Article

Does the "Greenwashing" and "Brownwashing" of Corporate Environmental Information Affect the Analyst Forecast Accuracy?

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Abstract: Taking the listed firms of heavy pollution industries in China for 2010–2021 as a sample, this study explored the impact and heterogeneity of corporate environmental disclosure behavior on analyst forecasts' accuracy. We discovered that corporates measure or disclose environmental information and, the more environmental information is measured or disclosed, the more accurate analysts' forecasts are; moreover, there is a strong and significant correlation between the environmental information given in the special reports and analysts' forecast accuracy. This positive correlation is even more significant in cases of "matching words to deeds" and "brownwashing" by corporates. A mechanism analysis revealed that the analysts' coverage and site visits both have a full or partial mediating effect. Specifically, analysts' coverage is more likely to be elicited when corporates measure or disclose environmental information; the higher the degree of measurement or disclosure, disclose in the special reports, "matching words to deeds" and "brownwashing". Analysts conducted site visits when corporates measured or disclosed environmental information, the higher the degree of measurement or disclosure, disclose in the special reports and "brownwashing". The information above demonstrates that, on the one hand, specialized reports are published to supplement financial disclosures and, on the other hand, that analysts place importance on corporates' incremental and explicit environmental information; however, "information screening" is insufficient and some "information mining" was carried out when corporate environmental information disclosure was insufficient. This study shed light on analysts' roles in the improvement of the information environment of China's capital market as well as the objective appraisal of the impact of corporate environmental information disclosure.

Keywords: measurement; disclosure; greenwashing; brownwashing; analysts' forecasts

1. Introduction

Globally, the problem of sustainable development has gained significant attention. Transforming Our World: The 2030 Agenda for Sustainable Development, which was adopted by the United Nations General Assembly's 70th session in September 2015 and was signed by 193 member states, calls for systematic reform of existing economic, social, and environmental elements in order to incorporate the concepts of equity and justice, environmental sustainability, and equal partnership. The subject of sustainable development is very important to the Chinese government. At the 20th National Congress of the Communist Party of China on 16 October 2022, General Secretary Xi Jinping declared that "Chinese-style modernization is a modernization in which man and nature live in harmony" and emphasized the need to "unwaveringly take the road of civilized development of production development, affluent living, and good ecology".

Corporates measure or disclose environmental information through annual financial statements and special reports in the context of global environmental governance to communicate to external stakeholders the situation of corporates establishing environmental protection concepts and exercising environmental protection responsibilities. Chinese

corporates currently disclose environmental information in both voluntary and mandatory ways, with voluntary disclosure serving as the predominant method. The amount of environmental responsibility information disclosure by listed companies had progressively increased by the end of December 2022. The disclosure index reached its highest level in a decade in 2021, hovering around 39.89 points, up 6.97% from 2020 (Data source: http://www.cfej.net/bwzl/jxdt/202212/t20221228_1008892.shtml, accessed on 28 December 2022). However, the disclosure framework and content system are incomplete, the form and content of disclosure are not unified, and the proportion of third-party independent institutions for verification is low. Additionally, according to Ba et al. [1], the mandatory disclosure was determined based on whether or not it was a key emission unit and, after organizing the relevant data in the CSMAR database (China Stock Market & Accounting Research Database), we found that, from 2010 to 2021, the percentage of corporates making mandatory disclosure increased each year but remained below 50%, and more than half of them continued to make voluntary disclosure (see Figure 1 for additional information). According to the facts above, Chinese corporates still have a great deal of discretion over whether to disclose environmental information as well as the extent of disclosure and in what format (measurement or disclosure).
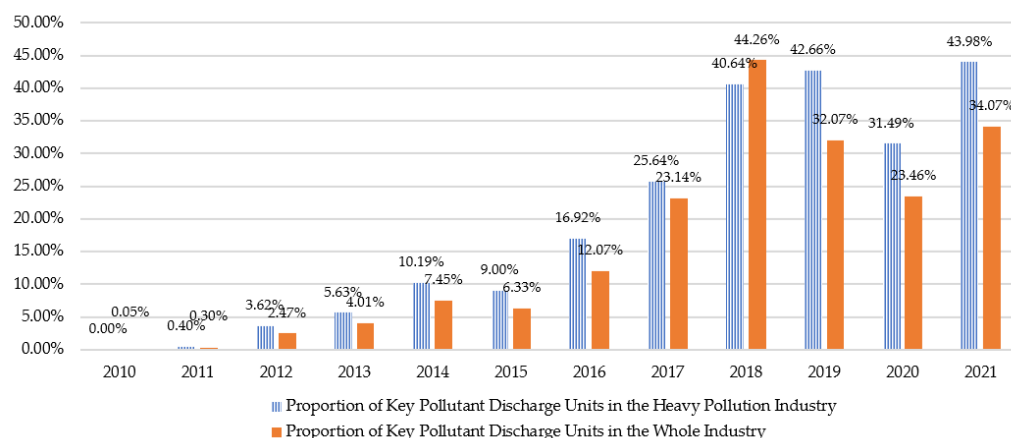

Figure 1. The proportion of key pollutant discharge units in the heavy pollution industry and the whole industry from 2010 to 2021. Source: Based on data from the CSMAR database.

At the same time, the phenomenon of "inconsistent words and deeds", such as "greenwashing" and "brownwashing", also objectively exists in corporate environmental information [2,3]. Corporates tend to downplay poorly executed environmental protection measures, selectively disclose information that is beneficial, or use language to "whitewash" their environmental performance [4]. This practice is known as "greenwashing". For instance, the "China Greenwashing List" (Website: http://www.infzm.com/contents/1235 32?source=131, accessed on 16 March 2017) published in the South Weekend in 2016 and the "A-share Green Weekly Report" (Based on authoritative data sources such as environmental quality, environmental emissions, and pollution source supervision records released by the governments of 31 provinces, 337 prefectures, and municipalities, the Daily Economic News, in collaboration with the Institute of Public and Environmental Affairs (IPE), a leading environmental NGO, has been collecting and analyzing the environmental information of thousands of listed firms and their tens of thousands of firms (including subsidiaries, participating firms, and holding firms) in China on a weekly basis since September 2020 and publishing the "A-Share Green Weekly Report".) published jointly by the NGO Public Environment Research Center and the Daily Economic News from 2020 to 2022 both demonstrate the involvement of numerous listed firms in false reporting, data concealment, and environmental penalties. As opposed to the aforementioned "greenwashing" conduct, many corporates try to under-disclose or hide their environmental performance, which is

known as "brownwashing" [2]. For instance, IKEA has made the decision to withhold the information that the cotton used in its products is "BCI certified" [5].

Analysts are crucial for reducing information asymmetry in the capital market since they serve as the informational link between corporates and investors. Compared with individual investors, analysts have more professional knowledge with which to collect, analyze, and evaluate information about listed firms and eventually form forecasts that are useful to investors. The publicly disclosed information about listed firms is a key source of data for analysts' earnings forecasts, which are viewed as a crucial issue in the capital markets. Studies from recent years have shown that non-financial information plays an important role in analysts' production of accurate forecasts, in addition to financial information, with information such as CSR, environmental information, ESG information, and others serving as useful inputs.

The literature on the association between corporate environmental disclosure and analyst forecast accuracy has come to the conclusion that the disclosure of corporate environmental information lowers analyst forecast errors and raises analyst forecast accuracy [6–10]. For example, Dhaliwal et al. [6] used data from companies in 31 countries/regions and found that the release of independent CSR reports reduced analyst prediction errors and that this relationship was more pronounced in companies and countries with more stakeholder-oriented and less transparent financial disclosures. According to Qi and Liu [7] and Zhang et al. [8], the accuracy of analysts' earnings forecasts decreases as corporate environmental information quality increases. According to the intonation, readability, length, and numerical and horizontal content of corporate social responsibility report texts, Muslu et al. [9] developed disclosure scores and examined the correlation between the scores and analyst forecasts. It was discovered that CSR report content helped increase the accuracy of analyst forecasts. Furthermore, Li [10] discovered that "cheap talk" decreased the forecast accuracy of analysts with poor reputations.

However, most of the above literature is based on a single dimension of corporate environmental information quality, ignoring the different characteristics (e.g., voluntary disclosure and mandatory disclosure coexist and voluntary disclosure predominates) and the different quality (e.g., "greenwashing" or "brownwashing") of the environmental information of corporates in China; in terms of mechanism, it only highlights the role of analysts in transmitting high-quality environmental information, ignoring their screening of low-quality environmental information (such as "greenwashing") and their mining of undisclosed environmental information (such as "brownwashing"). Analysts are better able to rapidly and precisely identify the misreporting, fraud, and impression management behaviors of listed firms because they have the ability to utilize professional information acquisition and identification capabilities. Therefore, based on the fact that the environmental information disclosure behaviors of corporates in China have different characteristics and varying quality, exploring their impact on the information environment of China's capital market is an issue worthy of in-depth investigation.

Taking the listed firms of heavy pollution industries in China for 2010–2021 as a sample, this study explored the impact of corporate environmental information disclosure behavior on analyst forecasts' accuracy from three perspectives: whether corporates measure or disclose environmental information and the degree of measurement or disclosure of corporate environmental information, the form of corporate environmental disclosure (measurement or disclosure), and the "inconsistent words and deeds" of corporate environmental information such as "greenwashing" and "brownwashing". We found that corporates measure or disclose environmental information, and the more that is measured or disclosed, the more accurate analysts' forecasts are. The environmental information disclosed in the special reports is positively and significantly correlated with analysts' forecast accuracy, whereas the environmental information measured in the annual financial statements is positively but not significantly related to analyst forecast accuracy. Environmental information disclosed in the special reports is significantly and positively correlated with analysts' forecast accuracy when corporates "match words to deeds" and

"brownwash", while being positively but not significantly correlated with analysts' forecast accuracy when corporates "greenwash". A mechanism analysis revealed that the analysts' coverage and site visits both have a full or partial mediating effect. Specifically, analysts' coverage is more likely to be elicited when corporates measured or disclosed environmental information, the higher the degree of measurement or disclosure, disclose in the special reports, "matching words to deeds" and "brownwashing". Analysts conducted site visits when corporates measured or disclosed environmental information, the higher the degree of measurement or disclosure, disclose in the special reports and "brownwashing". The information above demonstrates that, on the one hand, specialized reports are published to supplement financial disclosures and, on the other hand, analysts place importance on corporate incremental and explicit environmental information; however, "information screening" is insufficient and some "information mining" was carried out when corporate environmental information disclosure was insufficient. The contributions of this study mainly reflect the following three points:

First, it broadens the analytical paradigm of existing literature on the relationship between the disclosure of non-financial information and the accuracy of analyst forecasts. Most of the literature has been discussed based on a single perspective of information quality; this study examined the impact of corporate environmental disclosure behavior on analyst forecast accuracy from two perspectives: the characteristics of corporate information disclosure behavior and the "information screening"/"information mining" of analysts.

Second, it constructs a more comprehensive dimension of the corporate environmental information disclosure index. The majority of the existing literature on environmental information data uses the more subjective Clarkson et al.'s [11] method of constructing indices by calculating scores based on content analysis. By manually collecting environmental information measured in the annual reports, especially the financial statements of listed firms in China's heavy pollution industries, and combining it with the number of "environment and sustainable development" items in the CSMAR CSR database, this study constructed a more objective and verifiable environmental disclosure indicator.

Third, it expands the theory of organizational disclosure. While Li [10] has only explored the impact of corporate "greenwashing" on analysts' forecast accuracy, this study considered the impact of environmental information disclosure on analysts' forecast accuracy based on the Chinese context with different characteristics and different qualities of Chinese corporates. Specifically, on one hand, based on the form of environmental information disclosure, corporate environmental information disclosure was divided into two forms: measurement and disclosure. On the other hand, based on identifying the "words" and "deeds" of corporate environmental information disclosure, the three dimensions of "consistent with words and deeds", "greenwashing", and "brownwashing" were further classified to study the impact of corporate environmental information disclosure behavior on the accuracy of analysts' forecasts.

2. Institutional Background and Literature Review

2.1. Institutional Background of Corporate Environmental Disclosure in China

A number of environmental regulatory combinations have been established since 2003 when the former State Environmental Protection Administration (SEPA) released the "Announcement on Corporate Environmental Information Disclosure". The Ministry of Ecology and Environment, the Securities Regulatory Commission, and the Shanghai and Shenzhen Stock Exchanges have all released a series of environmental information disclosure norms. Environmental disclosure norms were established with the promulgation of the Measures for Environmental Disclosure (for Trial Implementation) by the former State Ministry of Environmental Protection in 2007. In addition, the Guidelines for Disclosure of Environmental Information of Listed Corporates (Draft for Public Comments) issued by the former Ministry of Environmental Protection in 2010 stipulates that listed firms in 16 types of heavy polluting industries should issue annual environmental reports. In 2017, the "Guidelines on the Content and Format of Information Disclosure by Corporates

Issuing Public Securities No. 2 (No. 3)—Content and Format of Annual (Semi-Annual) Reports (Revised 2017)" issued by the China Securities Regulatory Commission requires mandatory disclosure of environmental information by key emission units, while other corporates implement the principle of "explanation without disclosure". In 2021, the Ministry of Ecology and Environment promulgated the "Administrative Measures for the Legal Disclosure of Corporate Environmental Information", which further expanded the subjects of environmental disclosure. In 2023, the Shenzhen Stock Exchange released the "White Paper on Environmental Information Disclosure of Listed Firms in the Shenzhen Stock Exchange", which initially established the environmental information disclosure model of "voluntary disclosure + mandatory disclosure of specific matters" for listed firms. In conclusion, China's environmental information disclosure form combines voluntary disclosure and mandatory disclosure with voluntary disclosure now dominating at present.

2.2. The Economic Consequences of "Greenwashing" and "Brownwashing" of Corporate Environmental Information

Studies have shown the value relevance of corporate environmental disclosure [12–18]. The value effect of environmental information disclosure has been examined in the existing literature with regard to factors including the cost of equity capital [19–24], financial constraints [25,26], firm risk [27], investment efficiency [28], stock price crash risk [29–31], and improving stakeholder relationships [32]. The majority of the 21pieces of literature mentioned above (17 papers) found positive economic consequences of corporate environmental disclosure, while three studies found negative economic consequences and one study found irrelevant economic consequences. Recent research has shown that different corporate environmental disclosure behavior features have varying economic consequences. For example, Ji and Wei discovered that the value relevance of environmental information in measurement and disclosure varied. The phrase "greenwashing" was initially proposed by Jay Westerveld in 1986. According to Ramus and Montiel [33], "greenwashing" is the behavior of portraying a corporation as being environmentally conscious through the use of misleading data. Lyon and Montgomery [34] defined "greenwashing" as a broad concept that includes various misleading information patterns. In essence, "greenwashing" refers to a corporate strategy of projecting a socially responsible image while doing nothing to actually implement it [33,35–37]. The various economic consequences of corporate "greenwashing" behavior have been extensively investigated in previous studies, including negative market reactions [38–40], reduced/no impact on financial performance [36,41,42], reduced audit fees [43], and benefits in the loan market [44]. Li additionally found that cheap talk on environmental responsibility led to a decrease in the number of securities analysts who released forecasts, a rise in the divergence of earnings forecasts, and a decline in the forecast accuracy of analysts with a poor reputation [10]. Li and Wang discovered that cheap talk on environmental responsibility aids corporates in getting more short-term bank loans [45]. "Brownwashing", on the other hand, is typically used by corporates to downplay their environmental performance when they do take substantive actions but refrain from using symbolic strategies [5,46]. The existing literature discusses the influencing factors of corporates' "brownwashing", including stakeholder pressure, maintaining the position of environmental leader, avoiding public concern and slowing down their growth demand for environmental investment, avoiding competition and reducing social cost, fear of being seen as hypocritical, etc., but there are few studies on the economic consequences of "brownwashing", though Testa et al. [5] discovered a negative correlation between "brownwashing" and financial performance.

2.3. Determinants of Analyst Forecast Accuracy

Analyst forecast accuracy is a hot issue of concern in the capital market. Current research has examined the factors influencing analyst forecast accuracy from the perspectives of company characteristics, information disclosure, analysts' personal characteristics and behavior, information environment, and political institutional environment respectively.

In terms of information disclosure, Hope [47] used an international sample to study the disclosure practices of analysts' forecasts in different countries and the nature of the implementation of accounting standards. The study found that annual report disclosures provide useful information to financial analysts and this positive effect was shown in the sample of mandatory implementation. The majority of the relevant literature has recently concentrated on the effect of non-financial disclosures on the accuracy of analysts' forecasts. Barron et al. [48] demonstrated that the information contained in MD&A has a substantial impact on analysts' earnings forecasts, as evidenced by the fact that the quality of MD&A disclosure reduces analysts' earnings forecast errors and dispersion. Bozzolan et al. [49] and Li et al. [50] found that forward-looking information improved analyst forecast accuracy and reduced forecast dispersion. Bassemir et al. [51] used companies holding conference calls in Germany from 2004 to 2007 as a sample and found that conference calls improved the accuracy of analysts' earnings forecasts. Chen et al. [52] found that impairment charges are negatively correlated with analyst forecast accuracy and positively correlated with forecast dispersion. However, the industry expertise and institutional ownership of auditors have reduced the adverse impact of goodwill impairment on the dispersion of analyst forecasts. Li and Xiao [53] found that management performance forecasts help reduce the errors in analyst earnings forecasts. Hu and Wang [54] found that the disclosure of Weibo information significantly improved the accuracy of analysts' earnings forecasts. Wang et al. [55] found that the higher the frequency of risk information disclosure, the higher the accuracy of analyst forecasts, and this positive impact is mainly reflected in non-state-owned corporates, higher earnings quality, good corporate governance, and in analysts who are not celebrities, have lower industry expertise, and have less time to track companies. Lin et al. [56] found that credit ratings can significantly improve analyst forecast accuracy and reduce analyst dispersion and optimistic bias.

2.4. Corporate Environmental Disclosure and Analyst Forecast Accuracy

In the existing literature on environmental information disclosure and analyst forecast accuracy, Dhaliwal et al. [6] found that the release of corporate social responsibility reports reduced analyst forecast errors. Muslu et al. [9] developed disclosure scores based on the intonation, readability, length, and numerical and horizontal content of corporate social responsibility report texts and tested the relationship between disclosure scores and analyst forecasts. It was found that the content of CSR reports helps improve the accuracy of analyst forecasts. Qi and Liu [7] and Zhang et al. [8] found that the higher the quality of corporate environmental information disclosure, the lower the error of analysts' earnings forecasts.

Most of the above literature carried out discussions based on a single dimension of the quality of corporate environmental information, ignoring the different characteristics (e.g., voluntary disclosure and mandatory disclosure coexist and voluntary disclosure predominates) and the different quality (e.g., "greenwashing" or "brownwashing") of the environmental information of corporates in China; in terms of the mechanism, it only emphasizes the role of analysts in transmitting high-quality environmental information, while ignoring the role of analysts in screening low-quality environmental information (such as "greenwashing") and in mining the undisclosed environmental information (such as "brownwashing") of corporates. Therefore, in light of the fact that voluntary disclosure is the primary method used by corporates to disclose their environmental information, as well as the varied behavioral traits and quality of corporate environmental disclosure in China, this study aimed to analyze the effect of environmental information disclosure on the accuracy of analyst forecasts.

3. Theoretical Analysis and Hypothesis Development

3.1. Whether and the Degree of Measurement or Disclosure of Corporate Environmental Information and Analyst Accuracy Forecast

The accuracy of an analyst's earnings forecast depends on the information used and the effectiveness of their earnings forecast behavior [57]. Corporate environmental information

includes environmental investments made to prevent future environmental pollution (such as construction in progress), cost compensation for environmental pollution caused (such as paying pollution fees, environmental violation fines, etc.), and forward-looking information on the future sustainable development of corporates. Numerous studies have proven that environmental information has information content and is a necessary basis upon which investors can reasonably estimate the future cash flows and potential risks of listed firms [58]. So, can analysts effectively improve forecasts accuracy using corporate environmental information? The behavioral traits of corporate environmental disclosure and the "information screening" and "information mining" roles of analysts are the two topics that this study tries to cover.

In recent years, although the number of environmental information disclosures made by corporates has been increasing year by year, there is still a clear fact of "inconsistent quality of corporate environmental information". According to economics-based voluntary disclosure theory [59], corporates voluntarily disclose information to reduce information asymmetries between managers and outside stakeholders to convey their good performance. Similarly, signaling theory suggests that, in cases of information asymmetry, the better-informed party tries to credibly convey information about itself to the less-informed party [60] to reduce this asymmetry. As a result, corporates that are excellent in environmental performance have the incentive to disclose more high-quality information, to transmit to market participants the signal that they are "excellent corporates" that cannot be imitated by inferior corporates, and distinguish themselves from those corporates with poor environmental performance. High-quality environmental information disclosure can have an "information effect" and reduce information asymmetry [61,62], which in turn improves analysts' forecast accuracy. On the other hand, based on the limited attention theory of behavioral finance, the scarcity of cognitive resources makes analysts constrained by their limited attention span to promptly react to all publicly available information in the market [63,64] and to track and predict the business conditions and market performance of all listed companies. Qiu et al. [65] found a limited role for analysts in professional interpretation, and information with high quality, transparency, and readability is more likely to attract the attention of analysts, which in turn improves forecast accuracy.

According to social-political theories of disclosure [66], voluntary disclosure is not merely used to inform capital market participants but also to manage impressions. The aim is to help corporates maintain their legitimacy in the face of social and political pressure exerted by non-market stakeholders, such as NGOs, policymakers, or the media. According to legitimacy theory, corporates use social and environmental disclosure as a legitimization management tool to influence stakeholders' perceptions of the social and environmental consequences of their activities [64]. Therefore, "low-quality corporates" with poor environmental performance may use environmental information disclosure as a "self-interest tool" [31], releasing low-quality and unreliable environmental information to prove the legitimacy of the company or to manage impressions [67–72]. Low-quality environmental information disclosure increases the level of information asymmetry between information users and managers, thus reducing information transparency. In addition, the disclosure of future environmental information increases the uncertainty of corporate production and operation, which makes it more difficult for analysts to interpret and identify the information and thus reduces forecast accuracy. Accordingly, we hypothesize that:

Hypothesis 1a. *Other things being equal, measure or disclose environmental information, and the higher the degree of measuring or disclosing environmental information, the lower the analyst forecast error and the higher the forecast accuracy.*

Hypothesis 1b. *Other things being equal, measure or disclose environmental information, and the higher the degree of measuring or disclosing environmental information, the higher the analyst forecast error and the lower the forecast accuracy.*

3.2. The Forms of Corporate Environmental Disclosure and Analyst Accuracy Forecast

Previous studies have found that the way information is disclosed has a significant impact on decision-maker behavior and decision-making effectiveness [73]. In China, corporates mainly measure or disclose environmental information through annual financial statements and special reports (such as corporate social responsibility reports, environmental reports, sustainable development reports, ESG reports, etc.). Ji and Wei found that the number and proportion of enterprises with environmental information measurement in the notes of annual financial statements have increased rapidly since 2014, and more than 90% of heavy pollution corporates measured their environmental information between 2014 and 2016. The information measured in the annual financial statements can be clearly defined, quantifiable, relevant, and reliably reflect the substantive actions and economic consequences of the corporate's environmental behavior, with high information quality. However, the environmental information measured in the annual financial statements is essentially financial information. According to the current accounting system recognition and measurement standards, it reflects the historical information of the corporate's past environmental investment and is also a part of the corporate's earnings, which is information that analysts have already paid attention to and evaluated.

Although the information disclosed in the special reports has more qualitative descriptions and fewer quantitative data [74], a low percentage of validation by third-party institutions [18], which cannot avoid impression management [75] and the interference of false information. However, compared with the annual financial statements, the special reports provide more environmental information content [76], contain more forward-looking information about the future sustainable development of corporates, are non-financial information, are mostly disclosed voluntarily by corporates, and contain more corporate-specific information; for analysts, the information disclosed in special reports is incremental and useful information [77]. High-quality information disclosed in the special reports can reduce the degree of information asymmetry and improve forecast accuracy; on the contrary, when the quality of information disclosed in the special reports is low, analysts can rely on their professional abilities to further mine private information through on-site research activities, thereby reducing the degree of information asymmetry and improving forecast accuracy. Accordingly, we hypothesize that:

Hypothesis 2. *When ceteris paribus, the higher the degree of corporate environmental information disclosed in the special reports, thelower the analyst forecast error, and the higher the analyst forecast accuracy.*

3.3. "Greenwashing" and "Brownwashing" of Corporate Environmental Information, Disclosure (in the Special Reports), and Analyst Forecast Accuracy

Corporates strategically manage their environmental disclosures to influence stakeholder expectations [78], to bring poor environmental performance into compliance [71], and to maximize corporate interests [79]. Oliver [80] found that firms tend to use decoupling (the gap between a firm's policy and implementation) to protect their environmental legitimacy, with both "brownwashing" and "greenwashing" being special cases of decoupling. Specifically, environmentally well-performing firms tend to be leaders in industry standards for others to emulate and may adopt a "brownwashing" [81] strategy, hiding relevant environmental information or making modest claims about their environmental activities to avoid competition and reduce social costs or to hide relevant environmental information or make appropriate statements about their environmental activities. Conversely, companies with poor environmental performance may view "greenwashing" as a corporate strategy and selectively report misleading environmental information [33] to present an environmentally responsible image without actual implementation [37].

If corporates "brownwash", analysts are not fully informed about the corporate environment. It is found that analysts can use their professional knowledge and industry background to uncover private information, identify upward earnings risk [82], and screen

corporates' R&D activities [83], which ultimately alleviates information asymmetry and improves forecast accuracy. On the contrary, if corporates "greenwash", they disclose more environmental information that cannot be verified, so analysts cannot accurately judge the authenticity and accuracy of the information and it is difficult to effectively identify the true environmental performance of corporates. Accordingly, we hypothesize that:

Hypothesis 3. *When ceteris paribus, the positive effect of disclosure (in the special reports) on analyst forecast accuracy is more significant in the corporates that "match words to deeds" and "brownwashing".*

4. Research Design

4.1. Sample Selection and Data Sources

4.1.1. Sample Selection

This study took listed firms in the heavy pollution industry in China from 2010 to 2021 as the research sample. This study took 2010 as the starting year for research, as the corporate environmental information disclosure regulations that are currently being implemented and oriented towards the Shanghai and Shenzhen stock markets began in 2010 with the "Guidelines for Environmental Information Disclosure of Listed firms" (draft for soliciting opinions) issued by the Ministry of Ecology and Environment. This study took 2021 as the end year of the study as, considering the availability of data, the data that can be collected from listed firms such as annual reports, social responsibility reports, ESG reports, and sustainable development reports are currently only available up to 2021. Based on "the Guidelines for the Classification of Industries of Listed Firms" issued by the China Securities Regulatory Commission in October 2012, concerning "the Guidelines for Environmental Information Disclosure of Listed Firms" issued by the Ministry of Ecological Environment in September 2010 (Draft for Comments), the definition of heavy pollution industries involves 16 industries including thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemical industry, petrochemical, building materials, paper making, brewing, pharmacy, fermentation, textile, tanning, and mining. In addition, this article treated the variables as follows: (1) only the most recent forecast from the date of annual report publication was retained, considering that analysts may make multiple predictions for the same company in the same year; (2) financial and ST companies were deleted; (3) Samples with missing data were removed; (4) the tail of all continuous variables were shrunk at 1% and 99% quantiles to control the influence of outliers; (5) finally, 210,384 analysts, corporates, and annual observations were determined.

4.1.2. Data Sources

Except for the data on corporate environmental information measured in the annual financial statements and the data of "inconsistent words and deeds" such as "greenwashing" and "brownwashing", which were manually collected and compiled from the annual financial statements and their notes, the data on financial characteristics, governance status, and institutional investors were obtained from the China Stock Market & Accounting Research Database (CSMAR), and the data on analysts were compiled from the China Research Data Services Platform database (CNRDS).

4.2. Variable Design and Model Construction

4.2.1. Variable Definition

Explained variables. The analyst forecast error (FERROR) was used as a proxy variable for the accuracy of the analysts' forecasts in this study, and the lower the analyst forecast error, the higher the analyst forecast accuracy. According to Liu and Ji [84] and Tan and Cui [85], the deviation (AFERR) of each analyst's earnings forecast (FEPS) relative to the firm's true position (EPS) was calculated first and its average deviation ($MAFERR_{it}$) was calculated based on all analysts' earnings forecasts for firm i in the current period. Following that, as shown in Equation (1), the accuracy of each analyst's earnings forecast

adjusted for average deviation ($FERROR_{ijt}$) was computed. This was then multiplied by 100 to ensure data readability.

This was calculated as follows:

$$AFERR_{ijt} = FEPS_{ijt} - EPS_{it}$$
$$FERROR_{ijt} = (AFERR_{ijt} - MAFERR_{it})/MAFERR_{it} \tag{1}$$

where $FEPS_{ijt}$ is the analyst j's forecast for earnings per share for firm i in period t. If analyst j made several forecasts before the announcement of actual earnings per share in period t, the most recent forecast was used.

Explanatory variables. According to Ji and Su [86] and Deng et al. [87], corporate environmental information was measured by a total of five indicators in the three categories listed below.

The first variable was whether corporates measure or disclose environmental information, as well as the degree of such measurement or disclosure. They were measured using two distinct indicators. First, whether corporates measure or disclose environmental information (Ed_dum). This is a dummy variable that measures the overall measurement or disclosure of corporate environmental information. It was obtained by summing up the number of items measured in the annual financial statements and disclosed in the special reports. The value was set to 1 if the sum was more than zero; otherwise, it was set to 0. The second variable was the number of items measured or disclosed (Ednum1). This indicator measures the overall measurement or disclosure of corporate environmental information, which was obtained by taking the logarithm of the sum of the items' numbers measured in the annual financial statements and disclosed in the special reports plus one.

Another variable was the form of corporate environmental information disclosure. Based on the environmental information in the notes to the annual financial statements and the special reports, it was classified as either measured in the annual financial statements or disclosed in the special reports. The first variable is disclosure (EdDisclosurenum1), which was measured by the logarithm of the number of "environment and sustainable development" items disclosed in special reports plus one. The second variable is measurement (EdMeasurementnum1), which was measured by the logarithm of the number of corporate environmental information items measured in the annual financial statements plus one. This was undertaken by manually collecting and summarizing the number of environmental-related items, such as "construction in progress" and "management expenses", from the notes to the annual financial statements.

Finally, the "inconsistent words and deeds" of corporate environmental disclosure was a further variable. Based on disclosure and measurement, we further identified and quantified the "words" and "deeds" of corporate environmental behavior and distinguished three dimensions: "match words to deeds", "greenwashing", and "brownwashing". The transactions or matters measured in the annual financial statements are measurable and affect the corporates' operating performance and financial condition, reflecting the substantive input and economic results of the corporate's environmental protection actions. In addition, the corporate environmental information disclosed in the special reports coexists with voluntary disclosure and mandatory disclosure. It primarily uses qualitative expressions, such as words, but fewer quantitative expressions, such as money and physical quantities, which are less verifiable and have impression management. It also only reflects what corporates "say", not necessarily what they "do", and does not always correspond to substantive inputs and economic results. Therefore, the "words" were measured by the number of "environment and sustainable development" items disclosed in the special reports and the "deeds" were measured by the number of environmental information items measured in the annual financial statements. Furthermore, an internal comparison of the "words" and "deeds" of corporate environmental disclosure was undertaken in the form of rankings to get around the lack of uniform measurement units and improve the comparability of words-deeds differences. Specifically, "inconsistent words and deeds" (Ed_Dis) was measured by the difference between the rank of the number of "environment and sustainable

development" items disclosed in the corporate's special reports and the rank of the number of environmental information items measured in the annual statements within the same industry and the same year. Among them, the definition of "match words to deeds" refers to the value where the difference between the two in the sample of disclosed items equals zero, whereas the definitions of "brownwashing" and "greenwashing" refer to the value where the difference is less than zero and more than zero, respectively.

Control variables. The following control variables were used, with references to the research of Chu et al. [88], Liu and Ji [84], Tan and Cui [85], and Wang and Wang [89]. First, the fundamental financial characteristics of the firm, including the nature of ownership (Soe), earnings volatility (STDEPS) (see Equation (2) for details), accounting robustness (Cscore), and price to net ratio (PB); second, we controlled for the effects of corporate governance factors on analysts' earnings forecasts, specifically dual ownership (Dual) and the proportion of sole directors (DR); third, we also controlled for the influence of institutional investors and analysts' factors on their forecasts, including institutional investors' shareholding (INST), star analysts (Star_Analyst), and forecast horizon (Horizon). Finally, we took industry (ind) and year (Year) variables into account. The definitions of the specific variables are displayed in Table 1.

The formula for calculating earnings volatility is as follows:

$$\text{Adj\_Roa}_{it} = \frac{\text{EBIT}_{it}}{\text{ASSET}_{it}} - \frac{1}{X}\sum\nolimits_{k=1}^{x} \frac{\text{EBIT}_{it}}{\text{ASSET}_{it}}$$

$$\text{STDEPS}_{it} = \sqrt{\frac{1}{T-1}\sum\nolimits_{t=1}^{T}\left(\text{Adj\_Roa}_{it} - \frac{1}{T}\sum\nolimits_{t=1}^{T}\text{Adj\_Roa}_{it}\right)^2} |T = 3. \tag{2}$$

4.2.2. Model Construction

According to Wang et al. [77], the regression model (3) was built to test the hypotheses mentioned above:

$$\begin{aligned} \text{FERROR}_{ijt} = \alpha &+ \beta_1 \text{Ed}_{\text{dum}_{it-1}}/\text{Ed}_{\text{num}_{it-1}} + \beta_2 \text{Soe}_{it} + \beta_3 \text{Star\_Analyst}_{it} + \beta_4 \text{Horizon}_{it} + \beta_5 \text{STDEPS}_{it} + \\ &\beta_6 \text{Dual}_{it} + \beta_7 \text{DR}_{it} + \beta_8 \text{INST}_{it} + \beta_9 \text{PB}_{it} + \beta_{10} \text{Cscore}_{it} + \beta_{11} \text{ind} + \beta_{12} \text{Year}. \end{aligned} \tag{3}$$

Table 1. Definitions of main variables.

Variable Type	Variable Name	Variable Code	Variable Definition
Explained variables	Analyst forecast error	FERROR	$\text{AFERR}_{ijt} = \text{FEPS}_{ijt} - \text{EPS}_{it}$ $\text{FERROR}_{ijt} = \left(\text{AFERR}_{ijt} - \text{MAFERR}_{it}\right)/\text{MAFERR}_{it}$ (According to Liu and Ji [84], Tan and Cui [85])
Explanatory variables (According to Ji and Su [86], Deng et al. [87])	Whether to measure or disclose environmental information	Ed_dum	1 if the sum of the number of environmental information items (including measurement and disclosure) is not 0; 0 otherwise
	The number of items measured or disclosed	Ednum1	Ln[sum of the number of corporates environmental information items (including measurement and disclosure) + 1]
	Measurement	EdMeasurementnum1	Ln(the number of corporates environmental information items measured in the notes to the annual financial statements + 1)
	Disclosure	EdDisclosurenum1	Ln(the number of "Environment and Sustainability" items disclosed in special reports + 1)
	Inconsistent words and deeds	Ed_Dis	The number of "environment and sustainable development" items disclosed in the special reports in the same industry and year minus the number of environmental information items measured in the annual financial statements in the same industry and year, without taking the absolute value

Table 1. *Cont.*

Variable Type	Variable Name	Variable Code	Variable Definition
Control variables (According to Chu et al. [88], Liu and Ji [84], Tan and Cui [85], Wang and Wang [89])	Nature of ownership	Soe	1 if it is a state-owned enterprise, 0 otherwise.
	Star analysts	Star_Analyst	1If analyst j is a star analyst in New Fortune for the year, 0 otherwise
	Forecast horizon	Horizon	Ln(the difference between the date of a forecast by analyst i in year t and the date of the annual earnings announcement + 1)
	Earnings volatility	STDEPS	Standard deviation of net earnings for the three years prior to year t, as detailed in Equation (2)
	Dual ownership	Dual	1if the general manager and the chairman are the same person, the value is, 0 otherwise
	Proportion of sole directors	DR	Ratio of the number of sole directors to the total number of directors
	Institutional investors' shareholding	INST	Number of shares held by institutional investors at the end of the year/Number of shares outstanding at the end of the year
	Price to net ratio	PB	Total market value of equity divided by book value of equity
	Accounting robustness	Cscore	Calculated according to CSore model
	Industry	ind	Industry dummy variables
	Year	Year	Annual dummy variables

5. Empirical Results and Analysis

5.1. Descriptive Statistics

The descriptive statistics for all variables for the entire sample are displayed in Table 2 Panel A. From the table, we can deduce that: (1) the 25th percentile of the environmental information dummy variable (Ed_dum) is 1, indicating that the number of samples measuring or disclosing environmental information is much larger than the number of samples not measuring or disclosing environmental information, and the mean value is 0.9, indicating that, on average, 90% of corporates measure or disclose environmental information; (2) there is a significant variation between analyst forecast errors, as seen by the mean value of 0.030, with a minimum value of 0.001, and maximum value of 0.451. In Table 2 Panel B, Ednum1 excludes the sample with the number of environmental information items of 0 in the entire sample, and the mean value of the number of environmental information items (Ednum1) is 1.683, the minimum value is 0.693, and the maximum value is 3.584; EdMeasurementnum1 excludes the sample with the number of measured environmental information items of 0 in the table, and the mean value is 1.387, the minimum value is 0.693, and the maximum value is 3.178; EdDisclosurenum1 excludes the sample with the number of disclosed environmental information items of 0 in the table, and the mean value is 1.150, the minimum value is 0.693, and the maximum value is 3.332. The above shows that there are significant differences between the disclosure, measurement in the annual financial statements, and disclosure in the special reports of environmental information.

5.2. Univariate Test and Analysis

The samples were divided into two groups and tested for differences based on disclosed environmental information, median number of items of environmental information disclosed, median number of items of environmental information measured in the annual financial statements, and median number of items of environmental information disclosed in the special reports, respectively. According to Table 3, the analysts' forecast errors of the corporates that disclosed environmental information are smaller and significant at the 1% level compared to the corporates that did not disclose environmental information. The analysts' forecast errors of the corporates that disclosed environmental information to a greater extent are smaller and significant at the 1 percent level compared to the corporations that disclosed environmental information to a lesser extent. The analysts forecast errors of

the corporates that measured environmental information to a greater extent are smaller but not significant compared to the corporates that measured environmental information to a lesser extent. The analysts' forecast errors of the corporates that disclosed environmental information to a larger extent are smaller and significant at the 1% level when compared to the corporates that disclosed environmental information to a lesser extent. The findings show that, with the disclosure of corporate environmental information, the more environmental information that is disclosed and the more environmental information that is disclosed in the special reports, the smaller the analyst forecast error and the higher the forecast accuracy; therefore, hypotheses 1a and 2 are initially verified.

Table 2. Descriptive statistical table of main variables.

Panel A: Full-Sample Descriptive Statistics								
Variable	**N**	**Mean**	**Standard Deviation**	**Median**	**P25**	**P75**	**Minimum**	**Maximum**
FERROR	210,384	0.030	0.058	0.013	0.007	0.028	0.001	0.451
Ed_dum	210,384	0.900	0.299	1.000	1.000	1.000	0.000	1.000
Soe	210,384	0.417	0.493	0.000	0.000	1.000	0.000	1.000
Star_Analyst	210,384	0.202	0.402	0.000	0.000	0.000	0.000	1.000
Horizon	210,384	5.918	0.830	6.031	5.361	6.593	3.045	7.035
STDEPS	210,384	0.074	0.096	0.057	0.044	0.067	0.010	0.728
Dual	210,384	0.238	0.426	0.000	0.000	0.000	0.000	1.000
DR	210,384	0.373	0.054	0.357	0.333	0.400	0.313	0.571
INST	210,384	53.224	24.901	58.806	35.669	72.328	1.511	94.287
PB	210,384	2.278	1.999	1.677	0.896	2.953	0.185	10.209
Cscore	210,384	0.482	2.682	0.034	−0.002	0.106	−1.237	23.455
Panel B: Sub-Sample Descriptive Statistics								
Variable	**N**	**Mean**	**Standard Deviation**	**Median**	**P25**	**P75**	**Minimum**	**Maximum**
Ednum1	189,426	1.683	0.752	1.609	1.099	2.197	0.693	3.584
EdMeasurementnum1	160,467	1.387	0.622	1.386	0.693	1.792	0.693	3.178
EdDisclosurenum1	160,243	1.150	0.708	0.693	0.693	1.609	0.693	3.332

Note: This excludes samples in which the number of environmental information items in the entire sample is 0, the number of measured environmental information items is 0, and the number of disclosed environmental information items is 0.

Table 3. Difference test.

Grouping Variables	**N**	**Mean**	**T-Test**
Ed_dum	=0 (N = 20,958)	0.037	0.008 ***
	=1 (N = 189,426)	0.029	(19.169)
Ednum1	≤median (N = 111,346)	0.031	0.004 ***
	>median (N = 78,080)	0.026	(17.154)
EdMeasurementnum1	≤median (N = 99,477)	0.024	0.005
	>median (N = 60,990)	0.019	(1.053)
EdDisclosurenum1	≤median (N = 21,363)	0.033	0.006 ***
	>median (N = 138,880)	0.027	(15.507)

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.3. Correlation Analysis

According to Table 4's correlation coefficients, Ed_dum and Ednum1 are all significantly negatively correlated with FERROR at the 1% level, which is consistent with the findings in Table 3. The maximum correlation coefficient between the other explanatory variables was 0.303, and the maximum value and the mean value of the variance inflation coefficient of the independent variables using the VIF test were 1.41 and 1.10, respectively, indicating that there was no serious multicollinearity among the variables.

Table 4. Correlation analysis.

	Ed_dum	Ednum1	FERROR	Soe	Star_Analyst	Horizon	STDEPS	Dual	DR	INST	PB	Cscore
Ed_dum	1	0.522 ***	−0.025 ***	0.130 ***	0.008 ***	0.004 *	0.084 ***	−0.052 ***	0.034 ***	0.049 ***	−0.084 ***	0.074 ***
Ednum1	0.577 ***	1	−0.040 ***	0.275 ***	0.014 ***	−0.005 **	0.029 ***	−0.129 ***	0.039 ***	0.142 ***	−0.303 ***	0.190 ***
FERROR	−0.042 ***	−0.045 ***	1	−0.052 ***	−0.013 ***	−0.062 ***	−0.085 ***	0.011 ***	−0.057 ***	−0.112 ***	−0.068 ***	−0.072 ***
Soe	0.130 ***	0.272 ***	−0.033 ***	1	−0.007 ***	0.020 ***	−0.100 ***	−0.264 ***	0.021 ***	0.426 ***	−0.324 ***	0.184 ***
Star_Analyst	0.008 ***	0.012 ***	−0.004 **	−0.007 ***	1	0.050 ***	−0.052 ***	−0.009 ***	−0.011 ***	−0.015 ***	0.006 ***	0.019 ***
Horizon	0.004 *	−0.001	−0.060 ***	0.023 ***	0.047 ***	1	−0.021 ***	−0.021 ***	−0.019 ***	−0.045 ***	−0.091 ***	0.001
STDEPS	0.012 ***	0.031 ***	−0.013 ***	0.011 ***	0.015 ***	0.004 **	1	0.070 ***	0.029 ***	−0.091 ***	0.261 ***	−0.145 ***
Dual	−0.052 ***	−0.131 ***	0.012 ***	−0.264 ***	−0.009 ***	−0.019 ***	−0.020 ***	1	0.069 ***	−0.196 ***	0.141 ***	−0.096 ***
DR	0.032 ***	0.035 ***	−0.029 ***	0.019 ***	−0.013 ***	−0.020 ***	−0.021 ***	0.080 ***	1	0.034 ***	0.012 ***	0.004 **
INST	0.052 ***	0.153 ***	−0.047 ***	0.449 ***	−0.012 ***	−0.036 ***	−0.047 ***	−0.212 ***	0.005 **	1	−0.085 ***	0.169 ***
PB	−0.079 ***	−0.233 ***	−0.021 ***	−0.244 ***	0.013 ***	−0.087 ***	0.002	0.130 ***	0.019 ***	−0.028 ***	1	−0.282 ***
Cscore	0.032 ***	0.065 ***	−0.032 ***	0.152 ***	−0.000	0.007 ***	−0.062 ***	−0.072 ***	−0.015 ***	0.126 ***	−0.137 ***	1

Note: Spearman correlation coefficient is at the top right and Pearson correlation coefficient is at the bottom left; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.4. Regression Results and Analysis

5.4.1. Whether and the Degree of Measurement or Disclosure of Corporate Environmental Information and Analyst Forecast Accuracy

The findings of empirical tests on the effect of corporate environmental disclosure on analyst forecast accuracy are shown in Table 5. In univariate regressions, the disclosure and disclosure degree of corporate environmental information are significantly negatively related to analyst forecast error. After adding numerous control variables that influence analysts' forecast accuracy, whether or not to disclose environmental information (Ed_dum) and the number of items of environmental information disclosed (Ednum1) are significantly negatively related to analyst forecast error at the 5% and 10% levels, respectively, supporting hypothesis 1a of this study. According to the findings, when compared to the corporates that did not measure or disclose environmental information, the measurement or disclosure and the higher the degree of measuring or disclosing environmental information, the lower the analyst forecast error and the higher the forecast accuracy.

Table 5. Corporate environmental disclosure and analyst forecast accuracy.

	(1) FERROR	(2) FERROR	(3) FERROR	(4) FERROR
Ed_dum	−0.714 ***	−0.618 **		
	(−2.653)	(−2.318)		
Ednum1			−0.428 ***	−0.385 ***
			(−3.957)	(−3.436)
Soe		−0.029		−0.078
		(−0.146)		(−0.377)
Star_Analyst		−0.059		−0.034
		(−1.095)		(−0.683)
Horizon		−0.390 ***		−0.383 ***
		(−11.966)		(−11.194)
STDEPS		0.084		0.233
		(0.122)		(0.313)
Dual		−0.084		−0.174
		(−0.393)		(−0.829)
DR		−3.265 **		−3.541 **
		(−2.342)		(−2.454)
INST		−0.010 ***		−0.010 **
		(−2.633)		(−2.480)
PB		0.026		−0.016
		(0.442)		(−0.260)
Cscore		−0.050 ***		−0.047 ***
		(−3.129)		(−2.951)
constant	3.613 ***	7.604 ***	3.611 ***	7.788 ***
	(13.745)	(12.442)	(16.734)	(11.999)
Year/ind	Yes	Yes	Yes	Yes
N	210,384	210,384	189,426	189,426
Adj. R2	0.032	0.038	0.023	0.030

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.4.2. The Forms of Corporate Environmental Disclosure and Analyst Forecast Accuracy

The findings of the empirical tests of the effect of the form of corporate environmental information disclosure on the accuracy of analysts' forecasts are shown in Table 6. In univariate regressions, although the number of items disclosing environmental information (EdDisclosurenum1) is significantly and negatively related to analyst forecast error at the 10% level, the number of items measuring environmental information (EdMeasurement-num1) is not. After adding numerous control variables that affect the accuracy of analysts' forecasts, the number of items measuring environmental information (EdMeasurement-num1) is still not significantly related to analyst forecast errors but the number of items disclosing environmental information (EdDisclosurenum1) is significantly and negatively

related to analysts' forecast errors at the 10% level, supporting hypothesis 2 of this paper. The results indicate that the higher the degree of disclosure of environmental information, the higher the accuracy of analysts' earnings forecasts.

Table 6. The forms of corporate environmental disclosure and analyst forecast accuracy.

	(1) FERROR	(2) FERROR	(3) FERROR	(4) FERROR
	Measurement		Disclosure	
EdMeasurementnum1	−0.170	−0.134		
	(−1.010)	(−0.774)		
EdDisclosurenum1			−0.515 ***	−0.452 ***
			(−4.642)	(−3.984)
Soe		−0.098		−0.147
		(−0.454)		(−0.672)
Star_Analyst		−0.002		0.014
		(−0.041)		(0.253)
Horizon		−0.396 ***		−0.367 ***
		(−10.651)		(−9.922)
STDEPS		0.096		0.463
		(0.126)		(0.580)
Dual		−0.132		−0.151
		(−0.585)		(−0.696)
DR		−3.840 **		−2.971 **
		(−2.449)		(−2.083)
INST		−0.009 **		−0.009 **
		(−2.018)		(−2.004)
PB		0.035		0.001
		(0.539)		(0.012)
Cscore		−0.040 *		−0.045 **
		(−1.955)		(−2.570)
constant	3.171 ***	7.386 ***	3.353 ***	7.174 ***
	(12.349)	(10.840)	(19.701)	(10.991)
Year/ind	Yes	Yes	Yes	Yes
N	160,467	160,467	160,243	160,243
Adj. R2	0.022	0.028	0.026	0.032

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.4.3. "Greenwashing" and "Brownwashing" of Corporate Environmental Information, Disclosure (in the Special Reports), and Analyst Forecast Accuracy

The empirical findings of the moderating effects of the three corporate environmental disclosure dimensions of "match words to deeds", "greenwashing", and "brownwashing" on the relationship between disclosure (in the special reports) and analyst forecast accuracy are shown in Table 7. The findings in columns (1) through (3) of Table 7 show that the disclosure and analyst forecast errors are significantly negatively related at the 1% level for the "match words to deeds" and "brownwashing" groups, while they are negative but not significant for the "greenwashing" group. The coefficient of difference between the "greenwashing" and "brownwashing" groups is significant ($p = 0.00$). According to the findings, the negative relationship between disclosure (in the special reports) and analyst forecast error is more significant in the groups of "match words to deeds" and "brownwashing", which supports hypothesis 3 of this study. This suggests that better environmental information disclosure can improve analyst forecast accuracy, but analysts' "information screening" is not in place when environmental disclosure is of low quality and, when environmental disclosure is inadequate, analysts may reduce information asymmetry through "information mining", which would increase forecast accuracy.

Table 7. "Greenwashing" and "brownwashing" of corporate environmental information, disclosure (in the special reports) and analyst forecast accuracy.

	(1) FERROR "Match Words to Deeds"	(2) FERROR "Greenwashing"	(3) FERROR "Brownwashing"
EdDisclosurenum1	−1.662 ***	−0.469	−0.372 ***
	(−3.056)	(−1.020)	(−3.267)
Soe	−0.971	−0.183	−0.069
	(−0.971)	(−0.562)	(−0.250)
Star_Analyst	0.349	−0.009	−0.002
	(1.412)	(−0.112)	(−0.030)
Horizon	−0.306 **	−0.485 ***	−0.299 ***
	(−2.450)	(−7.081)	(−7.341)
STDEPS	−5.712	−0.889	1.311
	(−1.067)	(−0.631)	(1.240)
Dual	0.769	0.498	−0.485 **
	(0.951)	(1.378)	(−2.110)
DR	0.366	−2.654	−2.727 *
	(0.089)	(−1.101)	(−1.789)
INST	0.030 *	−0.008	−0.011 *
	(1.743)	(−1.050)	(−1.911)
PB	0.114	−0.085	0.035
	(0.289)	(−0.961)	(0.434)
Cscore	0.012	−0.006	−0.061 ***
	(0.184)	(−0.132)	(−3.144)
constant	4.955 *	7.960 ***	6.493 ***
	(1.920)	(6.678)	(9.391)
Ind/Year	Yes	Yes	Yes
N	4689	56,207	99,347
Adj. R2	0.308	0.036	0.035

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.5. Robustness Tests

5.5.1. Propensity Score Matching Method (PSM)

Due to the self-selection problem, which arises from the significant differences in the characteristics between firms that disclose environmental information and those that do not, corporate environmental disclosure behavior as well as analyst forecast accuracy may be impacted by these differences. To mitigate this problem, this study used the propensity score matching method (PSM) to reduce the effect of individual firm heterogeneity on the results and mitigate sample self-selection bias. This was accomplished in the following way: the propensity score matching method (PSM) was used to find paired samples for samples with environmental information disclosure higher than 0, and the underlying hypothesis was retested using propensity score matched samples. The matching was performed using caliper matching with control variables as covariates, after which samples that failed to match were eliminated. The control variables were as follows: nature of ownership (Soe), earnings volatility (STDEPS), accounting robustness (Cscore), price-to-net ratio (PB) dual employment (Dual), proportion of sole directors (DR), institutional investor ownership (INST), star_analyst, forecast horizon (Horizon), industry (ind), and year (Year). The results are shown in Table 8 and it can be seen that the main findings of this study are still valid.

Table 8. Corporate environmental disclosure and analyst forecast accuracy: propensity score matching.

	FERROR
Ed_dum	−0.257 ***
	(−3.745)
constant	−8.319 ***
	(−23.767)
Controls/ind/Year	Yes
N	99,914
Adj. R2	0.054

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.5.2. Two-Stage Instrumental Variables (2SLS)

Corporate environmental information measurement or disclosure in this study may be influenced by corporate idiosyncratic variables not yet taken into account in the model, which may affect both environmental information disclosure as well as analyst forecast accuracy, and some other unobservable factors may also have an impact on the stability of the results. As a result, there may be an endogeneity problem between corporate environmental disclosure and analyst forecast accuracy. To address this issue, this study drew on the research method of Ye et al. [20] and selected the industry average number of environmental information items (m_Ed) as the instrumental variable and performed regressions using the two-stage instrumental variable method (2SLS). According to the regression results in Table 9, the number of corporate environmental disclosure items (Ednum1) is significantly and negatively correlated with analyst forecast error at the 10% level, which is consistent with the previous findings.

Table 9. Corporate environmental disclosure and analyst forecast accuracy: 2SLS.

	(1) Ednum1	(2) FERROR
m_Ednum	0.893 ***	
	(14.754)	
Ednum1		−0.005 ***
		(−6.186)
constant	0.293	0.065 ***
	(1.520)	(38.144)
Controls/ind/Year	Yes	Yes
N	189,426	210,384
Adj. R2	0.374	0.040

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.5.3. Heckman Treatment Effect Model

Furthermore, this study used the Heckman treatment effect model to verify the robustness of the main findings. Based on the treatment of Xu et al. [90], a selection model (probit model) of whether to make environmental disclosure was constructed first and, according to Ye et al. [20], the industry average number of environmental information items (m_Ed) was selected as the explanatory variable. Based on this selection model, the inverse Mills ratio was calculated and then substituted into the basic model. According to the regression results (see Table 10 for details), the main conclusions of this paper still hold after taking into account potential endogeneity and sample selection problems, which clearly show that the inverse Mills coefficient (lambda) is not significant and the relationship between environmental information disclosure (Ed_dum) and analyst forecast error (FERROR) is significantly negative at the 5% level.

Table 10. Corporate environmental disclosure and analyst prediction accuracy: Heckman treatment effect.

	(1) Ed_dum	(2) FERROR
m_Ednum	2.367 ***	
	(32.642)	
Ed_dum		−0.635 **
		(−2.368)
lambda		−0.093
		(−0.236)
constant	−2.088 ***	6.739 ***
	(−6.902)	(6.372)
Controls/ind/Year	Yes	Yes
N	255,358	210,384
Adj. R2		0.038

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

5.5.4. Replacement of Explanatory Variables

To ensure the robustness of the study findings, Ednum2 used the total number of corporates environmental information items (including those measured in the annual financial statements and those disclosed in the special reports), EdMeasurementnum2 used the number of corporate environmental information items measured in the notes to the annual financial statements, and EdDisclosurenum2 used the number of "environment and sustainable development" items disclosed in the special reports of the corporates. According to the regression results in Table 11, the number of environmental disclosure items (Ednum2) is significantly and negatively related to analysts' forecast error at the 10% level, but the number of environmental information items measured in the annual financial statements (EdMeasurementnum2) is not. The items number of environmental information disclosed in the special reports (EdDisclosurenum2) is significantly and negatively related to analysts' forecast error at the 10% level. This negative relationship is more significant in the "match words to deeds" and "brownwashing" groups, which is generally consistent with the previous section.

5.5.5. Replacement of Explanatory Variables

Referring to Wang and Wang [89], the analyst forecast error (FERROR1) was measured using the mean error between the analyst forecast and the actual value, as shown in Equation (4). According to the regression results in Table 12, whether or not to disclose environmental information (Ed_dum) and the number of items of environmental information disclosed (Ednum1) are significantly and negatively related to analysts' forecast error (FERROR1) at the 10% level, while the items number of environmental information items measured in the annual financial statements (EdMeasurementnum1) is not significantly related to analysts' forecast error (FERROR1). The items number of environmental information disclosed in the special reports (EdDisclosurenum1) is significantly and negatively related to analysts' forecast error (FERROR1) at the 10% level, and this negative relationship is more significant in the "match words to deeds" and "brownwashing" groups, which is generally consistent with the previous paper.

The analyst forecast error was calculated as follows:

$$\text{FERROR1}_{it} = \frac{|\text{mean}(\text{FEPSit}) - \text{MEPSit}|}{|\text{MEPS}_{it}|}. \tag{4}$$

Table 11. Corporate environmental disclosure and analyst forecast accuracy: replacing explanatory variables.

	(1) FERROR Sample Environmental Information Disclosure	(2) FERROR Measurement	(3) FERROR Disclosure	(4) FERROR "Match Words to Deeds"	(5) FERROR "Greenwashing"	(6) FERROR "Brownwashing"
Ednum2	−0.042 *** (−3.264)					
EdMeasurementnum2		−0.012 (−0.443)				
EdDisclosurenum2			−0.063 *** (−4.659)	−0.235 *** (−3.469)	−0.060 (−0.542)	−0.053 *** (−3.826)
constant	7.396 *** (11.733)	7.243 *** (10.998)	6.848 *** (10.770)	4.063 (1.605)	7.644 *** (6.828)	6.208 *** (9.033)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	189,426	160,467	160,243	4689	56,207	99,347
Adj. R2	0.030	0.028	0.032	0.310	0.042	0.040

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

Table 12. Corporate environmental disclosure and analyst forecast accuracy: replacing explained variables.

	(1) FERROR1 Full Sample	(2) FERROR1 Sample Environmental Information Disclosure	(3) FERROR1 Measurement	(4) FERROR1 Disclosure	(5) FERROR1 "Match Words to Deeds"	(6) FERROR1 "Greenwashing"	(7) FERROR1 "Brownwashing"
Ed_dum	−0.105 *** (−3.079)						
Ednum1		−0.233 *** (−2.864)					
EdMeasurementnum1			−0.023 (−0.254)				
EdDisclosurenum1				−0.096 *** (−6.801)	−2.455 *** (−3.850)	−0.059 (−0.279)	−0.035 * (−1.770)
constant	3.586 *** (7.725)	3.716 *** (7.852)	−4.049 *** (−7.333)	3.655 *** (8.391)	4.445 (1.619)	−3.190 *** (−4.657)	3.022 *** (4.824)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	210,384	189,426	160,467	160,243	4689	56,207	99,347
Adj. R2	0.117	0.116	0.116	0.117	0.250	0.126	0.128

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

6. Mechanism Test

Tables 5–7 verify that corporate environmental information disclosure can significantly improve the accuracy of analysts' forecasts, which is embodied in the aspects of the disclosure and degree of corporate environmental information and disclosure in the special reports. According to the above assumptions and results, analysts can not only transmit and interpret high-quality information to investors with their professional knowledge and ability but also have a certain ability to mine private information; however, "information screening" is not in place. Based on the important role of analysts, this study further examined the mechanism of the impact of corporate environmental disclosure on the accuracy of analysts' forecast from the two aspects of analyst coverage and analyst site visits.

6.1. Analyst Coverage

The explained variable in this study was analyst forecast error (FERROR). The explanatory variables included whether or not a corporate disclosed environmental information (Ed_dum), the number of environmental information items disclosed by the corporate (Ednum1), the number of environmental information items measured in the annual financial statements (EdMeasurementnum1), and the number of environmental information items disclosed in the special reports (EdDisclosurenum1). The intermediary variables were analyst coverage (Follow) and analyst site visit (Visit). The relationship between the three makes up the mediating effect model. Concerning the studies of Ye et al. [91], Liu and Ji [84], the following three models were designed to test whether the mediating effect exists.

$$\text{FERROR}_{ijt} = \alpha_0 + \alpha_1 x_{i,t-1} + \text{Control}_{it} + \varepsilon \tag{5}$$

$$M_{it} = \beta_0 + \beta_1 x_{i,t-1} + \text{Control}_{it} + \varepsilon \tag{6}$$

$$\text{FERROR}_{ijt} = \gamma_0 + \gamma_1 x_{i,t-1} + \gamma_2 M_{it} + \text{Control}_{it} + \varepsilon. \tag{7}$$

Among them, M_{it} is the intermediary variable, representing analyst coverage and analyst site visit. First, model (5) was used for regression to test the impact of corporate environmental disclosure on the accuracy of analysts' forecasts without adding intermediary variables. If $\alpha 1$ is significant, it indicates that there is a total effect of corporate environmental disclosure on the accuracy of analysts' forecasts. Second, the impact of corporate environmental information disclosure on the intermediary variables M_{it} (analyst coverage and analyst site visit) was tested in the next step of the analysis using model (6). Finally, based on model (5), the intermediary variable M_{it} was added to test model (7). If the coefficients β_1 of model (6) and γ_2 of model (7) are both significant, the mediating effect exists.

Existing studies have found that analyst coverage can alleviate the degree of internal and external information asymmetry [92], improve the transparency of corporate information [93], and improve the accuracy of analysts' forecasts. According to the practice of Chu et al. [88], this study used the logarithmic value of the number of analysts who follow a corporate every year to measure the analyst coverage (Follow), and the data were obtained from the CSMAR database. By substituting the analyst coverage (Follow) as the intermediary variable M_{it} into model (6) and model (7), if the coefficient $\alpha 1$ of model (5), the coefficient β_1 of model (6), and the coefficient γ_2 of model (7) are all significant, then the mediating effect is established. The regression results of model (5) are shown in columns (2) and (4) of Table 5, columns (2) and (4) of Table 6, and columns (1), (2), and (3) of Table 7. It indicates that there is a total effect of corporate environmental disclosure on the accuracy of analysts' forecasts. The regression results of model (6) and model (7) are shown in Tables 13 and 14. Columns (1), (3), (5), (7), (9), (11), and (13) are the regression results of model (6). From column (1) and column (3), it can be seen that the regression coefficients of Ed_dum and Ednum1 are significantly positive at the level of 1%, This shows that corporates that measure or disclose environmental information and corporates

with higher levels of measurement or disclosure have attracted more analysts' coverage. After further subdividing the form of environmental information disclosure and the three dimensions of "inconsistent words and deeds" such as "greenwashing" and "brownwashing", it was discovered that the regression coefficients of EdDisclosurenum1, the "match words to deeds" group, and the "brownwashing" group, are significantly positive at the 1% level, indicating that analysts are concerned about corporate disclosure (in the special reports) (see columns 5 and 7) as well as "match words to deeds" and "brownwashing" (see columns 9 and 13). Columns (2), (4), (6), (8), (10), (12) and (14) are the regression results of model (7). After adding analyst coverage (Follow), the regression coefficients of Ed_dum, Ednum1, EdDisclosurenum1, and EdDisclosurenum1 in the "brownwashing" group are all not significant (columns 2, 4, 8 and 14). Although the regression coefficient of EdDisclosurenum1 in the "match words to deeds" group is significant, it is smaller than that of EdDisclosurenum1 in column (1) of Table 7. It is clear that the analyst coverage (Follow) plays a completely or partially mediating role, that is, analysts pay more attention to the corporates that measure or disclose environmental information, have a higher degree of environmental information disclosure or measurement, have more disclosure in the special reports and those that "match words to deeds" and "brownwash", which significantly improves their forecast accuracy; however, there is not enough attention paid to "greenwashing" corporates, and "information screening" is not in place.

Table 13. The regression results for mediated effects of analyst coverage.

	(1) Follow	(2) FERROR	(3) Follow	(4) FERROR	(5) Follow	(6) FERROR	(7) Follow	(8) FERROR
	Full Sample		Sample Environmental Information Disclosure		Measurement		Disclosure	
Ed_dum	0.277 ***	0.218						
	(4.850)	(0.878)						
Follow		−2.288 ***		−2.261 ***		−2.337 ***		−2.180 ***
		(−20.721)		(−20.080)		(−19.244)		(−17.256)
Ednum1			0.108 ***	−0.117				
			(4.289)	(−1.121)				
EdMeasurementnum1					0.030	−0.044		
					(0.944)	(−0.262)		
EdDisclosurenum1							0.121 ***	−0.170
							(5.070)	(−1.610)
constant	2.178 ***	12.528 ***	2.251 ***	12.900 ***	2.462 ***	13.123 ***	2.258 ***	12.155 ***
	(14.456)	(19.780)	(15.871)	(19.562)	(16.278)	(17.901)	(15.178)	(18.232)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	210,384	210,384	189,426	189,426	160,467	160,467	160,243	160,243
Adj. R2	0.256	0.112	0.267	0.112	0.250	0.112	0.301	0.101

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

Table 14. The regression results for mediated effects of analyst coverage.

	(9) Follow	(10) FERROR	(11) Follow	(12) FERROR	(13) Follow	(14) FERROR
	"Match Words to Deeds"		"Greenwashing"		"Brownwashing"	
EdDisclosurenum1	0.197 **	−1.289 **	0.047	0.052	0.108 ***	−0.140
	(2.326)	(−2.467)	(0.996)	(0.114)	(4.265)	(−1.301)
Follow		−1.892 ***		−2.275 ***		−2.142 ***
		(−4.058)		(−11.160)		(−14.818)
constant	2.916 ***	10.474 ***	2.264 ***	12.824 ***	2.283 ***	11.384 ***
	(7.432)	(3.249)	(6.890)	(11.033)	(12.959)	(15.182)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	4689	4689	56,207	56,207	99,347	99,347
Adj. R2	0.592	0.359	0.785	0.114	0.316	0.110

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

6.2. Analyst Site Visit

An analyst site visit helps to improve analyst forecast accuracy [85]. For listed firms with low-quality financial reports and information disclosure, the "information mining" effect of an analyst site visit is more significant, and the effect of improving forecast accuracy is greater [94]. In this study, according to Cao et al. [94] and Luo and Li [95], the number of analysts' site visits was determined by a brokerage's visits to the corporates they follow, and the analysts' site visit variable was based on whether the number of the site visits was larger than 0. The variable was taken as 1 if the corporate has a site visit in the year, otherwise, it was taken as 0.

Substituting analyst site visit (Visit) as a mediating variable M_{it} into model (6) and model (7), the mediating effect holds if the coefficient α1 of model (5), coefficient $β_1$ of model (6), and coefficient $γ_2$ with model (7) are significant. The regression results of model (5) are shown in columns (2) and (4) of Table 5, columns (2) and (4) of Table 6, and columns (1), (2) and (3) of Table 7. It indicates that the total effect of corporate environmental disclosure on the accuracy of analysts' forecasts exists. The regression results of model (6) and model (7) are shown in Tables 15 and 16. Columns (1), (3), (5), (7), (9), (11), and (13) are the regression results of model (6). From column (1) and column (3), it indicates that the regression coefficient of Ed_dum is significantly positive at the 5% level, and the regression coefficient of Ednum1 is significantly positive at the 1% level. After further subdividing the form of environmental disclosure and the three dimensions of "inconsistent words and deeds" of environmental disclosure, the regression coefficient of EdDisclosurenum1 is significantly positive at the level of 1% (see column 7), and the regression coefficient of EdDisclosurenum1 in the "brownwashing" group is significantly positive at the level of 10% (see column 13), indicating that the analysts conducted site visit on the corporates of disclosure in the special reports and "brownwashing". Columns (2), (4), (6), (8), (10), (12), and (14) are the regression results of model (7). After adding the analyst site visit (Visit), the regression coefficients of EdDisclosurenum1 in Ed_dum, Ednum1, EdDisclosurenum1, "match words to deeds" group, and "brownwashing" group are all significantly negative at the 1% level (column 2, 4, 8, 10 and 14). The regression coefficients of EdMeasurementnum1 and EdDisclosurenum1 in the "greenwashing" group are negative but not significant. This indicates that the analyst site visit (Visit) has a partial intermediary role, that is, analysts conducting site visits to corporates that disclosed environmental information, had a higher level of environmental information disclosure, more disclosures in the special reports, and "brownwashing" then significantly improved their forecast accuracy by mining for undisclosed environmental information.

Table 15. Regression results for mediated effects of analyst site visit.

	(1) Visit	(2) FERROR	(3) Visit	(4) FERROR	(5) Visit	(6) FERROR	(7) Visit	(8) FERROR
	Full Sample		Sample Environmental Information Disclosure		Measurement		Disclosure	
Ed_dum	0.048 ** (1.980)	−0.226 *** (−4.212)						
Visit_dum		−0.167 *** (−3.945)		−0.216 *** (−4.945)		−0.169 (−0.961)		−0.373 *** (−7.745)
Ednum1			0.041 *** (−9.962)	−0.196 *** (−7.878)				
EdMeasurementnum1					0.001 (0.048)	−0.133 (−0.774)		
EdDisclosurenum1							0.005 *** (−3.951)	−0.054 ** (−2.250)
constant	0.660 *** (5.451)	7.808 *** (12.576)	0.648 *** (5.051)	7.921 *** (12.156)	0.642 *** (4.737)	7.495 *** (10.960)	0.647 *** (4.694)	7.311 *** (10.920)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	210,384	210,384	189,426	189,426	160,467	160,467	160,243	160,243
Adj. R2	0.158	0.039	0.149	0.030	0.137	0.028	0.153	0.032

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

Table 16. Regression results for mediated effects of analyst site visit.

	(9) Visit	(10) FERROR	(11) Visit	(12) FERROR	(13) Visit	(14) FERROR
	"Match Words to Deeds"		"Greenwashing"		"Brownwashing"	
EdDisclosurenum1	0.043	−1.670 ***	0.053	−0.454	0.019 *	−0.359 ***
	(0.685)	(−3.072)	(0.983)	(−0.993)	(1.908)	(−3.165)
Visit		0.184		−0.275		−0.165 **
		(0.206)		(−0.945)		(−2.326)
constant	1.095 ***	4.754	0.598 ***	8.125 ***	0.597 ***	6.770 ***
	(3.472)	(1.635)	(3.034)	(6.679)	(5.031)	(9.907)
Controls/ind/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	4689	4689	56,207	56,207	99,347	99,347
Adj. R2	0.541	0.312	0.115	0.043	0.201	0.041

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t-values for robust standard error are in parentheses.

7. Conclusions and Recommendations

Despite the extensive literature on the relationship between corporate environmental information disclosure and the accuracy of analysts' forecasts, the majority of this literature is based on a single aspect of corporate environmental information quality, ignoring the different characteristics (e.g., voluntary and mandatory disclosures coexist and are primarily voluntary) and varying quality (e.g., "greenwashing" or "brownwashing") of corporate environmental information in China. In terms of mechanism, they only highlight the role of analysts in transmitting high-quality environmental information, ignoring their screening of low-quality environmental information (such as "greenwashing") and their mining of undisclosed environmental information (such as "brownwashing").

Based on empirical evidence from China, this study provided a comprehensive portrayal of the different characteristics of corporate environmental disclosure behavior, verified the heterogeneous impact on analysts' forecast accuracy, and explored the role of "information screening" and "information mining" in the use of corporate environmental information by analysts. We found that corporates measure or disclose environmental information and, the more that is measured or disclosed, the more accurate analysts' forecasts are. The environmental information disclosed in the special report is positively and significantly correlated with analysts' forecast accuracy, whereas the environmental information measured in the annual financial statements is positively but not significantly related to analyst forecast accuracy. Environmental information disclosed in the special report is significantly and positively correlated with analysts' forecast accuracy when corporates "match words to deeds" and "brownwash", whereas it is positively but not significantly correlated with analysts' forecast accuracy when corporates "greenwash". Mechanism testing showed that analysts' coverage and analysts' site visits have a complete or partial mediating effect. Specifically, analysts' coverage is more likely to be elicited when corporates measured or disclosed environmental information, had a higher degree of measurement or disclosure, disclosed in the special report, "matched words to deeds" and "brownwashed". Analysts conducted site visits when corporates measured or disclosed environmental information, had a higher level of measurement or disclosure, disclosed in the special reports, and "brownwashed".

The contributions of this study mainly reflect the following three points: First, it broadens the analytical paradigm of existing literature on the relationship between the disclosure of non-financial information and the accuracy analyst forecasts. We examined the impact of corporate environmental disclosure behavior on analyst forecast accuracy from two perspectives: the characteristics of corporate information disclosure behavior and the "information screening"/"information mining" of analysts. Second, it constructed a more comprehensive dimension of the corporate environmental information disclosure index. By manually collecting environmental information measured in the annual reports, especially the financial statements of listed firms in China's heavy pollution industries

by setting keywords and combining it with the number of "environment and sustainable development" items in the CSMAR CSR database, it constructed a more objective and verifiable environmental information indicator. Third, it expanded the theory of organizational disclosure. We considered the impact of environmental information disclosure on analysts' forecast accuracy based on the Chinese context, which has different characteristics and qualities.

The research conclusions of this study are consistent with existing research findings and have a complementary role. On one hand, it expands the understanding of the economic consequences of corporate environmental information disclosure behavior in the context of China's new era and unique institutional framework. It has a supporting and guiding role in understanding the practice of corporate environmental information disclosure, promoting sustainable economic development in China, and building a modern harmonious coexistence between humans and nature. On the other hand, analysts are important intermediaries in the capital market and can play a role in conveying and mining corporate-specific information, thereby alleviating information asymmetry in the market, promoting the transformation of the market from weak form efficiency and semi-strong form efficiency to strong form efficiency, and improving market efficiency.

In addition, it has important practical insights for governments and corporates around the world, for the objective evaluation of the effectiveness of corporate environmental information disclosure in improving the information environment in the capital market, and for the in-depth understanding of the role of analysts in it. First, the government should continue to strengthen environmental information disclosure publicity and education, popularize the role of environmental information disclosure in promoting environmental protection, make heavy polluters aware of the importance of environmental information disclosure, and increase incentives for good environmental protection corporates as well as inspectors and penalties for corporates that exhibit "inconsistent words and deeds". Second, listed firms should voluntarily and promptly disclose environmental information, neither exaggerate nor understate the disclosure of environmental information and "match words to deeds", in order to truly reflect the environmental behavior of corporates, to improve the quality of corporate environmental information, to enhance external stakeholders' awareness of the environmental performance of enterprises, to enhance investor confidence, and to maintain the stability of corporate market value. Third, the construction of an environmental information system requires not only the environmental protection construction of corporates themselves but also the participation of other intermediaries in the market, such as analysts. Analysts should pay attention to the status of corporate environmental information disclosure and behavioral characteristics promptly, strengthen their ability to screen and mine environmental information, harmonize "listening to their words" and "seeing their actions", give full play to their important role in the capital market, and improve the market information environment. Fourth, investors can use analysts to obtain incremental information on corporate environmental responsibility fulfillment and future development using specialized reports such as social responsibility reports, environmental reports, and ESG reports, as a way to improve investment decisions and portfolios.

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