

An Empirical Investigation into the Association Between ESG Ratings and Stock Price Volatility of Listed Firms

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Abstract. In the context of the dual-carbon policy and the rise of Environmental, Social, and Governance (ESG) investment, there is still a lack of research on the mechanism by which ESG ratings affect stock price fluctuations. This paper is based on 11,934 observations of A-share stocks from 2019 to 2023. It employs a panel fixed effects model, with the SynTao Green Finance ESG rating as the core explanatory variable and the adjusted stock price fluctuation (VAR_{ADJ}) as the dependent variable. It controls for enterprise size, financial and governance variables, and conducts an empirical test to examine the relationship between the two. The research has found that ESG ratings are significantly negatively correlated with stock price volatility. In the Ordinary Least Squares (OLS) regression, the ESG coefficient was -0.134 (without control variables) and -0.051 (with control variables). In the two fixed effects model, it was -0.037 (with industry and year fixed) and -0.024 (with control variables added), all of which passed the significance test (at 1% to 10% levels), indicating that for every 1 unit increase in ESG rating, stock price volatility decreases by 2.4% to 13.4%. The conclusion confirms that ESG performance mitigates abnormal stock price fluctuations by alleviating information asymmetry and conveying signals of sustainable development. It is recommended that enterprises enhance environmental and governance information disclosure to reduce valuation discrepancies, and investors incorporate ESG into the risk assessment framework to optimize asset allocation.

Keywords: ESG rating, stock price volatility, panel fixed effect, information asymmetry

1. Introduction

Under the backdrop of green recovery and the dual-carbon policy, the Environmental, Social, and Governance (ESG) investment concept has rapidly gained popularity, giving rise to an increasingly active ESG rating market. Currently, ESG ratings have become an important reference for investors' decision-making. By disclosing ESG information, enterprises not only can obtain their own ESG performance data, but also can enhance information transparency, reduce the difficulty for investors in making evaluations and investment risks, and alleviate the negative impacts brought about by information asymmetry. Current research indicates that the ESG performance of enterprises can convey positive signals of social responsibility and sustainable development to stakeholders, thereby influencing stock price fluctuations and enterprise value. For instance, Cai conducted an empirical study on listed mining companies from 2011 to 2020. Using a fixed effects model for regression

analysis, they found that the overall ESG performance coefficient was -0.140, and it was significantly correlated at the 5% level, showing a significant negative correlation with stock price volatility [1]. Wang et al. further pointed out that the higher the ESG score, the lower the risk of stock collapse, indicating that ESG performance has a stabilizing market screening function [2]. From a long-term value perspective, Zheng proposed that ESG performance can promote the growth of enterprise value by reducing financing costs and enhancing innovation capabilities, and as for investors, when evaluating an enterprise, what one would prefer to see is a higher long period value [3].

Furthermore, ESG performance has multiple impacts on investor behavior. Zhuang has confirmed that corporate investors have ESG preferences, and green innovation significantly positively influences the choice of institutional investors [4]. Feng et al. found that ESG performance exerts an influence on stock liquidity through the channels of investor attention and sentiment [5]. It is worth noting that with the rapid increase in ESG rating agencies, the differences in investors' opinions regarding the rating results may lead to emotional fluctuations, which in turn can be transmitted to stock price fluctuations [6]. Xu et al. found that the characteristic risks and extreme risks associated with quoted company stocks have been markedly reduced in cases where ESG performance is excellent, confirming that ESG performance mitigates the stock price fluctuation risks through reducing their level of earnings management and enhancing corporate reputation, thereby alleviating characteristic risks and extreme risks of stock prices [7].

Although present literature has extensively discussed the influence of ESG ratings on enterprises' investment efficiency, performance, stock returns, and market risk premiums, there is still a lack of systematic examination of the direct mechanism of their effect on stock price fluctuations. To promote the stability of the capital market, it is urgent to clarify the impact path of ESG ratings on stock price fluctuations, thereby supplementing the theoretical framework of factors influencing stock price fluctuations. This study, based on the panel fixed-effects model, achieves two goals through basic regression and robustness tests. Theoretically, it reveals the dominant effect of ESG on the stock market and deepens the application of the theory of information asymmetry in sustainable finance. Practically, it helps investors identify risks and optimize strategies, while guiding enterprises to improve the quality of information disclosure and avoid valuation deviations.

2. Method

2.1. Data source and explanation

The ESG rating data and individual stock return data used in this article are sourced from the Wind database. The ESG rating companies included are China Securities Index, SynTao Green Finance, and Wind, which released ESG rating data for A-share listed companies from 2019 to 2023. Based on the final significance, SynTao Green Finance was selected as the target company for the study [8]. The sample companies were drawn from A-share listed companies in China that were rated by all three ESG rating agencies between 2019 and 2023. All the data generated by these sample companies each year from 2016 to 2020 were compiled into a panel dataset. The primary source of the data was the Wind database, with a minor portion obtained from the CSMAR [9]. The relevant data were processed in Excel, and the empirical section was examined through regression analysis employing Stata 16.0. To guarantee the reasonableness and validity of the data, the authenticity and reliability of the regression outcomes, as well as to prevent the impact of aberrant and illogical samples on the regression analysis, this paper carries out the following filtering and processing procedures on the sample dataset. Firstly, for data that contains missing or abnormal values, they

will be eliminated. Secondly, given that the capital structure of companies in the financial industry is different from that of ordinary companies, the financial industry companies defined by the CSMAR database will be excluded. Furthermore, due to the numerous problems associated with enterprises experiencing consecutive losses, they may have an impact on the regression results. Therefore, all companies with Special Treatment (ST, *ST), and Particular Transfers (PT) were excluded. After the aforementioned screening process, a total of 11,934 observations were obtained within the study period.

2.2. Indicator selection and explanation

The explanatory variable selected for this study is the ESG rating (from SynTao Green Finance). Based on this rating, which ranges from C^- to A^+ , this paper assign values ranging from 1 to 9 to each of them, as shown in Table 1.

Table 1. Rating assignment

	9	8	7	6	5	4	3	2	1
SynTao Green Finance	A^+	A	A^-	B^+	B	B^-	C^+	C	C^-

In this paper, stock price fluctuation (VAR_{ADJ}) for firm i in year t is defined as the variance of the firm's annual stock return. This value is calculated as the average variance of monthly stock returns from May of year t to April of year $t + 1$, multiplied by 100. A higher value of monthly stock return variance indicates greater stock price volatility (Qingquan Xin et al., 2014). The computational formulas are presented as follows.

$$\sigma_{month}^2 = \sum \left((R_{day} - R_{avg})^2 / n_{days} \right) \times n_{days} \quad (1)$$

$$VAR_{ADJ} = (\sum \sigma_{month}^2 / 12) \times 100 \quad (2)$$

Here, σ_{month}^2 represents the variance of monthly stock returns, R_{day} is defined as the daily stock return within the month after market adjustment, R_{avg} is the average daily stock return within the month, and n_{days} is the number of trading days in the month. VAR_{ADJ} is defined as the variance of the stock returns for firm i in year t . Meanwhile, σ_{month}^2 refers to the variance of the returns calculated for each month.

Furthermore, the following control variables were selected for this study, and all the data were obtained from the Wind database: Leverage (Lev), Return on Equity (ROE), Enterprise Growth Rate (Revenue Growth Rate), Dual Positioning (Dual), Proportion of Independent Directors (Indep), and Enterprise Size (logarithm of total assets) (Size).

2.3. Method introduction

This study employs panel data regression analysis to explore the impact of corporate ESG ratings (from SynTao Green Finance) on stock price volatility (VAR_{ADJ}). The sample were sourced from A-share listings spanning the fiscal years 2019 through 2023., with a total of 11,934 observations. Firstly, the OLS model is adopted. Its core principle is to find the best linear fitting line for the data

by minimizing the sum of squared residuals. Compared with other methods, it isolates the influence of scale, finance, industry, etc., and focuses on the net effect of ESG, providing reliable significance tests to support the conclusion.

In this study, the stock price fluctuation VAR_{ADJ} was taken as the dependent variable, while ESG rating (SynTao Green Finance) and ESG were used as the explanatory variables. The regression analysis was conducted without including control variables and with control variables (asset-liability ratio Lev, return on equity ROE, enterprise growth rate (revenue growth rate) Growth, dual position integration Dual, proportion of independent directors Indep, enterprise size (logarithm of total assets) Size). The equation formula (3) used in the regression analysis is as follows, where *control* represents control variables, *Year* represents the year, and *ind* represents the industry identifier.

$$VAR_{ADJ_{it}} = \alpha_0 + \alpha_1 ESGR_{it} + \sum \beta_j control_{it} + \sum Year + \sum ind + \epsilon_{it} \quad (3)$$

Secondly, a dual-effect fixed effect model was adopted. With the stock price volatility VAR_{ADJ} as the dependent variable and ESG rating (SynTao Green Finance) and ESG as the explanatory variables, a regression analysis was conducted while controlling for the fixed years and industries, and also with and without the inclusion of control variables.

3. Results and discussion

3.1. Descriptive statistical analysis

This study utilized a sample of 11,934 observations from companies listed on China's A-share market, comprising data from the period 2019 to 2023, for empirical investigation. The corresponding descriptive statistics are presented in Table 2.

Table 2. Descriptive statistical analysis

Variable	Mean	SD	Min	p50	Max
VAR ADJ	1.187	0.995	0.0720	0.984	45.59
ESGR	4.532	1.020	2	4	8
Size	22.84	1.679	18.90	22.56	31.43
Lev	0.430	0.213	0.0140	0.419	1.797
ROE	0.0480	0.573	-58.80	0.0670	1.442
Growth	0.161	4.959	-2.684	0.0550	526.0
Dual	0.314	0.464	0	0	1
Indep	38.08	5.670	15.38	36.36	80

The average stock price fluctuation (VAR_{ADJ}) is 1.187, with a standard deviation of 0.995, suggesting considerable variation in price movements across the sample firms. Its minimum value is 0.072, the median is 0.984, and the maximum value is as high as 45.59, confirming the existence of extreme fluctuation values and conforming to the characteristics of the Chinese stock market. The mean value of the core explanatory variable, the ESG rating of SynTao Green Finance (ESG), is 4.532 (between B^- and B levels), with a standard deviation of 1.020. The score range is from 2 (C^-) to 8 (A^-), indicating that the ESG performance of listed companies is at a medium level and shows significant differentiation.

Among the control variables included in the analysis, the average enterprise size (Size), measured as the logarithm of total assets, is 22.84, with a standard deviation of 1.679. This suggests that the sample encompasses a diverse range of listed companies, including large, medium, and small enterprises. Regarding financial indicators, the mean asset-liability ratio (Lev) is 43.0%, which falls within a generally acceptable range. The average net asset return rate (ROE) was 4.8%, but the standard deviation was relatively large (0.573), and the minimum value was -58.80, suggesting that some enterprises suffered severe losses. The average growth rate of operating income was 16.1%, accompanied by an extremely high standard deviation (4.959), with the maximum value reaching 526.0. This indicates that there is a significant disparity in the growth potential of enterprises. Among the corporate governance variables, 31.4% of the samples have dual positions (Dual = 1). The average proportion of independent directors (Indep) is 38.08%, which is close to the lower limit of the legal requirement (33%), but in some companies it is as high as 80%, highlighting the heterogeneity of the governance structure. These statistical characteristics provide a data basis for the subsequent regression analysis, and the distribution of each variable conforms to the actual situation of the Chinese capital market.

3.2. Regression result

This study selected a total of 11,934 samples from 2019 to 2023 for research. Table 3 presents the basic regression results of these samples. Columns (1) - (2) represent the OLS model, with stock volatility VAR_{ADJ} as the dependent variable, and ESG rating (SynTao Green Finance) ESG as the independent variable. The regression results without including control variables and with including control variables (Lev, ROE, (revenue growth rate) Growth, dual position Dual, proportion of independent directors Indep, enterprise size (logarithm of total assets) Size). The results show that the coefficients of ESG are -0.134 and -0.051, both negative, and are significant at the 1% and 1% confidence levels, respectively. This indicates that the good ESG performance of the enterprise helps to reduce the risk of stock price fluctuations.

Columns (3) - (4) represent the dual-effect fixed-effects model, with stock price volatility VAR_{ADJ} as the dependent variable, and ESG rating (SynTao Green Finance) as the explanatory variable. The regression results are presented for both cases, where fixed years and industries are considered without including control variables and with control variables included. The results show that the coefficients of ESG are -0.037 and -0.024, both negative, and are significant at the 5% and 10% confidence levels, respectively. This further indicates that the good ESG performance of the enterprise is conducive to reducing the risk of stock price fluctuations.

Table 3. Analysis of regression results

	(1)	(2)	(3)	(4)
	VAR_{ADJ}	VAR_{ADJ}	VAR_{ADJ}	VAR_{ADJ}
ESG	0.134*** (-15.17)	-0.051*** (-5.52)	-0.037** (-2.32)	-0.024* (-1.87)
Lev		0.212*** (4.11)		0.433** (2.19)
ROE		-0.007 (-0.44)		0.003 (0.16)
Growth		0.002 (0.98)		0.002 (0.86)
Dual		0.052*** (2.64)		0.023 (0.49)
Indep		0.001 (0.43)		-0.006* (-1.90)
Size		-0.153*** (-22.01)		-0.467*** (-7.24)
_cons	1.795*** (43.68)	4.775*** (31.93)	1.347*** (19.56)	11.867*** (8.28)
Ind	No Control	No Control	Control	Control
Year	No Control	No Control	Control	Control
N	11934	11934	11934	11934
r^2	0.019	0.070	0.078	0.086

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

However, the research still has certain limitations. During the course of this study, a system with numerous problems was identified. These problems include inconsistent measurement standards, and the rating system has never fully taken into account the different regulatory systems in different regions. Different rating agencies have each adopted their own proprietary methods, measurement standards, weights, and even have different definitions of ESG [10]. In order to integrate ESG as a critical factor in investment decision-making, it is essential for these institutions to adopt specific measures aimed at furnishing authentic and transparent reports on sustainability; furthermore, any initiatives and actions pertaining to ESG must be promptly and accurately mirrored in the corresponding ESG ratings [11].

4. Conclusion

This study, based on 11,934 observations of firms traded on the A-share board (2019-2023), empirically investigated the influence of SynTao Green Finance ESG ratings on fluctuations in stock prices by employing a panel fixed-effects model. The findings from the study demonstrate that a statistically significant inverse relationship exists between corporate ESG performance and the volatility in stock prices, as measured by (VAR_{ADJ}). In the OLS model, the ESG rating coefficient is -0.134 (without control variables) and -0.051 (with control variables), both of which are significant at the 1% level; in the double fixed effect model controlling for industries and years, the coefficients are -0.037 (5% significant) and -0.024 (10% significant). This means that for every one-unit increase in the ESG rating, the stock price volatility decreases by 2.4% to 13.4%. This confirms the theoretical mechanism that ESG performance can effectively curb abnormal stock price fluctuations by alleviating information asymmetry and conveying signals of corporate sustainable development. Based on this, enterprises should strengthen the quality of information disclosure in the environmental and governance dimensions in a targeted manner, reducing market valuation deviations; investors need to incorporate ESG ratings into the risk assessment framework and optimize their long-term asset allocation strategies.

The theoretical value of this study lies in filling the empirical gap regarding the influence of ESG ratings on stock price fluctuations, deepening the application of the theory of information asymmetry in the field of sustainable finance, and revealing the functional mechanism of ESG as a market stabilizer. At the practical level, it provides a basis for regulatory authorities to promote the standardization of ESG disclosure, facilitate the implementation of the dual-carbon policy, and assist investors in identifying non-financial risks, thereby guiding capital to flow towards high-quality ESG enterprises.

Regarding the improvement directions for this research, in terms of data, we can further incorporate the results from multiple rating agencies and integrate the rating divergence effects from institutions such as Wind. The sample distinguishes the heterogeneity impact between high-pollution industries and non-pollution industries. Mechanically, additional intermediary variables such as investor sentiment or financing costs can be incorporated. Future research can explore the differentiated impacts of ESG sub-dimensions (such as carbon emission intensity) and deepen the analysis of the correlation between ESG performance and extreme market risks (such as stock price crashes).

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