The Influence of Environmental Information Disclosure on Stock Liquidity

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Abstract. With the promotion of ecological civilization in China, environmental information disclosure is increasingly concerned by investors and has a certain impact on the capital market. I mainly study the impact of the quality of environmental information disclosure on stock liquidity in Chinese capital market. This paper analyzes the current situation of environmental information disclosure in China by taking the unfinancial and nonspecial-treatment listed companies in all A-share markets from 2018 to 2022 as samples. Through the empirical analysis, it is concluded that environmental information disclosure has a significant positive impact on stock liquidity. It also discovers that the quality of environmental information disclosure of Chinese firms is improving. This paper is not limited to pollution enterprises, which not only enriches the economic consequences of environmental information disclosure, but also discusses the stock liquidity from two dimensions of depth and width, broadening the influence factors of stock liquidity.

Keywords: Environmental Information Disclosure, Stock Liquidity, Information Asymmetry

1. Introduction

Since decades ago, ESG information has been widely concerned by investors as a kind of important non-financial information of enterprises. In September 2018, China's Securities Regulatory Commission also added ESG-related content when revising the Code of Governance for Listed Companies. In China, ESG as a kind of voluntary disclosure information, differs greatly in the quality of disclosure of different enterprises, and such differences are transmitted to investors through kinds of media, affecting their judgment of risk of enterprises and decision making of trading, and thus affecting the flow of stocks in the market. Healy et al. (1999) [1] found that improving the quality of voluntary information disclosure could both increase the stock price and accelerate the flow of individual stocks. What's more, Chen et al. (2023) [2] believed that ESG disclosure could serve as an additional positive signal to help companies improve their social reputation, thereby increasing the flow of individual stocks. Under the trend of ecological damage, climate changing and global warming, the environmental information disclosed by companies, as one vital part of ESG, obtains more attention from investors. This phenomenon conveys more signals to market, then leading to stock trading. Therefore, I assumed that there may be a certain relationship between quality of environmental information disclosure and stock liquidity, based on data of the whole A-Share Market in China.

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2. Literature, Theory and Hypothesis

When investors or shareholders make investment or trading decisions, ESG information is often considered, which has been confirmed by Barko et al. (2022) [3] . Then, referring to Serafeim et al. (2023) [4] , stock market will make reactions for ESG news, such as stock price reactions. A change in price means that a trade has taken place in the stock market, that is, shares have been liquid. Chen et al. (2023) [5] found that ESG disclosure, as an additional positive signal, can improve the social reputation of firms, thereby expanding market trading and enhancing stock liquidity. Egginton et al. (2019) [6] believed that increasing the CSR transparency could reduce information asymmetry in the market, thus enhancing stock liquidity. In addition, when Lv, W. D. et al. (2022) [7] studied the influence of CSR disclosure on the cost of equity in China, they used samples of heavy polluting enterprises and found that the influence of environmental information disclosure is obviously stronger than CSR disclosure. Therefore, I determined to separately investigate the influence of environmental information disclosure of all kinds of industries in China but financial industry, rather than just limited to those polluting enterprises.

Healy et al. (2001) [8] discovered information asymmetry and principal-agent problems in modern capital market made the quality of information disclosure more significant, and further found that the improvement of quality of information disclosure would cause a positive influence in stock liquidity. Nowadays, shareholders not only pay attention to financial report, but also highlight the externalities of enterprises to the environment. In addition, Corporate Social Responsibility (CSR) also needs enterprises to bear environmental duty, especially polluting enterprises. However, environmental information isn't required to disclose within traditional financial reports, so there is information asymmetry between investors and company executives, which may lead to the low enthusiasm of executives to disclose negative environmental information, resulting in moral hazard and principal-agent problems. Therefore, improving environmental information disclosure is conducive to improving the overall quality of information disclosure and reducing information asymmetry, which enables investors to judge the risk and value of enterprises more correctly, to make trading decisions more frequently, and thus improve stock liquidity. Therefore, the following hypothesis (H1) is proposed: The quality of environmental information disclosure is positively correlated with the stock liquidity.

3. Research Design

3.1 Data

I selected samples from the data of A-share listed companies in Shanghai, Shenzhen and Beijing from 2018 to 2022, deleted the samples of ST stocks, missing data and unable to be evaluated based on the environmental information disclosure system constructed in my paper, and finally left 3,623 enterprises, totaling 11,307 samples. All sample data are from CSMAR Database. To avoid the influence of extreme values, selected sample data are winsorized by 5% and 95%.

Dependent variable (Stock liquidity). Stock liquidity was evaluated in four dimensions, including immediacy, depth, width and price shock. Two dimensions, depth and width, were chosen to carry my research. Concretely, Volume is the natural log of total trading volume plus one, then expanding it tenfold. Roll (1984) proposed to use Roll index to measure the bid-ask spread [9], the Roll_{KL} index improved by Kim and Lee (2014) [10] is more suitable for Chinese stock market. And $Roll_{KL} = 1000 * 2\sqrt{|cov(\Delta P_t, \Delta P_{t-1})|}$, where ***Pt*** refers to a stock's daily return on reinvestment in year t, taking cash dividend into account. ***cov(*ΔP_t*,* ΔP_{t-1}*)*** represents the first-order difference sequence covariance of ***Pt***. In addition, stocks with less than 4 days of active trading during the year are excluded for robustness. What's more, Volume is positively correlated with stock liquidity, while Roll_{KL} with a negative correlation with stock liquidity.

Table 1. Evaluation system of EDI

Serials	Disclosure Item	Standards
I. Strategic Environmental Statement		YES: 1 score for each NO: 0 score
1	Clear environmental protection concept	
2	Environmental Targets setting	
II. Environmental information disclosure carrier		YES: 1 score for each NO: 0 score
3	Disclosed in the annual financial report	
4	Disclosed in the Social Responsibility report	
5	Disclosing environmental report separately	
III. Environmental governance structure and management system		YES: 1 score for each NO: 0 score
6	Environmental management systems, regulations, duties	
7	ISO14001 system certification	
8	ISO9001 certification	
9	The "three simultaneous" system	
IV. Voluntary environmental protection activities and rewards		YES: 1 score for each NO: 0 score
10	Emergency mechanisms for major environmental events	
11	Environmental protection special and public benefit	
12	Internal environmental education and staff training	
13	Honors or awards received for environmental protection	
14	Meeting pollutant discharge standards	
V. Disclosure of environmental liabilities		Quantitative: 2 scores for each Qualitative: 1 score for each No disclosure: 0 score
15	Carbon dioxide (CO_2) emissions	
16	Chemical oxygen demand (COD) emissions	
17	Sulfur dioxide (SO_2) emissions	
18	Wastewater discharge	
19	Soot and dust emissions	
20	Solid waste discharge	
VI. Environmental performance disclosure		Quantitative: 2 scores for each Qualitative: 1 score for each No disclosure: 0 score
21	Waste gas abatement	
22	Waste water abatement	
23	Soot and dust abatement	

24	Utilization and disposal of solid waste	
25	Abatement of noise, light pollution and radiation	
26	Implementation of cleaner production	

Independent variable (Environmental information disclosure, EDI) and Control variables. I constructed an evaluation system of environmental information disclosure (EDI) based on the structure of CSMAR. Through the content analysis method, EDI scores of all firms are calculated and summarized. The scoring standards of EDI, with 38 scores totally, are shown in Table 1. Referring to literatures on stock liquidity, I selected enterprise size (Size), asset-liability ratio (LA), return on total assets (ROA), proportion of independent directors (INDE), proportion of institutional investors (INIHolder), equity concentration (TOP10) and analyst attention (Attention) as control variables, and designed two dummy variables to control industry and year.

3.2 Model Design

To test the H1 of the positive impact of EDI on stock liquidity, the model (1) is constructed:

$$Volume_{it}/Roll_{it} = \beta_0 + \beta_1 EDI_{it} + \beta_2 Size_{it} + \beta_3 LA_{it} + \beta_4 ROA_{it} + \beta_5 INDE_{it} + \beta_6 INIHolder_{it} + \beta_7 TOP10_{it} + \beta_8 Attention_{it} + Industry + year + \varepsilon_{it} \quad (1)$$

4. Results

4.1 Descriptive Statistics

EDI is grouped for descriptive analysis. Table 2 shows the descriptive statistical results of EDI grouping by year. It can be seen from the table that during 2018-2022, EDI level of samples over the years is highly dispersed, and the overall level of EDI is not high, showing that EDI level of listed enterprises is not high. However, in the five years, the mean of EDI increased nearly every year, and the median also showed an upward trend. Therefore, although the overall EDI level is not high in the five years, it is improving year by year, which may be related to the improvement of enterprises' concept of environment protection, the issuance of the Environmental Protection Law and the optimization of related information disclosure standards.

Table 2. EDI Descriptive Statistics by Year

Year	Observation	Mean	St.d	Minimum	Median	Maximum
2018	2010	8.878	7.881	0	7	25
2019	2057	9.582	8.126	0	8	25
2020	2174	8.820	7.547	0	7	25
2021	2401	11.71	8.106	0	11	25
2022	2665	13.01	8.285	0	13	25
Total	11307	10.57	8.189	0	9	25

Table 3 reflects the basic information of all variables (except dummy variables). The minimum of EDI is 0, the maximum is 25 and the mean is 10.569. Combined with a full score of 38, it indicates the current EDI level of Chinese enterprises is still not high generally. And the

median is 9, slightly less than the mean, indicating EDI is right-skewed and overall EDI level is not high, too. In addition, the standard deviation of 6.657 is also relatively large, indicating the overall EDI level of Chinese enterprises is uneven and dispersed. So the EDI level of Chinese enterprises still needs to be improved. For stock liquidity, Roll has a minimum of 32.619 and a maximum of 86.046, Volume with a minimum of 19.134 and a maximum of 23.05, which shows the stock liquidity of samples is significantly different, showing its research value.

Table 3. Descriptive Statistics of Variables

Variables	Observations	Mean	St.d	Minimum	Median	Maximum
Roll	11307	56.873	14.226	32.619	56.036	86.046
Volume	11307	21.227	1.140	19.134	21.251	23.050
EDI	11307	10.569	8.189	0.000	9.000	25.000
Size	11307	23.169	1.104	21.154	23.053	25.195
LA	11307	0.408	0.185	0.101	0.406	0.758
ROA	11307	0.060	0.048	-0.026	0.054	0.156
INDE	11307	37.497	4.479	33.330	36.360	45.450
INIHolder	11307	46.091	24.895	5.121	47.564	85.678
TOP10	11307	60.869	13.911	34.356	61.674	83.653
Attention	11307	1.924	0.931	0.693	1.792	3.497

4.2 Empirical Results

Results. Column (1) and Column (2) in table 4 shows the basic results of 2018-2022 panel data. I used a multiple linear regression method for panel data. In addition, there is the influence of heteroscedasticity in panel data. To solve the problem, under controlling industry and year, fixed effect regression of panel data was carried out on the model established respectively. In column (1), the coefficient of EDI is 0.0029, greater than 0, significant at the 5% level. It manifests that EDI has a significant positive impact on the Volume. What's more, the Volume is positively correlated with stock liquidity. Thus, it apparently means that the EDI level has a significant positive impact on the depth dimension of stock liquidity.

In column (2), the coefficient of EDI is -0.1689, less than 0, significant at the 1% level. It indicates that EDI has a significant negative impact on Roll index. What's more, Roll is inversely correlated with stock liquidity, which obviously explains that the EDI level has a significant positive impact on the width dimension of stock liquidity. In addition, most control variables of the two models are shown significantly. To sum up, the results after the basic regression test verifies the H1, and it is concluded that the quality of environmental information disclosure is positively correlated with stock liquidity.

5. Robustness Test

In the section, two types of methods were used to perform a robustness test. First, I extended the window period, using data from year 2013-2022, totally 4,244 firms and 21,235 observations from the whole A-Share market in China. The column (3) and (4) in Table 4

shows the EDI coefficients are both significant at the level of 1%, in line with expectations. It means that the quality of environmental information disclosure is positively correlated with stock liquidity.

Second, I used E-Score from Sino-Securities Index, an authority of ESG evaluation in China, as an alternative measurement to independent variable, which has been chosen by many literatures in the past. After data matching from year 2018 to 2022, 3572 firms and 11150 observations are left. We can see the results in column (5) and (6) of Table 4 that both dimensions on stock liquidity are conforming to expectations significantly, at the level of 5% and 1% respectively. In sum, via different tests, the empirical results are still robust, supporting H1.

Table 4. Results of Regression Analysis and Robustness Test

	Basic regression		Window extension		Alternative measurement	
	2018-2022		2013-2022		2018-2022	
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Volume	Roll	Volume	Roll	Volume	Roll
EDI	0.0029**	-0.1689***	0.0034***	-0.0896***		
	(2.506)	(-7.754)	(3.656)	(-5.390)		
E-Score					0.0020**	-0.1170***
					(2.008)	(-5.538)
Size	0.4849***	-2.3836***	0.5257***	-1.9941***	0.4896***	-2.6986***
	(32.024)	(-10.379)	(44.940)	(-11.257)	(31.318)	(-11.552)
LA	0.2488***	3.1664***	-0.1037**	1.3406*	0.2288***	2.3521**
	(3.535)	(2.822)	(-2.057)	(1.667)	(3.235)	(2.119)
ROA	-0.6515***	36.9938**	-1.3990***	34.4658**	-0.5710***	26.6530**
	(-3.696)	(10.380)	(-9.526)	(12.761)	(-3.647)	(8.065)
INDE	0.0007	0.0643*	0.0007	0.0600**	0.0000	0.0380
	(0.373)	(1.959)	(0.496)	(2.559)	(0.009)	(1.302)
INIHolder	-0.0002	0.0180**	-0.0007	-0.0019	-0.0001	0.0082
	(-0.447)	(2.061)	(-1.613)	(-0.290)	(-0.134)	(0.956)
TOP10	-0.0314***	-0.0462***	-0.0309***	0.0040	-0.0308***	-0.0431***
	(-32.662)	(-3.387)	(-44.361)	(0.401)	(-31.726)	(-3.206)
Attention	-0.0681***	2.0590***	-0.0519***	1.3272***	-0.0701***	2.2544***
	(-6.831)	(10.629)	(-6.946)	(9.530)	(-6.992)	(11.745)
Constant	12.6891**	0	11.3342**	89.7334**	12.2576**	120.7386*
	(32.207)	(.)	(38.118)	(22.095)	(30.444)	(21.394)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Observations	11,307	11,307	21,235	21,235	11,150	11,150
Firms	3,623	3,623	4,244	4,244	3,572	3,572

Robust z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6. Conclusions

6.1 Discussion

The trend of environmental information disclosure of enterprises is increasingly transparent in Chinese capital market. In the long run, this phenomenon is beneficial to the long-term development of our capital market. However, environmental information is still lacking unified standards, leading to the uneven quality of disclosure by various firms. According to information asymmetry, this kind of information difference inside and outside the enterprise is transmitted to investors as a signal, affecting their trading decisions. Combined with the current environmental situation, environmental information is more easily captured by investors. Then shares trading happens and stock liquidity changes. Other than affecting the financial performance of enterprises, stock liquidity is also a vital indicator to measure the health of capital market. The externality of environment from enterprises is also a hot topic, too. As a result, it is filled with meanings to carry on a study on the influence mechanism of the two.

6.2 Conclusions and Suggestions

After some theoretical deduction with information asymmetry and CSR, I assumed a possible impact of environmental information disclosure on stock liquidity. In addition, 10242 A-share listed company samples from 2016 to 2020 were selected. Then, after data analysis, following conclusions are drawn: First, the quality of environmental information disclosure of Chinese listed enterprises is generally not high, showing uneven distribution and strong dispersity. However, the quality of environmental information disclosure has been improving year by year, possibly related to the improvement of enterprises' environmental consciousness and related regulations. Second, the quality of environmental information disclosure has a significant positive impact on stock liquidity, both in the depth and width dimension of stock liquidity.

According to result, both enterprises and governments should take measures to improve the quality of environmental information disclosure. For governments, better official disclosure systems and mandatory disclosure regulations are necessary, with powerful supervision and propaganda. For enterprises, establishing an environmental management mechanism and disclosing environmental information proactively or separately is encouraged.

6.3 Future Research

In the future, I intend to examine the moderating effect of digital transformation in this mechanism, referring to Lin, Y. J. et al. (2023) [11] , whose paper discovered digital transformation played a positive moderating role in the positive influence mechanism of ESG on investment efficiency. A firm with a high digital transformation means its efficient information processing and transmission capability. In addition, the digital information transparency is higher, leading to it more difficult to false information. Higher information transparency and speed of transmission reduce information asymmetry, then accelerating the trading decisions of investors and shareholders, thus influencing stock liquidity.

Endogeneity is one of the most common problems in the study of corporate finance. I will attempt to find an instrumental variable and use 2SLS model to alleviate the endogeneity of

the research. What's more, the two-step Heckman procedure, another method generally used to solve the self-selection problem, will be considered, too.

6.4 Limitations

Although various factors were considered in the research design of my paper, there are still some limitations. First, although referring to plenty of literatures and testing robustness with the alternative E-Score from Sino-Securities Index, there is still some subjectivity when constructing independent variable EDI, which may result in some bias and faults.

Second, while setting dependent variables, I just considered two dimensions of depth and width, but do not select the indicators of immediacy and price shock. Therefore, the research conclusion is to explain the impact of stock liquidity just on part dimensions, and whether the remaining two dimensions are still consistent with the conclusion needs further testing and verification. Those above are two main limitations to my paper.

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