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The Effect of ESG Performance on the Systematic Risk of Listed Companies in China: A Comparative Analysis of High-Tech Manufacturing Versus Conventional Industries

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Abstract: The continued growth of the ESG (environment, society, and governance) investing trend has garnered great interest from both academics and professionals alike in the past decade. Nowadays, even developing countries like China are seeing a new wave of ESG investment opportunities. However, the research on ESG investing in emerging markets remains relatively lackluster, and fewer ESG studies concentrate on the topic of systematic risk. Therefore, this study wants to provide an analysis of the effect of ESG rating on the systematic risk of listed companies on the A-share stock market in China through the lens of a comparative study between high-tech manufacturing and conventional industries. Based on the fixed-effect model regression result on the quarterly data of 240 companies from 2018 to 2021, this paper discovers a negative correlation between ESG rating and the systematic risk a company is exposed to and a greater effect of ESG performance on systematic risk in high-tech manufacturing industries than conventional industries. Overall, this paper not only presents a new perspective on the correlation between ESG investing and the systematic risk a firm is exposed to but also serves as an inter-industry research that tackles a phenomenon specific to the Chinese capital market.

Keywords: ESG, Systematic Risk, High-tech Manufacturing Industry

1. Introduction

As climate change and environmental problems worsen across the world, the concept of sustainable development has garnered more attention. Countries and regions such as the US, EU, and China have published their plans for carbon neutrality in the past few years. China, in particular, outlines the estimated time for carbon-peak as before 2030 and carbon-neutral before 2060. This increasing concern for environmental protection generated a substantial demand for corporate sustainability strategies and practices, and one of the major tools at the disposal is of the ESG score—also known as the environmental, social, and governance rating. As its definition suggests, ESG is a multifaced index that evaluates the firm's impact on the environment, responsiveness to stakeholders, business ethics, and more. These factors are generally beyond the traditional investment framework which emphasizes analyzing financial indicators [1]. In recent years, the growing public discourse surrounding ESG has risen to a status of mainstream popularity. Many researchers and investors are beginning to incorporate ESG into their work. Some have looked at the potential impact of ESG on

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corporate finance. The stakeholder theory is one of the theoretical frameworks that incentivize the adaptation of ESG in corporate management. It suggests that companies should consider the best interest of all those engaged with the firm, which in turn can potentially provide the company with competitive advantages that result in better financial performance [2-3]. Studies by De Lucia et al. and Xiao na Yin et al. support this theory by reporting a positive correlation between ESG rating and financial performances in the Chinese capital market and beyond [4-5]. In addition to financial performance and stock price, the effect of ESG rating on the systematic risk of a portfolio is being addressed by researchers as well. Serafeim G recognizes the disclosure of information such as ESG scores attracts more long-term shareholders, reducing the shortsightedness of a company in decision-making [6]. This allows the firm to alleviate systematic risks including losing competitiveness or experiencing stronger post-merger stock price shocks. studied the relationship between risk experienced by a company and the ESG performance of the A-shared companies in China, concluding that a positive ESG performance can greatly diminish risk experienced by the company [7]. However, most of the studies on ESG investing analyze the market as a whole without examining the effect of ESG on different industries. Therefore, this paper will inspect the effect of ESG rating on systematic risks and compare the results between the high-tech industries and conventional industries in China. Hopefully, the findings of this study can contribute valuable insights for ESG research on emerging markets like China and deepen the understanding of ESG investment strategies in developing nations.

The remaining parts of this paper are written as follows: Section 2 summarizes related theories and introduces the hypothesis of this paper. Section 3 discusses data selection, variable setting, and empirical model. Section 4 includes the descriptive statistics and empirical results. Section 5 presents the result of the robustness test. Section 6 is the conclusions.

2. Related Theories and Conception of Hypothesis

2.1. ESG, Systematic Risk and Industry-Specific Effects

The research on ESG-related concepts and firm risk can be found as early as 2006, and some studies show promising results on the correlation between ESG scores and systematic risk. Yet the earlier effort suffers from data selection issues such as small sample size and being outdated, and most researchers mainly focus on US or European firms without considering the industry-specific effect ESG performance has on systematic risk. The more recent studies rectify some of these problems. For instance, in the research by Sassen et al. on European companies, they discovered that a higher aggregate ESG score could decrease both total and idiosyncratic risk, and social performance can greatly lower systematic, idiosyncratic, and total risk at the same time [8]. More importantly, they also found that though a better environmental performance generally reduces the idiosyncratic risk exposure of all firms, only the environmentally sensitive firms are affected by the environmental performance in terms of systematic risk. This suggests that industry-specific effects of ESG scores on systematic risk might exist. The study by He et al. analyzed the data of the A-share stock market in China and revealed that companies can mitigate financial constraints by having a positive ESG performance, thus reducing firm risk derived from those constraints [9]. This study presents valuable insights into the correlation between ESG and risk exposure experienced by a firm in developing nations like China, but it, unfortunately, didn't specify whether the systematic risk can be reduced through the mechanisms proposed in the paper. Overall, only a few pieces of literature discuss the relationship between ESG and systematic risk using data from developing countries, and an even smaller number of studies include industry-specific analysis in their paper. Therefore, the above-mentioned topic still requires more substantial research, which is what this paper aims to provide.

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2.2. Hypothesis Formulation

There are several theories on how ESG rating influences systematic risk. The first theory is the stakeholder theory. The stakeholder theory proposes an "insurance effect" derived from a firm's reputation capital, which allows the company to avoid adverse external impacts and reduce uncertainties, thereby mitigating risks. The reputation of a company will improve when it makes the conscious decision to fulfill ESG responsibilities since being environmentally friendly or caring for social issues are common ways of building a positive public image.

The second theory involves green finance and the practice of subsidizing low-carbon development. Created in December 2015, the green bond was first categorized after the emergence of the Catalogue of Green Bond Support Projects. As an integral part of the green credit system, green bonds are issued to facilitate green economy practices such as lowering carbon emissions, energy conservation, pollution reduction, and more. The adoption of these practices requires significant R&D spending, which means high-tech industries generally produce less waste and carbon footprints. According to the study by Yu and Du [10], technological innovation can be a contributing factor in improving environmental qualities based on their analysis of the data from China. This suggests that companies with higher R&D investment levels in China are potentially more eligible for green bond issuance due to their better ESG performance. Based on the research by Zheng et al., they have discovered that green bond issuance improves firm operation in many ways, such as reducing financing costs, easing the constraints of corporate financing, and improving the maturity structure of corporate debt [11]. Therefore, in theory, the high-tech manufacturing firms in China will have lower firm risk because of their access to green financing instruments.

Therefore, taking this analysis into consideration, this paper will propose the following two hypotheses:

Hypothesis 1: a positive ESG rating can reduce systematic risk exposure

Hypothesis 2: a positive ESG rating of a company in the high-tech manufacturing industry has a greater effect on its systematic risk than the ESG rating of a firm in the conventional industry

3. Data Selection and Research Design

3.1. Data Selection and Sources

The sample selected in this study consists of 240 A-share listed firms in China, categorized into two groups: high-tech manufacturing firms and conventional firms. The National Bureau of Statistics first standardized the categorization of the high-tech manufacturing industry in 2002 and later revised the categorization in 2013 and 2017. The current catalog of high-tech industries includes the pharmaceutical industry, electronics and telecommunication industry, aerospace industry, computer and office equipment industry, information technology chemicals industry, and medical apparatus and scientific instrument industry. The conventional industries include the oil and gas industry, specialized equipment industry, automotive manufacturing industry, home appliance industry, textile industry, and non-ferrous metal industry. After removing companies with incomplete or abnormal data, 20 firms are randomly chosen from each of the six industries mentioned above using the China Securities Index Classification Standard. Another 120 firms are then chosen from industries excluding the high-tech manufacturing, financial, and real estate industries in a similar manner. All ST or *ST firms are excluded from the sample. The result contains the quarterly data of 240 companies from 2018 to 2021. The databases used in this study are the Wind database and the Choice database.

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3.2. Variables and Definitions

3.2.1. Explained Variable: Systematic Risk (BETA)

Systematic risk is the volatility that influences the stock market as a whole. Since the Beta coefficient denotes the relative risk exposure of investing in a particular stock or sector in relation to the market, it is used to measure the systematic risk of a specific portfolio. In this paper, we use the Beta coefficient of the stock of selected companies to represent the systematic risk that they are exposed to. The Beta coefficient is calculated based on the standard CAPM model [12]. The study uses the Beta coefficient with the 60-month moving window since systematic risk changes relatively slowly over time [13].

3.2.2. Explanatory Variable: ESG Performance (ESG)

Currently, multiple ESG rating systems exist in China and the ESG rating standards created by foreign institutions frequently face acclimatization issues when trying to rate Chinese companies. To alleviate this problem, Huazheng ESG, also known as the international mainstream ESG system architecture, combines factors such as ESG practice of listed firms, regulatory policies, and the development of the capital market with Chinese characteristics when building a set of localization index systems. Thus, Huazheng ESG rating system can synthetically reflect the ESG practice level of companies. For this reason, this study chooses the Huazheng ESG rating to determine companies' ESG performance. The ESG scores of all firms are lagged by two quarters compared to other variables.

3.2.3. Control Variables

Factors relating to the financial performance and internal governance level of the company are chosen as control variables. Based on previous studies, this paper selects six indicators, which are return on asset (ROA), market capitalization (SIZE), debt to asset ratio (DR), quick ratio (QR), Financial expense to revenue ratio (FER), and cash ratio (CR).

3.3. Model Formulation

$$BETA_{i,t} = a + \beta_1 ESGScore_{i,t-2} + \beta_2 \sum ControlVariables_{i,t} + \varepsilon_{i,t} \quad (1)$$

Table 1: Descriptive statistics of the variables

Variable types	Variables	Abbreviations	Definition	Average	Std.Dev.
Explained variable	Beta coefficient	BETA	Beta coefficient of the CAPM model	1.181	1.120
Explanatory variable	ESG score	ESG	Huazheng ESG score	3.574	1.118
Control variables	Return on asset	ROA	Net profit*2/ (beginning of the period total asset + end of the period total asset) * 100%	2.916	6.214
	Market capitalization	SIZE	Natural algorithm of market capitalization	22.854	1.262

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Table 1: (continued).

Debt to asset ratio	DR	Total liability/total asset	38.780	21.204
Quick ratio	QR	(Current asset – inventory- total prepaid expenses)/current liability	2.347	3.001
Financial expense to revenue ratio	FER	Financial expense/total revenue	1.296	4.884
Cash ratio	CR	(Cash + cash equivalents) / current liabilities	1.169	2.148

Table 2: Regression results

Variables	Conventional industries	High-tech manufacture industries	Conventional and high-tech manufacture industries combined
ESG	-0.037**	-0.112***	-0.070***
	(-2.16)	(-3.02)	(-3.40)
ROA	0.003	0.003	0.002
	(1.12)	(0.64)	(0.82)
SIZE	0.113***	-0.082	-0.001
	(3.16)	(-1.00)	(-0.02)
DR	-0.002	0.000	-0.001
	(-1.49)	(0.15)	(-0.31)
QR	0.016	0.033	0.029**
	(1.44)	(1.58)	(2.32)
FER	-0.001	0.008	0.002
	(-0.26)	(0.97)	(0.43)
CR	-0.007	-0.001	-0.009
	(-0.63)	(-0.02)	(-0.64)
c	-1.267	3.597*	1.507
	(-1.53)	(1.88)	(1.50)
R^2	0.043	0.027	0.022
Year	YES	YES	YES
N	1920	1920	3840

Note: 1%, 5%, and 10% significance levels are denoted by ***, **, and *. The parentheses contain the standard errors. The format remains unchanged for all the remaining graphs.

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4. Empirical Findings and Analysis

4.1. Benchmark Empirical Results Analysis

Table 1 lists the descriptive statistics of the variables used in this study, which contains the variable name, the definition, and the corresponding mean and standard deviation. The table shows that most of the financial indicators, such as ROA and quick ratio, have a relatively high standard deviation, suggesting that the financial performance of the firms in the sample vary greatly. On the other hand, the ESG performance of the sample firms is more similar and has less variation. Table 2 contains the regression results of the relationship between ESG score and systematic risk. All 3 regressions use a time-fixed effects model. Model 1 and Model 2 only regress on data from conventional industries and high-tech manufacturing industries, respectively. Model 3 regresses on all firms regardless of their industry. Overall, the improvement of ESG score has a noticeable and statistically significant impact on systematic risk. The ESG coefficient in model 3 is -0.071 and it is significant at the 1% level, and the ESG coefficient in models 1 and 2 are -0.038 and -0.114 and are significant at the 5% level and 1% level respectively. Therefore, based on the result, we can conclude that a greater ESG score can generally reduce the systematic risk of a firm, regardless of which industry it belongs to. Moreover, the result also suggests that the ESG score of high-tech manufacturing firms has a greater effect on the systematic risk than firms in conventional industries, meaning that there exists a correlation between industries and the effectiveness of lowering a firm's systematic risk by raising its ESG scores.

5. Robustness Test and Other Issues

The robustness test is performed to verify the reliability and robustness of the results from the previous section. Table 3 contains the results of the test.

5.1. On Resolving Endogeneity Issues

Generally, the main endogeneity problem arises from reverse causality between two variables. In the case of this paper, the endogeneity problem can be that the systematic risk of a firm potentially affects its ESG score. However, as mentioned before, the ESG scores of all firms lag by two quarters, effectively eliminating the endogeneity problem since the current systematic risk does not influence the firm's ESG rating. Therefore, the regression results from Table 2 are robust regarding endogeneity issues.

5.2. Replace Variable

Another frequently utilized robustness test method is the method of variable replacement. To verify the ubiquity of the regression results, the robustness test changes the explanatory variable of the model and replaces it with the Wind ESG score. The new regression outcome is listed in Table 3 and the result is in line with that of the previous regression. Therefore, this paper concludes that the regression result from Table 2 is robust.

Table 3: Robustness test results

Variables	Conventional industries	High-tech manufacture industries	Conventional and high-tech manufacturing industries combined
ESG (Wind)	-0.036**	-0.040***	-0.046**
	(-2.31)	(-3.22)	(-2.53)
ROA	0.004	0.002	0.002

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Table 3: (continued).

	(1.26)	(0.77)	(0.48)
SIZE	0.109***	-0.006	-0.095
	(3.05)	(-0.15)	(-1.14)
DR	-0.002	-0.001	-0.000
	(-1.33)	(-0.46)	(-0.09)
QR	0.019*	0.030**	0.032
	(1.67)	(2.42)	(1.53)
FER	-0.001	0.002	0.009
	(-0.36)	(0.42)	(1.05)
CR	-0.010	-0.011	0.001
	(-0.89)	(-0.77)	(0.02)
c	-1.147	1.641	3.846**
	(-1.38)	(1.62)	(1.99)
R^2	0.044	0.022	0.025
Year	YES	YES	YES
N	1920	1920	3840

6. Conclusion

This paper evaluates the correlation between ESG rating and systematic risk based on the data of Chinese listed companies from conventional and high-tech manufacturing industries from 2018 to 2021. Several conclusions can be drawn from the results of fixed-effect regression models constructed in this study. Firstly, there exists a statistically significant negative correlation between ESG rating and systematic risk. This relationship can be explained by previous studies, in which they suggest the integration of ESG rating into financial reports can improve the quality of information so that long-term investors can better assess the value of the firm and its management competency, therefore reducing the systematic risk of the company [14-15]. Secondly, ESG performance has a greater effect on systematic risk for firms in high-tech manufacturing industries than firms in conventional industries. According to research on green bonds and corporate technological innovations, high-tech manufacturing firms in China can potentially receive more financial support from green bond issuance by improving their ESG performance, mitigating their financial constraints as a result. Thus, when compared to firms from conventional industries, high-tech manufacturing firms tend to face lower systematic risk.

Overall, this study contributes to the existing literature on ESG research in two aspects: Firstly, the study on the correlation between systematic risk and ESG rating is relatively scarce in current ESG research, and this is especially the case for ESG research on emerging markets. This paper remedies the situation by providing an analysis of systematic risk and ESG performance based on the data collected from the A-share stock market in China. Secondly, this paper also serves as inter-industry research on a case that is specific to the Chinese A-share stock market, providing unique insights for ESG investors and researchers interested in the Chinese capital market. However, there are still several improvements that can be made in future studies. For example, further research is needed to better understand the influence mechanism between ESG rating and systematic risk. Moreover, this paper only discusses the relationship between ESG scores and systematic risk exposure while other risks are not accounted for. Thus, the impact ESG performance has on those risks remains unknown.

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