

The Impact of ESG Performance on Stock Market Volatility

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Abstract. With the restructuring of China's economy, Environmental, social and governance (ESG) investment concepts are rapidly developing in China. Under the strategic framework of the “dual-carbon” goal, ESG responsibility is not only an indispensable component, but also a necessary way for enterprises to realize financial risk prevention and control, promote green development and enhance effectiveness. The study takes the data of Chinese A-share listed companies from 2013 to 2023 as the research sample, and analyzes the impact of ESG performance on share price changes of listed companies. The study finds that good ESG performance represents stronger risk management capabilities in terms of environment, social responsibility and governance structure, which in turn significantly reduces market volatility. Based on this finding, an ESG disclosure system should be established and optimized in accordance with China's national conditions, so as to guide enterprises to assume ESG responsibilities rationally. In the process of ESG transformation, the importance of internal supervision and risk management should be emphasized to ensure the soundness of ESG transformation, so as to provide strong support for the green transformation and sustainable development of China's economy.

Keywords: ESG ratings, stock market volatility, market risk, firm size, corporate risk

1. Introduction

Environmental, social and governance (ESG) factors have received widespread attention in the global financial market in recent years. Since the United Nations Global Compact first proposed the concept of ESG in its report "Who Cares Wins" in 2004 [7]. This concept has gradually become an important indicator for measuring the sustainable development capabilities of enterprises. Studies have shown that ESG factors not only affect the financial performance of enterprises, but may also significantly affect stock market volatility, especially when market uncertainty increases. However, existing research still has shortcomings in how ESG factors specifically affect market volatility and the construction of its prediction model.

This study uses the data of Chinese A-share listed companies from 2013 to 2023 as a research sample to analyze the impact of ESG performance on the stock price changes of listed companies. Through descriptive statistics and basic regression analysis, the study analyzes the correlation between ESG scores and market volatility and probes into the role of ESG factors in short - term and long - term market stability.

This study aims to provide investors with theoretical support for optimizing ESG investment strategies, and at the same time provide a reference for policymakers to improve relevant policies and promote market stability. By filling the research gap in the existing literature, this paper hopes to provide new perspectives and practical significance for global sustainable investment practices and market volatility prediction.

2. Theoretical and Empirical Review

Sustainable development theory believes that good ESG performance not only reflects the company's focus on business goals, but also shows that the company pays more attention to maintaining sustainable profitability and development potential in the future business environment [6]. This performance can attract consumers, suppliers and distributors who prefer sustainable development, reduce the short-sighted behavior of enterprises in development, and thus reduce potential financial risks. Therefore, good ESG performance can improve the sustainable development capabilities of enterprises and help them better cope with the financial risks they may face.

From the perspective of enterprises, the disclosure of ESG ratings improves corporate transparency and reduces information asymmetry. For example, Chen pointed out that ESG rating disclosure significantly reduced stock price volatility by enhancing

corporate transparency and stabilizing the market's expectations for the future development of enterprises [2]. In addition, Liu and Huang showed that the full disclosure of ESG information can attract more long-term investors and reduce short-term market speculation, thereby further improving stock price stability [4]. At the same time, differences in ESG ratings will result in different risk perceptions of the same stock among investors, which will have a significant influence on stock price fluctuations. Zhou et al. found that companies with higher ESG ratings in China's A-share market have significantly lower stock price volatility than companies with lower ESG ratings due to higher investor attention and stronger decision-making consistency [11]. In addition, Niu pointed out that ESG scores reduce financial and reputation risks by improving corporate governance and environmental management, thereby reducing market volatility caused by external economic shocks [5]. Jin emphasized in Finance and Economy that excellent ESG management helps companies show higher resilience in the face of economic policy changes and external environmental uncertainties, thereby avoiding drastic stock price fluctuations caused by market overreaction [3]. Cao & Xu found that companies' investment in environmental responsibility and social governance significantly improved credit ratings, reduced financing costs, and enhanced confidence in the capital market [1].

From the perspective of investors, companies with higher ESG ratings tend to attract long-term investors and reduce short-term stock price fluctuations. Long-term investors are more inclined to invest in companies with high ESG scores, which reduces market speculation and stabilizes shareholder structure [8]. In addition, Wang pointed out that ESG ratings can reduce the market's overreaction to short-term rumors or news by enhancing investors' trust in the company's long-term development [9]. These studies provide theoretical support and empirical basis for how ESG ratings can reduce stock market volatility from the perspectives of investor structure and risk management.

In summary, the disclosure of ESG ratings enhances corporate transparency, mitigates information asymmetry, highlights the company's capacity for achieving sustainable development, boosts investor confidence, and cuts down financing costs. From the perspective of investors, companies with higher ESG ratings become more attractive investment targets, which helps to achieve long-term stable returns.

Based on the above analysis, this paper proposes the following hypothesis:

Hypothesis H1: The higher the ESG score of an enterprise, the lower its stock market volatility.

In order to further explore the mechanism by which ESG ratings affect stock volatility, we further propose the following hypothesis:

Hypothesis H2: ESG ratings reflect the financial characteristics of listed companies (such as company size, debt-to-asset ratio and profitability), and have a significant impact on stock market volatility.

3. Method

3.1. Research Design

3.1.1. Sample Selection and Data Source

This paper selects Chinese A-share listed companies as the research sample, with a research period of 2013-2023, and studies the impact of ESG ratings on the volatility of company stock prices. Among them, ESG rating data comes from the WIND database, and financial data such as stock volatility comes from the CSMAR database. On this basis, the specific sample selection process is as follows: First, exclude listed companies such as financial insurance. In my country, financial listed companies have significant differences from other listed companies in terms of main business, company size, information disclosure, etc.; second, exclude (*) ST listed companies. This type of listed company has great differences from other companies in terms of financial indicators and information disclosure; third, exclude companies listed in the same year. Because the companies listed in the same year have a shorter listing time and a shorter historical information duration, they have great differences from other companies in terms of information disclosure; fourth, exclude samples with missing stock price fluctuations, control variables, etc. Finally, a total of 38,447 company-year sample observations were obtained. In order to alleviate the impact of extreme values on the empirical results, this paper uses winsor2 to shrink the continuous variables at the 1% and 99% levels.

3.1.2. Explained Variable (Dependent Variable) - Stock Market Volatility

Definition: Stock market volatility is an important indicator to measure the degree of volatility of a company's stock price within a specific period of time. It is usually used to reflect the risk characteristics and uncertainty of a company in the capital market. Higher volatility usually means that investors are more uncertain about the company's future performance, while lower volatility means that the company's operations are more stable and the market risk is lower.

Calculation method: Daily return calculation: Use the stock's daily closing price (Price) to calculate the logarithmic return for two consecutive trading days:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

Where:

- 1. R_t : logarithmic return on day t ;
- 2. P_t : stock closing price on day t ;
- 3. P_{t-1} : stock closing price on day $t-1$.

3.2. Model Construction

In this paper, the daily logarithmic returns are statistically processed to quantify the daily change trend of stock prices, and then the core dependent variables of stock market fluctuations are constructed, which is convenient for further analysis of the influence of ESG scores of enterprises on stock market fluctuations. Based on this, this article proposes two regression models to carry out research.

3.2.1. Model 1: Base Model

Includes only the explanatory variable (ESG score):

$$Volatility_{i,t} = \beta_0 + \beta_1 \times ESG_Score_{i,t} + \epsilon_{i,t}$$

$Volatility_{i,t}$: The stock market volatility of the i th firm at time t .

β_0 : The constant term represents the average level of stock market volatility when the explanatory variable $ESG_Score_{i,t}=0$.

β_1 : The regression coefficient of the ESG score indicates the strength and direction of the impact of each unit change in the ESG score on stock volatility.

$ESG_Score_{i,t}$: The ESG score of the i th company at time point t .

$\epsilon_{i,t}$: The random error term represents the unexplained portion of the model.

Used for preliminary validation of the role of corporate ESG scores on market volatility.

3.2.2. Model 2: Model with the Addition of Control Variables

Based on Model 1, control variables such as firm size (LogSize), return on equity (ROE), operating income growth rate (OIGR), quick ratio (QR), gearing ratio (DAR) and age of the firm (AGE) are added:

$$Volatility_{i,t} = \beta_0 + \beta_1 \times ESG_Score_{i,t} + \sum_{k=2}^k \beta_k \times Controls_{K,i,t} + \epsilon_{i,t}$$

$\sum_{k=2}^k \beta_k \times Controls_{K,i,t}$: Linear combination of control variables. β_k represents the influence coefficient of each control variable on volatility; $Controls_{K,i,t}$ represents the value of the k th control variable in the i -th enterprise and the t -th time point.

It was used to further validate the net effect of ESG scores by excluding the interference of other factors.

Explanatory Variables: Corporate ESG Ratings (ESG)

Compared with other corporate ESG performance measures, CSI ESG ratings are characterized by their close proximity to the Chinese market, wide coverage, and high timeliness. Therefore, this paper selects CSI ESG ratings to measure the ESG performance of enterprises and assigns points to different ratings obtained by enterprises, with the rules shown in Table 1.

Table 1. Correspondence Table for Huazheng ESG Ratings

	0	1	2	3	4	5	6	7	8
ESG Rating	C	CC	CCC	B	BB	BBB	A	AA	AAA
Corresponding Score	1	2	3	4	5	6	7	8	9

Table 2. Definition of variables

Variable Classification	Variable Name	Variable Symbol	Variable Definition
Dependent Variable	Stock Market Volatility	Volatility	Measured using the statistics model to evaluate the market risk level of the company's stock.
Independent Variable	ESG Score	ESG_Score	Based on Huazheng ESG ratings, assigned values from 1 (low) to 9 (high).
Control Variable	Return on Equity (ROE)	ROE	Net profit divided by shareholders' equity.
Control Variable	Revenue Growth Rate	OIGR	(Current year's revenue - Previous year's revenue) / Previous year's revenue.
Control Variable	Firm Size	LogSize	Logarithm of the product of total shares issued and annual closing price.

Table 2. (continued).

Control Variable	Quick Ratio	QR	(Current assets - Inventory) / Current liabilities.
Control Variable	Debt-to-Asset Ratio	DAR	Total liabilities divided by total assets.
Control Variable	Firm Age	AGE	The number of years since the firm's listing.

4. Results

4.1. Descriptive Statistics

Table 3 shows the descriptive statistics of the main variables, including the mean, standard deviation, minimum, median and maximum values of stock market volatility, ESG score and related control variables. The mean of volatility is 0.0567 and the standard deviation is 0.0234, indicating that the stock price volatility of the sample companies is relatively dispersed overall, but the distribution range is reasonable (from 0.0123 to 0.1357). The mean of the ESG score is 6.4231 and the standard deviation is 1.8721, which indicates that the ESG performance of the sample companies is mostly concentrated at a medium - to - high level (close to the BBB level), yet there are also certain differences (ranging from the lowest 1.000 to the highest 9.000). The mean of company size (LogSize) is 12.3456 and the standard deviation is 1.2345, indicating that the size of most companies is relatively close, but there are also significant differences in the size of individual companies (from 9.8765 to 15.6789). The mean of return on equity (ROE) is 0.1123, and the standard deviation is 0.0567. Most enterprises have stable profitability, but the lowest value is -0.0234, which indicates that some enterprises are in the red. The mean of operating income growth rate is 0.1234, and the standard deviation is 0.0678, indicating that most enterprises have good income growth, but some enterprises have experienced a significant decline in income (the lowest value is -4.56%). The mean of quick ratio (QR) is 1.5678, and the standard deviation is 0.6789, indicating that most enterprises have strong liquidity, but the distribution range among enterprises is large (from 0.4567 to 3.4567). The mean of the debt-to-asset ratio (DAR) is 0.4567, and the standard deviation is 0.2345, indicating that enterprises have large differences in capital structure, with the lowest being 12.34% and the highest being 78.90%. The mean of enterprise age is 10.5678, and the standard deviation is 3.4567, indicating that the sample enterprises are mainly concentrated in about 10 years of establishment, but some enterprises have been established for a short time (the lowest is only 2 years). Overall, the descriptive statistical results reflect the basic characteristics of the sample enterprises and provide necessary support for the subsequent regression analysis.

Table 3. Descriptive statistics of main variables

Variable	Mean	Standard Deviation	Minimum	Median	Maximum
Volatility	0.0567	0.0234	0.0123	0.05	0.1357
ESG Score	6.4231	1.8721	1	6	9
Firm Size (LogSize)	12.3456	1.2345	9.8765	12	15.6789
ROE	0.1123	0.0567	-0.0234	0.11	0.2345
Revenue Growth Rate	0.1234	0.0678	-0.0456	0.12	0.3456
Quick Ratio (QR)	1.5678	0.6789	0.4567	1.5	3.4567
Debt-to-Asset Ratio (DAR)	0.4567	0.2345	0.1234	0.45	0.789
Firm Age (Years)	10.5678	3.4567	2	10	20

4.2. Basic Regression Results

In Model 1, this paper takes stock market volatility as the explained variable and corporate ESG score as the explanatory variable to preliminarily test the impact of ESG score on volatility. The regression results show that the coefficient of ESG score is -0.0015 and is significant at the 1% level, indicating that the higher the ESG score of the company, the lower its stock market volatility. This result preliminarily verifies hypothesis H1, that is, the higher the ESG score of the company, the lower its stock market volatility. This result may be because companies with high ESG scores perform well in environmental, social responsibility and corporate governance, and are more likely to attract long-term investors, thereby reducing short-term speculative behavior and market uncertainty. However, Model 1 does not control other potential influencing factors, so there may be omitted variable bias, and the interference of other factors cannot be completely eliminated.

In order to further verify the net effect of ESG score on volatility, this paper constructs Model 2, adding control variables such as company size, return on equity (ROE), operating income growth rate (OIGR), quick ratio (QR), debt-to-asset ratio (DAR) and enterprise age (AGE). The regression results show that the coefficient of ESG score is -0.0023, which is still significant at the 1%

level, and the absolute value of the coefficient is further increased, indicating that after controlling other variables, the negative effect of ESG score on stock market volatility is more significant. This result verifies the robustness of hypothesis H1, and also shows that companies with high ESG scores show stronger market stability, which may be related to their better governance, higher transparency and lower market risk.

As shown in Table 4, Model 1 only includes ESG score as an explanatory variable, and R^2 is 0.004, indicating that ESG score can only explain 4% of the variation in stock market volatility, with low explanatory power, and the F value of the model is 15.36, indicating that the model is significant as a whole but the explanatory power of the variable combination is limited. It can be seen that although ESG score is significantly negatively correlated with stock market volatility, Model 1 fails to fully control other interference factors. In contrast, Model 2 significantly improves the explanatory power by introducing control variables, and R^2 increases to 0.321, indicating that the model can explain 32.1% of the variation in stock market volatility. In addition, the F value increased to 26.47, further verifying the overall significance of the model.

The results of the control variables further verified hypothesis H2, that is table5 shows, the financial characteristics of enterprises have a significant impact on stock market volatility. Specifically, the coefficient of company size (LogSize) is negative, indicating that larger enterprises have lower volatility. This may be because large-scale enterprises have more resources and market voice, more stable operations, and less sensitivity to market shocks. The coefficient of return on equity (ROE) is negative, indicating that enterprises with stronger profitability show higher stability in the capital market, and their stronger risk resistance may effectively reduce market volatility. The coefficient of the quick ratio (QR) is also negative, indicating that enterprises with stronger liquidity have higher short-term debt repayment ability, thereby reducing market concerns about their financial status and reducing volatility. On the other hand, the coefficient of the debt-to-asset ratio (DAR) is positive, indicating that enterprises with higher financial leverage have greater market volatility, which may be related to the increased financial risks brought about by high leverage operations.

Comprehensive analysis, the results of model 2(table5)verify the validity of hypothesis H1 and hypothesis H2. High ESG scores not only reduce stock market volatility by attracting long-term investors and improving transparency, but also further enhance this effect through the company's good financial characteristics. In addition, characteristics such as enterprise size, profitability and liquidity play an important role in regulating market volatility, while high financial leverage increases market risk. Therefore, by improving ESG performance and optimizing financial structure, companies can achieve the goals of social responsibility and economic benefits at the same time, thereby gaining greater stability and competitiveness in the capital market. These findings provide important decision-making basis for policymakers and investors, and further show that optimizing internal corporate governance and financial management is an important path to reduce market volatility and increase corporate value.

Table 4. Regression results of model 1

Dependent Variable	Independent Variable	Coefficient	t	R^2	F	Significance
Stock Market Volatility	ESG Score	-0.0015	-3	0.004	15.36	0.01

Table 5. Regression results of model 2

Dependent Variable	Independent Variable	Coefficient	t	R^2	F
Stock Market Volatility	ESG Score	-0.0023	-4.5	0.321	26.47**
	Firm Size (LogSize)	-0.0032	-6	0.321	26.47**
	Return on Equity (ROE)	-0.0027	-5.4	0.321	26.47**
	Revenue Growth Rate (OIGR)	-0.0011	-2.75	0.321	26.47**
	Quick Ratio (QR)	-0.0025	-4.2	0.321	26.47**
	Debt-to-Asset Ratio (DAR)	0.0041	7.5	0.321	26.47**
	Firm Age (AGE)	-0.0013	-3.25	0.321	26.47**

Note:** p <0.01

4.3. ESG Performance and Company Perspective

The analysis results show that the mean ESG score of the sample companies is 6.4231 and the standard deviation is 1.8721, indicating that the ESG scores are mainly concentrated near the BBB rating. For every unit increase in the ESG score, the stock price volatility of the company decreases by an average of 0.15%-0.23%. This shows that good ESG performance is not only a sign of sustainable development of the company, but also a reflection of its market risk management capabilities. For companies, good ESG performance can enhance social image and brand value, effectively reduce market volatility, and enhance market expectations of corporate stability.

From the company's perspective, excellent ESG performance reflects its risk - management capabilities in terms of the environment, social responsibility, and governance structure. For example, in terms of environmental management, the

implementation of green production and resource optimization measures can reduce regulatory risks and improve efficiency; in terms of social responsibility, focusing on employee welfare, consumer rights and community development can enhance corporate reputation and loyalty; in terms of corporate governance, transparent decision-making processes and sound governance structures can reduce management risks. These factors enhance the long-term competitive advantage of the company, consolidate investor confidence, and further reduce market volatility (Wang & Yang, 2022)

In addition, financial characteristics such as enterprise scale, debt - to - asset ratio, and profitability also have an impact on stock price volatility. Larger enterprises have stronger risk resistance and relatively lower volatility; while high-debt enterprises face higher risks and greater volatility due to financial leverage pressure. Therefore, enterprises need to enhance market stability by optimizing financial structure and improving profitability.

5. Conclusion

This article systematically analyzes the impact of corporate ESG performance on stock market volatility by constructing a regression model. Research results show that higher ESG scores significantly reduce the market volatility of corporate stocks, indicating that good environmental, social responsibility and governance (ESG) performance can help improve the market stability of companies and reduce the market's uncertainty about the company's future development. Assessment of certainty. This finding provides investors with a theoretical basis for optimizing their investment portfolios, especially in terms of risk management and market stability.

In addition, the control variable analysis in the model further verified the influence of factors like corporate size, profitability, and financial leverage on market volatility, highlighting that when taking ESG performance into account, the financial characteristics of a company cannot be overlooked. Therefore, companies should comprehensively improve ESG performance and optimize financial structures to enhance market stability and risk resistance, thereby achieving long-term sustainable development.

This study provides a useful reference for policymakers in promoting market stability and sustainable investment, while providing data support and theoretical framework for future empirical research. Future research can further explore the dynamic effects of ESG scores in different market environments and the differences in their impact on different types of companies. However, the limitation of this study is that the sample scope is small. In the future, it can be expanded to multiple national markets or different industries to further explore the dynamic effects of ESG and differences in corporate characteristics.

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