate environmental efficiency. By identifying limitations in previous research, the study aims to clarify the research concept and provide a more robust understanding of the subject. Employing an inductive research method, the study constructs a logical analytical framework and proposes a series of research hypotheses to address the research problem. Several theories, including explorative innovation, agency theory, principal-agent problem theory, resource dependence theory, and upper echelon theory, are utilized in this work. These theories serve as the foundation for a qualitative analysis, showcasing the theoretical evidence index [14].

Previous research on retail investor interest has predominantly focused on the annual search rate for individual company tickers in the Baidu or Google Index [76]. However, assessing retail investor attention through means other than search engine data is considered more reasonable. An index from social media can present the active search behavior of retail investors. Stock forums, in contrast to conventional news outlets, are dynamic, multiparticipant platforms. They offer shareholders a direct line to a diverse audience and serve as prompt, cost-effective, and precise information sources. Small shareholders have the opportunity to express their views online, which are subsequently disseminated by other small shareholders from the same company. This way, the voice of the minor shareholder is magnified, and the instantaneous nature of this communication could stir public interest. Research has discovered that stock forums can influence a company’s worth and regulatory risk by inciting feedback from the capital market and drawing regulatory scrutiny. Following similar approaches [77,78], we propose a straightforward proxy to measure investors’ attention in the Chinese stock market: the yearly reading volume of each stock on the Eastmoney Guba website. Guba is among the most popular and active stock message boards in China [79]. A previous study indicated that an increased quantity of posts, readings, and comments on a stock forum bolsters the likelihood of management voluntarily forecasting performance [77]. In this study, the yearly reading volume (LnR) of each firm is utilized to indicate retail investor attention at the firm level on an annual basis.

To measure corporate environmental performance, various methods have been established, such as environmental investment, pollutant emissions, and environmental performance ratings [80,81]. Referring to the method of [82], this study employs the OLS method to conduct empirical testing. Each of the seven dimensions is granted equal weight, and the average value is used to calculate the corporate environmental performance index (CEP) [83]. In addition to environmental performance, this study examines disclosure quality (KV), which encompasses discretionary accruals and earnings management. The KV measure is calculated using the coefficient $\beta$ in the subsequent ordinary least squares (OLS) regression. The closing price on day $t$ is represented by $P_t$, while $Vol_t$ denotes the daily trading volume on day $t$. The mean trading volume during the selected period is symbolized by $Vol_0$. This approach allows for a thorough understanding of corporate disclosure and its relation with corporate environmental efficiency.
In situations where information integrity is compromised, investors often resort to relying on trading volume as an indicator rather than firm disclosures such as audited financial statements. The rationale behind this is that low-quality disclosures may not yield reliable information for sound investment decisions. When a company possesses more transparent information, investors depend less on trading volume and more on the quality of the disclosure to make informed investment choices. Consequently, there is a weaker relationship between stock returns and trading volume. As a result, lower positive values of $\beta$ indicate higher disclosure quality within the firm.

$$\ln\left|\frac{P_t - P_{t-1}}{P_{t-1}}\right| = \alpha + \beta\left(\frac{vol_t - vol_0}{vol_0}\right) + \epsilon_t$$

(1)

To investigate the impact of retail investor attention on corporate environmental performance, the following model is proposed, where the dependent variable $Cepscore_{i,t}$ represents the measure of corporate environmental performance. $LnR_{i,t}$ serves as a proxy for retail investor attention, and $X'$ denotes the control variables. By incorporating various control variables, we aim to identify any potential links between retail investor attention and firm environmental performance. Initially, the data suggest that unobservable year-level and industry-level factors [81] might have latent effects on corporate environmental performance. Consequently, we account for the year and industry fixed effects in this subsection. A summary of the variables can be found in Table 1. In this analysis, our primary focus is on $\beta_1$, which signifies the relation between retail investor attention and corporate environmental performance. We anticipate $\beta_1$ to be positive if retail investor attention contributes to improved corporate environmental performance. A detailed explanation of all variables can be found in the table below.

$$cepcore_{i,t} = \beta_0 + \beta_1 LnR_{i,t} + \beta'X' + Industry + Year + \epsilon_{i,t}$$

(2)
Table 1. Summary of variables.

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<th>Variables</th>
<th>Key Index</th>
<th>Index Measurements</th>
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<td><strong>Dependent variables</strong></td>
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<td>Corporate environmental performance:</td>
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<td>$C_{epscore_{i,t}} = \sum_{j=1}^{7} CEP \text{ Dimension}_j$</td>
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<td>The seven dimensions proposed to measure</td>
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<td>corporate environmental performance</td>
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<td>Green office</td>
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<td>Equals one if the firm’s office environment is environmentally friendly, and zero otherwise</td>
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<td>Waste reduction</td>
<td></td>
<td>Equals one if the firm introduces measures to reduce wastewater, waste gas, and solid waste, and zero otherwise.</td>
<td></td>
</tr>
<tr>
<td>Circular economy</td>
<td></td>
<td>Equals one if the firm employs a circular economy system, and zero otherwise.</td>
<td></td>
</tr>
<tr>
<td>Energy saving action</td>
<td></td>
<td>Equals one if the firm employs energy-saving processes, and zero otherwise.</td>
<td></td>
</tr>
<tr>
<td>Environmental protection certification</td>
<td></td>
<td>Equals one if the firm obtains environmental protection certification (ISO 14001:2015 or GB/T24001-2016), and zero otherwise.</td>
<td>84–86</td>
</tr>
<tr>
<td>Environmental protection recognition</td>
<td></td>
<td>Equals one if the firm receives environmental protection recognition, and zero otherwise.</td>
<td></td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail investor attention:</td>
<td>$\ln R_{i,t}$</td>
<td>Yearly natural logarithm of the reading volume of each firm</td>
<td>77,78</td>
</tr>
<tr>
<td>This three-dimensional variable is proposed</td>
<td>$\ln P_{i,t}$</td>
<td>Yearly natural logarithm of post volume of each firm</td>
<td></td>
</tr>
<tr>
<td>to measure retail investment attention.</td>
<td>$\ln C_{i,t}$</td>
<td>Yearly natural logarithm of comment volume of each firm</td>
<td></td>
</tr>
<tr>
<td><strong>Mediating variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate governance quality</td>
<td>$CGI$</td>
<td>Key indicators of the mediating variables are listed: chairman age, chairman tenure, board size, board independence, board meeting, ownership concentration, foreign auditor, and state shares</td>
<td>87–89</td>
</tr>
<tr>
<td>Information disclosure quality</td>
<td>$KV_{i,t}$</td>
<td>Corporate disclosure quality for firm $i$ in year $t$ constructed on Equation (1)</td>
<td>90</td>
</tr>
<tr>
<td>Variables</td>
<td>Key Index</td>
<td>Index Measurements</td>
<td>Source</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>--------------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Control variables (CV)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>Natural logarithm of the firm employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TobinQ</td>
<td>Market value equity of the firm scaled by total assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>The annual operating profit growth rate for the firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRST</td>
<td>The proportion of shares held by the largest immediate shareholder of the firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INDEP</td>
<td>The percentage of independent directors on the board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual</td>
<td>A dummy variable equals one when the same person holds both the CEO and board chairperson positions, and zero otherwise</td>
<td></td>
<td>[67,91,92]</td>
</tr>
<tr>
<td>ROA</td>
<td>Net profit scaled by total assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>The industry dummy variable that controls for industry fixed effects according to the CSRC’s industry classifications issued in 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>The year dummy variables to control for year FE (fixed effects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>These four control variables were used to identify for robustness analysis.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td>IC index from the DIB database; a dummy variable equals one if the IC index is higher than the year median value, and zero otherwise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIG4</td>
<td>A dummy variable equals one if the firm is audited by the four major international accounting firms (the Big_4 auditor), and zero otherwise</td>
<td></td>
<td>[6,93]</td>
</tr>
<tr>
<td>SOE</td>
<td>A dummy variable that equals one if the firm is an SOE and zero otherwise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTI</td>
<td>The shareholdings of the institutional investors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2. Research Method and Sampling

This study aimed to explore the relation between retail investor attention and corporate performance by focusing on listed Chinese firms with notable business efficiency. We conducted an empirical analysis using secondary data and employed a variety of methods, such as baseline regression, robustness tests, quantile estimation, and other tests. We implement methods such as Propensity Score Matching (PSM) tests and instrumental variable tests to perform robustness checks. To investigate the association between retail investor attention and corporate environmental performance, we developed study approaches and models for all Chinese A-share listed companies between 2008 and 2019. The data were obtained from various sources, including the Chinese Research Data Services (CNRDS) database and CSMAR. Following the literature [94], we excluded financial institutions, ST firms, IPO firms, and firm-year observations with missing information for the control variables. Our final sample consisted of 6758 firm-year observations, and we weighted the continuous variables at the 1% and 99% levels to mitigate the impact of potential outliers. Table 2, Panel A, illustrates the distribution of firm-year observations across sectors according to the China Securities Regulatory Commission’s guidance on industry classification for listed companies. Panel B of Table 2 presents the year-by-year distribution of the sample.

Table 2. Sample distribution.

<table>
<thead>
<tr>
<th>Panel A: Full Sample Distribution by Industry</th>
<th>Panel B: Full Sample Distribution by Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>N</td>
</tr>
<tr>
<td>Agriculture</td>
<td>78</td>
</tr>
<tr>
<td>Mining</td>
<td>319</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>3707</td>
</tr>
<tr>
<td>Electricity gas and water</td>
<td>400</td>
</tr>
<tr>
<td>Building and construction</td>
<td>213</td>
</tr>
<tr>
<td>Wholesale and retail</td>
<td>367</td>
</tr>
<tr>
<td>Transportation and logistics</td>
<td>430</td>
</tr>
<tr>
<td>Accommodation</td>
<td>13</td>
</tr>
<tr>
<td>Information technology</td>
<td>364</td>
</tr>
<tr>
<td>Real estate</td>
<td>474</td>
</tr>
<tr>
<td>Information technology</td>
<td>86</td>
</tr>
<tr>
<td>Research and technical services</td>
<td>28</td>
</tr>
<tr>
<td>Environment and public facilities management</td>
<td>74</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
</tr>
<tr>
<td>Health</td>
<td>45</td>
</tr>
<tr>
<td>Culture, sports, and entertainment</td>
<td>120</td>
</tr>
<tr>
<td>Conglomerates</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>6758</td>
</tr>
</tbody>
</table>

4. Results and Discussion

4.1. Descriptive Statistics and Correlations Test

The descriptive statistics for the analyzed variables are presented as follows: For corporate environmental performance score (CEPSCORE), the mean (median) value is 0.4101 (0.4286), with a standard deviation of 0.2192. This suggests that, on average, corporate environmental measures achieve approximately half of the desired environmental characteristics. LnR has a mean (median) value of 16.0680 (16.0923) and a standard deviation of 0.9929, indicating that the average annual reading volume on Guba is around 9,511,384, with maximum and minimum reading volumes of approximately 71,036,188 and 787,407, respectively. The findings reveal a significant variation in reading volume among organizations. The correlation matrix demonstrates the relation between independent variables and the absence of multicollinearity in our findings. Table 3 presents the descriptive analysis.
### Table 3. Descriptive statistics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Key Index</th>
<th>N</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate environmental performance</td>
<td>CEPSCORE</td>
<td>6758</td>
<td>0.410</td>
<td>0</td>
<td>0.857</td>
<td>0.429</td>
<td>0.219</td>
</tr>
<tr>
<td>Retail investors’ attention</td>
<td>LnR</td>
<td>6758</td>
<td>16.068</td>
<td>13.577</td>
<td>18.079</td>
<td>16.092</td>
<td>0.993</td>
</tr>
<tr>
<td>Information disclosure quality</td>
<td>KV</td>
<td>6758</td>
<td>0.073</td>
<td>0.004</td>
<td>0.735</td>
<td>0.041</td>
<td>0.094</td>
</tr>
<tr>
<td>Corporate governance quality</td>
<td>CGI</td>
<td>6758</td>
<td>4.042</td>
<td>0.000</td>
<td>9.000</td>
<td>4.000</td>
<td>1.417</td>
</tr>
<tr>
<td>Firm growth</td>
<td>GROWTH</td>
<td>6758</td>
<td>0.167</td>
<td>−0.592</td>
<td>3.348</td>
<td>0.107</td>
<td>0.394</td>
</tr>
<tr>
<td>Profitability</td>
<td>ROA</td>
<td>6758</td>
<td>0.048</td>
<td>−0.225</td>
<td>0.228</td>
<td>0.039</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>6758</td>
<td>1.529</td>
<td>0.160</td>
<td>10.825</td>
<td>1.056</td>
<td>1.533</td>
</tr>
<tr>
<td>Shareholders</td>
<td>FIRST</td>
<td>6758</td>
<td>0.376</td>
<td>0.086</td>
<td>0.748</td>
<td>0.369</td>
<td>0.158</td>
</tr>
<tr>
<td>Independent directors</td>
<td>INDEP</td>
<td>6758</td>
<td>0.375</td>
<td>0.333</td>
<td>0.571</td>
<td>0.364</td>
<td>0.055</td>
</tr>
<tr>
<td>Duality</td>
<td>DUAL</td>
<td>6758</td>
<td>0.164</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
<td>0.371</td>
</tr>
</tbody>
</table>

Descriptive analysis.

### 4.2. Baseline and Robustness Analysis

This study examines the baseline results by analyzing the impact of retail investor attention on corporate business performance. We hypothesize that a lack of attention from retail investors may negatively affect corporate environmental performance. The results show a significant positive relation between retail investor attention and firm environmental performance, as indicated in Column 1 of Table 4. The LnR coefficient is 0.0341, which is significant at the 1% level. The findings from the OLS model are reported in Column 1, with t-statistics provided in parentheses. To ensure the validity of our baseline results, we conducted a comprehensive set of robustness tests. Initially, we employed alternative proxies for retail investor attention. Three sources of integration errors are incorporated into the framework to assess the robustness of the relation between retail investor attention and business environmental performance. Specifically, business environmental performance is tested against variations in processor data type sizes, sampling rates, and quantization levels.

To address concerns regarding non-normality and potential measurement errors in the underlying corporate environmental performance data, we re-estimated Equation (2) using a dummy variable and logit regression. We created a dummy variable (CEP_DUM) to identify a high-performing firm as one with a CEPSCORE above the industry-year median, assigning a value of one and zero otherwise. The results in Column 3 of Table 4 are consistent with the findings in Table 4, further supporting the use of continuous variables for corporate environmental performance.

Moreover, we examined alternative proxies for measuring retail investor attention. We proposed the natural logarithms of post volume (LnP) and comment volume (LnC) as key indicators of retail investor attention for each firm on Guba. We reran the equation using LnP and LnC as dependent variables, and the results are displayed in Columns 4 and 5 of Table 4. The LnP coefficient is significantly positive at the 5% level, and the LnC coefficient is significantly positive at the 1% level. The logit model results are shown in Column 3, while the OLS model outcomes are presented in Columns 4 and 5.

In this section, we employ clustering of standard errors at the year, industry, and firm levels to address cross-sectional dependency in our data. Table 5 presents the results of the analysis, demonstrating that the positive association between retail investor attention and business environmental performance remains consistent even after introducing several new control variables. The literature suggests that factors such as institutional investors [95], internal control [96], external monitoring [97], and ownership structure [73] could all influence a company’s environmental performance. In our regression, we account for institutional investor shareholdings (INSTI), internal control (IC), external monitoring
(BIG4), and ownership type (SOE). The findings from the regression analysis are displayed in Column 1 of Table 5. The LnR coefficient remains significantly positive, indicating that the positive relation between retail investor attention and corporate environmental performance persists. Specifically, Column 1 reports the findings of the regression with additional control variables, while Columns 2, 3, and 4 present the results after clustering the standard errors at the year, industry, and firm levels, respectively. In all cases, we observed a significant and positive relation between retail investor attention and business environmental performance.

**Table 4.** Baseline analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) CEPSCORE</th>
<th>(3) CEP_DUM</th>
<th>(4) CEPSCORE</th>
<th>(5) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnR</td>
<td>0.0341 ***</td>
<td>0.0127 ***</td>
<td>0.0627 *</td>
<td>0.0087 **</td>
<td>0.0087 ***</td>
</tr>
<tr>
<td></td>
<td>(10.1578)</td>
<td>(3.6894)</td>
<td>(1.7215)</td>
<td>(2.3333)</td>
<td>(3.0444)</td>
</tr>
<tr>
<td>LnP</td>
<td>0.0396 ***</td>
<td>0.3452 ***</td>
<td>0.0407 ***</td>
<td>0.0404 ***</td>
<td>0.0076 ***</td>
</tr>
<tr>
<td></td>
<td>(17.5751)</td>
<td>(14.0097)</td>
<td>(18.0826)</td>
<td>(18.1166)</td>
<td>(1.9887)</td>
</tr>
<tr>
<td>LnC</td>
<td>0.1873 ***</td>
<td>2.1308 ***</td>
<td>0.1837 ***</td>
<td>0.1884 ***</td>
<td>0.0087 **</td>
</tr>
<tr>
<td></td>
<td>(3.9254)</td>
<td>(3.8918)</td>
<td>(3.8435)</td>
<td>(3.9365)</td>
<td>(2.3333)</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.002</td>
<td>0.0385</td>
<td>0.0026</td>
<td>0.0023</td>
<td>0.1244</td>
</tr>
<tr>
<td></td>
<td>(0.3096)</td>
<td>(0.5512)</td>
<td>(0.3929)</td>
<td>(0.3484)</td>
<td>(0.3484)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0004 **</td>
<td>0.0036 **</td>
<td>0.0003 *</td>
<td>0.0003 **</td>
<td>0.0076 **</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(2.0351)</td>
<td>(1.8717)</td>
<td>(2.0867)</td>
<td>(2.0867)</td>
</tr>
<tr>
<td>DUAL</td>
<td>0.00135 ***</td>
<td>0.1381 ***</td>
<td>0.0132 ***</td>
<td>0.0133 ***</td>
<td>0.0076 **</td>
</tr>
<tr>
<td></td>
<td>(1.8418)</td>
<td>(0.9984)</td>
<td>(1.8807)</td>
<td>(1.8777)</td>
<td>(1.8777)</td>
</tr>
<tr>
<td>GROWTH</td>
<td>0.00642</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
</tr>
<tr>
<td></td>
<td>(1.4034)</td>
<td>(1.2900)</td>
<td>(1.2656)</td>
<td>(1.3093)</td>
<td>(1.3093)</td>
</tr>
<tr>
<td>FIRST</td>
<td>0.0004 **</td>
<td>0.00036 **</td>
<td>0.0003 *</td>
<td>0.0003 **</td>
<td>0.0003 **</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(2.0351)</td>
<td>(1.8717)</td>
<td>(2.0867)</td>
<td>(2.0867)</td>
</tr>
<tr>
<td>Q</td>
<td>0.0024</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
<td>0.00135 *</td>
</tr>
<tr>
<td></td>
<td>(1.8418)</td>
<td>(0.9984)</td>
<td>(1.8807)</td>
<td>(1.8777)</td>
<td>(1.8777)</td>
</tr>
<tr>
<td>INDEP</td>
<td>0.0004 **</td>
<td>0.00036 **</td>
<td>0.0003 *</td>
<td>0.0003 **</td>
<td>0.0003 **</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(2.0351)</td>
<td>(1.8717)</td>
<td>(2.0867)</td>
<td>(2.0867)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0004 **</td>
<td>0.00036 **</td>
<td>0.0003 *</td>
<td>0.0003 **</td>
<td>0.0003 **</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(2.0351)</td>
<td>(1.8717)</td>
<td>(2.0867)</td>
<td>(2.0867)</td>
</tr>
<tr>
<td>Year dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.11</td>
<td>0.178</td>
<td>0.058</td>
<td>0.177</td>
<td>0.178</td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. t-values are displayed in parentheses.

**Table 5.** Impact of retail investor attention on corporate environmental performance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) CEPSCORE</th>
<th>(3) CEPSCORE</th>
<th>(4) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnR</td>
<td>0.0117 ***</td>
<td>0.0127 ***</td>
<td>0.0127 **</td>
<td>0.0127 **</td>
</tr>
<tr>
<td></td>
<td>(3.3299)</td>
<td>(4.2067)</td>
<td>(2.5565)</td>
<td>(2.4036)</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0317 ***</td>
<td>0.0396 ***</td>
<td>0.0396 ***</td>
<td>0.0396 ***</td>
</tr>
<tr>
<td></td>
<td>(12.2940)</td>
<td>(11.8505)</td>
<td>(9.0960)</td>
<td>(9.5531)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1161 **</td>
<td>0.1873 ***</td>
<td>0.1873 ***</td>
<td>0.1873 ***</td>
</tr>
<tr>
<td></td>
<td>(2.3512)</td>
<td>(3.5818)</td>
<td>(3.9372)</td>
<td>(2.7850)</td>
</tr>
<tr>
<td>DUAL</td>
<td>−0.0111</td>
<td>−0.0124 *</td>
<td>−0.0124</td>
<td>−0.0124</td>
</tr>
<tr>
<td></td>
<td>(1.6215)</td>
<td>(2.9916)</td>
<td>(1.9990)</td>
<td>(1.1993)</td>
</tr>
<tr>
<td>GROWTH</td>
<td>0.0056</td>
<td>0.0020</td>
<td>0.0020</td>
<td>0.0020</td>
</tr>
<tr>
<td></td>
<td>(0.8623)</td>
<td>(0.2340)</td>
<td>(0.4620)</td>
<td>(0.2949)</td>
</tr>
<tr>
<td>FIRST</td>
<td>−0.0001</td>
<td>0.0004 *</td>
<td>0.0004</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(−0.2553)</td>
<td>(1.8069)</td>
<td>(1.3843)</td>
<td>(1.1701)</td>
</tr>
</tbody>
</table>
### Table 5. Cont.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) CEPSCORE</th>
<th>(3) CEPSCORE</th>
<th>(4) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>−0.0120 ***</td>
<td>−0.0135 ***</td>
<td>−0.0135 ***</td>
<td>−0.0135 ***</td>
</tr>
<tr>
<td></td>
<td>(−6.0492)</td>
<td>(−4.3345)</td>
<td>(−5.6461)</td>
<td>(−4.7258)</td>
</tr>
<tr>
<td>INDEP</td>
<td>−0.0824 *</td>
<td>−0.0642 **</td>
<td>−0.0642</td>
<td>−0.0642</td>
</tr>
<tr>
<td></td>
<td>(−1.7893)</td>
<td>(−2.6559)</td>
<td>(−0.8405)</td>
<td>(−0.8285)</td>
</tr>
<tr>
<td>IC</td>
<td>0.0002</td>
<td>−0.0020</td>
<td>−0.0020</td>
<td>−0.0020</td>
</tr>
<tr>
<td></td>
<td>(−0.3727)</td>
<td>(−6.0492)</td>
<td>(−4.3345)</td>
<td>(−5.6461)</td>
</tr>
<tr>
<td>BIGFOUR</td>
<td>0.0548 ***</td>
<td>0.0548 ***</td>
<td>0.0548 ***</td>
<td>0.0548 ***</td>
</tr>
<tr>
<td>INSTI</td>
<td>0.0003 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.7116)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SOE</td>
<td>0.0157 **</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(2.5404)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Constant</td>
<td>−0.0734</td>
<td>−0.1911 ***</td>
<td>−0.1911 ***</td>
<td>−0.1911 **</td>
</tr>
<tr>
<td></td>
<td>(−1.2503)</td>
<td>(−3.3321)</td>
<td>(−2.8765)</td>
<td>(−2.2237)</td>
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<tr>
<td>Year dummy</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummy</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>6755</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.214</td>
<td>0.178</td>
<td>0.178</td>
<td>0.178</td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. t-values are displayed in parentheses.

#### 4.3. Mediation Analysis

In this study, we propose that companies attracting greater investor attention exhibit better market performance. To determine if information disclosure quality serves as the fundamental channel driving the relation between retail investor attention and corporate environmental performance, we conducted mediation analyses following the methodology outlined in previous research [98]. Numerous studies have recommended exploring underlying channels in various contexts [99]. To identify the mediation effect in this study, three specific conditions must be satisfied [97].

The empirical results of the mediation analysis are presented in Table 6. First, the independent variable (LnR) should exhibit a strong relation with the dependent variable (CEPSCORE). We replicated the baseline regression result in Column 1 and observed that CEPSCORE and LnR share a significant positive relation.

In the second step of the mediation analysis, the independent variable (LnR) should exhibit a significant association with the mediator variable (KV). Column 2 demonstrates that KV and LnR share a statistically significant negative relationship. This finding, consistent with prior research [10], suggests that increased retail investor attention may decrease information asymmetry and enhance information disclosure quality. This significant result also confirms that the second criterion of the mediation test is satisfied.

Lastly, both the independent variable (LnR) and mediator (KV) are regressed on the dependent variable (CEPSCORE). If the mediator variable mediates the relationship between LnR and CEPSCORE, it should be significant, and the significance of the independent variable (LnR) should diminish when the mediator variable is included in the regression. In Column 3, we include both LnR and KV in the regression for the third-stage outcome of the mediation analysis, with CEPSCORE as the dependent variable. The coefficient (0.0093) of LnR is smaller in magnitude compared to the corresponding coefficient (0.0127) in Column 2, suggesting that KV is significantly negatively associated with CEPSCORE.

The mediation effect through information disclosure quality was confirmed, and our findings satisfied the three criteria for a mediation effect. To determine if the mediation effect was statistically significant, we also conducted a Sobel test. Our Sobel test results in Column (3) show that, when using KV as the mediator variable, the mediation effect is statistically significant (p < 0.01). In summary, the results in Table 6 suggest that the quality
of corporate information disclosure serves as a valid channel through which retail investor attention can enhance a company’s environmental performance.

Table 6. Mediation effect of information disclosure quality on the relation between retail investor attention and corporate environmental performance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) KV</th>
<th>(3) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnR</td>
<td>0.0127 ***</td>
<td>−0.0572 ***</td>
<td>0.0093 **</td>
</tr>
<tr>
<td></td>
<td>(3.6894)</td>
<td>(−32.8885)</td>
<td>(2.4019)</td>
</tr>
<tr>
<td>KV</td>
<td>−0.0592 *</td>
<td>−0.0592 *</td>
<td>(−1.8643)</td>
</tr>
<tr>
<td>Sobel test (p-value)</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0396 ***</td>
<td>0.0012</td>
<td>0.0395 ***</td>
</tr>
<tr>
<td></td>
<td>(17.5731)</td>
<td>(−1.3643)</td>
<td>(17.5495)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1873 ***</td>
<td>0.1679 ***</td>
<td>0.1972 ***</td>
</tr>
<tr>
<td></td>
<td>(3.9254)</td>
<td>(9.1088)</td>
<td>(4.0987)</td>
</tr>
<tr>
<td>DUAL</td>
<td>−0.0124 *</td>
<td>0.0108 ***</td>
<td>−0.0118 *</td>
</tr>
<tr>
<td></td>
<td>(−1.8418)</td>
<td>(3.6729)</td>
<td>(−1.7424)</td>
</tr>
<tr>
<td>GROWTH</td>
<td>0.0020</td>
<td>0.0006</td>
<td>0.0021</td>
</tr>
<tr>
<td></td>
<td>(0.3096)</td>
<td>(0.2958)</td>
<td>(0.3146)</td>
</tr>
<tr>
<td>FIRST</td>
<td>0.0004 **</td>
<td>0.0002 ***</td>
<td>0.0004 **</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(3.4329)</td>
<td>(2.3688)</td>
</tr>
<tr>
<td>Q</td>
<td>−0.0135 ***</td>
<td>0.0102 ***</td>
<td>−0.0129 ***</td>
</tr>
<tr>
<td></td>
<td>(−6.8961)</td>
<td>(9.4913)</td>
<td>(−6.5003)</td>
</tr>
<tr>
<td>INDEP</td>
<td>−0.0642</td>
<td>−0.0658</td>
<td>−0.0658</td>
</tr>
<tr>
<td></td>
<td>(−1.4034)</td>
<td>(−1.7599)</td>
<td>(−1.4382)</td>
</tr>
<tr>
<td>Constant</td>
<td>−0.1911 ***</td>
<td>0.9124 ***</td>
<td>−0.1371 **</td>
</tr>
<tr>
<td></td>
<td>(−3.4438)</td>
<td>(32.4815)</td>
<td>(−2.1870)</td>
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<td>Year dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Industry dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.178</td>
<td>0.391</td>
<td>0.179</td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. t-values are displayed in parentheses.

Corporate governance quality mediates the relationship between corporate social and environmental efficiency, demonstrating its influence on the connection between retail investor attention and corporate environmental performance. The dependent variable is displayed in the header of each column, with robust t-statistics provided in parentheses. Prior research has identified a link between retail investor attention and corporate governance quality. The empirical results of the mediation analysis are presented in Table 7. Enhanced monitoring of environmental performance, which capitalizes on the attention of retail investors, can be achieved by improving corporate governance and mitigating agency conflicts between management and shareholders.

Table 7. Mediation effect of corporate governance quality on the relation between retail investor attention and corporate environmental performance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) CGI</th>
<th>(3) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnR</td>
<td>0.0127 ***</td>
<td>0.0801 ***</td>
<td>0.0122 ***</td>
</tr>
<tr>
<td></td>
<td>(3.6894)</td>
<td>(3.8367)</td>
<td>(3.5512)</td>
</tr>
<tr>
<td>CGI</td>
<td>0.0061 ***</td>
<td>0.0061 ***</td>
<td>(3.0216)</td>
</tr>
<tr>
<td>Sobel test (p-value)</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. t-values are displayed in parentheses.
### Table 7. Cont.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) CEPSCORE</th>
<th>(2) CGI</th>
<th>(3) CEPSCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>0.0396 ***</td>
<td>0.1130 ***</td>
<td>0.0389 ***</td>
</tr>
<tr>
<td></td>
<td>(17.5751)</td>
<td>(8.0394)</td>
<td>(17.0837)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1873 ***</td>
<td>−1.3478 ***</td>
<td>0.1956 ***</td>
</tr>
<tr>
<td></td>
<td>(3.9254)</td>
<td>(−4.5303)</td>
<td>(4.0838)</td>
</tr>
<tr>
<td>DUAL</td>
<td>−0.0124 *</td>
<td>−0.0609</td>
<td>−0.0120 *</td>
</tr>
<tr>
<td></td>
<td>(−1.8418)</td>
<td>(−1.4846)</td>
<td>(−1.7871)</td>
</tr>
<tr>
<td>GROWTH</td>
<td>0.0020</td>
<td>0.1056 **</td>
<td>0.0014</td>
</tr>
<tr>
<td></td>
<td>(0.3096)</td>
<td>(2.5741)</td>
<td>(0.2098)</td>
</tr>
<tr>
<td>FIRST</td>
<td>0.0004 **</td>
<td>0.0328 ***</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>(2.1936)</td>
<td>(31.6107)</td>
<td>(0.9422)</td>
</tr>
<tr>
<td>Q</td>
<td>−0.0135 ***</td>
<td>−0.0007</td>
<td>−0.0135 ***</td>
</tr>
<tr>
<td></td>
<td>(−6.8961)</td>
<td>(−0.0537)</td>
<td>(−6.8896)</td>
</tr>
<tr>
<td>INDEP</td>
<td>−0.0642</td>
<td>6.2994 ***</td>
<td>−0.1028 **</td>
</tr>
<tr>
<td></td>
<td>(−1.4034)</td>
<td>(22.4083)</td>
<td>(−2.1798)</td>
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<tr>
<td>Constant</td>
<td>−0.1911 ***</td>
<td>−2.2181 ***</td>
<td>−0.1775 ***</td>
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<td>(−3.4438)</td>
<td>(−6.2876)</td>
<td>(−3.1942)</td>
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<td>N</td>
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<td>6758</td>
<td>6758</td>
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<tr>
<td>Adj. R²</td>
<td>0.178</td>
<td>0.282</td>
<td>0.179</td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. t-values are displayed in parentheses.

#### 4.4. Additional Robustness Analysis

#### 4.4.1. PSM Test

To conduct a more robust analysis, we first implemented a propensity score matching (PSM) test. The propensity scores are generated by incorporating a set of control variables in the main regression [100], including SIZE, ROA, DUAL, GROWTH, FIRST, Q, and INDEP. We defined the treated group in the retail investor attention-corporate governance quality (CGI)-CEPScore method as companies with an investor attention (LnR) higher than the median and a CGI exceeding the upper third quartile value, resulting in a sample size of 1774. For the retail investor attention-KV-CEPScore method, the treated group consisted of firms with investor attention (LnR) above the median value and a KV index below the lower third quartile value, yielding a sample size of 1640. The results of the balance test in Table 8 show that the propensity score matching has effectively balanced the sample. The reduction in standardized differences shows that, with the exception of company size (Size) in the LnR-KV-CEPScore sample, the absolute values of the standardized biases for all covariates used for matching have been significantly reduced. After matching, the absolute values of the standardized biases for all covariates are either less than 10% or slightly above 10%. These results suggest that in the matched sample, good matches have been achieved on observable features, enhancing comparability between the two groups.

To establish the control group, we used nearest neighbor matching (one-to-one pairing). The treatment group was generated based on CGI, with corporate environmental performance as the output variable. The difference between the ATT-treated group and the control group is 0.0141, with a t-value of 1.72. When the output variable is corporate environmental performance and the treated group is built using KV, the difference between the ATT-treated group and the control group is 0.0141, with a t-value of 1.65. The PSM results in Table 9 suggest that firms with higher retail investor attention and superior corporate governance quality exhibit improved corporate environmental performance after controlling for firm variables. Companies that prioritize retail investors and offer better information disclosure tend to have better environmental performance.
Table 8. Results of the propensity score matching (PSM) balance test.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unmatched/Matched</th>
<th>Mean</th>
<th>%Bias</th>
<th>%Reduct</th>
<th>t Test</th>
<th>t</th>
<th>p &gt;</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treated</td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>8.3503</td>
<td>8.4532</td>
<td>-7.6</td>
<td>-34.3</td>
<td>-2.62</td>
<td>0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>8.3503</td>
<td>8.2121</td>
<td>10.2</td>
<td>58.1</td>
<td>-7.60</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LN R-KV-CEPSCORE</td>
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<td>0.03968</td>
<td>0.05188</td>
<td>-22.8</td>
<td>58.1</td>
<td>-7.60</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>0.03968</td>
<td>0.04479</td>
<td>-9.6</td>
<td>72.1</td>
<td>-1.56</td>
<td>0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>U</td>
<td>0.11646</td>
<td>0.18087</td>
<td>-18.2</td>
<td>-6.05</td>
<td>-2.49</td>
<td>0.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>0.11646</td>
<td>0.13445</td>
<td>-7.4</td>
<td>-1.56</td>
<td>-2.49</td>
<td>0.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual</td>
<td>U</td>
<td>0.15364</td>
<td>0.17448</td>
<td>-5.5</td>
<td>25.3</td>
<td>-1.56</td>
<td>0.12</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>0.15364</td>
<td>0.18153</td>
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<td>-1.56</td>
<td>-2.49</td>
<td>0.013</td>
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<td>Growth</td>
<td>U</td>
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<td>37.13</td>
<td>10.9</td>
<td>86.0</td>
<td>3.75</td>
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<td></td>
<td>M</td>
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<td>-0.44</td>
<td>0.663</td>
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<td></td>
</tr>
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<td>First</td>
<td>U</td>
<td>1.0087</td>
<td>1.6278</td>
<td>-48.5</td>
<td>77.9</td>
<td>-15.09</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>1.0087</td>
<td>1.1458</td>
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<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
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<td>0.37309</td>
<td>-0.4</td>
<td>91.6</td>
<td>-1.82</td>
<td>0.069</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>0.37284</td>
<td>0.37309</td>
<td>-0.4</td>
<td>91.6</td>
<td>-1.82</td>
<td>0.069</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. PSM test.

<table>
<thead>
<tr>
<th>Treated Group</th>
<th>Sample</th>
<th>Treated</th>
<th>Controls</th>
<th>Difference</th>
<th>S.E.</th>
<th>t-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGI</td>
<td>Unmatched</td>
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<td>0.4021</td>
<td>0.0314</td>
<td>0.0060</td>
<td>5.19</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>0.4336</td>
<td>0.4195</td>
<td>0.0141</td>
<td>0.0082</td>
<td>1.72</td>
</tr>
<tr>
<td></td>
<td>ATU</td>
<td>0.4021</td>
<td>0.4200</td>
<td>0.0179</td>
<td>0.0169</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ATE</td>
<td>0.0169</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KV</td>
<td>Unmatched</td>
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<td>0.4189</td>
<td>-0.0170</td>
<td>0.0064</td>
<td>-2.67</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>0.4019</td>
<td>0.3878</td>
<td>0.0141</td>
<td>0.0085</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>ATU</td>
<td>0.4189</td>
<td>0.4151</td>
<td>-0.0038</td>
<td>0.0010</td>
<td></td>
</tr>
</tbody>
</table>

4.4.2. The Lagged Value and Instrumental Variable

To address potential endogeneity concerns between retail investor attention and corporate environmental performance, we measure corporate environmental performance in year t + 1, retail investor attention, and other control factors in year t to mitigate the possible reverse causation issue. Consequently, the dependent variable of corporate environmental performance (CEPSCORE) is one year ahead of the control variables of retail investor attention (LnR) and others. The data for corporate environmental performance spans from 2009 to 2019, while the data for retail investor attention spans from 2008 to 2018. The empirical findings in Column 1 of Table 10 demonstrate a positive and significant relationship between retail investor attention and business environmental performance.
Additionally, we conducted a two-stage least squares (2SLS) regression analysis using the average value of province-level retail investor attention, excluding the firm itself (LnFNum). The results for the 2SLS regression are reported in Columns 2 and 3 of Table 10. Investors may prefer to focus on companies within the same province, as similar governance policies may influence these firms. The instrumental variable (IV) is expected to be related to firm-level retail investor attention but not to corporate environmental performance. The F-test indicates that the IV is not weak, and the overidentification test (Sargan statistic) shows that the IV is valid and the model is correctly specified. The coefficient of LnR remains significantly positive with respect to CEPSCORE, as demonstrated by the second-stage regression analysis results.

Table 11 indicates hypothesis summary. Hypothesis 1 states that retail investor attention is positively associated with corporate environmental performance, meaning that an increase in attention is linked with a rise in sustainability performance. This could be
due to investors are more likely to support companies aligned with their values. However, further research is required to better comprehend this relationship, as well as to determine its precise nature and how it manifests in real-world scenarios. Hypothesis 2 suggests that a company’s information disclosure quality mediates the relation between retail investor attention and corporate environmental performance. Companies should prioritize high-quality disclosure practices for informed investment decisions and accountability. Hypothesis 3 suggests that corporate governance quality mediates the relation between retail investor attention and corporate environmental performance. Poor governance may hinder environmental performance. Therefore, companies should prioritize both environmental sustainability and high-quality corporate governance practices to achieve optimal sustainability.

Table 11. Hypothesis summary.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Expected Sign</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Retail investor attention is positively associated with corporate environmental performance.</td>
<td>Ve+ (institutional theory)</td>
<td>Accepted</td>
</tr>
<tr>
<td>H2: Information disclosure quality can mediate the relation between retail investor attention and corporate environmental performance.</td>
<td>Ve- (agency Theory)</td>
<td>Accepted</td>
</tr>
<tr>
<td>H3: Corporate governance quality can mediate the relation between retail investor attention and corporate environmental performance.</td>
<td>Ve+ (institutional theory)</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

4.5. Heterogeneity Analysis

The previous statement indicates that retail investor attention has a positive promotional effect on corporate environmental performance. Internal characteristics of the enterprise, such as executive traits, will also affect the implementation of the company’s environmental strategy. At the same time, the effectiveness of the environmental strategy is also influenced by other external monitoring parties. Analyst reports play a pivotal role in spreading information about the supervisory role of investor attention on corporate behavior. The purpose of this paper is to conduct a cross-sectional analysis based on executive traits and analyst coverage from the perspective of corporate environmental performance. In essence, this study aims to understand if and how various factors, such as executive traits and analyst coverage, impact a company’s environmental strategy. This analysis could provide important insights for both investors and corporations alike.

4.5.1. The Role of Analyst Coverage

Huang (2022) clearly demonstrates that analyst coverage adds value to organizations by providing concise information about their performance and increasing their visibility to investors [101]. However, analysts do not actively contribute new data related to corporate environmental performance; they primarily utilize existing data and knowledge. As a result, organizations actively seek analyst coverage. [102] posits that there are various ways to engage with and cover information about company performance and information stability. Refs. [32,103] argue that financial analysts serve as external monitors for managers and that analyst coverage is crucial for reducing information asymmetry within organizations. Retail investors and financial analysts both have the potential to improve corporate governance and decrease information asymmetry [10]. Analyst reports play a pivotal role in spreading information about the supervisory role of investor attention on corporate behavior. Analyst reports are one of the primary sources of information for many investors. These reports often include detailed analyses of company performance, future projections, and assessments of various risks and opportunities. They can provide crucial insights into a company’s behavior and strategies. Moreover, analysts monitor companies closely and report on investor sentiment and behavior. By doing this, they can highlight areas where investor attention is particularly strong, helping to exert an indirect form of supervision over a company. For example, if investors are particularly concerned about a company’s environmental policies, this attention will likely be reported by analysts,
pushing the company to act more responsibly in environmental performance. In essence, analyst reports function as a vital channel for the dissemination of information, enabling investors to effectively supervise corporate behavior. Considering these factors, it is natural to question whether analyst coverage and retail investor attention complement or substitute for one another.

In companies with higher analyst coverage, retail investor attention may play a more significant monitoring role. To investigate this, we separate the sample into two groups based on the median value of analyst coverage and assess the effect within each group individually. Table 12, based on the median value of analyst coverage, demonstrates the influence of retail investor attention on CEPSCORE for companies with high and low analyst coverage. Analyst coverage is determined by the number of analysts following a company. The data reveal that firms with greater analyst coverage experience a larger impact from retail investor attention, supporting the notion that retail investor attention and analyst coverage jointly enhance environmental performance.

Table 12. Effect of analyst coverage.

<table>
<thead>
<tr>
<th>Variables</th>
<th>High Analyst Coverage</th>
<th>Low Analyst Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CEPSCORE</td>
<td>CEPSCORE</td>
</tr>
<tr>
<td>LnR</td>
<td>0.0165 ***</td>
<td>−0.0064</td>
</tr>
<tr>
<td></td>
<td>(4.0669)</td>
<td>(−0.9800)</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0429 ***</td>
<td>0.0318 ***</td>
</tr>
<tr>
<td></td>
<td>(15.1312)</td>
<td>(6.7781)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1483 **</td>
<td>0.2085 **</td>
</tr>
<tr>
<td></td>
<td>(2.3376)</td>
<td>(2.4866)</td>
</tr>
<tr>
<td>DUAL</td>
<td>−0.0056</td>
<td>−0.0306 **</td>
</tr>
<tr>
<td></td>
<td>(−0.7149)</td>
<td>(−2.3643)</td>
</tr>
<tr>
<td>GROWTH</td>
<td>−0.0005</td>
<td>0.0036</td>
</tr>
<tr>
<td></td>
<td>(−0.0594)</td>
<td>(0.3744)</td>
</tr>
<tr>
<td>FIRST</td>
<td>0.0002</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>(1.1380)</td>
<td>(0.8557)</td>
</tr>
<tr>
<td>Q</td>
<td>−0.0118 ***</td>
<td>−0.013 1 ***</td>
</tr>
<tr>
<td></td>
<td>(−4.7931)</td>
<td>(−3.7817)</td>
</tr>
<tr>
<td>INDEP</td>
<td>−0.0102</td>
<td>−0.2283 **</td>
</tr>
<tr>
<td></td>
<td>(−0.1932)</td>
<td>(−2.4390)</td>
</tr>
<tr>
<td>Constant</td>
<td>−0.3135 ***</td>
<td>0.2641 **</td>
</tr>
<tr>
<td></td>
<td>(−4.8115)</td>
<td>(2.4205)</td>
</tr>
<tr>
<td>Year Dummy</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry Dummy</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>4768</td>
<td>1990</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.197</td>
<td>0.135</td>
</tr>
</tbody>
</table>

*** and ** indicate significance at the 1% and 5% levels, respectively. $t$-values are displayed in parentheses.

4.5.2. The Role of Management Overconfidence

Due to characteristics such as the long return period of environmental investments, the subjective willingness of the management team is a key internal driving force for a company’s green governance. Overconfident executives often tend to overestimate returns and underestimate risks. That is, overconfident executives tend to overestimate the social and economic benefits brought by environmental projects and underestimate the short-term operational risks that environmental activities might bring. Therefore, overconfident managers tend to proactively increase the scale of corporate environmental investments, hoping to achieve higher comprehensive returns. Simultaneously, overconfident managers enjoy the incentive effect brought on by external respect and praise. Out of a strong desire for reputation, overconfident executives are more likely to seek a sense of self-accomplishment by improving environmental performance.
This study follows the methodology of [104], choosing companies that have disclosed first quarter, semiannual, third quarter, and annual earnings forecasts as sample objects. Various earnings forecast data is statistically collected, and it is stipulated that if a company’s actual earnings level is lower than the forecasted earnings level at least once during the sample period, the company’s manager is defined as overconfident. In earnings forecasting, samples of a predictive nature are excluded.

From the empirical results shown in Table 13, it can be seen that when the sample has a high degree of overconfidence, the coefficient of retail investment attention (\( \text{LnR} \)) is significantly positive at the 1% level, with a \( t \)-value of 2.976. As shown in the empirical results of Column 1 in Table 13, when the sample has a lower degree of overconfidence, the coefficient of investment attention (\( \text{LnR} \)) is not significant, with a \( t \)-value of 1.523. The empirical test indicates that there are significant differences in environmental responsibility between groups with high and low executive overconfidence. The empirical results show that executives with a higher degree of overconfidence, compared to those with a lower degree of overconfidence, will take on corporate environmental responsibilities more actively and improve the company’s environmental performance.

### Table 13. Effect of management overconfidence.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) Low Overconfidence</th>
<th>(2) High Overconfidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \text{CEPSCORE} )</td>
<td>( \text{CEPSCORE} )</td>
</tr>
<tr>
<td>( \text{LnR} )</td>
<td>0.008 ( (1.523) )</td>
<td>0.014 *** ( (2.976) )</td>
</tr>
<tr>
<td>Size</td>
<td>0.039 *** ( (12.341) )</td>
<td>0.040 *** ( (12.119) )</td>
</tr>
<tr>
<td>ROA</td>
<td>0.273 *** ( (2.892) )</td>
<td>0.152 ** ( (2.445) )</td>
</tr>
<tr>
<td>dual</td>
<td>-0.005 ( (-0.524) )</td>
<td>-0.018 ** ( (-2.006) )</td>
</tr>
<tr>
<td>growth</td>
<td>0.003 ( (0.262) )</td>
<td>-0.001 ( (-0.088) )</td>
</tr>
<tr>
<td>First</td>
<td>0.000 ( (1.179) )</td>
<td>0.001 ** ( (2.258) )</td>
</tr>
<tr>
<td>( Q )</td>
<td>-0.017 *** ( (-4.921) )</td>
<td>-0.012 *** ( (-4.223) )</td>
</tr>
<tr>
<td>Indep</td>
<td>-0.020 ( (-0.318) )</td>
<td>-0.097 ( (-1.518) )</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.209 ** ( (-2.356) )</td>
<td>-0.183 ** ( (-2.265) )</td>
</tr>
<tr>
<td>Year Dummy</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Industry Dummy</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>N</td>
<td>3429</td>
<td>3329</td>
</tr>
<tr>
<td>Adj. ( R^2 )</td>
<td>0.175</td>
<td>0.193</td>
</tr>
</tbody>
</table>

*** and ** indicate significance at the 1% and 5% levels, respectively. \( t \)-values are displayed in parentheses.

### 4.6. Quantile Analysis

In addition to the pooled OLS specification, our research employs alternative econometric models to assess the robustness of the baseline results [26]. Given that our dependent variables are correctly skewed, we initially adopt a quantile regression model. Quantile regression provides a more detailed explanation of dependencies compared to conventional methods, particularly when assumptions of mean regression, like homoscedasticity, are violated or when the conditional distribution’s outer regions are involved [69]. When conducting regression analysis, it is insufficient to simply obtain a quantitative prediction for an issue; the study must also establish the level of confidence in that prediction. This is where quantile regression proves useful. While OLS regression calculates the conditional mean of the target variable across different feature values, quantile regression computes the
conditional median \[105\]. Our findings reveal that the baseline results remain consistent when using quantile regression. The equation formed is as follows:

\[
Q_\theta(y_i|x_i) = \alpha(\theta) + x_i'\beta(\theta) \quad \text{with} \quad \theta \in (0, 1)
\]

where \(y_i\) is the explanatory variable of observation \(i\), \(x_i\) is the covariate vector demonstrating different adherence \(i\), and \(\theta\) represents the \(\theta\)-th quantile \[106\]. The first model examined the relationship between retail investor attention and corporate capital efficiency (CEPScore). Column 1 of Table 14 and Figure 4 show that if retail investors grow by 1%, corporate environmental performance will increase by 10%. Column 2 shows how a 1% increase in retail investors leads to a 20% decrease in KV. Column 3 reveals that if retail investor attention increases by 1%, the CGI will rise by 11%. In summary, empirical analysis shows that quantile estimation, OLS, and other robustness methods may be used to provide statistical evidence of a link between retail investor attention and corporate environmental performance. This can also be seen in Figures 4–6.

Table 14. Quantile estimation.

<table>
<thead>
<tr>
<th>Variables</th>
<th>CEPScore</th>
<th>KV</th>
<th>CGI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnR</td>
<td>0.0110 ***</td>
<td>−0.0246 ***</td>
<td>0.109 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.0032)</td>
<td>(−0.0007)</td>
<td>(−0.0212)</td>
</tr>
<tr>
<td>Size</td>
<td>0.0483 ***</td>
<td>−0.00121 ***</td>
<td>0.0669 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.00258)</td>
<td>(−0.00046)</td>
<td>(−0.0155)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.241 ***</td>
<td>0.0562 ***</td>
<td>−1.718 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.0557)</td>
<td>(−0.00906)</td>
<td>(−0.31)</td>
</tr>
<tr>
<td>Dual</td>
<td>−0.00929</td>
<td>0.00809 ***</td>
<td>−0.102 **</td>
</tr>
<tr>
<td></td>
<td>(−0.00638)</td>
<td>(−0.0017)</td>
<td>(−0.0443)</td>
</tr>
<tr>
<td>Growth</td>
<td>0.00173</td>
<td>−0.00011</td>
<td>0.135 **</td>
</tr>
<tr>
<td></td>
<td>(−0.0102)</td>
<td>(−0.00181)</td>
<td>(−0.0549)</td>
</tr>
<tr>
<td>First</td>
<td>0.000484 **</td>
<td>2.865</td>
<td>0.0359 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.00019)</td>
<td>(−3.32 \times 10^{-5})</td>
<td>(−0.00121)</td>
</tr>
<tr>
<td>Q</td>
<td>−0.0184 ***</td>
<td>0.00732 ***</td>
<td>−0.0243 *</td>
</tr>
<tr>
<td></td>
<td>(−0.00175)</td>
<td>(−0.00092)</td>
<td>(−0.0132)</td>
</tr>
<tr>
<td>Indep</td>
<td>−0.0533</td>
<td>−0.0150 *</td>
<td>6.674 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.05)</td>
<td>(−0.00809)</td>
<td>(−0.505)</td>
</tr>
<tr>
<td>Constant</td>
<td>−0.162 ***</td>
<td>0.446 ***</td>
<td>−2.023 ***</td>
</tr>
<tr>
<td></td>
<td>(−0.0365)</td>
<td>(−0.011)</td>
<td>(−0.346)</td>
</tr>
<tr>
<td>Year dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>6758</td>
<td>6758</td>
<td>6758</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.137</td>
<td>0.162</td>
<td>0.145</td>
</tr>
</tbody>
</table>

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are displayed in parentheses.

Figure 4. Cont.
Figure 4. The significant and positive association between LnR and CEP.

Figure 5. The negative association mediating LnR with KV.
Figure 6. The positive and significant relation between LnR and CGI.

5. Conclusions and Policy Implications
This study explores the multidimensional relationship between retail investor attention and its influence on corporate environmental performance in China. Specifically, we aimed to determine whether retail investor attention (LnR), along with the quality of corporate governance and information disclosure, significantly impacts corporate environmental performance (CEP). Our focus lies on Chinese-listed firms from 2008 to 2019. Our results indicate that the relationship between retail investor attention and corporate environmental performance is statistically significant, with corporate governance quality and information disclosure quality also playing a mediating role. To address potential endogeneity concerns, we conducted two-stage least squares analyses and several robustness checks, including alternative measures of corporate environmental performance and retail investor attention, the PSM method, and lagging values of independent variables. Based on our findings, we recommend that Chinese listed firms incorporate retail investor attention into their strategies to improve corporate environmental performance. This can be achieved by implementing green technologies and practices, conducting regular environmental impact assessments, and ensuring transparency and accountability through proper reporting and disclosure. By doing so, firms can benefit from increased investor confidence and support while promoting sustainable business practices that benefit both the environment and society. It also underscores the need to consider China’s unique industrial and financial landscape when developing policies to address environmental concerns.
5.1. Policy Implication

To reinforce policies for corporate environmental efficiency, Chinese government policymakers should focus on several key areas. First, they must promote the adoption of green technologies and practices by offering incentives such as tax breaks, subsidies, and investments in research and development. This approach can drive innovation, enhance resource use efficiency, and reduce costs for firms, all while benefiting the environment. Second, policymakers ought to encourage companies to conduct environmental impact assessments and report their environmental performance regularly. This measure can increase accountability and provide consumers with the information necessary to make informed decisions about the products they purchase. Third, the government should establish clear regulations and guidelines for companies to follow regarding environmental protection. Fourth, policymakers must work to foster a culture of environmental responsibility and awareness among businesses and consumers. Lastly, the government should incentivize companies to adopt circular economy practices that minimize waste and optimize resource use. This can encompass measures such as promoting product designs that facilitate recycling and encouraging material reuse. It is crucial for the government to consider the role of stakeholders, such as local communities and other interested parties, in the policymaking process. By engaging with these groups and soliciting their input, policymakers can develop policies that address the needs and concerns of all stakeholders, leading to greater buy-in and support for these policies.

5.2. Theoretical Implication

Firstly, this helps enrich the theoretical research related to corporate ESG (environmental, social, and governance) behavior. Based on institutional theory, agency theory, and information asymmetry theory, this paper examines, from the dimension of corporate environmental performance, whether individual investors have a governance effect of “voting with their mouth”, and further explores the channels and heterogeneous tests of how individual investors’ environmental demands affect listed companies’ environmental behavior. This paper expands the research on the related influencing factors of corporate environmental performance and its goal realization. Furthermore, it broadens the research on the supervisory effect of individual investors. Based on the theory of external governance effects as an analytical framework, this paper constructs a corresponding model and uses empirical analysis to test the impact and mechanism of retail investors’ attention on corporate environmental performance. It elaborates on the principle of retail investors “voting with their mouths” and constructs a theoretical analysis framework for the governance effect of retail investors. Lastly, it expands the research on the external governance mechanisms of enterprises. As important stakeholders of enterprises, individual investors’ attention and the supervision it brings can help alleviate the conflict of interest between management and stakeholders and optimize the goals of corporate sustainable development. The purpose of this study is to address the problem of alleviating conflicts of interest among various equity subjects by proposing ways to solve the problem, obtaining relevant policy implications and practical suggestions, and, ultimately, improving the external governance mechanism of enterprises, thus promoting the long-term sustainable development of enterprises.

5.3. Limitations

There are several limitations to this study. First, due to cost restrictions and the absence of incentives, minority shareholders may be unable to compel firms to disclose more information. Consequently, controlling shareholders’ willingness to disclose social responsibility information may be insufficient, which is not conducive to enhancing corporate information transparency. Second, the research is limited to the Chinese manufacturing industry and Chinese retail investors, narrowing the study’s scope. Additionally, this study relies on quantitative research, which is confined to statistical analysis. Incorporating qualitative analysis could have provided a more contextual and theoretical perspective, expanding
the research scope. Furthermore, common constraints such as time, budget, and resources affected the study. Limited time led to the selection of a smaller sample, and a restricted budget meant that fewer tests were conducted. Finally, the study focused on specific factors, while the inclusion of more factors related to corporate performance could have produced improved results for the organization.

**Author Contributions:** J.Z.: Conceptualization, data curation, formal analysis, investigation, methodology, software, visualization, writing—original draft, writing—review and editing. Z.W.: Data curation, formal analysis, methodology, supervision, visualization. H.U.: formal analysis, methodology, writing—review and editing, project administration, resources. All authors have read and agreed to the published version of the manuscript.

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**References**


13. Xu, J.; Ru, X.; Song, P. Can a New Model of Infrastructure Financing Mitigate Credit Rationing in Poorly Governed Countries? *Econ. Model.* 2021, 95, 111–120. [CrossRef]


15. Qi, P.; Shang, Y.; Han, F. The Effects of Environmental Regulation on Investment Efficiency—An Empirical Analysis of Manufacturing Firms in the Beijing–Tianjin–Hebei Region, China. *Sustainability* 2022, 14, 6371. [CrossRef]


17. Danila, N. Random Walk of Socially Responsible Investment in Emerging Market. *Sustainability* 2022, 14, 11846. [CrossRef]
44. Koulaib, A. Corporate Sustainability Disclosure and Investment Efficiency: The Saudi Arabian Context. Sustainability 2022, 14, 13984. [CrossRef]
89. Sule, A. Appointments of Outsiders as CEOs, State-Owned Enterprises, and Firm Performance: Evidence from China. *CFA Dig.* 2013, 43, 49–64. [CrossRef]
100. Shipman, J.E.; Swanson, Q.T.; Whited, R.L. Propensity Score Matching in Accounting Research. *Account. Rev.* 2017, 92, 213–244. [CrossRef]

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