ESG Information Disclosure and Asset Mispricing

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Abstract. Using Shanghai and Shenzhen A-share listed companies from 2011 to 2020 as the research sample, this paper empirically examines the relationship between ESG information disclosure and asset mispricing. The findings show that high-quality corporate ESG information disclosure can mitigate the level of asset mispricing, with environmental (E) dimension disclosure being a key factor in reducing the level of asset mispricing. The mediating effect shows that corporate ESG disclosure reduces the level of asset mispricing by increasing the transparency of corporate information. Further research shows that the mitigation effect of corporate ESG disclosure on asset mispricing is stronger when the shareholding of pressure-resisting institutional investors in the underlying company is higher and the media monitoring is stronger. The research in this paper provides a theoretical basis for an in-depth understanding of the impact of corporate ESG information disclosure on asset mispricing, to better improve the efficiency of capital market resource allocation and promote the healthy long-term development of the real economy.

Keywords: ESG information disclosure, asset mispricing, information transparency, institutional investors, media monitoring.

1. Introduction

In the context of green development becoming popularized and normalized in the international community, ESG (Environment, Social, and Governace) investment concepts and strategies arouse more and more investors' attention. Unlike the traditional CSR (Corporate Social Responsibility), ESG has a better system, a clearer framework and more objective criteria. Based on ESG information, investors can observe the ESG performance of each company to evaluate their own investment behavior, identifying the opportunities and challenges faced by their investment targets in creating business value and achieving sustainable development. Meanwhile, Creditors are able to use ESG information to predict the corporate future performance and cash flows more accurately, conducive for them to assess long-term credit risks comprehensively [1]. Regulators can also make more effective and convenient regulation of listed companies according to those information.

Corporate ESG information meets the needs of multiple stakeholders so that it graudually becomes a global trend. According to the United Nations Sustainable Stock Exchange Initiative (SSE), as of August 2022, 32 stock exchanges worldwide have made ESG information disclosure mandatory. Meanwhile, China's State-owned Assets Supervision and Administration Commission (SASAC) is trying to promote ESG information disclosure for all listed companies held by central enterprises They are planning to issue ESG information disclosure guidelines for listed companies held by central enterprises in late 2023, which will provide a strong guarantee for domestic and foreign investors to comprehensively evaluate the value of enterprises held by central enterprises.

Asset mispricing refers to the phenomenon that corporate stock prices deviate from their intrinsic value, which is mainly caused by the existence of asymmetric information and a certain specific psychology of investors that makes investors improperly apply Bayesian method[2].It brings many hazards to enterprises, investors, regulators, etc. If left unchecked, it is likely to further interfere with market resource allocation, reduce resource allocation efficiency, and ultimately hinder the healthy long-term development of the real economy [3]. Therefore, it is of considerable significance to study the factors affecting asset mispricing as well as the formation mechanism in order to find out the solutions.

Current research on the antecedents of asset mispricing focuses on investor characteristics, financial information quality, and auditor behavior, among which Wang Songhe et al. (2018)

empirically analyze and find that social responsibility information can mitigate the degree of corporate asset mispricing by improving the accuracy of analysts' surplus forecasts.[4] In addition, Xu Gang (2020) confirms the negative correlation between mandatory disclosure of social responsibility information and asset mispricing.[5] Both of them provide strong support for the study of this paper. However, since there are some differences between ESG information and social responsibility information, and the channel is not yet unique with the restrictions unclear, further improvements and additions are still needed.

In view of this, it is worthwhile to explore comprehensively and thoroughly whether the quality of ESG information disclosure affects the degree of corporate asset mispricing, through what channels it will do so and whether there is variability in the effect under different conditions. In this paper, I select A-share listed companies in Shanghai and Shenzhen from 2011 to 2020 as the research sample, analyze the effect of the overall level of ESG information disclosure and the level of each individual information disclosure of E, S and G on asset mispricing. On this basis, I carry out the anlaysis of mediating effect based on information transparency. Then I also empirically examines the moderating effects of institutional investor heterogeneity and media monitoring. It is found that the high level of ESG disclosure at this stage helps to mitigate the asset mispricing problem, and this effect is achieved by increasing the transparency of corporate information. In addition, the mitigating effect of ESG disclosure on asset mispricing is enhanced under the conditions of high shareholding of pressure-resisting investors and strong media monitoring.

Compared with the existing studies, the incremental contribution of this paper may be reflected in the following two aspects: First, this paper explores the impact of ESG disclosure on asset mispricing, which enriches the literature on “ESG disclosure and capital markets”. Second, this paper confirms the channels through which ESG disclosure affects asset mispricing, that is to say ESG disclosure can reduce asset mispricing by improving the transparency of corporate information. Additionally, this paper further explores the relationship between ESG disclosure and asset mispricing based on two different external contexts, namely institutional investor heterogeneity and media monitoring, which helps to understand the specific mechanisms and constraints of ESG disclosure better.

2. Theoretical analysis and research hypothesis

2.1. Literature review

Asset mispricing is a serious obstacle that has long plagued the securities market to effectively perform its function of resource allocation, causing the anomaly that the stock prices of listed companies deviate from their intrinsic values for a long time. So many scholars have conducted an in-depth investigation into its causes. After sorting out, it is found that capital market valuation mispricing is mainly related to the characteristics of institutional investors, information disclosure quality, investor sentiment and ect.

On the side of investors, many scholars have focused on the effects of institutional investor characteristics such as the number of holdings, duration, and network linkages on asset mispricing, while some have found that investor optimism can also lead to stock mispricing. Bartov et al. (2000) suggest that mispricing caused by abnormal stock returns following quarterly earnings announcements of listed companies may be related to institutional investor holdings, and later in the negative correlation was confirmed.[6] Sakaki et al. (2021) study the effect of institutional investors' shareholding stability and investment horizon on firm stock mispricing, finding that the greater the share of institutional investors' holdings are, the lower the degree of stock price bias is.[7] Using a social network algorithm, Bi, Peng and Wang, Lili (2022) find that institutional investor networks promote information dissemination and force firms to improve governance, thereby significantly mitigating the degree of asset mispricing.[8] Differently, Miwa (2016) extends the study to all investors and finds that bullish sentiment across the capital market induces optimism among investors, causing them to aggressively differentiate companies with high growth prospects from others, while this overly bold behavior leads to high levels of mispricing.[9] Using data on A-share listed

companies in Shanghai and Shenzhen, our scholar Zhang Jing et al. (2018) similarly confirm the exacerbating effect of investor optimism on stock price overvaluation.[10]

Berkman et al. (2009) find that asset mispricing is affected by earnings announcements of listed companies, and further observe that stock price volatility is highest in the first trading day after the earnings announcement through an event study method. The highest stock price volatility and the most anomalous trading volume are observed in the first trading day after the surplus announcement.[11] Xu Fushou and Xu Longbing (2015) use the KV index to measure the quality of information disclosure and demonstrate that the higher the quality of information disclosure, the lower the deviation of the market price from the intrinsic value of the company.[12] Focusing on CSR information, Wang Songhe et al. (2018) select the Hexun social responsibility score as a proxy variable for the quality of social responsibility information disclosure, empirically find that social responsibility information can mitigate the degree of mispricing of company assets by improving the accuracy of analysts' surplus forecasts.[4] Xu Gang (2020) uses 2009 as the boundary to set the dummy variable of mandatory CSR disclosure, and also obtains a negative relationship between mandatory disclosure and asset mispricing.[5] Similarly, Chen et al. (2022) use textual analysis with a self-constructed disclosure indicator system to confirm that CSR information disclosure helps reduce stock price volatility and mitigate the degree of capital market valuation bias.[13] From the perspective of social responsibility report tone, Liu et al. (2022) find that the net positive tone of the report helps to enhance information transparency and promote rational trading behavior of investors, thus alleviating the degree of company valuation bias, and such information incremental effect is more obvious in the case of higher news media attention, higher audit quality and more intense research by institutional investors.[3]

A systematic review of the above literature reveals that there is no shortage of literature discussing the relationship between social responsibility disclosure and asset mispricing in academia. Although CSR and ESG are both based on the concept of sustainable development, requiring enterprises to take social responsibility while pursuing economic interests, they are not the same thing. On the one hand, CSR is more oriented to the public and communicated through public relations, while ESG is mainly oriented to the capital market and has a professional rating and measurement system, which can be judged quantitatively and is more useful for institutional investors or supervisors to determine the investment direction and monitoring standards[14]. On the other hand, CSR emphasizes corporate giving back to society and not closely related to business, while ESG emphasizes the unity of company value and social value, closely linking to business. Therefore, this paper argues that ESG disclosure is more effective in mitigating asset mispricing and attempts to further explore the ways and external constraints for its realization.

2.2. Research hypothesis

Based on the efficient market hypothesis, all publicly available information about companies and industries, as well as all private internal information available to individuals and groups, is fully reflected in stock price movements. The price of securities in the stock market accurately measures the current and future value of firms. However, in the real capital market, due to the information gap between investors and management, as well as the blind investment of many noisy traders [15], the stock price of a company shows serious deviations from its intrinsic value, i.e., the anomaly of mispricing of assets. This anomaly is particularly evident in China's capital market today because of the unregulated operation of the stock market, the uneven quality of investors [16], and the serious information asymmetry[17]. This paper argues that ESG information, as typical non-financial information, alleviates the principal-agent problem, makes up for the inherent deficiencies of traditional financial reporting, improves the transparency of corporate information, and plays a pivotal role in reducing asset mispricing.

On the one hand, ESG disclosure improves information transparency, alleviates the principal-agent problem, reduces the possibility of insiders manipulating stock prices, and mitigates assets mispricing. Based on the principal-agent theory, the management, who is involved in the daily operation of the

company, has a lot of inside information about the company. But the shareholders or investors, who are paid with personal wealth, are at disadvantage in terms of information because they are disconnected from the daily operation of the company and have difficulty in knowing the whole picture of the company. So it gives the management an opportunity to engage in "tunnel digging"[18] and other opportunistic behaviors, which creates the prerequisites for asset mispricing. However, with the massive disclosure of corporate ESG information, internal and external investors can not only grasp the performance of the target company through the traditional "four statements and one note" analysis, but also further analyze the environmental, social and internal governance performance of the target company. This helps investors and regulators accurately identify the private income status of major shareholders and timely detect profit-seeking behaviors such as insider trading and predatory financing by agents[12]. With stakeholder monitoring of management enhanced through ESG disclosure, the cost of insider agents to perform predatory financial activities is greatly increased, which considerably curbs their tendency to manipulate and influence share prices and mitigates asset mispricing. In addition, related scholars also point out that companies with better environmental and social performance are also less likely to engage in information manipulation[5]. They are more willing to disclose truthful and reliable information. When investors use this higher level of information to assess the operating risks and future returns of the underlying company, they will obtain more accurate valuation results, thus further mitigating asset mispricing.

On the other hand, ESG disclosure compensates for the inherent weaknesses of traditional financial reporting, reduces the degree of corporate information asymmetry, mitigatse differences in investor opinion, and alleviates the degree of asset mispricing. The traditional balance sheet, statement of cash flows, income statement and notes are limited by the complexity of transactions and the limitations of monetary measurement, which make it difficult to include non-monetary events that are valuable to stakeholders' decisions but do not meet the conditions of accounting measurement, recognition and reporting[19, 20]. Investors' valuations of the underlying company based on the above information and combined with some macro and micro parameters are likely to lead to some bias in the results, resulting in mispricing of assets. Unlike the information disclosed in the formatted financial reports, ESG information covers three levels of contents: environmental, social and corporate governance. This information comprehensively and systematically considers the non-financial performance of the company[21] and provides a judgment basis for investors to identify the financing ability, cost of capital, management advantages, and possible environmental and social risks faced by the underlying company. Based on such non-quantitative and textual information as carbon emissions, employee welfare, board structure, etc.[22], investors or other stakeholders can fully perceive the attitude of the company and its senior management towards ESG issues, further know whether the company has established corresponding control systems and risk identification measures, then reasonably assess the sustainable investment value of the invested company, which ultimately leads to a return of the market value of the company to its intrinsic value. In addition, relevant studies have shown that investor heterogeneous beliefs are also an important cause of asset mispricing[23], and investor heterogeneous beliefs can be effectively mitigated by information disclosure[15]. Therefore, a high level of ESG information disclosure can help reduce the barriers to interpretation of professional financial information by some investors and alleviate the degree of disagreement among investors as a whole about the underlying company's earnings forecast, thus mitigating asset mispricing.

In summary, ESG disclosure enhances corporate information transparency, mitigates principal-agent problems, inhibits the tendency of insider agents to manipulate and influence stock prices, supplements traditional financial reporting with qualitative bulk, weakens differences of opinion among investors, and reduces the degree of asset mispricing. Therefore, this paper proposes the following hypotheses:

H1: Ceteris Paribus, ESG disclosure reduces the level of asset mispricing.

3. Research design

3.1. Sample Selection and Data Sources

This paper selects the listed companies in Shanghai and Shenzhen A-shares in China from 2011 to 2020 as the sample. Since the Bloomberg ESG disclosure score data can be traced back to 2011 at the earliest, 2011 is taken as the starting year. On the basis of this initial sample, further screening was conducted based on the following principles: (1) exclude all companies with ST, *ST and PT; (2) exclude all listed companies in finance and securities and insurance categories; (3) exclude samples with missing values and outliers; and (4) apply a 1% up and down winsorizing to all continuous variables. Finally, 9369 annual company data were obtained, totaling 1103 companies. ESG disclosure data were obtained from Bloomberg database, and all other data were taken from Guotaian database (CSMAR).

3.2. Variable definition and measurement

3.1.1 Dependent variable

The core idea is that firms with approximate intrinsic value should be in the same industry. Therefore, the first step of this method is to find the median ratio of the sum of the annual market value of common stock and the book value of liabilities (Market) to the total assets (Asset) of each firm in the same industry, and use this number This number is then multiplied by the total assets of the individual company each year to calculate the intrinsic value of the company, and finally, the market price of the common stock of the individual company is divided by this number and the logarithm is taken as a measure of mispricing, as shown in the following formula:

$$\mathrm{Misp_{it}} = \ln\left(\frac{\mathrm{Market_{it}}}{\mathrm{Asset_{it}}*\mathrm{Ratio}}\right) \quad (1)$$

Since asset mispricing has both positive values, i.e., upward bias, and negative values, i.e., downward bias. Therefore, in order to avoid misinterpretation of the economic meaning of this variable, this paper refers to Liu, Jianqiu (2022) and others, and takes the absolute value of the calculation result, where a larger value represents a higher degree of asset mispricing.

3.1.2 Independent variable

The independent variable in this paper is ESG disclosure (ESG), and Bloomberg's ESG disclosure score is used to measure the level of ESG disclosure of listed companies. Since Bloomberg's ESG disclosure score has been adopted in many literatures and this score mainly reflects the level of ESG disclosure [24], this paper also applies this data to quantify the explanatory variables. The Bloomberg ESG disclosure score takes the lowest value of 0 and the highest value of 100, and the higher the score, the better the ESG disclosure performance of the company.

3.1.3 Control variable

Drawing on the research results of Liu Jianqiu et al. (2022) and Xu Gang (2020), this paper selected the following 11 control variables: firm size, gearing ratio, return on net assets, increase rate of main business revenue, listing years, TobinQ value, proportion of independent directors, equity concentration, audit opinion, account receivable ratio, and average monthly excess turnover, in addition to controlling for year and industry fixed effects, as shown in Table 1 for the specific variable definitions.

Table 1 Variable definitions

Type	Variable	Symbol	Definition
Independent variable	ESG information disclosure	ESG	From Bloomberg ESG disclosure scores for listed companies
Dependent variable	Asset mispricing	Misp	The degree of asset mispricing(see previous variable description)
Control variable	Firm size	Size	ln(Size)
	Gearing ratio	Lev	Total liablities/total assets
	Return on net assets	Roe	Net profit/total assets
	Increase rate of main business revenue	Growth	Revenue for this year/revenue last year-1
	Listing years	ListAge	ln(current year-listing year+1)
	TobinQ value	TobinQ	Market value of equity and market value of net debt/total assets at the end of the period
	Proportion of independent directors	Indep	proportion of independent directors/total number of directors
	Equity concentration	Top1	Percentage of shareholding of the largest shareholder
	Audit opinion	Opinion	The value is 1 if the company's financial report for the year was issued with a standard audit opinion, otherwise it is 0
	Account receivable ratio	Rec	Account receivables/total assets
	Average monthly excess turnover	Dturn	Current year's average monthly stock turnover rate-last year's average monthly stock turnover rate
	Industry	Ind	Take an industry as 1 and the rest as 0
	Year	Year	Take an year as 1 and the rest as 0

3.1.4 Empirical Model

To test the relationship between ESG disclosure and asset mispricing, the following model is developed:

$$\begin{aligned}\mathrm{Misp}_{it} = \alpha_0 + \alpha_1 \mathrm{ESG}_{it} + \alpha_2 \mathrm{Size}_{it} + \alpha_3 \mathrm{Lev}_{it} + \alpha_4 \mathrm{Roe}_{it} + \alpha_5 \mathrm{Growth}_{it} + \alpha_6 \mathrm{ListAge}_{it} + \\ \alpha_7 \mathrm{TobinQ}_{it} + \alpha_8 \mathrm{Indep}_{it} + \alpha_9 \mathrm{Top1}_{it} + \alpha_{10} \mathrm{Opinion}_{it} + \alpha_{11} \mathrm{Rec}_{it} + \alpha_{12} \mathrm{Dturn}_{it} + \sum \mathrm{Year} + \\ \sum \mathrm{Industry} + \varepsilon \end{aligned} \quad (2)$$

4. Main Results

4.1. Summary statistics

According to the descriptive statistics in Table 2, it can be found that the dependent variable asset mispricing (Misp) has a mean value of 0.378, a median of 0.290, a standard deviation of 0.329, a minimum value of 0.03 and a maximum value of 1.611, and the market value of the company is not equal to the intrinsic value, indicating the existence of asset mispricing problems in the research samples. The independent variable ESG information disclosure (ESG) has a mean value of 20.718, a median value of 19.835, a standard deviation of 6.840, a minimum value of 9.091, and a maximum value of 44.628, indicating that the overall level of ESG disclosure of the study population is not high and has a large gap. The remaining control variables do not have outliers and the data do not differ significantly from previous related studies.

Table 2 Summary statistics

Variable	Observation	Mean	Median	Standard Error	Min	Max
Misp	9369	0.378	0.290	0.329	0.003	1.611
ESG	9369	20.718	19.835	6.840	9.091	44.628
Size	9369	23.111	22.990	1.333	20.458	26.973
Lev	9369	0.473	0.484	0.199	0.068	0.866
Roe	9369	0.086	0.086	0.111	-0.427	0.390
Growth	9369	0.157	0.101	0.365	-0.498	2.253
ListAge	9369	2.462	2.639	0.656	0.000	3.296
TobinQ	9369	1.906	1.473	1.262	0.821	8.002
Indep	9369	0.375	0.364	0.055	0.333	0.571
Top1	9369	0.373	0.360	0.161	0.088	0.771
Opinion	9369	0.983	1.000	0.129	0.000	1.000
REC	9369	0.097	0.067	0.096	0.000	0.449
Dturn	9369	-0.031	-0.007	0.299	-1.134	0.803

4.2. Correlation Analysis

Table 3 reports the Pearson correlation coefficient matrix for ESG disclosure and asset mispricing. The table shows that the correlation coefficient between mispricing (Misp) and ESG information disclosure (ESG) is -0.061 significant at the 1% level, which tentatively confirms the main hypothesis that ESG information disclosure can reduce the degree of asset mispricing. Among the remaining variables, firm size (Size), gearing ratio (Lev), listing years (ListAge), and account receivable ratio (Rec) have a significant negative relationship with the dependent variable (Misp), while return on net assets (Roe), increase rate of main business revenue (Growth), Tobin Q value (TobinQ), independent director ratio (Indep) and equity concentration (Top1) have significant positive relationship with the dependent variable (Misp), while audit opinion (Opinions) is not significantly related to the asset mispricing (Misp), which may indicate that the effect of audit opinion on mispricing of assets is not significant.

Table 3 Correlation Analysis

Variable	Misp	ESG	Size	Lev	Roe	Growth	ListAge	TobinQ	Indep	Top1	Opinion	REC	Dturn
Misp	1												
ESG	-0.061***	1											
Size	-0.170***	0.447***	1										
Lev	-0.254***	0.151***	0.535***	1									
Roe	0.145***	0.032***	0.074***	-0.178***	1								
Growth	0.070***	-0.062***	0.009	0.027***	0.277***	1							
ListAge	-0.048***	0.176***	0.266***	0.260***	-0.095***	-0.115***	1						
TobinQ	0.654***	-0.174***	-0.435***	-0.410***	0.209***	0.072***	-0.147***	1					
Indep	0.026**	0.054***	0.092***	0.024**	0.005	-0.007	-0.011	0.025**	1				
Top1	0.020*	0.102***	0.235***	0.094***	0.095***	-0.005	-0.029***	-0.112***	0.073***	1			
Opinion	0.002	0.023**	0.038***	-0.075***	0.211***	0.053***	-0.036***	-0.011	0.009	0.045***	1		
REC	-0.035***	-0.067***	-0.159***	0.003	0.019*	0.068***	-0.194***	0.096***	-0.004	-0.114***	0.020**	1	
Dturn	0.031***	0.050***	0.052***	0.057***	-0.072***	-0.057***	0.223***	0.070***	0.005	-0.042***	-0.055***	0.005	1

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

4.3. ESG information disclosure and asset mispircing: fundmental analysis

The regression results of ESG information disclosure and asset mispricing are shown in Table 4. From the regression results, it can be seen that the regression coefficient of the independent variable

ESG information disclosure (ESG) is -0.003 when no control variables are included and -0.001 when control variables are included, both of which are significantly negatively correlated at the 1% level. So the research hypothesis H1 is verified, showing that ESG information disclosure can mitigate asset mispricing to a certain extent. This also indicates that the high level of ESG information disclosure in China's capital market compensates for the limitations of traditional monetary measures of earnings reports, supplements a large amount of non-numerical, textual incremental information, and to a certain extent alleviates the principal-agent problem. It inhibits the tendency of internal agents to manipulate stock prices, and provides a realistic basis for investors to reasonably assess the operating risks and future returns of the underlying companies.

Table 4 ESG information disclosure and asset mispricing

Variable	(1) Misp	(2) Misp
ESG	-0.003***	-0.001***
	(-6.111)	(-2.694)
Size		0.048***
		(17.029)
Lev		-0.086***
		(-4.952)
Roe		-0.175***
		(-6.811)
Growth		0.036***
		(5.070)
ListAge		0.022***
		(4.513)
TobinQ		0.200***
		(81.655)
Indep		-0.010
		(-0.214)
Top1		0.132***
		(8.063)
Opinion		0.021
		(1.065)
REC		-0.277***
		(-9.339)
Dturn		-0.009
		(-0.839)
_cons	0.440***	-1.200***
	(41.179)	(-18.079)
Industry		YES
Year		YES
N	9369	9369
R-squared	0.004	0.491
Adjusted R-squared	0.004	0.489

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

4.4. ESG information disclosure and asset mispircing: E/S/G single comparison analysis

The Bloomberg database provides an aggregate ESG disclosure score along with individual corporate disclosure scores for environmental (E), social (S) and corporate governance (G). Therefore, the paper also considers the impact of these three separate ESG scores on asset mispricing, to assess which dimension of ESG disclosure is a key factor in mitigating asset mispricing. As can be seen

from Table 5, both the social (S) dimension and the corporate governance (G) dimension of disclosure have insignificant effects on asset mispricing, while the environmental (E) dimension of disclosure has a significant effect on asset mispricing with a negative coefficient. This shows that in the context of dual carbon policy and sustainable development, detailed environmental information disclosure is crucial for investors' reasonable valuation. From another perspective, it also reflects the importance investors attach to corporate energy conservation and green development nowadays. In contrast, due to the late start of social responsibility information disclosure in China, there are still some problems in the degree and quality of disclosure[25]. Corporate governance information has problems such as inconsistent disclosure rules and unclear conclusions[26], so it may be difficult to provide an effective reference for investors' valuation, resulting in an insignificant impact on asset mispricing.

Table 5 E/S/G individual disclosure score and asset mispircing

Variable	(1) Misp	(2) Misp	(3) Misp
E	-0.001**		
	(-2.327)		
S		-0.000	
		(-1.440)	
G			0.001
			(0.978)
	(-5.369)	(-5.133)	(-4.795)
Roe	-0.201***	-0.182***	-0.176***
	(-7.377)	(-7.020)	(-6.847)
Growth	0.041***	0.041***	0.037***
	(4.979)	(5.617)	(5.247)
ListAge	0.018***	0.023***	0.020***
	(3.496)	(4.646)	(4.203)
TobinQ	0.201***	0.199***	0.200***
	(74.221)	(80.328)	(81.608)
Indep	0.042	-0.005	-0.013
	(0.871)	(-0.111)	(-0.289)
Top1	0.142***	0.130***	0.130***
	(8.120)	(7.889)	(7.944)
Opinion	0.006	0.021	0.020
	(0.301)	(1.060)	(1.031)
REC	-0.287***	-0.271***	-0.275***
	(-9.104)	(-9.041)	(-9.267)
Dturn	-0.011	-0.009	-0.008
	(-0.924)	(-0.880)	(-0.794)
_cons	-1.279***	-1.198***	-1.164***
	(-18.166)	(-18.139)	(-17.953)
Industry		YES	
Year		YES	
N	7998	9165	9369
R-squared	0.484	0.489	0.491
Adjusted R-squared	0.482	0.487	0.489

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

4.5. Robustness test

4.5.1. Propensity Matching Score(PSM)

Firms with better ESG performance are usually more willing to disclose ESG information to investors for valuation reference, which may lead to systematic differences between firms with good ESG performance and poor ESG performance[3], resulting in biased regression results. Therefore, this paper refers to Li Huiyun et al. (2022) and uses propensity matching score to match the sample. The ESG ratings of the sample companies were selected as the basis for grouping based on Huazheng's rating results: "C", "CC", "CCC", "B", "BB", "BBB", "A", "AA" and "AAA" are assigned the values 1 to 9 in turn, and if the score of the sample company is higher than the average value of the same year in the same industry, the value is 1, otherwise it is 0. The experimental group and control group of the sample data are constructed. Then the nearest neighbor 1:1 matching sample was conducted according to the original 11 control variables in this paper. The regression was performed using the obtained 6068 annual data of the companies. The results show that ESG disclosure is negatively associated with asset mispricing at the 1% level, indicating that ESG disclosure reduces the level of asset mispricing significantly and the findings are robust.

Table 6 PSM results

Variable	Misp
ESG	-0.001***
	(-2.600)
Size	0.052***
	(12.790)
Lev	-0.066***
	(-3.104)
Roe	-0.160***
	(-5.246)
Growth	0.028***
	(2.968)
ListAge	0.017***
	(2.676)
TobinQ	0.211***
	(67.153)
Indep	-0.032
	(-0.569)
Top1	0.130***
	(6.501)
Opinion	0.024
	(1.042)
REC	-0.221***
	(-6.007)
Dturn	-0.005
	(-0.383)
_cons	-1.280***
	(-13.690)
Industry	YES
Year	YES
N	6068
R-squared	0.507
Adjusted R-squared	0.504

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

4.5.2. Changing the measurement of dependent variable

In this paper, drawing on Liu, Jianqiu et al. (2022) and You, Jiaxing and Wu, Jing (2012), we use the industry relative valuation method (Berger et al., 1995), the industry regression value valuation

method (Rhodes-Kropf, 2005) and the residual income valuation method (Ohlson, 1995) to calculate asset mispricing indicators respectively. The three results are then standardized and summed and taken in absolute terms to measure the level of asset mispricing.Then the model (2) is regressed again. The regression results in Table 7 show that the coefficients and directions of the main variables are consistent with the original regression, and the research hypothesis H1 is again validated and the conclusion is robust.

Table 7 Results of subsititued dependent variable

Variable	Misp_sum
ESG	-0.011***
	(0.002)
Size	0.222***
	(0.014)
Lev	0.200**
	(0.088)
Roe	-1.329***
	(0.167)
Growth	0.121***
	(0.035)
ListAge	0.100***
	(0.026)
TobinQ	0.818***
	(0.013)
Indep	0.020
	(0.225)
Top1	0.251***
	(0.082)
Opinion	0.179
	(0.112)
REC	-1.807***
	(0.151)
Dturn	-0.149**
	(0.059)
_cons	-5.510***
	(0.338)
Industry	YES
Year	YES
N	8766
R-squared	0.388
Adjusted R-squared	0.386

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

4.5.3. Changing the measurement of independent variable

Since 78% of the ESG ratings of Huazheng are based on the information disclosure of relevant listed companies and it include the rating of the relevant content of information disclosure, the data can reflect the level of ESG information disclosure of enterprises to a considerable extent. Therefore, this paper refers to Li Huiyun et al. (2022) and assigns a score of 1-9 to each of the nine outcomes from the lowest "C" to the highest "AAA" ESG ratings of Huazheng to measure the independent variable ESG information disclosure. The empirical results show that ESG disclosure remains robust to reducing asset mispricing.

Table 8 Results of subsititued independent variable

Variable	Misp
ESG	-0.010***
	(0.002)
Size	0.041***
	(0.002)
Lev	-0.108***
	(0.009)
Roe	-0.127***
	(0.014)
Growth	0.023***
	(0.004)
ListAge	0.009***
	(0.002)
TobinQ	0.208***
	(0.001)
Indep	-0.005
	(0.027)
Top1	0.117***
	(0.010)
Opinion	-0.021**
	(0.009)
REC	-0.190***
	(0.017)
Dturn	-0.008**
	(0.003)
_cons	-0.953***
	(0.039)
Industry	YES
Year	YES
N	25997
R-squared	0.544
Adjusted R-squared	0.543

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

5. Additional analyses

5.1. Mediating effect based on information transparency

Due to the complexity of corporate information itself, many valuable information for decision makers cannot be disclosed outwardly through formatted financial reports, resulting in the lack of detailed first-hand information for investors to value the underlying company. ESG information, however, is not limited to monetarily measured items. It provides comprehensive and multi-faceted disclosure of a company's environmental performance, social responsibility fulfillment, and corporate governance structure, which greatly narrows the information gap between investors and management, improves information transparency, and reduces the level of asset mispricing.

To test this channel, this paper uses the classical causal stepwise regression method to build a model and refers to Wang, Yaping et al. (2009) to measure information transparency using the sum of the absolute values of manipulable accrued surplus (Opaque) for the past three years[27], and the value of manipulable accrued surplus for each year is calculated by the modified Jones model. The higher the Opaque value, the lower the transparency of information. The results of the second column of the mediating mechanism test in Table 9 show that Opaque has a significant negative relationship with ESG disclosure, i.e., the higher the level of ESG disclosure, the lower the manipulable accrued surplus and the higher the information transparency. And when the variable Opaque is added to model (2), Opaque shows a positive relationship with asset mispricing at 1% level and ESG information disclosure is significantly negatively related to asset mispricing, which indicates that information transparency plays a partial mediating effect between the two relationships. This confrims ESG

information disclosure can reduce the level of asset mispricing by increasing information transparency.

Table 9 Mediating effect

Variable	(1) Misp	(2) Opaque	(3) Misp
ESG	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Opaque			0.069***
			(0.025)
Size	0.050***	-0.005***	0.051***
	(0.003)	(0.001)	(0.003)
Lev	-0.057***	0.031***	-0.059***
	(0.018)	(0.008)	(0.018)
Roe	-0.180***	0.058***	-0.184***
	(0.026)	(0.012)	(0.026)
Growth	0.044***	0.008**	0.044***
	(0.008)	(0.003)	(0.008)
ListAge	0.069***	0.002	0.068***
	(0.006)	(0.003)	(0.006)
TobinQ	0.211***	0.005***	0.211***
	(0.003)	(0.001)	(0.003)
Indep	0.028	0.036*	0.025
	(0.046)	(0.021)	(0.046)
Top1	0.092***	-0.007	0.093***
	(0.017)	(0.008)	(0.017)
Opinion	0.020	-0.041***	0.023
	(0.020)	(0.009)	(0.021)
REC	-0.287***	0.067***	-0.291***
	(0.031)	(0.014)	(0.031)
Dturn	0.006	-0.010*	0.007
	(0.013)	(0.006)	(0.013)
_cons	-1.397***	0.282***	-1.416***
	(0.070)	(0.031)	(0.070)
Industry		YES	
Year		YES	
N	8115	8115	8115
R-squared	0.525	0.142	0.525
Adjusted R-squared	0.524	0.140	0.523

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

5.2. Moderating effect based on institutional investor heterogeneity

As an important participant in the capital market, institutional investors have the effect of “ballast” on the long-term stable development of the securities market. Generally speaking, institutional investors in China's capital market can be broadly divided into two categories based on their shareholding time and investment style: pressure-resistant institutional investors, represented by funds, social security funds, corporate pension funds and qualified foreign investors; and pressure-sensitive institutional investors, including trust companies, finance companies, insurance companies and brokerage wealth management products. The former usually hold shares for a long time and prefer long-term returns[28]. This paper argues that pressure-resistant investors will actively exercise their monitoring function to promote listed companies to disclose true and comprehensive ESG information to the capital market in a timely and proactive manner due to low monitoring costs and the need for long-term profits, and find out the problems in ESG information disclosure by virtue of their information advantages and professional abilities. In addition, they can reduce the reputation risk brought by information disclosure, mitigate information asymmetry between company management and external investors, and help the market value of enterprises return to their intrinsic value.

Unlike resistant investors, pressure-sensitive investors have difficulty in participating in corporate governance due to their commercial dependence on enterprises and short-term profit motive[29]. China's trust companies do not have the ability to promote corporate information transparency due to their small shareholding size. Corporate annuities also lack the ability because they are in the early stage of development without independent stability[28]. The trusts do not play a moderating role between ESG information disclosure and asset mispricing. Based on this, this paper refers to Liang

Shangkun (2018) and uses the shareholding ratio of two types of institutional investors as proxy variables to construct the interaction term between the two and ESG information disclosure respectively. And then regress the interaction terms after centralizing them. As the results in Table 10 show, the coefficient of the interaction term between stress-resistant institutional investors and ESG disclosure (ESG*Preresi) is -0.001 and significant at the 1% level, while the coefficient of the interaction term between pressure-sensitive institutional investors and ESG disclosure (ESG*Presenti) is not significant, which indicates that only when the shareholding proportion of pressure-resistant institutional investors is larger, the the stronger the mitigating effect of ESG disclosure on asset mispricing.

Table 10 Mediating effect based on institutional investor heterogeneity

Variable	(1) Misp	(2) Misp
ESG	-0.001***	-0.001***
	(0.000)	(0.000)
Preresi	-0.163***	
	(0.049)	
ESG*Preresi	-0.018***	
	(0.006)	
Presenti		-0.732***
		(0.146)
ESG*Presenti		-0.002
		(0.020)
Size	0.050***	0.050***
	(0.003)	(0.003)
Lev	-0.085***	-0.090***
	(0.017)	(0.017)
ROE	-0.156***	-0.169***
	(0.026)	(0.026)
Growth	0.036***	0.035***
	(0.007)	(0.007)
ListAge	0.022***	0.023***
	(0.005)	(0.005)
TobinQ	0.203***	0.200***
	(0.003)	(0.002)
Indep	-0.014	-0.013
	(0.045)	(0.045)
Top1	0.121***	0.125***
	(0.017)	(0.016)
Opinion	0.020	0.020
	(0.019)	(0.019)
REC	-0.263***	-0.274***
	(0.030)	(0.030)
Dturn	-0.008	-0.009
	(0.010)	(0.010)
_cons	-1.228***	-1.231***
	(0.067)	(0.067)
Industry		YES
Year		YES
N	9369	9369
R-squared	0.492	0.493
Adjusted R-squared	0.490	0.490

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

5.3. Moderating effect based on media monitoring

As a medium for transmitting information, Chinese news media plays an important role in social supervision and are instrumental in promoting the openness and transparency of corporate information. On the one hand, the news media in China has the obligation to collect and organize information of listed companies and verify and interpret it for publication [31], and the news media's coverage of corporate ESG information and other internal information effectively alleviates the

irrational stock investment behavior of investors due to cognitive bias and limited ability, thus reducing the number of noise traders and further enhancing corporate information content. It generates the "spiral of silence" effect [32], suppresses stock market bubbles, reduces the degree of asset mispricing, and strengthens the mitigating effect of ESG information disclosure on asset mispricing.

On the other hand, with media monitoring, management's profit-seeking manipulation is curbed to a certain extent. So listed companies are able to disclose higher levels of ESG and other internal information more proactively and actively, which improves the accuracy of internal and external stakeholders' use of disclosed public information to assess market value and reduces asset mispricing. Based on this, this paper draws on Shen, Hongtao, and Feng, J. (2012) to measure the intensity of media monitoring using the Janis-Fadner coefficient (J-F) calculated from the number of positive, negative, and neutral reports provided by the financial database of the China Research Data Service Platform (CNRDS)[33]. The J-F coefficient taking values in the range [-1,1] and the closer the value is to -1, the stronger the media monitoring. In addition, the interaction term of ESG disclosure and media monitoring (ESG*JF) is constructed. Then it is centered and regressed. The results are shown in Table 11. As can be seen from the table, the coefficient is -0.007, which is significant at the 5% level, indicating that the news media has a non-negligible role in conveying corporate information and monitoring information disclosure, which can further improve the information asymmetry between corporate management and investors and reduce the degree of mispricing of corporate assets.

Table 11 Mediating effect based on media monitoring

Variable	Misp
ESG	-0.002***
	(0.001)
JF	-0.090***
	(0.019)
ESG*JF	-0.007**
	(0.003)
Size	0.045***
	(0.004)
Lev	-0.059**
	(0.025)
ROE	-0.154***
	(0.038)
Growth	0.041***
	(0.012)
ListAge	0.021***
	(0.007)
TobinQ	0.190***
	(0.004)
Indep	-0.083
	(0.065)
Top1	0.137***
	(0.024)
Opinion	0.055*
	(0.030)
REC	-0.283***
	(0.043)
Dturn	-0.015
	(0.014)
_cons	-1.121***
	(0.095)
Industry	YES
Year	YES
N	4403
R-squared	0.475
Adjusted R-squared	0.470

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

6. Summary and insights

This paper selects a research sample of A-share listed companies in Shanghai and Shenzhen from 2011 to 2020 to empirically test the relationship between ESG information disclosure and asset mispricing and the mechanism of its effect. It is found that: (1) All other things being equal, a high level of ESG information disclosure by firms helps to reduce the level of asset mispricing. (2) Compared with social responsibility (S) and corporate governance (G) disclosure, environmental (E) disclosure is more beneficial to investors' reasonable valuation and has a more significant mitigating effect on asset mispricing. (3) The mitigating effect of corporate ESG disclosure on asset mispricing can be achieved by improving information transparency. (4) The mitigation effect of ESG disclosure on asset mispricing is more significant when the shareholding of pressure-resisting investors is larger and media monitoring is stronger.

Based on the above findings, the following insights are obtained from this paper: (1) To further promote domestic listed companies to actively disclose high-level ESG information, urge relevant regulatory authorities to improve the framework and content of ESG information disclosure, formulate specific norms and implementation rules for ESG information disclosure, and form an ESG information disclosure system with Chinese characteristics to ensure the orderly operation of the capital market. (2) At the present stage, news media and long-term institutional investors have a significant role in promoting the relationship between ESG information disclosure and asset mispricing. They should actively play the role of third parties such as news media and institutional investors in monitoring the capital market and promoting more open and transparent information of listed companies. (3) ESG information provides many non-financial performance contents of the underlying company that cannot be presented in traditional financial reports, which can be used as effective reference information by investors when valuing the subject company to avoid investment risks and improve decision quality.

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