The impact of ESG rating uncertainty on green investors

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Abstract. As global awareness of sustainable development grows, the role of ESG ratings in capital markets has become increasingly prominent. However, the issue of information asymmetry caused by rating discrepancies requires urgent attention. This study uses Chinese listed companies as a sample to investigate the impact of ESG rating discrepancies on green investors. The findings indicate that ESG rating discrepancies significantly inhibit the entry of green investors, and this conclusion remains robust after testing using lag models, variable substitution, and instrumental variable methods. Mechanism analysis indicates that information asymmetry and corporate risk are the core transmission pathways: rating discrepancies exacerbate market information chaos, elevate corporate risk levels, and prompt green investors to adopt avoidance strategies. Heterogeneity tests show that state-owned enterprises are more significantly affected, and companies in heavily polluting industries face more pronounced negative impacts. This study expands the research boundaries of ESG rating discrepancies and recommends that regulatory authorities standardize rating criteria, companies improve the quality of information disclosure, and financial institutions optimize green risk assessment systems to promote the healthy development of the green financial market.

Keywords: ESG rating uncertainty; Green investor; Information asymmetry; Enterprise risk.

1. Introduction

With the deepening of ESG (Environmental, Social and Corporate Governance) concepts globally, especially after China's "2030 carbon peak" and "2060 carbon neutral" targets, ESG has become a topic of focus for regulators. Regulators and stock exchanges in various countries have launched relevant policies to strengthen ESG disclosure management of listed companies, and ESG concepts have gradually become not only a consensus in the industry, but also a key indicator for investors to assess the quality of companies.

As early as 2004, the United Nations Global Compact (UNGC), the world's largest international organisation promoting CSR, first proposed the concept of ESG in its report "Who Cares Wins: Connecting Financial Markets to a Changing World". report, proposed the ESG concept for the first time. Although the regulatory requirements for disclosure of ESG reports of listed companies vary from country to country, it is undeniable that disclosure of ESG reports has become an international trend.On 28 November 2022, the EU adopted the Corporate Sustainability Reporting Directive (CSRD), followed by the approval of the Corporate Sustainability Due Diligence Directive (CS3D or (CS3D or CSDD) on 15 March 2024, which is known as the EU's "new ESG regulation". These two directives not only cover the control of enterprises in the supply chain, but also mandate information disclosure, and their scope of influence even extends to third-country enterprises that meet the EU's regulatory conditions.

In China, the capital market's attention to ESG also continues to rise. Since 2018, when the China Securities Regulatory Commission (CSRC) issued the Code of Governance for Listed Companies, the basic framework for ESG disclosure has been clarified for the first time. Subsequently, the Guidelines for the Construction of Green Financial System jointly issued by seven ministries and commissions further promoted green investment and constructed a more complete green financial system.20 The White Paper on China's ESG Development released in December 2020 was also aimed at promoting responsible investment and improving the ESG evaluation system of Chinese enterprises.2023 In July 2023, the General Office of the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council issued a circular on central-owned

holding listed companies' In July 2023, the General Office of the State-owned Assets Supervision and Administration Commission of the State Council issued a notice on the research on the preparation of special ESG reports for listed companies held by central enterprises and published the project results, which provided valuable suggestions and references for the preparation of ESG reports for listed companies held by central enterprises.2024 In April 2024, the Shanghai Stock Exchange, Shenzhen Stock Exchange and Beijing Stock Exchange simultaneously issued the "Guidelines for Sustainability Reporting of Listed Companies", which provides clearer requirements and norms for ESG disclosure of listed companies. This will help raise the importance of ESG disclosure by listed companies, and thus better promote the sustainable development of China's economy and society.

Due to the lack of clear standardised rating criteria, there are inevitable differences in the ESG ratings of Chinese companies (Hu et al., 2023)[1] . Some scholars have explained the root causes of these differences. One is the technical perspective, which is based on three sources: differences in subject coverage, differences in indicator measurement, and differences in weights (Berg et al., 2022)[2] . For example, the FTSE Russell ESG ratings have 14 major themes and more than 300 indicators under three dimensions, but Allied Wave's ESG ratings include three primary indicators, 28 key questions, and about 400 underlying ESG data structures. The second is the difference between the rating agencies themselves. As rating agencies have different cognitive models and value judgements, ESG evaluations of companies are also subjective. For example, in 2023, the ESG rating of a listed company in China's photovoltaic industry named JinkoSolar (listing code 688223) was A in WIND's ESG rating, BBB in CSI's ESG rating, and A- in ShangDao RongLu's ESG rating.

In recent years, with the establishment and soundness of the green financial system and the in-depth implementation of the sustainable development strategy, green institutional investors have taken a series of actions in green finance.The 2016 Guiding Opinions on the Construction of a Green Financial System and the 2035 Vision proposed by the Fifth Plenary Session of the 19th CPC Central Committee have emphasised the importance of green finance and green production and lifestyle, which has provided policy support and directional guidance for the green investor's development, providing policy support and directional guidance. Through comprehensive consideration of economic, social and environmental factors, green investors prompt enterprises to actively undertake social responsibility while pursuing economic benefits, and ultimately realise both economic and social values (Barnea et al., 2005)[3] . Green investors not only pay attention to the economic benefits of enterprises, but also focus on the environmental and social benefits of enterprises.The uncertainty of ESG ratings has begun to attract the attention of the financial market, which brings new challenges to green investors.ESG ratings reduce the information asymmetry between enterprises and investors, but the existence of the uncertainty of ESG ratings alters the validity of the ESG ratings, and increases the difficulty of the information discernment (Chatterji et al. 2016)[4] . Currently, a number of studies have argued that the presence of ESG rating disagreement increases the risk of holding a company's stock, affects the liquidity of the stock, reduces the demand for the stock, and leads to a higher risk premium, which significantly reduces stock returns (Avramov et al. 2022; Brandon et al. 2021; Wang et al. 2024)[5-7] . Meanwhile, Avramov et al. (2022)[5] and Wang et al. (2024)[7] confirm that ESG rating divergences make it difficult for investors to make effective comparisons and evaluations, leading to greater investment risk and affecting investor sentiment, which significantly reduces investor engagement.

Institutional investors are dominant and experienced investors in financial markets and are highly sensitive to news (Chen et al., 2020; Covrig et al., 2006)[8, 9] . Second, institutional investors have been flourishing in China's capital market. They play a role not only in resource allocation but also in value guidance (Sun et al., 2015)[10] . Green investors, as a kind of institutional investors, are more sensitive to companies' ESG information. Although there have been some studies on the relationship between ESG ratings and institutional investors (Bai et al. 2022; Bazrafshan, 2023; Chen et al. 2023; Li and Wu, 2024)[11-14] , ESG rating disagreement has not been taken into account and the specific impact of ESG rating disagreement on green investors has not been examined. Therefore, this study

examines the impact of ESG rating divergence on green investors in the Chinese financial market from the perspective of ESG rating divergence.

2. Theoretical analysis and research hypothesis

Institutional investors belong to a special group of financial institutions that centralise the savings of small investors and maximise investment returns within acceptable risk and time horizons (Davis and Steil, 2001)[15] , in the process, institutional investors help to improve corporate governance and enhance the quality of corporate disclosure (Tan, Jinsong, and Lin, Yuchen, 2016)[16] . Based on the social investment theory, compared with general institutional investors, green investors, as the main body of socially responsible investment, aim to choose socially responsible investment, guide enterprises to implement green concepts into social behaviours such as cleaner operations, and prompt enterprises to pay more attention to social responsibility and public interest while pursuing economic interests. Stakeholder theory states that enterprises should take the initiative to assume social responsibility and fulfil social responsibility for stakeholders (Brown and Forster, 2013)[17] . At the same time, firms should be concerned about the environment and society when pursuing economic benefits (Baker, 2015; Khalili, 2011)[18, 19] .

In the last decades, ESG has become the main criterion for building optimal portfolios (Chibane and Joubrel, 2024)[20] . Most studies show that ESG factors have a positive impact on investment performance (Broadstock et al. 2021; Kappou and Oikonomou, 2016; Park and Lee, 2018)[21-23] . The end-users of ESG ratings are the investors, and green investors use ESG ratings as a source of objective data to ensure that their money is flows to companies with good CSR, as increasingly demanded by their limited partners (Amel-Zadeh and Serafeim, 2018)[24] . However, as Dimson et al. (2020)[25] and Berg et al. (2022)[2] point out, in contrast to credit ratings, ESG ratings strongly diverge among leading ESG organisations for a number of reasons: the weighting, scope and methodology of each metric often vary from one organisation to another. Therefore, obtaining ESG ratings in isolation is not sufficient to improve portfolio performance.

According to information asymmetry theory, buyers are generally at an information disadvantage when the information held by the two sides of the market differs significantly, which makes it difficult for them to distinguish between the quality of products and thus influences their economic behaviour. Green investors often use ESG ratings as an important investment reference (Pástor et al., 2021; Bauer et al., 2021)[26, 27] . When confronted with divergent ESG ratings, they can be confused in their decision-making. For green investors, the validity of ratings is reduced when there are differences in ratings between ESG rating agencies. Companies may know more about their ESG-related information than green investors do, and green investors may not be able to determine the true information about ESG ratings.ESG rating disagreements may make green investors less trusting of the overall ESG rating system. If they perceive the rating results as unreliable, they will be more cautious in entering the green investment market. To circumvent this uncertainty, green investors may choose to avoid investing in companies with large ESG rating divergences.The more severe the ESG rating divergences, the more severe the information asymmetry is likely to be, and the more likely it is that green investors will flee the capital markets. Effective capital market functioning relies on reliable disclosures, but investors' utilisation of these disclosures is affected by information processing costs (Blankespoor, 2019; Barber et al. 2022; Ozik et al. 2021)[28-30] . Based on these studies, in the information processing process, green investors need time, effort and resources to understand the news, access it and integrate it into their trading decisions.ESG ratings disagreement increases analysts' information processing costs (Zhou, Ze, et al., 2023)[31] , and these additional costs affect the cost-effectiveness of investments. Investors will reduce the size of their investment if they perceive that the increased costs to cover the risks associated with ratings divergence are too high. In addition, green investors may have to pay a higher risk premium when entering the market due to increased market uncertainty caused by rating disagreement (Dunbar et al., 2023)[32] . If firms' ESG ratings are divergent, investors may demand higher yields to compensate for possible ESG risks,

which also increases the cost of investment, which in turn affects green investors' willingness to enter and the scale of entry. When there is significant divergence in a firm's ESG ratings, this may trigger questions and concerns from the media and the public. Such questioning and concern may damage the image and reputation of the company, which in turn affects its market position and competitiveness. For green investors, they are more inclined to invest in companies that have a good green reputation. Therefore, ESG rating divergence may reduce the attractiveness of firms in the minds of green investors. Accordingly, the hypotheses of this paper are proposed:
H1: High ESG rating divergence is negatively associated with green investor entry

3. Data sources, variable selection, and model design

3.1. Data sources

In order to systematically examine the impact of ESG rating divergence on corporate green investor behaviour, this paper selects all corporate data of Chinese listed companies between 2015 and 2023 as the initial research sample. The corporate ESG ratings data come from WIND ESG ratings, Huazhou ESG ratings, Allied Wave FIN-ESG ratings, and Shangdao Ronggreen ESG ratings agencies, which have their own characteristics in the design of the index system, scoring methodology, and data collection methodology, and are able to more comprehensively reflect the mainstream views of the current Chinese ESG ratings market. By comparing the differences in ESG ratings of different agencies for the same company, the core variables to measure the divergence of ESG ratings are constructed. The rest of the firms' data comes from the CSMAR database and the CNRDS database. In addition, the data in this paper are processed as follows:(1) Easy to exclude ST and *ST type of firms. (2) Excluding financial industry enterprises. (3) Excluding enterprises with missing data. (4) In order to exclude the influence of some extreme data, all continuous variables are treated by shrinking the tail at 1% and 99% quantile. After data cleaning, 12,153 observations are finally obtained, covering a wide range of industries and regions, with good representativeness and statistical validity.

3.2. Variable selection

(1) Explained variable: green investors (lnGI)

As a key force to promote corporate green transformation, the entry behaviour of green investors directly reflects the market's recognition of corporate ESG ratings. As the core explanatory variable of this study, the measurement of green investors is based on the research method of Wang Hui et al. (2022)[33] , which is as follows: Firstly, the "fund subject information table" and "stock information table" are extracted from the "fund market series" module of the Cathay Pacific database, and the "fund subject information table" and "stock information table" are extracted from the "fund market series" module of the Cathay Pacific database. Firstly, "fund body information table" and "stock investment details table" are extracted from the "fund market series" module of Cathay Pacific database, and matched to obtain the details of listed company stocks held by each fund. Subsequently, the investment objectives and investment scope of the funds are analysed to identify whether they include "environmental protection", "ecology", "green", "new energy development", "new energy development" and "new energy development". energy development", "clean energy", "low carbon", "sustainable development", "energy saving" and so on. " and other keywords. If the above terms appear in the investment description of a fund, it is defined as a green investment fund and the enterprise is considered to have green investors; otherwise, it is regarded as a traditional investment fund with no green investors. In this paper, the number of green investors is taken as the natural logarithm after adding 1, which is to construct the final explanatory variable - the number of green investors (lnGI).

(2) Explanatory variables

The relevant data of ESG rating divergence are from WINDESG rating, Huazhou ESG rating, Allied Wave FIN-ESG rating, and Shangdao Ronggreen ESG rating index. In this paper, we draw on

the practice of Tai-Ming Ho et al. (2023)[34] to calculate the standard deviation of the ESG rating scores of the four types of indicators, so as to obtain the data of ESG rating divergence ESGdif4 . The standard deviation, as an indicator of the degree of dispersion, can effectively quantify the degree of divergence in the rating results of different agencies. The larger the value, the more significant the difference in the market's evaluation of corporate ESG performance. The method avoids the bias caused by subjective assignment and provides a quantitative basis for reflecting the lack of market consensus on rating divergence with objective data.

(3)Control Variables

In this paper, we refer to Wang Hui et al. (2022)[33] , Zhou and Jin (2023)[35] , and Hao et al. (2025)[36] , and select age of the firm (Age), size of the firm (Size), gearing ratio (LEV), proportion of fixed assets (PPE), Tobin's Q (TobinQ), growth rate of operating income (Growth), Dual (Dual), Board (Board), Balance (Balance), Executives' Green Perception (EGP), and Nature of Equity (SOE) as control variables. Among them, Executive Green Perception (EGP) refers to Li Yabing et al. (2022)[37] for the measurement of Executive Green Perception, and adopts the text analysis method to analyse the annual reports of listed companies, and constructs the keywords based on the three dimensions of Green Competitive Advantage Awareness, Corporate Social Responsibility Awareness, and External Environmental Pressure Awareness. The variables of listed company executives' environmental cognition are constructed through the frequency of the above words appearing in the company's annual report. The variable definition table is shown in Table 1.

Table 1. Variable definition table

Variable Nature	Variable name	Variable Symbol	Variable Definition
Explained Variable	Green Investor	lnGI	Number of Green Investors + 1 taking logarithm
Explanatory Variables	ESG rating divergence	ESGdif4	Standard deviation of ratings from four ESG rating agencies
Control Variables	Firm Age	Age	Natural logarithm of the number of years the firm has been listed
	Size	Size	Natural logarithm of total assets
	Gearing Ratio	LEV	Total Liabilities/Total Assets
	Fixed Asset Ratio	PPE	Fixed Assets/Total Assets
	TobinQ	TobinQ	Enterprise market value / asset replacement cost
	Revenue Growth	Growth	Current year's operating income/previous year's operating income-1
	Dual Employment	Dual	If the chairman and general manager are the same person, the value is 1, and vice versa is 0.
	Number of Directors	Board	The natural logarithm of the number of board members
	Balance	Balance	Shareholding of the second largest shareholder / Shareholding of the first largest shareholder
	Executive Green Perception	EGP	Frequency of "green" keywords in company annual reports
	Nature of Shareholding	SOE	1 for state-owned, 0 otherwise

3.3. Model design

In order to examine the impact of ESG rating differences on green investors, the following model is used to test the research hypotheses. Control variables are introduced in the model to control both industry and year effects, denoted as Controls.ε in the model denotes the random disturbance term.

$$lnGI = \beta_0 + \beta_1 ESGdif4 + \gamma Controls + \sum Year + \sum Industry + \varepsilon \quad (1)$$

4. Analysis of the empirical results

4.1. Baseline regression analysis

4.1.1 Descriptive statistics

The results of descriptive statistics are shown in Table 2. The mean value of green investors (lnGI) in the whole sample is 0.6504, the median value is 0, and the maximum value is 4.39, which can be seen from the indicators that the number of green investors is still low in China, and the median value is 0, which indicates that more than half of the enterprises don't have any green investor, reflecting that China's green investment market is still in the early stage of development, and the threshold for enterprises to obtain green capital is high. ESG rating divergence (ESGdif4) has a mean value of 1.03, a median value of 1.01 and a standard deviation of 0.51, indicating that the degree of rating divergence is medium and the distribution is basically symmetrical; however, the difference between the maximum value of 1.86 and the minimum value of 0.30 is significant, reflecting that different enterprises are facing greater differences in ESG information transparency. However, the difference between the maximum value of 1.86 and the minimum value of 0.30 is significant, reflecting that different enterprises face greater differences in ESG information transparency. The mean value of enterprise size (Size) is 21.97 and the median value is 21.80, indicating that the sample is dominated by medium-sized enterprises. The mean value of LEV is 0.37 and the median is 0.36, indicating that the overall debt level is moderate. The mean value of Tobin's Q (TobinQ) is 1.87, which is higher than 1, indicating that the market value of the sample firms is generally higher than the replacement cost of assets, and that the growth is better. Executive Green Perception (EGP): Mean value 3.01, median 2, standard deviation 3.21, indicating that there are significant differences in the attention paid by executives to "green" issues, with no mention of "green" in the annual reports of some companies (minimum value 0), and the frequency of mentioning in the annual reports of the headline companies is up to 10 times, reflecting the management's ESG awareness. (minimum value 0), while the frequency of mentioning "green" in the annual reports of the top companies reaches 10 times, reflecting that management's awareness of ESG is uneven. The mean value of the nature of equity (SOE) is 0.137, which means that state-controlled enterprises account for about 13.7%, and non-state-owned enterprises predominate.

Table 2. Descriptive statistics results

VarName	Obs	Mean	SD	Min	Median
lnGI	12153	0.6504	0.907	0.0000	0.00
ESGdif4	12153	1.0287	0.507	0.3001	1.01
Age	12153	1.6309	0.611	0.6931	1.61
Size	12153	21.9744	0.928	20.8947	21.80
LEV	12153	0.3746	0.168	0.1540	0.36
PPE	12153	0.1824	0.131	0.0001	0.16
TobinQ	12153	1.8746	0.708	0.9998	1.66
Growth	12153	0.1202	0.204	-0.2105	0.11
Dual	12153	0.4060	0.491	0.0000	0.00
Board	12153	2.0904	0.127	1.9459	2.20
Balance	12153	0.4111	0.280	0.0040	0.34
EGP	12153	3.0118	3.207	0.0000	2.00
SOE	12153	0.1371	0.344	0.0000	0.00

4.1.2 Main regression analysis

The results of the main regression show that the core explanatory variable ESG rating divergence (ESGdif4) has a significant inhibitory effect on the explanatory variable green investors (lnGI) after controlling for firm age, size, financial status, and corporate governance.The regression coefficient of ESGdif4 is -0.039 and significant at the 1% level (t-value = -2.937), implying that the ESG rating divergence increases by one unit, the logarithm of the number of green investors will decrease by 0.039 units on average, which is consistent with the results of the correlation analysis, and further verifies the theoretical hypothesis that ESG rating divergence inhibits the entry of green investors by exacerbating information asymmetry, interfering with signaling, and enhancing the perception of corporate risk.

Table 4. Lagged one-period regression results

	(1)
VARIABLES	lnGI
ESGdif4	-0.039***
	(-2.937)
Age	-0.556***
	(-45.996)
Size	0.562***
	(61.864)
LEV	-0.525***
	(-11.200)
PPE	-0.203***
	(-3.456)
TobinQ	0.362***
	(33.656)
Growth	0.347***
	(9.822)
Dual	0.052***
	(3.719)
Board	0.004
	(0.077)
Balance	-0.012
	(-0.503)

EGP	0.003
	(1.373)
SOE	-0.154***
	(-7.215)
Year FE	YES
Industry FE	YES
Constant	-11.512***
	(-44.191)
Observations	12,153
R-squared	0.359

Note: Values of t are in parentheses, *, **, and *** indicate that the test passes at 10%, 5%, and 1% significance levels, respectively.

4.2. Robustness test

4.2.1 One period lag

The empirical results in Table 3 confirm that ESG rating divergence inhibits the attraction of green investors into the country, considering the possibility of bidirectional causality or contemporaneous correlation between the core explanatory variables and the explanatory variables, which leads to estimation bias and endogeneity problems. For example, changes in green investors may not only be affected by ESG rating divergence in the current period, but may also in turn affect firms' future ESG governance strategies and disclosure quality. To mitigate this problem, this paper adopts a lagged one-period model in which the core explanatory variable ESGdif4 is lagged one period in order to reduce the estimation bias due to reverse causation and improve the causal identification ability of the model. This paper further introduces the lagged effect of ESG rating divergence in the regression model to test the persistent impact of ESG rating divergence on corporate green investor entry, and the specific impact effects are shown in Table 4. In terms of the core variables, ESGdif4 has a coefficient of -0.044 in the lagged one-period regression with a significance level of 1% (t=-3.380), which is not only in the same direction as the negative coefficient of -0.039 in the main hypothesis test, but also increases in absolute value by 12.8%, which is a further increase in significance. This result suggests that the inhibitory effect of ESG rating divergence on the entry of green investors not only exists in the current period, but also presents a lagged cumulative characteristic. The economic logic lies in the fact that green investors need more time to collect information and assess the true ESG performance of firms in the face of rating disagreement, which leads to the negative impact of disagreement to be further manifested in the subsequent period. The robustness test of control variables shows that among the nine variables that are significant in the main hypothesis test, eight variables (firm age Age, firm size Size, gearing LEV, etc.) maintain the consistency of the direction of the coefficients with the significance level in the lagged one-period regression. In summary, the lagged one-period regression results further verify that the inhibitory effect of ESG rating divergence on green investor entry has cross-period persistence, and the findings are robust and reliable.

Table 4. Regression results of main hypothesis testing

	(1)
VARIABLES	lnGI
ESGdif4	-0.039***
	(-2.937)
Age	-0.556***
	(-45.996)
Size	0.543***
	(59.819)
LEV	-0.300***
	(-6.350)
PPE	0.071
	(1.209)
TobinQ	0.421***
	(39.731)
Growth	0.439***
	(12.453)
Dual	0.060***
	(4.286)
Board	-0.028
	(-0.512)
Balance1	0.003
	(0.139)
EGP	0.001
	(0.493)
SOE	-0.180***
	(-8.395)
Year FE	YES
Industry FE	YES
Constant	-11.519***
	(-45.020)
Observations	8,950
R-squared	0.407

Note: Values of t are in parentheses, *, **, and *** indicate that the test passes at 10%, 5%, and 1% significance levels, respectively.

4.2.2 Replacement of explanatory variables

In order to verify whether the inhibitory effect of ESG rating divergence on green investor entry is dependent on the number of rating agencies, this paper adopts another measure to construct a new indicator of ESG rating divergence, ESGdif6 (based on 6 rating agencies), on the basis of the original core explanatory variable, ESGdif4 (based on 4 rating agencies). agencies), and robustness tests are conducted by expanding the coverage of rating agencies. Data from six mainstream ESG rating agencies are selected, including: WIND ESG ratings, CSI ESG ratings, Allied Wave FIN-ESG ratings, Shangdao Ronggreen ESG ratings, FTSE Russell ESG ratings, and Runling Global ESG ratings indicators. On this basis, after standardising the corporate ESG ratings given by each agency, the standard deviation at the corporate level is calculated as a new ESG rating divergence indicator - ESGdif.6 The larger the value of this indicator, the greater the difference in the evaluation of corporate ESG performance by different rating agencies.

As shown in Table 5, the ESGdif6 coefficient is -0.022 (t=-2.175), which is significantly negatively correlated at the 5% level, indicating that for every 1-unit increase in ratings divergence, green investors decline by 2.2%. This result is consistent with the sign and significance of the main

regression (ESGdif4 coefficient of -0.039), a result that is consistent with the core conclusions drawn from using ESGdif4 in the main regression. This suggests that even if the measure of ESG rating divergence is replaced, its negative impact on firms' green capital allocation remains, further validating the robustness of the study's findings.

Table 5. Results of regression with replacement of explanatory variables

	(1)
VARIABLES	lnGI
ESGdif6	-0.022**
	(-2.175)
Age	-0.319***
	(-13.444)
Size	0.374***
	(14.853)
LEV	-0.464***
	(-5.605)
PPE	-0.437***
	(-3.914)
TobinQ	0.261***
	(19.594)
Growth	0.336***
	(11.680)
Dual	0.035
	(1.625)
Board	0.154
	(1.616)
Balance	-0.051
	(-0.964)
EGP	0.001
	(0.171)
SOE	-0.128***
	(-2.783)
Year FE	YES
Industry FE	YES
Constant	-7.589***
	(-13.581)
Observations	12,153
Number of Scode	3,045
R-squared	0.090

Note: Values of t are in parentheses, *, **, and *** indicate that the test passes at 10%, 5%, and 1% significance levels, respectively.

4.3. Test for the mediating effect of information asymmetry

When rating agencies disagree on corporate ESG performance, it is difficult for investors to accurately judge the extent to which corporations are actually fulfilling their social responsibilities, thus weakening the stability of their cooperation. This rating disagreement directly exacerbates the problem of information asymmetry, so that investors have to bear higher information screening and verification costs. From the perspective of stakeholder theory, ESG rating divergence reflects the inconsistency of information conveyed by companies in their interactions with regulators, communities, consumers and other parties. For example, rating discrepancies on environmental

dimensions may reveal deviations between a firm's actual performance in pollution management or carbon reduction and its disclosed data. The lack of transparency prevents investors from accurately assessing the impact of these deviations on a firm's long-term value, which in turn raises their level of perceived risk. This is especially true for green investors, whose investment decisions depend on the reliability of ESG information. Uncertainty caused by rating disagreements directly affects their judgement and behaviour, which may lead to a decrease in willingness to invest or a delay in investment decisions. As Akerlof (1970) pointed out in the "lemon market" theory, information asymmetry will lead to reduced market efficiency and increased transaction costs. In the context of ESG investment, investors need to devote more resources to information verification in order to verify the true performance of companies, which further raises the investment threshold. In addition, according to signalling theory, ESG rating divergence itself is a negative signal. Regardless of whether the disagreement stems from inadequate disclosure of information or different standards of different rating agencies, it sends a signal to the market that "corporate ESG performance is uncertain". This ambiguity strengthens investors' risk aversion and reduces their trust in the companies concerned, which may ultimately inhibit the effective allocation of green capital.

In summary, divergent ESG ratings can indirectly inhibit the entry of green investors by exacerbating the information asymmetry between firms and investors. This paper constructs information asymmetry indicators based on the construction methods of Song Min et al. (2021)[38] and Yu Wei et al. (2012)[39] . Firstly, three stock liquidity indicators are constructed: liquidity ratio indicator LR, illiquidity ratio indicator ILL, and yield inversion indicator GAM, and the worse stock liquidity means the higher degree of information asymmetry. Then LR, ILL, and GAM are subjected to principal component analysis to construct the information asymmetry (ASY) composite indicator. The measurement methods are respectively.

$$\mathrm{LR_{it}} = -\frac{1}{\mathrm{D_{it}}}\sum_{\mathrm{k=1}}^{\mathrm{D_{it}}}\sqrt{\frac{\mathrm{V_{it}(k)}}{|\mathrm{r_{it}(k)}|}} \tag{2}$$

$$\mathrm{ILL_{it}} = \frac{1}{\mathrm{D_{it}}}\sum_{\mathrm{k=1}}^{\mathrm{D_{it}}}\sqrt{\frac{|\mathrm{r_{it}(k)}|}{\mathrm{V_{it}(k)}}} \tag{3}$$

where$\mathrm{r_{it}(k)}$ denotes the stock return on the kth trading day of year t of firm i,$\mathrm{V_{it}(k)}$ denotes the daily turnover, and $\mathrm{D_{it}}$ denotes the number of trading days in the year. The yield reversal indicator$\mathrm{GAM_{it}} = |\gamma_{it}|$, where the coefficientγ_{it} is estimated by the following equation:$\mathrm{r_{it}^{e}(k)} = \theta_{it} + \varphi_{it}\mathrm{r_{it}(k-1)} + \gamma_{it}\mathrm{V_{it}(k-1)sign[r_{it}^{e}(k-1)]} + \varepsilon_{it}\mathrm{(k)}$, where$\mathrm{r_{it}^{e}(k)} = \mathrm{r_{it}(k)} - \mathrm{r_{mt}(k)}$ is the excess return and$\mathrm{r_{mt}(k)}$ denotes the market return weighted by market capitalisation.

According to the results in Table 6, the coefficient of ESGdif4 is -0.039 (t=-2.937), which is significantly negatively correlated, indicating that ESG rating disagreement directly inhibits the entry of green investors. the coefficient of ESGdif4 on information asymmetry (ASY) is 0.019 (t=2.625), which is significantly positively correlated, indicating that the ESG rating disagreement significantly exacerbates information asymmetry between firms and investors. asymmetry.For every 1 unit increase in ESGdif4, the ASY indicator rises by 0.019 units. Column (3) shows that the coefficient of ASY is -0.616 (t=-37.042), which is significantly negatively correlated, indicating that information asymmetry significantly inhibits the entry of green investors; the coefficient of ESGdif4 is -0.039 (t=-3.113), which is significantly negatively correlated, indicating that there is a partially mediating effect of information asymmetry in the relationship between ESG ratings divergence and the entry of green investors. both directly inhibits green investors and indirectly has a negative effect by exacerbating information asymmetry.

Table 6. Information asymmetry mediation effect test

	(1)	(2)	(3)
VARIABLES	lnGI	ASY	lnGI
ASY			-0.616***
			(-37.042)
ESGdif4	-0.039***	0.019***	-0.039***
	(-2.937)	(2.625)	(-3.113)
Age	-0.556***	0.341***	-0.534***
	(-45.996)	(16.526)	(-46.555)
Size	0.562***	-0.457***	0.284***
	(61.864)	(-35.413)	(24.829)
LEV	-0.525***	0.534***	-0.376***
	(-11.200)	(12.636)	(-8.431)
PPE	-0.203***	0.241***	-0.091
	(-3.456)	(4.209)	(-1.628)
TobinQ	0.362***	-0.253***	0.161***
	(33.656)	(-35.126)	(13.948)
Growth	0.347***	-0.094***	0.266***
	(9.822)	(-6.221)	(7.910)
Dual	0.052***	-0.018	0.036***
	(3.719)	(-1.616)	(2.663)
Board	0.004	0.163***	0.028
	(0.077)	(3.367)	(0.541)
Balance	-0.012	0.076***	0.001
	(-0.503)	(2.845)	(0.035)
EGP	0.003	-0.003*	0.005**
	(1.373)	(-1.894)	(2.373)
SOE	-0.154***	0.071***	-0.095***
	(-7.215)	(3.019)	(-4.671)
Year FE	YES	YES	YES
Industry FE	YES	YES	YES
Constant	-11.512***	9.408***	-5.643***
	(-44.191)	(28.429)	(-19.236)
Observations	12,153	12,153	12,153
R-squared	0.359	0.365	0.424

Note: Values of t are in parentheses, *, **, and *** indicate that the test passes at 10%, 5%, and 1% significance levels, respectively.

4.4. Heterogeneous effect of ESG rating uncertainty on green investment

4.4.1 Test for heterogeneity of enterprise property rights

The nature of corporate property rights is an important basis for investors' decisions. First, state-owned enterprises (SOEs) indicate that firms are linked to the government, which is important for business operations in China (Wu et al., 2016)[40] . Firms that are closely linked to the government have more economic information, which exacerbates the information gap between business operators and business investors in terms of ESG ratings. Compared to non-state-owned firms, investors need more insight to make investment decisions when faced with ESG rating divergence of state-owned firms. To investigate whether the effect of ESG rating disagreement on green investor entry varies by the nature of corporate ownership, this study conducts group regressions based on corporate ownership attributes (SOE=1 for state-owned firms and SOE=0 for non-state-owned firms) and tests the significance of the difference in coefficients between the groups by Chow Test. The results in

Table 7 show that the inhibitory effect of ESG rating divergence (ESGdif4) on the logarithm of the number of green investors (lnGI) is significantly different across firms with different ownership properties, revealing the moderating effect of institutional context on the effectiveness of ESG information.

In non-state-owned enterprises (SOE=0), the coefficient of ESG rating divergence (ESGdif4) is -0.027 (t=-1.897), which is significantly negative at the 10% level. This suggests that for every 1 unit increase in ESG rating divergence of NEMs, the size of green investor entry decreases by approximately 2.7 per cent. Non-state-owned firms face stronger competitive market pressures, green investors are more sensitive to uncertainty about their ESG performance, and rating disagreement may exacerbate information asymmetry and lead to investor caution. In SOEs (SOE=1), the coefficient of ESG rating divergence (ESGdif4) is -0.078 (t=-2.111), which is significant at the 5% level, and the absolute value of the coefficient is 2.89 times higher than that of non-SOEs. As the main body of policy implementation, the ESG performance of SOEs is often linked to government objectives, and rating divergences may lead investors to question the efficiency of policy implementation or the rationality of resource allocation. In addition, the "implicit guarantee" attribute of SOEs may make investors more stringent in pricing ESG risks, leading to the magnification of the negative impact of rating divergences.Chow Test results show that the statistic of coefficient difference between the groups is 3.66, with a p-value approaching 0, which rejects the original principle of "no difference in coefficients for the whole sample". The results of Chow Test show that the statistic of coefficient difference between groups is 3.66, and the p-value is close to 0, which rejects the original hypothesis of "no difference in coefficients of the whole sample" and confirms that there is a significant heterogeneity of the impact of ESG rating divergence among enterprises with different ownership properties.

Table 7. Heterogeneity analysis: based on the nature of ownership of enterprises

	(1)SOE=0	(2)SOE=1
VARIABLES	lnGI	lnGI
ESGdif4	-0.027*	-0.078**
	(-1.897)	(-2.111)
Age	-0.576***	-0.484***
	(-44.012)	(-14.604)
Size	0.593***	0.438***
	(59.000)	(18.675)
LEV	-0.531***	-0.589***
	(-10.525)	(-4.400)
PPE	-0.164**	-0.317**
	(-2.465)	(-2.334)
TobinQ	0.359***	0.315***
	(31.561)	(9.194)
Growth	0.340***	0.307***
	(9.024)	(3.024)
Dual	0.060***	-0.031
	(4.129)	(-0.539)
Board	-0.026	0.214
	(-0.447)	(1.235)
Balance	-0.000	-0.127*
	(-0.012)	(-1.810)
EGP	0.005*	-0.006
	(1.905)	(-0.922)
Year FE	YES	YES
Industry FE	YES	YES
Constant	-12.002***	-9.595***

	(-40.894)		(-14.073)
Observations	10,487		1,666
R-squared	0.375		0.305
Chow Test		3.66	
		[0.000]	

Note: Values for t are in parentheses and p-values for chow test in middle brackets. *, **, and *** indicate that the test was passed at the 10 per cent, 5 per cent, and 1 per cent significance levels, respectively.

4.4.2 Heterogeneity test for being a heavy polluter or not

Tirodkar and Berkman (2023)[41] find a relative decrease in institutional investor holdings of heavily polluting firms in the United States, which suggests that investment institutions do not favour heavily polluting firms.Gao et al. (2020)[42] Using data from China's stock market, it is found that institutional investors clearly favour non-polluting firms. Therefore, in order to respond to the Chinese government's green development concept and maintain investment sustainability, institutional investors will prefer non-polluting firms, resulting in institutional investors being relatively cautious about information about non-polluting firms. To investigate whether the effect of ESG rating divergence on green investor entry varies according to whether a firm has heavy pollution characteristics, this study conducts a group regression based on whether a firm is a heavy polluter (Poll=1 for heavy polluters and Poll=0 for non-heavy polluters). According to the Notice on Issuing the Management List of Industry Classification for Environmental Verification of Listed Companies issued by the Ministry of Ecology and Environment of the People's Republic of China (formerly the Ministry of Environmental Protection of the People's Republic of China), and drawing on Liu Yunguo and Liu Mengning (2015)[43] and Liu Xinghe (2016)[44] , this paper defines the following industries as heavy polluting industries: coal mining and washing industry, oil and gas extraction industry, ferrous metal ore mining and processing industry, and non-ferrous metal ore mining and processing industry. Textile industry. Leather, fur, feather and their products and footwear industry, paper and paper products industry, petroleum processing, coking and nuclear fuel processing industry, chemical raw materials and chemical products manufacturing, chemical fibre manufacturing, rubber and plastic products industry, non-metallic mineral products industry, ferrous metal smelting and rolling processing industry. Non-ferrous metal smelting and rolling processing industry, electricity and heat production and supply industry. According to the Guidelines on Industry Classification of Listed Companies revised by the China Securities Regulatory Commission in 2012, the codes for heavily polluting industries are B06, B07, B08, B09, C17, C19, C22, C25, C26, C28, C29, C30, C31, C32, and D44 respectively, and if an enterprise belongs to any of the abovementioned 15 industries, it is considered to be a heavily polluting enterprise (Pollutant). considered as a heavy polluter (Poll=1), otherwise it is a non-heavy polluter (Poll=0).

Table 8 shows that the dampening effect of ESG rating divergence (ESGdif4) on green investor entry (lnGI) is significantly different between heavily polluting firms and non-heavily polluting firms. The ESGdif4 coefficient of -0.020 (t=-1.340) in non-heavily polluting firms (Poll=0) fails the significance test. This suggests that ESG rating divergence has a weaker impact on green investor entry in industries with lower environmental risks, possibly because the ESG performance of non-heavy polluters is inherently more likely to meet the standards, and divergence does not significantly shake investor confidence. Investors can discipline firms by "voting with their feet" without relying on ESG ratings. The ESGdif4 coefficient of -0.109 (t=-3.786) for heavily polluting firms (Poll=1) is significant at the 1% level, and the absolute value of the coefficient is 5.45 times higher than that of non-heavily polluting firms. This result confirms the specificity of heavily polluting firms, which face stricter environmental regulations (e.g., "dual carbon" targets), and the divergence in ESG ratings can be easily interpreted as a signal of environmental compliance deficiencies, and their high environmental risks can trigger investor concerns about the risks of fines, production restrictions, and so on. Green investors are more demanding of ESG authenticity in high-polluting industries, and

rating divergence may be seen as "greenwashing" (e.g., misreporting of emission reduction data), leading to accelerated capital withdrawal. The Chow Test statistic of coefficient difference between groups is 2.69, with a p-value of <0.001, which rejects the hypothesis of "no difference in coefficients of the whole sample" and confirms that there is significant heterogeneity in the impact of ESG rating disagreement between heavily polluting and non-polluting firms.

Table 8. Heterogeneity analysis: based on whether they are heavy polluters or not

	(1)Poll=0		(2)Poll=1
VARIABLES	lnGI		lnGI
ESGdif4	-0.020		-0.109***
	(-1.340)		(-3.786)
Age	-0.559***		-0.557***
	(-40.469)		(-22.153)
Size	0.575***		0.522***
	(55.226)		(27.596)
LEV	-0.554***		-0.435***
	(-10.475)		(-4.222)
PPE	-0.206***		-0.216*
	(-3.036)		(-1.793)
TobinQ	0.361***		0.361***
	(29.194)		(16.467)
Growth	0.330***		0.360***
	(8.240)		(4.714)
Dual	0.044***		0.070**
	(2.723)		(2.431)
Board	0.038		-0.108
	(0.602)		(-0.977)
Balance	0.047*		-0.170***
	(1.714)		(-3.431)
EGP	0.003		0.003
	(0.956)		(0.771)
SOE	-0.191***		0.006
Year FE	YES		YES
Industry FE	YES		YES
	(-8.020)		(0.116)
Constant	-11.791***		-10.952***
	(-39.823)		(-20.886)
Observations	9,243		2,900
R-squared	0.368		0.345
Chow Test		2.69	
		[0.000]	

Note: Values for t are in parentheses and p-values for chow test in middle brackets. *, **, and *** indicate that the test was passed at the 10 per cent, 5 per cent, and 1 per cent significance levels, respectively.

5. Summary

The empirical part of this paper firstly verifies the negative correlation between ESG rating divergence and green investors, and analyses the influence path of this relationship to verify the mediating role of misinformation. And the heterogeneity moderating effect is analysed from the perspective of grouping, which is explored separately from two grouping methods: whether it is a

state-owned enterprise or not, and whether it is a heavy polluting enterprise or not. The specific conclusions of this paper are as follows.

First, at the level of green investor behaviour, this paper finds that ESG rating divergence significantly inhibits green investor entry (lnGI) through multiple regression model test. This result suggests that when different rating agencies give widely differing evaluations of a firm's ESG performance, green investors face higher information uncertainty and risk perception, and thus tend to reduce their investment in the firm. Especially for those green investors who use ESG information as the core decision-making basis, such divergence may be seen as a negative signal of inadequate corporate ESG governance capacity, which in turn weakens their investment confidence or delays their entry decision. This finding still holds under robustness tests such as replacing explanatory variables and lagged one-period regression, which verifies the reliability of the results. Further, this paper examines the specific pathways through which ESG rating divergence affects green investor behaviour at the mechanism level. The mediation effect analysis shows that information asymmetry plays a key mediating role, and ESG rating disagreement exacerbates the market's biased understanding of ESG information, which raises the information search cost and uncertainty perception of green investors, and thus inhibits their willingness to invest. In addition, this paper carries out heterogeneity analyses from multiple dimensions to reveal the boundary conditions of the impact of ESG rating divergence. It is found that: first, in terms of corporate property rights, the negative impact of rating divergence on green investment is 2.89 times higher for state-owned enterprises than for non-state-owned enterprises due to the policy-related attributes; non-state-owned enterprises, although weakly affected, are faced with stronger market competition pressures, and rating divergence likewise exacerbates the risk of information asymmetry; second, in terms of whether or not they are heavy polluters, the inhibitory effect of ESG rating divergence for heavily polluting enterprises is is significantly higher than that of non-heavily polluted firms, reflecting that investors in high-environmental risk industries are more sensitive to ESG information.

In summary, this study not only reveals how ESG rating disagreement inhibits green investor participation by enhancing information asymmetry, but also systematically identifies the heterogeneous manifestation of this effect across firm characteristics. The findings expand the research perspectives on ESG rating divergence, and also provide important theoretical basis and practical insights for the construction of green financial system, the unification of ESG information disclosure standards, and the guidance of green investor behaviour.

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