



Research article

ESG rating divergence and financing constraints: Evidence from China[☆]Jiahua Zhao, Minglin Wang^{*}, Saisai Hong, Si Tan

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ABSTRACT

In the context of the escalating global environmental, social, and governance (ESG) risks, ESG performance has increasingly become a crucial reference for companies when formulating business strategies. This paper, drawing on the information asymmetry and signaling theories, delves into the impact of divergences in ESG ratings among various institutions on corporate financing constraints. By taking the sample of Chinese A-share listed companies during the period from 2018 to 2022, and using an index of ESG rating divergence, we test the theoretical hypotheses. The empirical results indicate that ESG rating divergence exacerbates financing constraints, which still hold after conducting various robustness tests. From the perspective of analysts, this phenomenon occurs because the divergences in ESG ratings lead to increased prediction biases, thereby intensifying the corporate financing constraints. Nevertheless, compliant ESG disclosure can mitigate the adverse effects of ESG rating divergences on a company's financing constraints. Moreover, within enterprises with higher ESG ratings and greater profitability, the influence of ESG rating divergences on financing constraints is less pronounced. Further analysis shows that the effect of ESG rating divergence mainly stems from domestic rating divergence, domestic and international rating divergence, and environmental rating divergence. Additionally, the impact of the inter-institutional difference, potential for ESG development, and the impact on Alpha have also been analyzed. This study significantly enriches the theoretical framework of ESG rating divergences, provides new empirical evidence on the effects of ESG ratings divergences on corporate financing activities, and offers recommendations for investors to better grasp ESG information, as well as for both enterprises and governments to alleviate financing constraints.

1. Introduction

In recent years, the investment landscape has witnessed a significant transformation as an increasing number of investors have started to integrate ESG (Environmental, Social, and Governance) factors into their decision-making processes. This shift stems from the recognition that ESG elements play a crucial role in shaping a company's long-term performance and risk management strategies. Concurrently, various institutions and organizations have developed ESG rating standards and indices, aiming to assist investors in evaluating a company's ESG performance and facilitating informed investment choices. As illustrated in Table 1, it provides an overview of the rating information from major institutions. Governments and regulatory authorities have also taken proactive steps by implementing relevant policies and measures to promote the sustainable development of enterprises. For instance, in 2018, the China Securities Regulatory Commission issued the

"Guidelines for Corporate Governance of Listed Companies (Revised in 2018)". Notably, although ESG theory and practice are still in their nascent stages in China, remarkable progress has been achieved. Over the past five years, the disclosure rate of ESG reports by Chinese companies has been on a continuous upward trend. The number of A-share listed companies releasing independent ESG reports has steadily increased, rising from 951 in 2018 to 1819 in 2022.¹ This rapid development highlights the growing importance of ESG in the Chinese corporate landscape. over.

However, the burgeoning interest in ESG indices has given rise to a new set of challenges. With numerous agencies constructing their own ESG standards and disclosing corresponding reports to secure more resources, the global ESG rating agency landscape has become highly fragmented. According to KPMG's 2020 global data, there are approximately 30 ESG rating agencies worldwide. This proliferation has led to significant differences in the ESG ratings of the same company among

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¹ Data comes from <https://finance.eastmoney.com>.

Table 1
Major domestic and international rating agencies and their ESG ratings.

ESG ratings	Rating agency	Covered firm	Starting year
MSCI ESG Ratings	MSCI	Global listed companies	2010
Sustainalytics ESG Risk Ratings	Morningstar	Global listed companies	2018
FTSE Russell ESG Ratings	FTSE Russell	Global listed companies	2018
Sino-Securities index ESG Ratings	Sino-Securities index information service	Chinese listed companies	2009
Bloomberg ESG Ratings	Bloomberg	Global listed companies	2006
Wind ESG Ratings	Wind	Global listed companies	2018

Data source: Official websites of rating agencies

different agencies, as evidenced by previous studies (Chatterji et al., 2016; Christensen et al., 2022; Kimbrough et al., 2024). Such discrepancies not only undermine the effectiveness of ESG information (Chatterji et al., 2016) but also have a profound impact on investors' investment decisions based on ESG ratings.

Existing literature predominantly focuses on the impact of ESG rating releases on corporate management. However, the research on the divergence of ESG ratings remains relatively scarce. Previous studies have delved into the reasons for the formation of ESG rating divergence (Dimson et al., 2020) and its impact on company operation (Serafeim and Yoon, 2023). While some research has explored the influence of ESG rating divergence on corporate investment activities (Lin et al., 2025), operational activities (Ling et al., 2024), and stock market performance (Wang H. et al., 2024), the area of financing activities has received limited attention. Additionally, there is a lack of in-depth analysis regarding the specific details of how ESG rating differences affect financing activities, such as the relative importance of rating differences among the three ESG sub-items and between domestic and foreign rating agencies. This study aims to fill this significant research gap.

By leveraging information asymmetry theory and signaling theory, this paper systematically analyzes the impact of differences in ESG ratings among various institutions on corporate financing constraints. We select multiple domestic and international ESG rating data sources to construct an ESG rating divergence index and conduct an empirical test on Chinese A-share listed companies to explore the relationship between ESG rating divergence (ESGRD) and corporate financing constraints. From the perspective of analysts, we delve into the mechanism through which ESG rating differences affect financing constraints. Furthermore, we discuss the moderating factors, heterogeneity, and other related issues of this effect, with the ultimate goal of providing valuable insights for companies, investors, and governments to better understand and interpret ESG rating differences.

This study makes several marginal contributions to the existing literature. Firstly, it offers new empirical evidence on the impact of ESGRD. Previous research has mainly concentrated on the overall impact of ESGRD on corporate performance and stock market prices, without fully exploring its specific influence on the financing activities of enterprises. Although the impact of rating data on financing constraints has been studied, the impact and mechanism of rating divergence on financing constraints have not been thoroughly investigated. Given that these two aspects have distinct impacts, it is crucial to consider them separately when analyzing corporate financing activities. Secondly, this study demystifies the relationship between rating divergence and financing constraints by exploring, from the perspective of analysts, the reasons behind the influence of rating divergence on financing constraints. By doing so, it presents a comprehensive logical framework to elucidate how rating differences affect corporate financing. Thirdly, we further explore which components of rating divergence truly influence financing constraints (domestic or foreign, E,

S, or G) and analyze the factors that can moderate this impact (compliance of information disclosure, ESG development potential). The conclusions drawn from this study provide practical methods for companies, investors, and governments to better interpret ESG information and take appropriate measures to mitigate the adverse effects of ESG rating differences.

The remainder of this paper is organized as follows. Section 2 provides a comprehensive literature review, summarizing the relevant theoretical and empirical research on ESG, corporate financing activities, and the impact of ESGRD. In Section 3, based on information asymmetry theory and signaling theory, we analyze the impact mechanism of ESGRD on corporate financing constraints and develop our research hypotheses. Section 4 details the data, samples, and variables used in the empirical analysis. Section 5 presents the empirical analysis results and in-depth discussions. Finally, Section 6 summarizes the research conclusions, puts forward relevant suggestions from the perspectives of companies, governments, and investors, and discusses the limitations of this study and potential directions for future research.

2. Literature review

The influence of ESG ratings on corporate operations (Friede et al., 2015), stock prices (Albuquerque et al., 2019), investment efficiency (Samet and Jarboui, 2017), and green innovation (Yang et al., 2020) has emerged as a focal point of academic research. This study is closely intertwined with two research fields: the implications of ESG ratings on corporate financing, and the implications of ESG rating divergence.

2.1. ESG rating and corporate financing

Existing literature has demonstrated that ESG ratings exert a profound influence on various aspects of corporate financing activities. Corporate financing can be categorized into internal and external financing based on the source of funds, with ESG ratings primarily impacting external financing. The ESG information disclosed by enterprises serves as a valuable supplement to traditional financial information, effectively reducing information asymmetry between internal and external investors, enhancing market transparency, and alleviating investors' uncertainty, thereby facilitating a reduction in firms' financing constraints (Qiu and Yin, 2019; Raimo et al., 2021).

External financing can be further divided into equity financing and debt financing, both of which are significantly affected by ESG ratings. Xie and Lv (2024) discovered that superior ESG performance attracts more institutional investors to hold its shares, thereby bolstering its equity financing capabilities. Additionally, enterprises with excellent ESG performance (Hao and Zhang, 2022) and those that actively disclose ESG information (Ng and Rezaee, 2012) enjoy lower equity financing costs. This is because ESG information disclosure mitigates information asymmetry (Dhaliwal et al., 2011), reduces policy risks due to compliance with environmental policies, and attracts investments through green sustainable products, ultimately lowering equity costs (El Ghoul et al., 2011).

The impact of ESG ratings on debt financing has also garnered substantial attention (Gerwanski, 2020; Eliwa et al., 2021). Li and Feng (2022) posited that companies with higher ESG ratings possess stronger capabilities to obtain commercial credit financing, because ESG ratings strengthen their competitive advantages in the product market, enhance external supervision, improve corporate reputation, and boost risk resistance. Cojoianu et al. (2022) argued that good ESG performance enables companies to secure bank loans at lower interest rates. Moreover, maintaining high ESG performance reduces corporate debt financing cost by curbing managers' opportunistic behaviors (Christensen, 2016), minimizing agency costs (Eccles, 2014), enhancing investor confidence (Fan et al., 2023), reducing information asymmetry with lending institutions, improving investor trust (Amiraslani et al., 2023), and maintaining better employee relations to enhance enterprise

operational efficiency (El Ghoul et al., 2011). However, overemphasis on ESG and the pursuit of high ratings may consume corporate resources, increasing enterprises' risks and negatively affecting operations and profitability (Derwall et al., 2011), as well as potentially raising debt financing costs. Barnea and Rubin (2010) suggested that executives may improve ESG performance for personal reputation, leading to resource waste and hindering business development.

Irrespective of the financing method, companies with higher ESG ratings generally enjoy more favorable financing terms (Bird, 1981), a better information environment, lower information asymmetry, reduced corporate financing costs (Wong et al., 2021). They also attract greater willingness from external investors to invest (Dhaliwal et al., 2011). Nevertheless, the role of ESG ratings varies across different countries and regions (Baldini et al., 2018). Most of the existing literature focuses on the impact of individual ESG rating agencies' results on corporate financing activities, overlooking the significant differences among different rating agencies. These differences are widespread and have implications for corporate financing activities and the effectiveness of ESG information itself, which this study aims to address.

2.2. Impact of divergence in ESG ratings

The literature on the impact of ESG ratings divergence indicates that it has two primary effects: the information supplementation effect and interference effect. The divergence in ESG ratings contains more information compared to consistent ratings, providing additional insights into business operations for investors, analysts, and other users (Gibson Brandon et al., 2021), thus having a positive impact. This is known as the information supplementation effect.

Conversely, excessive information can mislead users and cause adverse consequences, referred to as the interference effect. The majority of empirical studies support the interference effect. From the perspective of enterprises, rating differences complicate managers' efforts to identify the causes of discrepancies, which in turn affects their investment decisions (Chatterji et al., 2016). External investors perceive higher information uncertainty (Dimson et al., 2020), increased information asymmetry risk (Abhayawansa and Tyagi, 2021), and elevated information search costs (Avramov et al., 2022) in companies with significant ESG rating divergence. This leads to higher market risks (Avramov et al., 2022), increased risk premiums (Viale et al., 2014), and reduced capital market efficiency (Cortez et al., 2012; Gibson Brandon et al., 2021). ESG ratings divergence also exacerbates asset return volatility (Christensen et al., 2022), hinders investment (Kotsantonis and Serafeim, 2019), even diminishes the signaling role of ESG rating information (Abhayawansa and Tyagi, 2021; Serafeim and Yoon, 2023), resulting in a mismatch between investment and financing periods (Bi and Sun, 2024). The combined effect of the two influences depends on the characteristics of different regions, enterprises and industries. Previous research has creatively focused on the rating differences among institutions, but mainly concentrated on their impact on corporate operating results without delving into the specific are of financing activities and constraints. This study also aims to fill this research gap.

3. Hypotheses development

3.1. ESGRD and financing constraints: based on information asymmetry theory and signaling theory

Prior research indicates that the ESGRD predominantly exerts a negative influence on corporate business activities, specifically on financing. This impact unfolds through two primary channels. On one hand, ESGRD distorts the operational signals that companies convey to external stakeholder; on the other hand, ESGRD intensifies the information asymmetry between investors and enterprises, thereby erecting additional obstacles for corporate financing.

For enterprises, divergent ESG ratings serve as a signal to the outside

world, suggesting the presence of latent risks within the enterprise. Christensen et al. (2022) posited that ESGRD can be attributed to the varying perspectives of different rating agencies on company-specific information, with each agency emphasizing distinct aspects. Consequently, ESGRD implies that there are significant disparities in the evaluations of the same company by different agencies, indicating that the company may be exposed to risks from multiple dimensions (Li et al., 2023). Prudent investors, upon detecting such signals, will exercise heightened vigilance against corporate risks. Once potential risks are identified, investors will demand a risk premium to compensate for the perceived uncertainty, leading to elevated financing costs, increased litigation risks, and stricter environmental regulations. Moreover, ESGRD can trap companies in a vicious cycle of escalating interest rate. Due to ESGRD, companies may be compelled to pay higher interest rates or pledged assets of greater value to secure financing. After obtaining funds, burdened with higher interest rates and financing costs, they are often forced to invest in high-risk projects to generate substantial returns. This, in turn, gives rise to severe moral hazard issues, as investors face amplified risks and demand an even higher risk premium, which perpetuates the cycle and discouraging companies with high ESGRD from seeking external funding. Ultimately, these companies may struggle to secure external financing (Christensen et al., 2022), resulting in internal capital shortages and disruptions to the financial chain (Zhou et al., 2023), which significantly exacerbate corporate financing constraints.

Simultaneously, ESGRD inflates the agency costs between shareholders and management. The existence of ESGRD can confound managers due to the inaccuracy of information (Berg et al., 2022), hindering their ability to develop effective strategies to enhance ESG performance. This situation also provides managers with opportunities to engage in opportunistic behaviors, such as earnings manipulation (Serafeim and Yoon, 2023), thereby exacerbating agency problems and significantly increasing agency costs. To offset increased agency costs, investors will impose more stringent financing requirements, further intensifying financing constraints.

From the investors' perspective, ESGRD conveys several unfavorable signals. Firstly, companies with significant rating differences tend to attract heightened media attention, and they typically focus on and report negative information about these companies to capture readers' interest (Capelle-Blancard and Petit, 2019). Therefore, such companies are more likely to receive negative reports, and negative information usually has a stronger impact than positive information. Moreover, for companies with significant ratings differences, negative information spreads more widely compared to those with smaller ratings differences. Secondly, ESGRD indicates that companies' ESG performance is uncertain, which undermines the stability of the capital market. Kimbrough et al. (2024) also found that higher ESGRD is associated with greater capital market instability, prompting investors to demand higher risk premiums. Thirdly, differences in ESG ratings may stem from corporate "greenwashing" and data manipulation (Yang et al., 2020), which can undermine the quality of ESG information and dampen investors' willingness to invest. Therefore, for investors, ESGRD has released more unfavorable signals. These factors collectively reduce investors' investment scale and enthusiasm, thus exacerbating corporate financing constraints.

ESGRD also inflates information analysis costs and diminishes decision accuracy. When there are differences in ESG ratings, the effectiveness of rating information is weakened (Chatterji et al., 2016), and the quality of ESG information declines (He et al., 2023). Therefore, the degree of information asymmetry between investors and enterprises increases, making it more challenging for investors to identify the true ESG information. On one hand, ESGRD necessitates that investors spend more time and resources processing information, increasing the time and economic costs associated with collecting and interpreting corporate ESG data. Higher information processing costs lead to decreased analysis accuracy. According to the limited attention theory, investors'

attention is limited (Da et al., 2011). Individuals have limited abilities and attention, so they cannot devote infinite time and energy to everything. Faced with ESG rating differences, investors should deal with the problem of limited attention. Divergent ESG ratings, as information with lower effectiveness and quality, require investors to spend more time and cost interpreting, which reduces their attention to other valuable information and affects overall accuracy of investment decisions. Consequently, investors are more inclined to focus on companies with consistent ratings and may ignore those with rating divergence. Therefore, for investors, ESGRD not only requires more time and effort in processing divergent data but also leads to a decline in the accuracy of investment decisions. Higher information analysis costs and lower accuracy will reduce investors' willingness to invest, and impose more stringent financing requirements on companies, thereby exacerbating financing constraints.

In summary, ESGRD will expose more potential risks, force enterprises into a vicious cycle of high interest rates, generate higher agency costs, and convey more negative information to investors. It increases the difficulty for investors in processing rating data, thereby exacerbating corporate financing constraints. In light of the above analysis, we propose the following hypothesis.

H1. ESG rating divergence exacerbates financing constraints.

3.2. Mechanism analysis: from the perspective of analysts

Analysts, with professional ability in information processing and interpretation (Huang et al., 2014), play a crucial role as information intermediaries in the capital market (Yu, 2008). Accurate analyst predictions, as reflected in their expected reports, can effectively reduce the information asymmetry between listed companies and investors (Barth and Hutton, 2004). Institutional and individual investors often make investment decisions based on the opinions of analysts. ESG rating is a key component of analysts' information sources. However, the existence of rating discrepancies will undoubtedly increase the difficulty for analysts when processing information. In this part, we analyze the mechanism of ESGRD affecting financing constraints from the perspective of analysts.

ESGRD will disrupt analysts' information environment and increase their information costs. On one hand, ESGRD will increase the degree of information asymmetry between enterprises and analysts (Serafeim and Yoon, 2023). The inconsistency of information disclosed in ESG reports will interfere with the public information of the capital market and form information noise (Liu et al., 2023). ESGRD reduces the quality of ESG information, and the effectiveness of information, which increases the information risk of enterprises (Abhayawansa and Tyagi, 2021). Although due to ESGRD, more ESG information is disclosed which can expand the information set used by analysts and reduce the cost for analysts to collect information, it simultaneously complicates information analysis. In a degraded information environment, analysts must spend more time collecting more private information, which increases their costs and, in turn, exacerbates their prediction bias (Hope, 2003).

Specifically, the deterioration of the information environment misleads analysts and directly leads to inaccurate predictions. Additionally, according to the limited attention theory, analysts spending more time and effort on divergent inefficient ESG information will inevitably pay less attention to other effective information, which will affect the accuracy of investment decisions and result in incorrect predictions. Consequently, ESGRD reduces the accuracy of analysts' earnings forecasts.

Analysts' inaccurate predictions will affect investors' decisions. When ESGRD leads to a decrease in analyst decision-making accuracy, the information intermediary function of analysts becomes ineffective, and the information asymmetry in the market increases. Investors, facing greater uncertainty, will either demand a higher return on investment or reduce their investment scale. Firms will suffer from more

severe financing constraints. Moreover, a decrease in the accuracy of analyst decisions erodes investors' trust in analysts. Investors may have doubts about the professional ability of analysts and lose confidence in their research. Some investors may even suspect that analysts intentionally produce biased reports for personal gain (Hong and Kubik, 2003). Investors who lack trust in analysts tend to be more rigorous in making investment decisions and ask for higher profit margins to compensate for perceived risks. They may shift their investment towards companies with smaller analyst forecast errors and avoid other companies with larger analyst forecast errors. Therefore, analysts' inaccurate predictions prompt investors to increase investment requirements, reduce investment scale, or even give up investment, which will exacerbate the financing constraints faced by enterprises.

Based on the above analysis, the following hypothesis is proposed.

H2. ESG rating divergence will lead to biased analyst profit forecasts, further increasing the financing constraints.

3.3. Regulatory effect of ESG disclosure compliance

The compliance of ESG information disclosure is an important factor which can influence the extent to which ESG rating differences impact financing constraints. Because the effectiveness of ESG information is reduced due to rating differences, investors may be worried that the information disclosed by enterprises is non-compliant, resulting in ESG rating information deviating from actual situation. This perception exposes investors to higher risks, prompting them to demand higher risk premiums. However, when ESG information disclosure is compliant, the source of divergence comes from differences between rating agencies rather than the quality of information disclosed by companies, which is a positive signal for companies. This positive signal alleviates investors' concerns about ESGRD, and the impact of ESGRD on corporate financing constraints will be weakened.

As the compliance of corporate ESG information disclosure improves, investment institutions will rely more on publicly disclosed information and reduce their reliance on less effective private information. Even if there are deviations in compliance ESG information, it has less impact on financing constraints. We formulate the following hypothesis.

H3. The higher the compliance of ESG information disclosed, the less significant the influence of corporate ESGRD on financing constraints.

4. Data and method

4.1. Data and sample selection

We use the annual ESG rating data of companies listed on the Chinese A-Shares which are sourced from six institutions, including SynTao Green, Sino-Securities index, FTSE Russell, MSCI, Bloomberg and Wind. We matched the rating data with the annual financial data of listed companies which came from Wind and China Securities Market and Accounting Research Database (CSMAR). In order to ensure the accuracy of the data, the sample data are selected according to the following criteria: (1) exclusion of the samples of ST and *ST companies; (2) exclusion of financial enterprises; (3) exclusion of the samples with missing values. As the rating agencies began to publish ratings in different years, we finally select the annual data of listed companies from 2018 to 2022 as the research sample to cover as much data as possible. Eventually, 9131 firm-year observations from 2643 companies were obtained.

4.2. Empirical model

We examine the relationship between ESG rating differences and corporate financing constraints using the following model:

$$WW_{i,t} = \alpha_0 + \alpha_1 ESG_div_{i,t} + \sum \beta_j Control_{i,t} + \sum Ind + \sum Year + \varepsilon_{it} \quad (1)$$

$WW_{i,t}$ is the dependent variable, representing the financing constraints level of listed enterprise i in year t . $ESG_div_{i,t}$ denotes the core independent variable, representing the enterprise ESGRD. $Control_{i,t}$ represents the max of control variables. To control for unobservable factors, industry ($\sum Ind$) and year ($\sum Year$) fixed effects were included respectively. ε_{it} is the random error term.

4.3. Variable definitions

4.3.1. ESG rating divergence

ESG rating divergence ($ESG_div_{i,t}$) is the independent variable that we mainly focus on. With reference to He et al. (2023) and Hu et al. (2023), we selected six third-party rating suppliers: SynTao Green (STG), Sino-Securities Index (SSI), FTSE Russell (FR), MSCI, Bloomberg and Wind to measure the degree of rating divergence among different agencies with the standard deviation of ratings given by these agencies. These institutions employ distinct rating rules. In order to make different ratings comparable, we standardized the ratings given by these institutions. For example, SynTao Green divides firms into ten grades A to D according to their ESG performance, and we assign them as 0 to 1. The score of each grade is equal to 1 divided by 9 and multiplied by the corresponding grade serial number. The higher the ESG rating, the greater the score. The standardization method of Sino-Securities index, Wind and FTSE Russell is the same. MSCI and Bloomberg give each company a continuous score of 0–10, which is adjusted to 0–1 for this paper. Table 2 shows the scores of different agencies' ESG ratings after standardization. Then the standard deviation of these ratings can be calculated to measure ESGRD. In the robustness test part, some other methods are used to measure ESGRD, which will be discussed in detail later.

Although standardization was adopted to make the ratings comparable, it may ignore the underlying differences in methodologies, scope, and weighting schemes used by these agencies. For instance, The ESG ratings of SynTao Green not only measure a company's management level in ESG aspects, such as its proactive initiatives and management strategies in environmental management, employee welfare protection, but also assess the extent to which existing or potential ESG risk factors impact corporate value. MSCI places significant emphasis on industry-specific materiality, meticulously tailoring its evaluation to the unique ESG factors that are most relevant and impactful within each industry. In contrast, Bloomberg places a premium on transparency and disclosure, considering these aspects as cornerstones for comprehensively assessing a company's ESG performance. The standardized data cannot reflect this difference, but because we applied the same processing method to each corporate, it can still reflect the differences in rating divergences among

different enterprises and years. This can provide sufficient information for our research.

4.3.2. Financing constraints

Financing constraint ($WW_{i,t}$) is the dependent variable of this paper. We select the WW index constructed by Whited and Wu (2006) to measure the degree of financing constraints of enterprises. The calculation formula of the WW index is:

$$WW_{i,t} = -0.091CF_{i,t} - 0.062DIVPOS_{i,t} + 0.021TLTD_{i,t} - 0.044Size_{i,t} + 0.102IGrowth_{i,t} - 0.0035Growth_{i,t} \quad (2)$$

where $CF_{i,t}$ denotes the ratio of cash flow to total assets; $DIVPOS_{i,t}$ is a dummy variable of dividend payment; $TLTD_{i,t}$ represents the ratio of long-term liabilities to assets; $Size_{i,t}$ denotes the natural logarithm of total assets; $IGrowth_{i,t}$ is the growth rate of operating revenue of the industry to which the enterprise belongs; $Growth_{i,t}$ is the growth rate of income. The $WW_{i,t}$ index is positively correlated with corporate financing constraints, that is, a higher $WW_{i,t}$ indicates greater corporate financing constraint.

4.3.3. Analysts' forecast bias

Analysts' forecast bias ($Forecast_{i,t}$) is the intermediary variable of this paper. We use the degree that analysts' average latest forecast level of earnings per share deviates from reality to measure analysts' forecast bias according to Sohn (2012). The calculation formula is as follows:

$$Forecast_{i,t} = \frac{|MEPS_{i,t} - AEPS_{i,t}|}{TA_{i,t}} \quad (3)$$

In this formula, $AEPS_{i,t}$ is the median of the last earnings per share forecast of all analysts in year t , $MEPS_{i,t}$ is the actual earnings per share, and $TA_{i,t}$ denotes the total assets per share. The larger the index, the greater the error of analysts' prediction.

4.3.4. ESG disclosure compliance

ESG disclosure compliance is the moderation variable of this paper. Two indicators are selected to measure the level of ESG disclosure compliance. The first is whether the enterprise ESG information disclosure meets the Global Reporting Initiative (GRI) standard. GRI standards are a set of reporting standards issued by the Global Reporting Initiative. These standards provide a standard framework for organizations to formulate and publish sustainability reports. The GRI standards are also the most widely used framework for preparing enterprise ESG reports in the world. The second is whether the enterprise ESG information disclosure has passed the certification of the third-party certification institution. The participation of third-party certification institutions can improve the standardization of enterprise information

Table 2
Original ESG rating and corresponding scores.

Agency	ESG rating and corresponding scores									
STG	A+	A	A-	B+	B	B-	C+	C	C-	D
Scores	1	0.889	0.778	0.667	0.556	0.444	0.333	0.222	0.111	0
SSI	AAA	AA	A	BBB	BB	B	CCC	CC	C	
Scores	1	0.875	0.75	0.625	0.5	0.375	0.25	0.125	0	
Wind	AAA	AA	A	BBB	BB	B	CCC	CC	C	
Scores	1	0.875	0.75	0.625	0.5	0.375	0.25	0.125	0	
FR	5		4	3	2		1			
Scores	1		0.8	0.6	0.4		0.2	0		
Bloomberg	10–0							0		
Scores	1–0									
MSCI	10–0									
Scores	1–0									

Data source: Manually collected by authors

disclosure and the effectiveness of information.

4.3.5. Control variables

Referring to previous studies (Hickman et al., 2021; Gong and Ho, 2021), we select a standard set of control variables representing firm specific characters which mainly include asset liability ratio (Lev), return on total assets (ROA), Equity multiplier (EM), etc. See Table 3 for the definition of specific variables.

4.4. Descriptive statistics and analysis

Table 4 shows the descriptive statistics of the variables used in this paper. The mean of ESG_div is 0.14 with a standard deviation of 0.0812, which belongs to the strong variation range under the measurement standard of a one-score system and is consistent with previous research using similar method and sample (He et al., 2023). The results imply that the sample provides considerable variability to observe the impact of ESGRD on financing constraints. Financing constraints range from −4.042 to −0.722, and the average value is −1.035 which is consistent with the conclusion of Chen et al. (2022).

Table 5 shows the Pearson correlation coefficient of key variables. The level of financing constraints of enterprises is significantly and positively correlated with ESG rating differences, which preliminarily verifies the hypothesis H1 in the previous chapter. The correlation coefficients between other variables are less than 0.6, VIF of variables are less than 10, which proves that our research does not suffer from multicollinearity.

We also make a correlation analysis of ESG ratings of various institutions. The average value of 15 correlation coefficients in Table 6 is 0.417. This is similar to the results of other literatures (Berg et al., 2022), indicating that institutions have not reached a consistent view on ESG rating of Chinese listed companies, and ESG rating differences are widespread, which should be paid attention to when analyzing corporate financing behavior.

5. Empirical results and discussion

5.1. Baseline regression results

Table 7 presents the impact of ESGRD on financing constraints. In column (1), we conduct a regression of model (1) without incorporation any control variables. The estimated coefficient of ESG rating is significantly negative. In column (2) to (5), we include control variables, year-fixed effect, industry-fixed effect, and double fixed effect respectively. We control the mean of firms' ESG ratings by six rating agencies (Mean_{it})

Table 3
Control variables.

Symbol	Variable name	Calculation method
Mean	Mean of ESG rating	arithmetic mean of ESG ratings from all agencies of the company in the same year
Number	Number of ESG rating agencies	number of agencies participating in the enterprise's ESG rating
Lev	Asset liability ratio	total liabilities at the end of the year/total assets at the end of the year
ROA	Return on total assets	net profit/average balance of total assets
Separate	Separation of two rights	(proportion of the actual controller owning the control right of the listed company - proportion of the actual controller owning the ownership of the listed company) *100 %
Balance	Equity structure	(sum of the equity proportion held by the second to fifth major shareholders/shareholding ratio of the largest shareholder) *100 %
Quick EM	Quick ratio Equity multiplier	(current assets - inventory)/current liabilities total assets at the end of the year/owner's equity at the end of the year

Data source: Manually collected by authors

Table 4
Descriptive statistics.

Variable	N	Mean	Std	Min	Max
WW	9131	−1.035	0.0913	−4.042	−0.722
ESG_div	9131	0.140	0.0812	0	0.530
Mean	9131	0.456	0.0904	0.125	0.843
Number	9131	2.911	1.257	1	6
Lev	9131	0.459	0.176	0.0189	0.994
EM	9131	2.220	2.880	1.019	177.5
ROA	9131	0.0363	0.0761	−0.931	0.880
Quick	9131	1.525	1.626	0.0747	74.66
Separate	9131	444.3	725.1	−1778	5814
Balance	9131	80.13	63.78	0.830	400

Data source: Analyzed by authors

so as to avoid the influence of the absolute value of ESG ratings on the regression coefficient of ESGRD. In addition, we also control the number of institutions (Number_{it}) that conduct ESG rating on an enterprise. The results suggest that the coefficients of ESGRD are significantly positive at the 1 % significance level, indicating that the divergence of enterprise ESG rating will aggravate their financing constraints, and hypothesis H1 is supported. We standardized the raw data when measuring rating discrepancies, which may flatten the rating differences between institutions. Therefore, in column (6), we calculated the rating divergence based on the original rating data. The results show that our conclusion still holds.

5.2. Robustness test

5.2.1. Alternative measurement method of financing constraints

In order to further test the robustness of our primary findings, we replace the WW index with the FC index referring to Hadlock and Pierce (2010). The first step of constructing the FC index is to standardize company size, company age and cash dividend payout rate. Then we rank the listed companies according to the standardized mean value of the variables (in ascending order). Listed companies above the 66 % percentile are defined as the low financing constraint group, and those below the 33 % percentile are defined as the high financing constraint group. The second step is to perform logit regression on the model of measuring the degree of corporate financing constraints. We fit the probability of financing constraints occurring each year, and define it as the financing constraints index FC. The larger the FC index, the more the financing constraints faced by the enterprise. Column (1) of Table 8 shows the regression result with FC index as the dependent variable. It shows that the regression coefficients of ESG rating divergence are significantly positive, indicating that ESG rating differences significantly affect the financing constraints of enterprises. The research conclusion of this paper is still valid and is not affected by the measurement method of dependent variable.

5.2.2. Alternative measurement methods of independent variable

As the use of standard deviation is based on the assumption that the ratings are normally distributed and equally informative, it may not fully capture the complexity of ESG rating divergence. We use entropy-based measures (Shannon Entropy) to show the uncertainty of ratings between different institutions. The results are listed in column (2) of Table 8. Our conclusion still holds with this measurement method. The standard deviation cannot reflect the differences in the influence of rating agencies in the market. We used a market weighted² method to measure rating divergence, reflecting the differences in market influence

² The weight data of rating agencies comes from <https://www.sgpjbg.com>. This website gathers research reports from major securities firms in China. We searched for research reports on the website that mentioned data from 6 rating agencies and use the proportion of research reports found through search as the weight.

Table 5
Correlation matrix and VIF.

Variable	WW	ESG_div	Number	Mean	Lev	EM	ROA	Quick	Separate	Balance	VIF
WW	1.000										
ESG_div	0.051***	1.000									1.08
Number	−0.517***	0.114***	1.000								1.11
Mean	−0.047***	−0.238***	−0.101***	1.000							1.10
Lev	−0.271***	0.007	0.142***	−0.114***	1.000						1.85
EM	−0.069***	0.028***	0.021**	−0.091***	0.395***	1.000					1.2
ROA	−0.277***	−0.062***	0.167***	0.144***	−0.294***	−0.153***	1.000				1.18
Quick	0.181***	−0.027***	−0.103***	0.081***	−0.562***	−0.145***	0.154***	1.000			1.48
Separate	−0.115***	0.000	0.107***	−0.041***	0.057***	0.019*	0.034***	−0.034***	1.000		1.02
Balance	−0.039***	0.006	0.042***	0.001	0.016	−0.002	0.003	−0.013	−0.012	1.000	1.00

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

Table 6
Correlation matrix of ESG ratings from different agent.

Agency	SSI	FR	Bloomberg	STG	MSCI	Wind
SSI	1					
FR	0.276	1				
Bloomberg	0.277	0.618	1			
STG	0.322	0.649	0.629	1		
MSCI	0.174	0.422	0.512	0.359	1	
Wind	0.271	0.472	0.465	0.547	0.273	1

Data source: Analyzed by authors

of rating agencies. The results are listed in column (3) of Table 8. In column (4) of Table 8, the coefficient of variation (dif_mean) serves as a measure of the divergence in ESG ratings. In this way, the ESG rating standard deviation of enterprise i in year t is divided by the average ESG rating of the enterprise in six institutions in that year. Column (5) takes the ESGRD of an enterprise divided by the average rating divergence of the industry (div_industry) to which the enterprise belongs as the measurement index of rating divergence, so that the divergence data can be adjusted by the industry level. In column (6), rating difference between

two institutions (Wind and SSI) with the widest A-share coverage among the six institutions is selected to calculate the rating divergence (SSI - Wind). The results show that the coefficients of ESGRD measured by the above three methods are still positive and significant. After changing the independent variables, the results are consistent with the previous baseline regression results, indicating that our conclusion is robust.

5.2.3. Dynamic panel model

To better capture the dynamic impact of ESG rating divergence on financing constraints, we use the system GMM method to estimate the dynamic panel model. The results are listed in column (6) of Table 8, indicating that our conclusion still holds. P-value of Arellano-Bond test for AR (1) is 0.030, while p-value of Arellano-Bond test for AR (2) is 0.091. P-value of Hansen overidentification test is 0.602. The model passes both the autocorrelation and over identification tests.

5.3. Endogeneity discussion

5.3.1. Add control variable

In order to reduce the impact of omitted variables on the regression results, we add two more control variables. The internal control index

Table 7
ESG rating divergence and corporate financing constraints.

Dep.var	(1)	(2)	(3)	(4)	(5)	(6)
	WW	WW	WW	WW	WW	WW
ESG_div	0.057*** (3.700)	0.078*** (6.090)	0.068*** (5.345)	0.052*** (3.768)	0.042*** (3.045)	
ESG_divori						0.001** (2.458)
Number		−0.032*** (−36.120)	−0.031*** (−35.064)	−0.030*** (−36.946)	−0.029*** (−36.021)	−0.029*** (−34.527)
Mean		−0.072*** (−6.071)	−0.082*** (−7.165)	−0.086*** (−7.225)	−0.097*** (−8.401)	−0.153*** (−7.977)
Lev		−0.146*** (−17.203)	−0.145*** (−17.242)	−0.118*** (−12.519)	−0.117*** (−12.493)	−0.117*** (−12.422)
EM		0.000 (0.409)	0.000 (0.244)	0.000 (0.654)	0.000 (0.505)	0.000 (0.532)
ROA		−0.329*** (−23.240)	−0.329*** (−23.407)	−0.309*** (−22.685)	−0.310*** (−22.883)	−0.310*** (−22.781)
Quick		0.001** (2.447)	0.001** (1.999)	0.001* (1.960)	0.001 (1.360)	0.001 (1.310)
Separate		−0.000*** (−3.655)	−0.000*** (−3.692)	−0.000*** (−2.594)	−0.000*** (−2.671)	−0.000*** (−2.675)
Balance		−0.000** (−2.146)	−0.000 (−0.455)	−0.000** (−2.184)	−0.000 (−0.361)	−0.000 (−0.387)
_cons	−1.043*** (−389.916)	−0.840*** (−112.354)	−0.845*** (−108.637)	−0.846*** (−108.199)	−0.851*** (−46.381)	−0.848*** (−46.250)
Time FE	No	No	YES	No	YES	YES
Industry FE	No	No	No	YES	YES	YES
N	9131	9131	9131	9131	9131	9131
adj. R ²	0.003	0.396	0.405	0.450	0.458	0.458

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent p < 0.01, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %.

Table 8
Robustness test.

Dep.var	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FC	WW	WW	WW	WW	WW	WW
ESG_div	0.149*** (4.338)						0.150** (2.554)
Entropy_div		0.005** (2.047)					
Weighted_div			0.058*** (3.070)				
div_mean				0.018*** (3.195)			
div_industry					0.478*** (2.823)		
SSI_Wind						0.021*** (2.644)	
L.WW							0.407*** (2.928)
Number	-0.127*** (-55.634)	-0.031*** (-31.261)	-0.030*** (-36.455)	-0.029*** (-35.492)	-0.029*** (-36.098)	-0.029*** (-33.279)	-0.016*** (-3.917)
Mean	-0.126*** (-4.089)	-0.101*** (-9.181)	-0.098*** (-8.761)	-0.080*** (-5.358)	-0.098*** (-8.665)	-0.100*** (-8.669)	-0.009 (-0.329)
Lev	-0.456*** (-18.765)	-0.118*** (-12.376)	-0.117*** (-12.498)	-0.117*** (-12.503)	-0.117*** (-12.520)	-0.117*** (-12.264)	-0.086*** (-4.492)
EM	-0.002*** (-2.995)	0.000 (0.563)	0.000 (0.513)	0.000 (0.451)	0.000 (0.449)	0.000 (0.522)	-0.000 (-0.136)
ROA	0.039 (1.116)	-0.311*** (-22.871)	-0.310*** (-22.853)	-0.309*** (-22.979)	-0.310*** (-22.891)	-0.310*** (-22.649)	-0.264*** (-12.709)
Quick	0.006*** (3.017)	0.001 (1.251)	0.001 (1.338)	0.001 (1.354)	0.001 (1.346)	0.001 (1.214)	0.000 (0.606)
Separate	-0.000*** (-5.457)	-0.000*** (-2.730)	-0.000*** (-2.682)	-0.000*** (-2.662)	-0.000*** (-2.683)	-0.000*** (-2.705)	-0.000 (-1.515)
Balance	-0.000 (-1.321)	-0.000 (-0.303)	-0.000 (-0.345)	-0.000 (-0.397)	-0.000 (-0.361)	-0.000 (-0.339)	0.000 (1.028)
_cons	1.015*** (20.557)	-0.848*** (-45.826)	-0.848*** (-46.322)	-0.860*** (-45.805)	-0.850*** (-46.170)	-0.850*** (-46.330)	-0.532*** (-4.465)
Time FE	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
N	9128	9131	9131	9131	9131	9068	6216
adj. R ²	0.629	0.458	0.458	0.458	0.458	0.456	-

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses of column 1–4, robust z-statistics in parentheses of column 5. (3) ***, **, * respectively represent $p < 0.01$, 0.05 , 0.1 , which is significant at 1 %, 5 % and 10 %. (4) The lack of FC index in some enterprises in some years leads to a smaller sample size in the first column. (5) Some enterprises lack SSI or Wind ratings, resulting in a smaller sample size in the column (4).

(ICI) is added in column (1) of Table 9, and the data is from BvD Database. The internal control index is a comprehensive index, which reflects the comprehensive capacity of corporate internal control and is used to measure the corporate internal control quality. The purpose of adding this index is to eliminate the influence of omitted variables, so as to make the experimental results more accurate and reliable. After adding the control variable, the regression results are still positive and significant, and the results still show that the divergence of ESG ratings will aggravate the financing constraints of enterprises. Column (2) of Table 9 further controls the quality of accounting information disclosure (VR). This variable is measured by the scores disclosed by Shanghai Stock Exchange and Shenzhen Stock Exchange on the quality of information disclosure of listed companies in CSMAR database. This variable ranges from 1 to 4. A higher value indicates a lower quality of information disclosure. After adding the control variable, the results still show that the divergence in ESG ratings will aggravate the financing constraints of enterprises. Combining the two regression results, considering that the baseline model controls the fixed effect of time and industry, the conclusion of this paper is basically not affected by the omitted variables.

5.3.2. Instrumental variable method

In order to mitigate other possible endogeneity issues, such as reciprocal causation where a high degree of financing constraints leads to greater rating differences among enterprises, we lag the independent variable for two periods, and use the 2SLS regression method to estimate

the model. The regression results are listed in columns (3) and (4) of Table 9. For the test of the original hypothesis "insufficient identification of instrumental variables", the p-value of Kleibergen-Paap rank LM statistic is 0.000, significantly rejecting the original hypothesis; In the test of weak identification of instrumental variables, the Cragg-Donald Wald F statistic is 2228.75 which is also greater than the critical value at the 10 % significance level of Stock-Yogo weak instrumental variable identification test, rejecting the original hypothesis of weak instrumental variables. Therefore, the instrumental variable is effective. The coefficient of ESGRD is still significantly positive, indicating that the results of baseline regression remain significant after controlling for endogeneity problems.

We also use the average rating divergence of peer companies in the same City and industry as an instrumental variable to solve the two-way causality problem. Enterprises are in a similar environment to those in the same industry and region, so rating differences are highly correlated. This instrumental variable meets the correlation requirements. In addition, due to the fact that the mean is jointly determined by many enterprises, it is minimally affected by individual enterprises, avoiding the impact of firms' financing constraints on their own rating differences. This instrumental variable satisfies the exogeneity condition. The results are listed in columns (5) and (6) of Table 9. For the test of the original hypothesis "insufficient identification of instrumental variables", the p-value of Kleibergen-Paap rank LM statistic is 0.000, significantly rejecting the original hypothesis; In the test of weak identification of instrumental variables, the Cragg-Donald Wald F statistic is

Table 9
Endogeneity discussion.

Dep.var	(1)	(2)	(3)	(4)	(5)	(6)
	WW	WW	WW	First stage	WW	First stage
ESG_div	0.040*** (2.942)	0.035*** (2.602)	0.082*** (3.341)		0.035*** (2.585)	
ICI	-0.000*** (-9.672)	-0.000*** (-8.500)				
VR		0.011*** (7.874)				
L.ESG_div				0.004*** (38.066)		
aveESG_div						0.967*** (129.146)
Number	-0.028*** (-34.544)	-0.027*** (-33.392)	-0.030*** (-36.491)	0.002*** (2.839)	-0.029*** (-35.592)	0.003*** (4.329)
Mean	-0.079*** (-6.671)	-0.066*** (-5.577)	-0.088*** (-6.880)	-0.176*** (-16.728)	-0.098*** (-8.827)	-0.089*** (-9.857)
Lev	-0.114*** (-12.234)	-0.115*** (-12.412)	-0.117*** (-12.558)	-0.003 (-0.387)	-0.117*** (-12.536)	0.001 (0.177)
EM	0.000 (0.231)	0.000 (0.248)	0.000 (0.438)	0.000* (1.769)	0.000 (0.520)	0.001** (2.426)
ROA	-0.277*** (-21.372)	-0.270*** (-20.852)	-0.307*** (-22.715)	-0.045*** (-3.818)	-0.310*** (-22.878)	-0.025*** (-2.843)
Quick	0.001 (1.065)	0.001 (1.080)	0.001 (1.505)	-0.001 (-1.277)	0.001 (1.336)	-0.001* (-1.808)
Separate	-0.000*** (-2.736)	-0.000*** (-2.842)	-0.000*** (-2.644)	-0.000* (-1.664)	-0.000*** (-2.686)	-0.000 (-1.112)
Balance	-0.000 (-0.264)	-0.000 (-0.287)	-0.000 (-0.380)	0.000 (0.187)	-0.000 (-0.360)	0.000 (0.101)
_cons	-0.813*** (-45.515)	-0.860*** (-45.876)	-0.859*** (-46.470)	0.168*** (17.369)	-0.850*** (-46.327)	0.000 (0.10)
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
N	9071	9071	9131	9131	9131	9131
adj. R ²	0.463	0.467	0.457	0.314	0.458	0.654

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05 , 0.1 , which is significant at 1 %, 5 % and 10 %.

113,000 which is also greater than the critical value at the 10 % significance level of Stock-Yogo weak instrumental variable identification test, rejecting the original hypothesis of weak instrumental variables. Therefore, the instrumental variable is effective. The results of using this instrumental variable for 2SLS regression also support our conclusion.

5.4. The role of analysts

The regression results with analysts' prediction errors (Forecast) as the intermediary variables are listed in Table 10. Column (1) reflects the total effect of ESGRD on corporate financing constraints. Column (2) reflects the impact of ESGRD on analysts' prediction errors, indicating that an increase in ESGRD will increase the degree of analysts' prediction errors. The coefficient of ESGRD in column (3) and the coefficient of analysts' prediction bias are both significant and positive, indicating that analysts' prediction bias significantly exacerbates corporate financing constraints. The ESGRD coefficient in column (1) is greater than in column (3), indicating that analysts' prediction bias plays a partial mediating effect. Our hypothesis H2 is supported, which means the ESG ratings divergence leads to the increase of analysts' prediction errors, and further aggravates the financing constraints of enterprises. However, in order to make the results more accurate and credible, Sobel test is carried out. The Z-statistic of Sobel test is 4.461, which is significant at the level of 1 % and further supports our conclusion.

5.5. The role of ESG disclosure compliance

When enterprises disclose non-compliant information, the effectiveness of their ESG information will decline, and the quality of information provided to the outside world will decline. For rating agencies,

different agencies will have less consistent information about them. For the needs of ESG rating, institutions will obtain information through non-public channels to get the information required for rating. However, the information acquisition ability and analysis ability of institutions are different, so the original information used in ESG rating report is quite different. Differences in the original information will eventually lead to different ESG ratings by different institutions. Therefore, the compliance of corporate information disclosure will affect the level of ESGRD, which will further affect corporate financing constraints. The decline in the quality of rating information can also lead investors to reduce their investments, thereby exacerbating the financing constraints of enterprises.

Referring to Kimbrough et al. (2024), we measure the degree of ESG disclosure compliance by two indicators. In column (1) and (2) of Table 11, the sample is divided into two groups according to the first indicator: whether enterprises' ESG information disclosure meets the GRI standard. The first column suggests that there are no obvious relationships between ESGRD and corporate financing constraints for firms whose ESG disclosure meets the GRI standard. This result is completely different from that in the second column, which shows that ESGRD still significantly affects corporate financing constraints for other firms. Therefore, for enterprises that do not meet the GRI standard, ESG rating differences have a more significant impact on financing constraints than for those that meet the GRI standard. In column (3) and (4) of Table 11, the sample is divided into two groups according to the second indicator: whether the ESG information disclosure has been certified by a third party. The comparison of column (3) and column (4) also shows that for enterprises whose ESG information has not been certified by a third party, the impact of ESG ratings divergence on financing constraints is significant. Subsequently, the results of *t*-test show that the difference was statistically significant, and there were

Table 10
Analysts' forecast errors as intermediary variable.

Dep.var	(1)	(2)	(3)
	WW	Forecast	WW
ESG_div	0.042*** (3.045)	0.054*** (2.916)	0.035** (2.294)
Forecast			0.068*** (4.032)
Number	-0.029*** (-36.021)		-0.028*** (-35.451)
Mean	-0.097*** (-8.401)		-0.087*** (-7.065)
Lev	-0.117*** (-12.493)	-0.116*** (-6.689)	-0.104*** (-10.833)
EM	0.000 (0.505)	0.005* (1.904)	-0.002 (-0.774)
ROA	-0.310*** (-22.883)	-0.779*** (-16.080)	-0.243*** (-12.022)
Quick	0.001 (1.360)	0.004*** (3.224)	0.001 (1.121)
Separate	-0.000*** (-2.671)	-0.000*** (-4.045)	-0.000 (-1.599)
Balance	-0.000 (-0.361)	0.000 (0.297)	-0.000 (-0.396)
_cons	-0.851*** (-46.381)	0.086*** (5.575)	-0.872*** (-56.142)
Time FE	YES	YES	YES
Industry FE	YES	YES	YES
N	9131	7439	7439
adj. R ²	0.458	0.362	0.455

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %.

Table 11
ESG disclosure compliance.

Dep.var	(1)	(2)	(3)	(4)
	GRI = 1	GRI = 0	CER = 1	CER = 0
ESG_div	0.034 (0.864)	0.045*** (3.117)	0.162 (1.706)	0.041*** (3.011)
Number	-0.027*** (-7.405)	-0.029*** (-38.185)	-0.035*** (-4.940)	-0.029*** (-35.684)
Mean	-0.077** (-2.437)	-0.099*** (-8.478)	-0.046 (-0.429)	-0.097*** (-8.277)
Lev	-0.112*** (-4.612)	-0.115*** (-13.210)	-0.057 (-0.514)	-0.117*** (-12.379)
EM	0.000*** (3.045)	0.000 (0.202)	0.001 (0.084)	0.000 (0.512)
ROA	-0.377*** (-6.955)	-0.302*** (-22.130)	-0.270** (-2.053)	-0.309*** (-22.702)
Quick	0.003 (1.603)	0.001 (1.259)	0.008** (1.996)	0.001 (1.350)
Separate	-0.000 (-0.079)	-0.000*** (-2.979)	0.000 (0.495)	-0.000*** (-2.654)
Balance	-0.000 (-0.697)	-0.000 (-0.130)	-0.000* (-1.761)	-0.000 (-0.386)
_cons	-0.925*** (-20.959)	-0.847*** (-45.333)	-0.848*** (-16.395)	-0.851*** (-46.356)
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
N	1102	7985	79	9008
adj. R ²	0.450	0.475	0.869	0.458

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %. (4) For firms whose ESG disclosure meets the GRI standard, GRI = 1, otherwise GRI = 0; For firms whose ESG information has not been certified by a third party, CER = 1, otherwise CER = 0.

significant differences between the two subsamples. So, compliant

information disclosure alleviates financing constraints caused by ESGRD. This result supports our hypothesis H3.

5.6. Heterogeneity analysis

We analyze the potential heterogeneity of the sample according to corporate profitability and ESG rating. When the profitability of enterprises declines, the funds used by the enterprise to repay the debt are limited. In this case, enterprises face higher debt risk because they may not be able to repay their debts in time due to poor profitability. According to MM theory, when there are taxes and bankruptcy costs, the increase of debt will increase the probability of bankruptcy, which makes enterprises more sensitive to risks. Therefore, enterprises with lower profitability will have more risks, which will aggravate the financing constraints of enterprises caused by ESGRD. The total return on assets (ROA) is used to measure the profitability of enterprises and the sample is divided into two subsamples according to whether the ROA is greater than the median of the sample. The coefficient of ESGRD in column (1) of Table 12 is not significant while the coefficient in column (2) is significant, which supports our analysis.

We further divide the sample into two groups based on the median of the average ESG rating of the sample. Investors trust companies with higher ESG ratings more. Despite divergences occurring in their ESG ratings, they are still willing to invest. While investors tend to be more cautious about companies with lower ESG ratings, especially those with divergent and confusing ESG ratings. So, companies with lower ESG ratings are more affected by rating divergence. Columns (3) and (4) of Table 12 confirm the above analysis. The marginal impact of ESG rating differences on financial constraints is greater in enterprises with low ESG ratings. Subsequently, the t-test shows that the difference of ESG_div coefficients between the two groups was statistically significant.

5.7. Further analysis

5.7.1. ESG rating divergence between domestic and foreign agencies

In previous studies, we selected six rating agencies to measure ESG

Table 12
Heterogeneity analysis.

Dep.var	(1)	(2)	(3)	(4)
	High ROA	Low ROA	High ESG rating	Low ESG rating
ESG_div	0.019 (1.198)	0.053*** (2.735)	0.048*** (4.040)	0.069*** (2.904)
Number	-0.025*** (-22.754)	-0.034*** (-28.915)	-0.034*** (-32.953)	-0.025*** (-22.866)
Mean	-0.065*** (-4.847)	-0.102*** (-5.958)	-0.088*** (-5.456)	-0.101*** (-4.185)
Lev	-0.054** (-2.024)	-0.111*** (-8.937)	-0.108*** (-8.523)	-0.113*** (-7.846)
EM	-0.021** (-2.430)	0.000 (0.376)	-0.001 (-0.405)	0.000 (0.480)
ROA	-0.232*** (-9.622)	-0.290*** (-16.225)	-0.303*** (-19.548)	-0.314*** (-17.079)
Quick	0.003*** (3.845)	-0.000 (-0.386)	0.001* (1.835)	0.001 (0.536)
Separate	-0.000*** (-2.690)	-0.000 (-1.469)	-0.000** (-2.214)	-0.000** (-2.551)
Balance	-0.000 (-0.760)	0.000 (0.261)	-0.000 (-1.260)	0.000 (0.140)
_cons	-0.866*** (-56.028)	-0.842*** (-37.572)	-0.867*** (-62.350)	-0.869*** (-42.352)
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
N	4205	4926	4147	4984
adj. R ²	0.440	0.476	0.677	0.369

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %.

rating differences, three of which are Chinese (SSI, STG, Wind) and the others are international (FR, MSCI, Bloomberg). Enterprises usually seek funds from domestic investors and institutions. Different ratings from different countries may have different impacts. Therefore, we would like to figure out following two questions: 1, Does the rating divergence within domestic or international institutions affect financing constraints? 2, Does the divergence between domestic and international institutions affect financing constraints? We calculated the rating differences within three domestic institutions and three international institutions, represented by h_div and f_div respectively. Using these two variables as explanatory variables, the model (1) was re estimated, and the results are listed in columns (1) and (2) of Table 13. It shows that only the rating divergence among domestic institutions has affected financing constraints. Furthermore, we selected a domestic rating agency (SSI) and an international rating agency (MSCI), and calculated the absolute value of the difference in these two ratings (hf_div) to measure the difference in ratings between domestic and international agencies.³ The results show that the difference in ratings between Chinese and foreign agencies also significantly affects the financing constraints of enterprises. Therefore, we believe that the impact of rating differences on financing constraints mainly comes from the differences within domestic institutions and the overall differences between domestic and foreign institutions. The main reason is that due to language and cultural differences, Chinese investors and institutions pay more attention to domestic rating information, and compare that with international ratings, but pay less attention separately to foreign rating information.

Table 13
ESG Rating Divergence between Domestic and Foreign agencies.

Dep.var	(1)	(2)	(3)
	WW	WW	WW
h_div	0.040** (2.346)		
f_div		-0.033 (-1.225)	
hf_div			0.040*** (2.845)
Number	-0.029*** (-34.450)	-0.028*** (-14.632)	-0.029*** (-16.416)
Mean	-0.099*** (-8.564)	-0.156*** (-9.029)	-0.152*** (-8.276)
Lev	-0.118*** (-12.392)	-0.114*** (-8.071)	-0.116*** (-7.750)
EM	0.000 (0.528)	0.001 (0.542)	0.001 (0.701)
ROA	-0.310*** (-22.921)	-0.303*** (-12.532)	-0.307*** (-11.428)
Quick	0.001 (1.300)	0.002** (2.557)	0.003*** (2.692)
Separate	-0.000*** (-2.688)	-0.000 (-0.168)	0.000 (0.329)
Balance	-0.000 (-0.368)	-0.000 (-0.380)	0.000 (0.850)
_cons	-0.849*** (-46.137)	-0.840*** (-37.337)	-0.846*** (-37.394)
Time FE	YES	YES	YES
Industry FE	YES	YES	YES
N	9131	3737	3384
adj. R^2	0.458	0.409	0.398

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %.

³ Our conclusions are not sensitive to the specific choice of rating agencies.

5.7.2. ESG rating divergence in sub-dimensions

The different dimensions of ESG may have varying impacts on financing constraints (Capizzi et al., 2021). As the main effect of ESGRD comes from differences within domestic institutions, we would like to further explore which sub item of domestic ESG rating plays a key role. We selected two institutions with available sub-dimensions rating data, Wind and SSI, and calculated the absolute differences in Environmental, Social, and Governance ratings provided by the two institutions. The regression results are listed in Table 14, which show that environmental rating divergence (E_div) significantly exacerbates financing constraints at the 1 % level, while social rating divergence (S_div) exhibits a significant negative association with financing constraints. This indicates that the Chinese government pays more attention to the impact of corporate operations on the environment, thereby prompting investors to focus on the environmental protection measures taken by companies. When facing divergence in environmental ratings, they will be more cautious. The mechanism analysis shows that the divergence in environmental ratings also exacerbates the financing constraints of enterprises by widening the divergence in analysts' forecasts (Column 4, Table 14). The compliance of disclosure has also played a similar moderating effect (Table 15). Enterprises with more compliant information disclosure have less significant impact on financing constraints due to divergences in environmental ratings.

The rating divergence in the social dimension has instead alleviated financing constraints. Information in the social dimension usually serves to "add flowers to the brocade" (i.e., enhance existing strengths). Even if enterprises assume less social responsibility, they will not be punished by the government in the short term, so it has less impact on their ability to repay funds. This is the main difference between the social dimension and the environmental dimension. When investors determine that the ESG rating divergence of an enterprise mainly originates from the social

Table 14
ESG Rating Divergence in sub items.

Dep.var	(1)	(2)	(3)	(4)
	WW	WW	WW	WW
E_div	0.015*** (3.097)			0.020*** (3.811)
S_div		-0.021*** (-3.102)		
G_div			0.011 (1.415)	
Forecast				0.068*** (4.093)
Number	-0.029*** (-35.486)	-0.029*** (-35.829)	-0.029*** (-34.667)	-0.027*** (-34.236)
Mean	-0.100*** (-9.912)	-0.120*** (-12.021)	-0.107*** (-10.376)	-0.085*** (-7.986)
Lev	-0.116*** (-12.238)	-0.115*** (-12.489)	-0.116*** (-12.349)	-0.103*** (-10.719)
EM	0.000 (0.604)	0.000 (0.561)	0.000 (0.582)	-0.002 (-0.752)
ROA	-0.312*** (-22.618)	-0.309*** (-22.764)	-0.311*** (-22.457)	-0.244*** (-12.134)
Quick	0.001 (1.150)	0.001 (1.264)	0.001 (1.237)	0.000 (1.019)
Separate	-0.000*** (-2.737)	-0.000*** (-2.637)	-0.000*** (-2.731)	-0.000 (-1.629)
Balance	-0.000 (-0.243)	-0.000 (-0.159)	-0.000 (-0.225)	-0.000 (-0.355)
_cons	-0.854*** (-45.413)	-0.828*** (-43.284)	-0.844*** (-45.833)	-0.881*** (-55.063)
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
N	9080	9081	9081	7401
adj. R^2	0.456	0.457	0.456	0.455

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05, 0.1, which is significant at 1 %, 5 % and 10 %.

Table 15
ESG disclosure compliance: E-dimension.

Dep.var	(1)	(2)	(3)	(4)
	GRI = 1	GRI = 0	CER = 1	CER = 0
E_div	0.022 (1.287)	0.014*** (2.795)	-0.055 (-1.140)	0.016*** (3.179)
Number	-0.025*** (-9.915)	-0.029*** (-37.442)	-0.036*** (-5.065)	-0.029*** (-35.188)
Mean	-0.070** (-2.120)	-0.104*** (-10.191)	-0.116 (-1.063)	-0.100*** (-9.797)
Lev	-0.115*** (-4.838)	-0.114*** (-12.962)	-0.018 (-0.159)	-0.116*** (-12.141)
EM	0.000 (0.762)	0.000 (0.258)	-0.007 (-0.382)	0.000 (0.616)
ROA	-0.382*** (-9.215)	-0.304*** (-21.896)	-0.291** (-2.044)	-0.311*** (-22.451)
Quick	0.003 (1.041)	0.001 (1.045)	0.009** (2.064)	0.001 (1.125)
Separate	-0.000 (-0.141)	-0.000*** (-3.040)	0.000 (0.176)	-0.000*** (-2.719)
Balance	-0.000 (-0.388)	-0.000 (-0.064)	-0.000* (-1.908)	-0.000 (-0.295)
_cons	-0.936*** (-14.418)	-0.849*** (-43.893)	-0.776*** (-9.920)	-0.855*** (-45.438)
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
N	1102	7985	79	88,959
adj. R2	0.450	0.473	0.863	0.456

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05 , 0.1 , which is significant at 1 %, 5 % and 10 %. (4) For firms whose ESG disclosure meets the GRI standard, GRI = 1, otherwise GRI = 0; For firms whose ESG information has not been certified by a third party, CER = 1, otherwise CER = 0.

dimension, they will instead consider the existence of such divergence unimportant, thereby mitigating the impact of rating divergence on financing constraints and producing a positive effect.

5.7.3. The impact of inter institutional differences

Some research believes that the main source of ESGRD is the differences among rating agencies themselves, such as differences in rating methods (Kotsantonis and Serafeim, 2019) and differences in agencies' definitions of ESG (Scalet and Kelly, 2010). So, does the impact of ESGRD on financing constraints come from inter-institutional differences? It is necessary to conduct research on the factor of differences in rating agencies. Assuming that the ESGRD is entirely caused by the differences between rating agencies, the degree of ESGRD rated by the same rating agency should also be the same. For example, if both Enterprise A and Enterprise B have received ratings from two rating agencies C and D, the rating differences between A and B caused by inter-institutional issue should be the same. But the fact is not so. There are also significant differences in ratings among companies rated by the same institutions which are caused by other issues. There are still many factors that can cause rating disagreements, such as the company itself releasing uncertain and vague information to the public, and the impact of some policies may be difficult to accurately evaluate, and so on. If the rating divergence is entirely caused by differences between institutions, then paying attention to rating divergence will be meaningless, because as long as one chooses to follow the information of one rating agency, the impact of rating divergence can be avoided. The rating divergence caused by factors other than inter institutional differences deserves attention. Therefore, we select two sub samples and recalculate the differences of enterprises' ESG rating within each sample. In column (1) of Table 15, the subsample contains firms that only received the ESG scores of SSI and Wind. In column (2), the subsample contains firms which only received the ESG scores of SSI, Wind and Bloomberg. The results show that inter institutional differences don't affect our

conclusion. After controlling the rating agencies, the rating divergence still exacerbates financing constraints. This indicates that it is not the differences between rating agencies that exacerbate financing constraints, and companies should seek their own ways to alleviate the financing constraints caused by rating differences.

5.7.4. ESG development potential

This section will discuss the impact of ESG development potential on the relationship between ESGRD and financing constraints. According to Wang Z. et al. (2024), the ESG development potential is measured based on whether its ESG rating for the current year is equal to or exceeds the rating of the previous year (if it exceeds, Improve takes 1; otherwise, Improves take 0). Enterprises with greater potential for ESG development typically have excellent management and operational capabilities (Jiang et al., 2023). The improvement of governance structure enables enterprises to better adapt to market changes, reduce the impact of adverse factors on enterprises, and ensure the stability of long-term value of enterprises (Wang et al., 2023). Investors also have stronger confidence and willingness to invest in these enterprises. Enterprises with higher ESG development potential will improve their brand image, business relationships, and social acceptance through positive ESG behaviors, which help them establish long-term trust and support from investors (Rahat and Nguyen, 2023; Li et al., 2023). Pedersen et al. (2021) also found that companies with high ESG potential increase investor confidence.

Enterprises with greater ESG development potential have gained more support from investors and society, which can alleviate the negative impact of ESGRD, and enable investors to focus more on the future development of enterprises. Therefore, when ESGRD occurs, companies with greater ESG development potential face less financing constraints. The specific impact of ESG development potential is shown in column (3). The regression results show that the interaction term between development potential and ESG divergence (Improve_div) is significantly negative, which means that the development potential of enterprises' ESG can alleviate the impact of ESGRD on financing constraints. The estimated parameters of ESGRD are significantly positive at the 1 % level. Therefore, even considering the effect of ESG development potential, the impact of ESGRD on financing constraints is still significant.

5.7.5. ESG rating divergence and ESG rating

ESG rating itself is also one of the influencing factors of financing constraints, and there is mutual influence between ESG rating and rating divergence. Therefore, we further examined the relationship between ESG ratings and financing constraints, as well as the role of ESG divergence after considering ratings. The results in column (4) of Table 16 indicate that enterprises with high ESG ratings have fewer financing constraints. Interestingly, when we add ESGRD to the model, the impact of ESG ratings on financing constraints is no longer significant but the coefficient of ESGRD is still significant (shown in column 5 of Table 16). It indicates that ESG rating differences weaken the positive effect of ESG rating on financing constraints.

5.7.6. ESG rating divergence and α

Some literature demonstrates that ESG ratings are not important for investors (Horn and Oehler, 2024). Is this conclusion valid for Chinese listed companies? In this section, we examine whether ESG rating divergences affect the abnormal return (α) of enterprises. We measure the α of a company by rolling regressions on a firms' excess return according to a five-factor model. The first column in Table 16 shows the regression result with α as the dependent variable and ESG rating divergence as the explanatory variable. The coefficient of ESG rating divergence is significantly positive, indicating that the existence of ESG rating divergences increases risk, thereby generating risk compensation. The second column further incorporates financing constraints. Both the coefficients of financing constraints and rating divergence are significantly

Table 16The impact of inter institutional differences, ESG development potential, ESG rating and α

Dep.var	(1)	(2)	(3)	(4)	(5)	(6)
	WW	WW	WW	WW	WW	α
ESG_div	0.0577*** (5.2177)	0.1345* (1.8237)	0.051*** (3.179)		0.044*** (3.184)	1.321** (2.201)
Improve_div			-0.370* (-1.929)			
Improve			0.003 (1.273)			
ESG				-0.003** (-2.042)	0.000 (0.020)	
Number	-0.0025 (-0.4014)	0.0000 (.)	-0.029*** (-32.741)	-0.028*** (-28.818)	-0.029*** (-32.675)	-0.037 (-1.041)
Mean	-0.0485*** (-4.0758)	-0.0589 (-1.1380)	-0.093*** (-7.448)	-0.082*** (-4.694)	-0.097*** (-6.322)	-0.181 (-0.339)
Lev	-0.1117*** (-14.9948)	-0.1098*** (-2.9868)	-0.117*** (-12.493)	-0.118*** (-12.369)	-0.117*** (-12.443)	0.378 (1.108)
EM	0.0001 (0.5092)	0.0017 (0.5315)	0.000 (0.492)	0.000 (0.565)	0.000 (0.502)	-0.017* (-1.827)
ROA	-0.3197*** (-25.0183)	-0.4166*** (-6.4552)	-0.309*** (-22.977)	-0.311*** (-22.739)	-0.310*** (-22.806)	-0.554 (-0.748)
Quick	0.0004 (0.6183)	0.0029 (0.6520)	0.001 (1.360)	0.001 (1.118)	0.001 (1.206)	0.002 (0.076)
Separate	-0.0000*** (-5.5225)	0.0000 (0.4260)	-0.000*** (-2.667)	-0.000*** (-2.718)	-0.000*** (-2.678)	-0.000 (-0.942)
Balance	0.0000 (0.0425)	0.0001 (1.2904)	-0.000 (-0.413)	-0.000 (-0.439)	-0.000 (-0.423)	0.000 (0.040)
_cons	-0.9215*** (-40.9453)	-0.9986*** (-22.0673)	-0.854*** (-46.823)	-0.845*** (-46.128)	-0.851*** (-46.492)	-1.977* (-1.725)
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
N	5359	943	9080	9106	9106	9065
adj. R ²	0.250	0.124	0.456	0.456	0.457	0.040

Note: (1) Robust standard errors are clustered at the firm level. (2) Robust t-statistics are reported in parentheses. (3) ***, **, * respectively represent $p < 0.01$, 0.05 , 0.1 , which is significant at 1 %, 5 % and 10 %.

positive, suggesting that the mechanism proposed in this paper, in which ESG rating divergence exacerbates financing constraints, is how ESG rating divergence affects α . Therefore, for Chinese investors, paying attention to ESG rating divergences holds significant reference value.

6. Conclusions and discussion

6.1. Conclusions

This study analyses the impact of ESGRD on financing constraints. By selecting a sample of Chinese A-share listed companies from 2018 to 2022 and integrating ESG rating data from six ESG rating agencies, namely SynTao Green, Sino-Securities index, FTSE Russell, MSCI, Bloomberg and Wind, an ESGRD index is constructed to explore the intricate relationship between ESGRD and corporate financing constraints. The empirical results reveal that enterprises with greater ESG ratings divergence suffer from more severe financing constraints. After multiple robustness tests, the conclusion remains valid. We find that ESGRD undermines the accuracy of analyst forecast information which exacerbate financing constraints. Additionally, standardized ESG information disclosure can alleviate the impact of ESGRD on financing constraints. The heterogeneity analysis demonstrates that the impact of ESGRD is less significant in companies with higher rating levels and profitability levels. Specifically, the impact of ESGRD mainly stems from domestic rating divergence, domestic and international rating divergence, while foreign rating divergence has no significant impact. For the three sub-dimensions of ESG ratings, only the divergence in environmental ratings exacerbates the financing constraints. Although differences in standards and methods among rating agencies may lead to differences in ESG rating results, this factor does not directly contribute to financing constraints, as evidenced by the finding that rating differences among companies rated by the same institution still exacerbate

financing constraints. Enterprises with greater ESG development potential are less affected by rating divergence. High-rated enterprises face less financing constraints, but the existence of rating differences weakens the positive role of rating information itself. More importantly, ESGRD can generate excess returns.

6.2. Implications

The findings of this research provide novel empirical evidence on the divergence of ESG ratings, providing valuable reference for investors, enterprises, and governments in interpreting ESG rating information.

For investors, it is necessary to have a comprehensive review of ESG information and the potential impact of rating discrepancies. By cross-referencing ESG rating results from different rating agencies, combined with third-party verification and industry analyst evaluations, more comprehensive and objective ESG information can be obtained to avoid policy risks during investment.

Enterprise should attach great importance to ESG ratings, improve their ESG management systems, and strengthen their own information disclosure system. International ESG reporting frameworks such as Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and Task Force on Climate-related Financial Disclosures (TCFD) can be considered to ensure consistency and standardization of ESG information disclosure, thereby reducing rating divergence and avoiding unnecessary financing constraints. Maintaining communication channels with rating agencies, investors, and stakeholders is also crucial for reducing rating discrepancies. When rating discrepancy occurs, enterprises should proactively explain the underlying causes of the different ESG rating and the improvement measures that will be taken to solve these problems.

For governments, relevant ESG policies and regulations should be formulated to promote sustainable development of enterprises in

environmental, social, and governance aspects. Special institutions or departments should be established to supervise ESG rating agencies, methods and data sources for ESG rating in order to increase rating consistency and comparability.

6.3. Limitations and future work

This study has several limitations that warrant further exploration in future research. Firstly, due to the limited coverage of ESG rating data, the research sample only includes companies that are more concerned about ESG information, potentially leading to sample selection bias. As enterprise rating data involves a wider range of enterprises in the future, this bias can be rectified. Secondly, we only analyzed the impact mechanism of ESGRD on financing constraints from the perspective of analysts, while ignoring other possible mechanisms. Future studies could explore additional mechanisms. Thirdly, the inability to measure the degree to which different institutions' ratings deviate from the true value makes it difficult to determine whether rating divergence is beneficial for investors. Future research could attempt to develop methods for quantifying rating accuracy and assess the implications of rating divergence from an investor-centric perspective.

CRediT authorship contribution statement

Jiahua Zhao: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Min-glin Wang:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Saisai Hong:** Writing – original draft, Formal analysis, Data curation. **Si Tan:** Writing – original draft, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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