

Shaping Liquidity: On the Causal Effects of ESG Disclosure

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Abstract. As a core element of the capital market, stock liquidity has always been valued by all stakeholders of enterprises. As the market mechanism becomes more complex and the degree of information asymmetry intensifies, information disclosure plays a vital role in various economic activities. From the perspective of investor confidence, this paper studies the internal mechanism and action paths of ESG information disclosure, investor confidence and stock liquidity. Through the sub-analysis of ESG rating scores, the impact of environment, social responsibility and corporate governance on corporate stock liquidity is studied. The results show that : (1) ESG information disclosure has a positive driving effect on corporate liquidity, and investor confidence partially mediates the relationship between ESG information disclosure and liquidity. (2) Through the sub-research of ESG information disclosure, it is found that the rating scores of environment (E) and social responsibility (S) have a significant impact on stock liquidity, while the information disclosure at the level of corporate governance (G) has no significant impact on liquidity. (3) Heterogeneity analysis shows that ESG disclosure has a more significant impact on stock liquidity for companies whose auditors are not from the Big Four accounting firms than for companies whose auditors are from the Big Four accounting firms.

Keywords: ESG Disclosure; Investor Confidence; Stock Liquidity.

1. Introduction

In 2004, based on the concept and goals of sustainable development, the UN report first proposed the concept of ESG. ESG is a proper term in responsible investment, which emphasizes Environmental, Social and Corporate Governance. It is a new investment concept and enterprise evaluation standard that focuses on not only financial performance. In June 2021, the CSRC issued the revised annual report and semi-annual report format guidelines for listed companies, with a new section on environmental and social responsibility. In February 2022, the Ministry of Ecology and Environment promulgated the new version of the Management Measures for Enterprise Environmental Information Disclosure officially took effect. At present, although China has not introduced separate legislation to ESG information disclosure, ESG information disclosure has become the focus of international and domestic society.

Reviewing the previous literature, the research on ESG information disclosure can be generally divided into two categories: one is the research on the enactment of laws and regulations and the internal motivation of ESG information disclosure. Lei Runzhou et al. (2022) explored the normative trend and institutional dilemma of ESG according to the characteristics of the current situation, and proposed suggestions to improve the legal regulation of ESG information disclosure in China by referring to the standard formulation of international organizations and relevant legislative development. Zhang Changjiang et al. (2022) took domestic and foreign literatures after the concept of ESG was first proposed by the United Nations in 2004 as the object of analysis, and systematically sorted out the supporting theories, disclosure motivations and disclosure effects of ESG information disclosure research of listed companies. It is found that the research focus of ESG information disclosure of listed companies basically follows the trajectory of "environmental information -- social responsibility information -- corporate governance information -- ESG comprehensive information". Hong Yin (2021) proposed the importance of ESG information disclosure system construction based on the background of China's "double carbon" target and successively launched the "1+N" low-carbon transition policy system, and encouraged the innovation of ESG themed financial products. The other is the research on the influence of ESG information disclosure on the multifaceted value of enterprises. Under the "investor sentiment effect", ESG information disclosure reduces the risk of stock price crash by calming investor sentiment. Based on the cost-benefit perspective, Wang Rong (2022) found

that ESG information disclosure has a "U-shaped" relationship with enterprise value, and enterprise value can be improved through two channels: enhancing enterprise information transparency and gaining more attention. Through cross-sectional data regression and placebo test, Wang Qi (2021) found that under an emergency, the company's ESG performance has a significant positive impact on the cumulative abnormal stock return during the event window.

Although a series of factors, such as risk information disclosure and environmental information disclosure, have been studied in the past literature on the impact of stock liquidity, few have taken a complete off-balance sheet information disclosure system as the research object to explore its impact on liquidity. Based on certain new perspectives and new dimensions, this paper aims to study the influence of ESG information disclosure on corporate stock liquidity in view of the shortage of previous literature and the necessity of studying ESG information disclosure and stock liquidity.

The marginal contribution of this paper can be roughly divided into two aspects:

In terms of theoretical value: Based on the influence mechanism of Stakeholder Theory and Signal Transmission Theory, the panel data of all listed A-shares from 2016 to 2020 are used to explore its internal influence mechanism. This paper not only studies the mediating transmission effect of investor confidence, but also analyzes the comprehensive ESG score separately, studies the impact of Environmental, Social and corporate Governance on stock liquidity, and enriches the path and mechanism of ESG information transmission. It provides theoretical basis for information disclosure of listed companies.

In terms of practical value: (1) Relying on the mediating transmission effect of investor confidence, investor confidence is taken as the mediating variable to study the relationship between ESG information disclosure and corporate stock liquidity, which enriches the path of ESG's effect on liquidity. Not only can equity liquidity be improved through the "information effect", the "sentiment effect" is also crucial. It provides a multi-dimensional path and theoretical basis for enterprises to improve liquidity and corporate performance. (2) Through a separate study of ESG information disclosure, it is found that liquidity is sensitive to information about environment (E) and social responsibility (S), but the marginal value of information disclosure score about corporate governance (G) to the goal of improving stock liquidity is low relatively. Through the analysis of its internal reasons, the paper further emphasizes the necessity of off-balance sheet information disclosure, enterprises should further improve the information transparency, as much as possible to achieve the marginal benefits of information disclosure.

2. Theories

2.1 Stakeholder Theory

(Freeman, 1984; Hart & Moore, 1990) Stakeholder Theory refers to the management activities carried out by business managers to comprehensively balance the interest requirements of various stakeholders. Enterprises pursue the overall interests of stakeholders, not just the interests of some subjects. Combined with the research in this paper, when we shift the focus of corporate management decisions from shareholders to all stakeholders, the sound operation of the company needs the support of all stakeholders, and this support needs efficient communication and rich information paths to maintain. ESG information disclosure reduces information asymmetry through the report disclosure system, so that all stakeholders can maximize their interests based on sufficient, real and effective information.

2.2 Signal Transmission Theory (John. Linter, Pettit)

Based on the Signal Transmission Theory, information obtained by different interested parties is asymmetric due to the differences in the environment and information channels. As external stakeholders of an enterprise, it is often difficult for investors to directly obtain information other than corporate financial statements, such as social responsibility and risk disclosure. Based on the information asymmetry theory, the Signal Transmission Theory reflects the completeness and

consistency of information disclosure. If ESG information disclosure can be highly consistent with the real business situation of the company, information transparency will be increased, and the degree of information asymmetry will be reduced. It is easier to realize the maximum benefit of stakeholders and the optimal allocation of resources.

3. Mechanism

3.1 Mechanism of ESG information disclosure on stock liquidity

Most research results show that the value-added theory of ESG information disclosure is correct, that is, ESG information disclosure has a positive driving effect on most aspects of corporate performance. (Fatemi et al., 2017; Qiu Muyuan, Yin Hong, 2019). From the perspective of stock liquidity alone, the influence of ESG information disclosure on stock liquidity is mainly achieved by reducing the degree of information asymmetry. Based on this perspective, ESG disclosure impact on stock liquidity can be roughly divided into the following two paths: one is from the perspective of the government, the current domestic ESG disclosure is still at the preliminary stage of development, when listed companies ESG performance is excellent, they are more likely to establish a good relationship with government and win loose environment for their own development (Liu Lin, 2016). Second, from the perspective of creditors, ESG information disclosure can reflect the adaptability of enterprises to environmental governance and green finance reform to the greatest extent. Financial institutions tend to be more willing to lend to companies that promote the efficient use of resources.

3.2 Mechanism of ESG information disclosure on investor confidence

In many economic models, we assume that investors are shortsighted, that is, most retail investors only pursue short-term gains. However, with the gradual improvement of the information transparency of enterprises, the information cost paid by investors is increasingly reduced, and the technical ability of information analysis is constantly enhanced. Investors have the ability to predict and control the current situation in the longer term, and they begin to pay attention to the future prospects and value orientation of enterprises. When the value orientation reflected by ESG is recognized by investors, investors' confidence will be enhanced. This enhancement is mainly reflected in the following three aspects: First, ESG information disclosure can avoid risks to a certain extent and reduce the "thunderbolt" phenomenon of enterprises. Generally speaking, companies with good ESG performance not only actively implement the concept of green development and social responsibilities, but also have a scientific and reasonable internal governance and supervision system and can effectively manage risks (Sassen et al., 2016). Second, ESG information disclosure can increase the cost of insider information trading. With the increase of information transparency, the reduction of insider trading dispels investors' concerns about information asymmetry, and investor confidence increases accordingly. Third, the higher the quality of ESG information disclosure, the smaller the volatility of investor returns will be. Generally, listed companies with good ESG performance have more advantages in resource utilization, social relations and corporate governance, and can still maintain good profitability and stability when the market fluctuates (Ge Yongsheng, Huang Tingting, 2013).

3.3 Mechanism of investor confidence on stock liquidity

According to behavioral finance theory, investor confidence can affect investors' decision-making behavior through psychological emotions, rational expectations and other ways, and finally affect enterprise value from the aspects of stock price, financing ability and equity capital cost (Brown and Cliff, 2004; Yongxing Lai and Limin Fan, 2016; Zhang Wei et al., 2018). On the one hand, high quality ESG information disclosure can win the recognition of investors, and the increase of confidence will promote the desire of investors to buy stocks, buying a large number of stocks will improve the liquidity of stocks. On the other hand, retail investors have a certain convergence

mentality. With the response of the national policy, investors who did not pay attention to ESG information disclosure will also participate in it, which further enhances the stock liquidity.

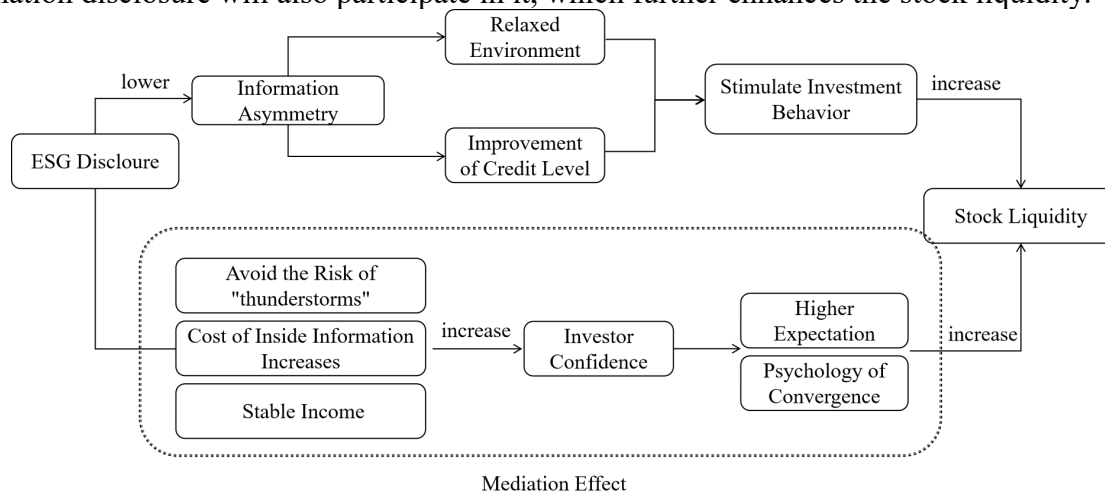


Figure 1. Influence Mechanism of ESG Information Disclosure on Stock Liquidity

4. Data Sources and Empirical Models

4.1 Data sources

In this paper, all Chinese A-share listed companies from 2016 to 2020 were selected as the research objects, and the following screening and processing were done : (1) Excluding financial enterprises; (2) Excluding companies that have been listed for less than one year, have been delisted or are suspended from listing; (3) Deleting incomplete data of main indicators; (4) In order to eliminate the influence of extreme values, the quantities of all continuous variables below 1% and above 99% were shrunk. After the above data screening and processing, 5431 sample data were obtained. The calculation data for the ESG Disclosure Score, Liquidity Indicator (Amihud) was obtained from Bloomberg, and the other control variables were obtained from the CSMAR database. In this paper, STATA16.0 software was used for data statistical analysis.

4.2 Construction and measurement of the index

Selection of stock liquidity indicators

Liquidity is not only an effective indicator to determine market performance, but also confirmed by Amihud and Mendelson(1986) and subsequent scholars that liquidity is a key factor to determine remuneration. Karthik Balakrishna et al. used Amihud's illiquidity index to measure stock liquidity when studying the impact of voluntary disclosure on liquidity, and Yang Mo also used this index when exploring the relationship between risk information disclosure and stock liquidity. In addition, a large number of studies have shown that, among many indicators reflecting stock liquidity, Amihud's illiquidity index has the best performance because it comprehensively reflects factors such as trading volume and trading price (Hasbrouck. J, 2009; Fong K Y L, 2017). Based on the above literature, this paper adopts Amihud's illiquidity index as the explained variable. The expression is as follows:

$$ILLIQ_{iy} = \frac{1}{D_{iy}} \sum_{d=1}^{D_{iy}} \frac{|R_{iyd}|}{TV_{iyd}} \times 10^6 \quad (4-2-1)$$

In formula 4-2-1, $ILLIQ_{iy}$ represents the illiquidity ratio of the i th stock in month y ; R_{iyd} represents the stock return rate on day d ; TV_{iyd} represents the stock turnover on day d . D_{iy} denotes the trading days of the i th stock in the y month. The higher the ratio, the less liquid it is.

Construction and measurement of Investor Confidence Index

Previous studies on investor confidence can be roughly divided into two categories: one is intuitive research from the perspective of investor sentiment. Yang Xiaolan et al. (2016) used stock bar Posting

sentiment as an indicator to measure investor sentiment to study the relationship between local preference, investor sentiment and stock return rate. Secondly, a comprehensive index can be obtained by selecting a specific index which can reflect investor confidence and using principal component analysis. Suechin Yang (2012) and Du Yong (2014) used this method to conduct a quantitative study on confidence. In fact, with the development of research today, more and more scholars prefer to use the second kind of method. On the one hand, the comprehensive analysis method excludes a certain degree of subjectivity and avoids the blurred boundary between positive and negative emotions. On the other hand, through the comprehensive consideration and key elements identification method, we can get a comprehensive index.

Referring to the second type of research methods in previous literature, this paper selects four variables as the measurement index of investor confidence: annual turnover rate (TR), institutional investors' shareholding ratio (INST), price-to-earnings ratio (PE) and price-to-book ratio (PB), and uses principal component analysis to construct the investor confidence index. Annual turnover rate is one of the commonly used indicators to measure market liquidity, and market liquidity can measure investor sentiment to a certain extent (Baker and Stein, 2004). The price-to-book ratio is the ratio of market value per share to net asset value per share. Kothari and Shanken (1997) used the price-to-book ratio as an alternative variable of investor sentiment to study the internal relationship between investor sentiment and stock returns. PE ratio is the ratio of market price per share to earnings per share. Lei Guangyong et al. (2011) believe that a higher PE ratio represents investors' optimism on the future profitability and operating conditions of enterprises. With the continuous improvement of market mechanism in China, institutional investors have gradually become the backbone of the confidence in the capital market. It is generally believed that institutional investors have more market rationality and market guidance than individual investors. The proportion of institutional investors can effectively reflect the sufficient degree of investment confidence. (Wu Yiling, 2017).

Firstly, the KMO and Bartlett sphericity tests were performed on the four single indicators, and Table 4-2-2-1 was obtained. The KMO value is 0.577, which is greater than the critical value of 0.5. The P value of Bartlett spherical test was 0.000, far lower than the significance level of 0.05, indicating that this group of indicators was suitable for principal component analysis and could be analyzed in the next step.

Table 4-2-2-1. KMO & Bartlett Sphericity Test

KMO	0.577(>0.5)
Bartlett Sphericity Test	Chi-square df P-value
	1243.201 6 0.000

After principal component analysis, we extracted two principal components with eigenvalues greater than 1, F₁ and F₂, whose cumulative contribution rate reached 65.89%, which could reflect most of the information of the four indicators.

Table 4-2-2-2. Variance Explained

	Initial Eigenvalues			Extract square sum		
	Eigenvalue	Variance %	Cumulative %	Eigenvalue	Variance %	Cumulative %
F ₁	1.61271	0.4032	0.4032	1.61271	0.4032	0.4032
F ₂	1.02293	0.2557	0.6589	1.02293	0.2557	0.6589
F ₃	.781907	0.1955	0.6589			
F ₄	.582456	0.1456	1.0000			

The function expression of two principal components is obtained:

$$F_1 = 0.46776 \times TR - 0.44311 \times INST + 0.29227 \times PE + 0.34570 \times PB$$

$$F_2 = -0.34182 \times TR + 0.44786 \times INST + 0.65098 \times PE + 0.48620 \times PB$$

Table 4-2-2-3. Coefficients of the principal components

Variables	F ₁	F ₂
TR	0.46776	-0.34182
INST	-0.44311	0.44786
PE	0.29227	0.65098
PB	0.34570	0.48620

Finally, the final score for investor confidence is obtained based on the variance contribution of the two main factors after rotation squared.

$$IC = \frac{\mu_1 F_1 + \mu_2 F_2}{\mu_1 + \mu_2} \quad \mu_1 = 0.3564, \mu_2 = 0.3025$$

Selection of control variables

Referring to the control variables commonly used in the existing literature and considering the factors that may affect stock liquidity and investor confidence, this paper selects four control variables: return on assets (ROA), asset-liability ratio (LEV), enterprise size (Logsize) and book-to-market ratio (BM) to reduce the endogeneity problem.

The definitions of each variable are shown in Table 4-3.

Table 4-3. Definition of Variables

Type	Name	Symbol
Explained Variable	Stock liquidity	ILLIQ
	Investor confidence	IC
Explaining Variable	ESG Disclosure	ESG
	Environment	E
	Social responsibility	S
	Corporate governance	G
Control Variable	Return on assets	ROA
	Liability-asset ratio	LEV
	firm size	Logsize
	Book market value ratio	BM

4.3 Model setting

Models based on mediating effect

Based on the step-by-step analysis method of mediation effect test (Baron and Kenny, 1986), this paper constructs a simultaneous equation structure model to test the relationship between variables. The model is as follows:

$$ILLIQ_{it} = \alpha_0 + \alpha_1 ES_{it} + \alpha_2 ROA_{it} + \alpha_3 LEV_{it} + \alpha_4 Logsize_{it} + \alpha_5 BM_{it} + \alpha_6 Year + \alpha_7 Industry + \varepsilon_1 \quad (4-3-1)$$

$$IC_{it} = \beta_0 + \beta_1 ES_{it} + \beta_2 ROA_{it} + \beta_3 LEV_{it} + \beta_4 Logsize_{it} + \beta_5 BM_{it} + \beta_6 Year + \beta_7 Industry + \varepsilon_2 \quad (4-3-2)$$

$$ILLIQ_{it} = \gamma_0 + \gamma_1 ES_{it} + \gamma_2 IC_{it} + \gamma_3 ROA_{it} + \gamma_4 LEV_{it} + \gamma_5 Logsize_{it} + \gamma_6 BM_{it} + \gamma_7 Year + \gamma_8 Industry + \varepsilon_3 \quad (4-3-3)$$

i represents the enterprise, *t* represents the year, and $ILLIQ_{it}$ is the illiquidity index of the enterprise numbered *i* in year *t*; ES_{it} is Bloomberg's score of ESG information disclosure, reflecting the quality of information disclosure to a certain extent; IC_{it} is the comprehensive score index of investor confidence; Year, Industry respectively represent time fixed effect and industry fixed effect; ε represents the error term.

According to the mediating effect mechanism, Formula 4-3-1 is the regression of stock liquidity on ESG information disclosure rating score, formula 4-3-2 takes the mediating variable investor confidence as the explained variable, and formula 4-3-3 adds the mediating variable on the basis of formula 3-3-1. Specific inspection steps are as follows:

(1) Test the significance of the coefficient α_1 , if the results are significant, the next step.

(2) Test the significance of coefficient β_1, γ_2 , if both are significant, it can be divided into the following two cases: when γ_1 is significant, IC_{it} is a partial mediation variable; When γ_1 is not significant, IC_{it} is a fully mediation variable.

(3) If at least one of the coefficient β_1 and γ_2 is not significant, further Sobel test is needed.

Itemized analysis of the ESG information disclosure

$$ILLIQ_{it} = \delta_0 + \delta_1 E_{it} + \delta_2 ROA_{it} + \delta_3 LEV_{it} + \delta_4 Logsize_{it} + \delta_5 BM_{it} + \delta_6 Year + \delta_7 Industry + \varepsilon_4 \quad (4-3-4)$$

$$ILLIQ_{it} = \theta_0 + \theta_1 S_{it} + \theta_2 ROA_{it} + \theta_3 LEV_{it} + \theta_4 Logsize_{it} + \theta_5 BM_{it} + \theta_6 Year + \theta_7 Industry + \varepsilon_5 \quad (4-3-5)$$

$$ILLIQ_{it} = \mu_0 + \mu_1 E_{it} + \mu_2 ROA_{it} + \mu_3 LEV_{it} + \mu_4 Logsize_{it} + \mu_5 BM_{it} + \mu_6 Year + \mu_7 Industry + \varepsilon_6 \quad (4-3-6)$$

E_{it} , S_{it} and G_{it} respectively represent the environmental, social responsibility, and corporate governance scores on ESG disclosure indicators in year t respectively. Equations 4-3-4, 4-3-5, and 4-3-6 are the significance tests of stock liquidity conducted by environmental scores, social responsibility scores, and corporate governance scores, respectively.

5. Empirical Analysis

5.1 Descriptive Statistics

By constructing the panel data of all A-share listed companies from 2016 to 2020, the descriptive statistics are shown in the following table. As can be seen from the table, the highest score of ESG information disclosure is 64.11, and the lowest score is 5.785, with a large difference in extreme values, indicating that there is a certain gap between enterprises' attention to ESG information disclosure and their specific performance. In terms of investor confidence, the minimum was 0.03, the maximum was 4.843, and the mean was 1.00. It shows that the confidence of investors to different enterprises is different, and the overall level is low. In terms of control variables, different indexes of different enterprises also differ greatly, which ensures the diversity and completeness of samples.

Table 5-1. Descriptive statistics

Variables	(1) Observations	(2) mean	(3) sd	(4) minimum	(5) maximum
Illiquidity	5,430	490.62	5,120	2.53	229,826
ESG	5,430	22.05	7.64	5.79	64.11
E	4,878	12.16	9.31	0.78	65.63
S	5,415	24.66	10.18	3.51	77.19
G	5,430	45.58	5.27	3.57	64.54
IC	4,351	1.00	0.71	0.03	4.84
ROA	5,430	0.04	0.08	-1.13	0.68
LEV	5,430	0.47	0.20	0.01	3.12
Logsize	5,430	4.82	0.65	2.09	7.47
BM	5,352	0.70	0.28	0.03	1.49

5.2 Regression analysis based on mediating effect

Regression analysis of the impact of ESG information disclosure score on stock liquidity

This paper uses multiple linear regression method to study the relationship between ESG information disclosure score and corporate stock liquidity. Table 4-2-1 (1) lists the regression results of formula 4-3-1. After adding control variables and fixed effects, it is not difficult to see from the regression results that the level of ESG score has a significant negative impact on the illiquidity index, that is, the higher the ESG score, the lower the illiquidity index and the better the liquidity. An

increase of 1% in the ESG disclosure score is associated with a 3.88% significant decrease in the illiquidity measure, and this effect is significant at the 1% level. It can be seen that high-quality ESG information disclosure can indeed significantly improve the liquidity of stocks.

Regression analysis of the impact of ESG information disclosure score on investor confidence

In order to further explore the relationship between ESG information disclosure score and the intermediary variable investor confidence, this paper conducts regression analysis on formula 4-3-2, and the results are shown in column (2) of Table 4-2. Research shows that ESG information disclosure is significantly positively correlated with investor confidence at the level of 1%, and every 1% increase in ESG information disclosure score will increase investor confidence by 0.8%. To a certain extent, the improvement of ESG information disclosure score can reduce the degree of information asymmetry, enhance investors' confidence and investors' expectation of stock expected returns, and then stimulate investment behavior, increase financing channels to maximize benefits.

Mediating effect test

Column (3) in Table 5-2 shows the regression results of model 4-3-3 to study the influence of ESG confidence disclosure and investor confidence on stock liquidity. The results show that every 1% increase in investor confidence index leads to a 32.5% increase in liquidity. Both investor confidence and ESG information disclosure have significant negative impact on stock illiquidity index at 1% level. The intermediary effect caused by investor confidence accounted for about 7.24% of the total effect. For every 100 units of liquidity increase, 7.24 units came from the "emotional effect" of investor confidence. To sum up, the mediating effect of investor confidence is significant and plays a part of the mediating effect, that is, ESG information disclosure can not only directly have a positive impact on stock liquidity, but also indirectly improve investors' psychological expectations by influencing investor confidence and stimulating investment behavior to improve stock liquidity.

Table 5-2 Regression results of model 4-3-3

	(1)	(2)	(3)
variable	ILLIQ	IC	ILLIQ
ESG	-3.882*** (-5.11)	0.008*** (2.89)	-3.329*** (-4.07)
IC			-32.463*** (-3.92)
ROA	116.991 (1.12)	1.610*** (4.89)	27.671 (0.25)
LEV	112.602** (2.27)	0.121 (0.71)	44.136 (0.85)
Logsize	-209.648*** (-7.86)	-0.236** (-2.21)	-188.872*** (-5.95)
BM	353.614*** (13.53)	-0.863*** (-10.08)	299.895*** (9.60)
Constant	1,033.175*** (7.59)	2.692*** (5.33)	1,009.385*** (6.46)
Year(Fixed effects)	Yes	Yes	Yes
Industry(Fixed effects)	Yes	Yes	Yes
Observations	4,822	4,005	3,961
R ²	0.317	0.230	0.344

(*** p<0.01, ** p<0.05, * p<0.1)

5.3 Itemized analysis of E (environment), S (social responsibility) and G (corporate governance)

Table 5-3 is the regression results of the 4-3-4, 4-3-5, 4-3-6. As a result, the research shows that when the ESG disclosure of information is divided into the environment, social responsibility and corporate governance, environment and social responsibility information disclosure has a significant negative effect on the illiquidity index, as for the corporate governance information disclosure, there

is no significant effect on liquidity. For every 1% increase in environmental information disclosure, liquidity will be increased by 2.035%; For every 1% increase in social responsibility information disclosure, the liquidity will increase by 1.819%. Comparatively, the improvement of environmental information disclosure score has greater marginal value. Based on previous literature (Peng Liujiang, 2021; Liu Qian, 2016), the results can be attributed to the following three reasons: Firstly, information disclosure about environment and social responsibility is in the preliminary stage with high marginal benefits, however, part of the corporate governance information disclosure can be reflected in the existing financial statements, so its marginal value to the company and the market is lower relatively. Secondly, because of the environment background of green finance, both companies and investors pay more attention to E and S, the information disclosure of corporate governance level temporarily can not get the same degree of attention, which contributes that the impact on stock liquidity is not significant. Thirdly, compared with the disclosure of the environmental and social responsibility, disclosure of corporate governance exists higher maneuverability, its authenticity and practicality are more vulnerable to external stakeholders questioning, such fears would inevitably weaken the effects of corporate governance information disclosure scores on overall enterprise value and stock liquidity.

Table 5-3. The regression results of the 4-3-4, 4-3-5, 4-3-6

Variables	(1)	(2)	(3)
		ILLIQ	
E	-2.035*** (-3.89)		
S		-1.819*** (-3.38)	
G			-0.123 (-0.06)
ROA	136.131 (1.28)	123.490 (1.19)	84.407 (0.79)
LEV	95.480* (1.72)	101.274** (2.07)	113.691** (2.30)
Logsize	-216.494*** (-7.29)	-211.594*** (-8.10)	-215.258*** (-8.13)
BM	350.155*** (12.33)	353.395*** (13.59)	356.116*** (13.64)
Constant	1,029.479*** (6.59)	1,008.371*** (7.51)	986.616*** (6.09)
Year(Fixed effects)	Yes	Yes	Yes
Industry(Fixed effects)	Yes	Yes	Yes
Observations	4,374	4,851	4852
R ²	0.324	0.315	0.313

(*** p<0.01, ** p<0.05, * p<0.1)

5.4 Robustness Test

In order to ensure the robustness of the results, Roll index, another liquidity index, is used as the explained variable for the test. The smaller the index, the better the liquidity. Additionally, because the index value is too small, the final index is obtained by multiplying the original value by 10⁶. The regression results based on mediating effects are shown in Table 5-4. The results show that ESG information disclosure score can significantly affect stock liquidity, with a positive driving effect at the 1% level. The intermediary variable investor confidence plays a part of the intermediary role, the results are stable.

The calculation formula of Roll index of individual stock in t period is as follows:

$$\text{Roll} = \begin{cases} 2\sqrt{-\text{cov}(\Delta P_t, \Delta P_{t-1})}, & \text{cov}(\Delta P_t, \Delta P_{t-1}) < 0 \\ 0, & \text{cov}(\Delta P_t, \Delta P_{t-1}) > 0 \end{cases}$$

P_t represents the daily rate of return of a single stock in t period considering reinvestment of cash dividends; $\text{cov}(\Delta P_t, \Delta P_{t-1})$ represents the first-order difference series covariance of the daily return rate of a single stock in period t , considering the reinvestment of cash dividends.

Table 5-4. Regression results based on the mediation effect

Variables	Roll	IC	Roll
ESG	-4.993*** (-3.69)	0.008*** (2.89)	-4.055*** (-2.65)
IC			-96.185*** (-6.31)
ROA	151.305 (1.10)	1.610*** (4.89)	150.332 (0.89)
LEV	187.249** (2.28)	0.121 (0.71)	117.808 (1.19)
Logsize	-305.229*** (-7.93)	-0.236** (-2.21)	-277.015*** (-5.78)
BM	802.138*** (16.61)	-0.863*** (-10.08)	707.369*** (13.24)
Constant	1,404.191*** (7.75)	2.692*** (5.33)	1,494.507*** (6.73)
Year(Fixed effects)	Yes	Yes	Yes
Industry(Fixed effects)	Yes	Yes	Yes
Observations	4807	4,005	3,945
R2	0.337	0.230	0.360

(*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

5.5 Heterogeneity Analysis

Nature of property right

Considering the differences between state-owned enterprises and non-state-owned enterprises in business strategy, competitive environment and shareholder composition, the impact of ESG information disclosure on stock liquidity may be heterogeneous to some extent. When Xi Longsheng and Wang Yan (2022) studied the relationship between ESG information disclosure and stock price collapse risk, they divided the samples into state-owned holding enterprises and non-state-owned holding enterprises for heterogeneity test, and found that the results had no significant difference on stock price collapse risk. Based on the previous literature, the heterogeneity analysis is carried out according to the property right. The results are shown in columns (1) and (2) of Table 4-5. The results show that ESG information disclosure has a significant positive impact on stock liquidity in both samples, which further verifies its robustness. Although the coefficients are different, the coefficients before ESG do not pass the inter-group difference test, indicating that the ESG information disclosure of state-owned enterprises and non-state-owned enterprises has no significant impact on stock liquidity.

External audit

High quality external audit can improve the stock liquidity by improving the quality of accounting information and reducing the degree of information asymmetry. In the heterogeneity analysis to test whether the auditor is from an international Big Four accounting firm, the regression results are shown in columns (3) and (4) of Table 5-5. The results show that the influence of ESG information disclosure on stock illiquidity index is negative and significant at 5% and 0.1% levels respectively. From the significance level, the influence of the non-Big Four audit group is greater, but the two coefficients do not pass the test of differences between groups.

Table 5-5. regression results

	(1) State-owned	(2) Non-state-owned	(3) “Big Four”	(4) “Not Big Four”
	ILLIQ	ILLIQ	ILLIQ	ILLIQ
ESG	-3.473** (-3.20)	-3.983** (-3.22)	-3.268* (-2.34)	-3.569*** (-3.71)
ROA	44.21 (0.40)	-56.87 (-0.71)	51.84 (0.24)	2.441 (0.04)
LEV	99.94 (1.74)	99.12* (2.07)	63.77 (0.54)	87.74* (2.28)
Logsize	-181.4*** (-6.95)	-177.6*** (-7.16)	-147.0** (-2.89)	-187.3*** (-9.86)
BM	364.4*** (12.65)	316.0*** (11.65)	305.0*** (6.30)	346.8*** (16.35)
Constant	-63.15*** (-6.97)	-44.36*** (-4.80)	-30.78 (-1.92)	-56.79*** (-8.13)
Year(Fixed effects)	Yes	Yes	Yes	Yes
Industry(Fixed effects)	Yes	Yes	Yes	Yes
Observations	2376	2397	509	4264
R2	0.3346	0.3140	0.2711	0.3261

(* p<0.05, ** p<0.01, *** p<0.001)

6. Conclusion and policy recommendations

By constructing the panel data of all A-share listed companies from 2016 to 2020, this paper uses the method of multiple regression analysis to explore the influence mechanism between ESG information disclosure, investor confidence and stock liquidity. The following conclusions are drawn : (1) high-quality ESG information disclosure has a significant positive driving effect on corporate stock liquidity, and the investor confidence plays a partial mediating role. The conclusion is still robust after changing the explained variables. (2) Through the sub-analysis of ESG information disclosure, it is found that the information disclosure of E (environment) and S (social responsibility) has a more significant impact on stock liquidity, while the information disclosure of G (corporate governance) does not significantly affect the level of stock liquidity. (3) Through heterogeneity analysis, the positive driving effect of ESG information disclosure on stock liquidity is further verified. There is no significant difference in the driving effect between state-owned enterprises and non-state-owned enterprises. However, from the significance level, compared with the group audited by the Big Four, the ESG information disclosure of the non-Big Four audited group has a more significant impact on stock liquidity.

According to the above conclusions, this paper suggests that government departments should further strengthen efforts to promote ESG information disclosure system, expand the scope of promotion, and gradually establish a national unified, healthy and efficient information disclosure environment in which all industries participate. At the same time, it's important to implement precise supervision and timely adjustment of disclosure policies for the heterogeneity of enterprises.

For enterprises, they should improve the quality of ESG information disclosure report, improve the transparency of information, minimize the degree of information asymmetry, pay more attention to the sentiment of investors while paying attention to the "information path", and indirectly improve the stock liquidity from the "sentiment path". At the same time, the enterprise can adjust the strategic decision of the company through the screening of information and preference of various stakeholders, improve the information disclosure system, and then continuously provide effective value for all stakeholders, so as to realize a virtuous circle. Finally, enterprises should actively grasp the high marginal benefits of ESG information disclosure under the policy, improve their competitiveness by resonating with investors' value orientation, accumulate intellectual capital and innovation capital to seize market share as soon as possible.

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