Empirical Research on the Impact of ESG Performance on the Valuation of Listed Manufacturing Companies in China

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Abstract

ESG refers to environmental, social, and corporate governance. The spread of ESG has become a raging trend in the western countries, and China has also kept pace with the times. In 2018, it released a new version of the *Code of Governance for Listed Companies* which requires Chinese-listed companies to disclose ESG-related information. Stakeholders such as investors consider the ESG performance of the company when valuing the company. Thus, this paper mainly focuses on the impact of ESG performance on the corporate valuation of China's listed manufacturing companies. The paper takes China's Shanghai and Shenzhen A-share listed manufacturing companies from 2012 to 2022 as a sample, uses a two-way fixed effect method to make an empirical analysis to study the impact of ESG performance of China's listed manufacturing companies on valuation, and according to high/low polluting industries and regions, conducts heterogeneity analysis, and finally conducts a robustness test. The paper's main conclusions are as follows: firstly, higher valuations are associated with better ESG performance of China's listed manufacturing companies in Shenzhen and Shanghai A-share; secondly, higher valuations are associated with better ESG performance of listed manufacturing companies in heavily polluting industries, while the improvement of ESG performance of listed manufacturing companies in low-polluting industries has relatively weaker impact on valuations; Further for the listed companies located in the eastern region the evidence is that an improvement of their ESG performance has a positive impact to their valuation. At last, the paper puts forward some suggestions for company, society, and government separately and formulates some search questions for potential future studies.

1. Introduction

In the process of promoting global green and low-carbon transformation, more and
more investors are beginning to pay attention to concepts such as ESG-responsible
investment and sustainable development. Based on the research result of the
Schroeder investment survey, emerging market investors lay a greater focus on
the theory of ESG investment than certain developed-country investors. In Eu-
rope, sustainable investing grew from $12 trillion in 2020 to $14 trillion in 2022.
Including Europe, Canada, Australia & New Zealand and Japan the global sus-
tainable investment market achieved $30.3 trillion until 2022 and is on track to
surpass $40 trillion by 2030 (Global Sustainable Investment Alliance et al., 2022).
In addition, an increasing number of stock exchanges, investors, and regulatory
bodies have acknowledged the significance of ESG disclosure. Globally, many
stock exchanges have established ESG disclosure rules or regulations for listed
companies in many countries, including the USA, UK, Germany, Brazil, Canada,
India, Malaysia, Norway, South Africa, Sri Lanka, Thailand, Philippines, Poland,
Singapore, Turkey, and so on (Meek et al., 1995).

In China, ESG starts relatively late and lags far behind other countries. How-
ever, it has grown rapidly and is in the rising stage of vigorous development. It
has attracted the attention of government agencies, stock exchanges, investors,
and other parties gradually. In September 2018, the China Securities Regulatory
Commission publicly released a revised version of the *Code of Governance for
Listed Companies*, which was the first time explicitly requiring Chinese listed
companies to disclose ESG-related information (Bian, n.d.).

In 2020, China proposed a "dual carbon" policy aiming to achieve a "carbon
peak" in 2023 and "carbon neutrality" in 2060 (Briefing, 2023). Given the in-
creasing adoption of ESG indicators by more and more market participants, and
the growing significance of ESG factors on corporate financial indicators and
valuations, it is necessary to study the impact of ESG performance on corporate
valuations.

2. Research Question

Based on available scholarly studies, many scholars and literatures have studied
the relationship between ESG performances and the value of listed companies in
some Western countries, like Germany, the UK, Romania, the USA, etc. And
some literatures study the relationship between corporate financial performance
and ESG in some financial institutions. Few literatures study the relationship

between ESG performance and listed firms in China, particularly those in some specific industries.

The purpose of this study is to investigate the impact of ESG performance on the valuation of Chinese listed companies, particularly those in the manufacturing industry, and then do some heterogeneity analysis according to the companies' polluting differences in some industries divided into high polluting or low polluting industries. And also a heterogeneity analysis based on different regions, which include east, middle, west, northeast, and additionally conducting robustness tests. The study uses both quantitative and qualitative analytical methods to introduce the concepts of ESG and corporate valuation, taking the Chinese Shanghai and Shenzhen A-share listed manufacturing companies from 2012 to 2022 as samples. Excel is used to process the screened data and then make regression analysis, to carry out the empirical analysis and determine the impact of ESG performance on corporate valuation.

This paper focuses on answering the following questions: 1) How is the valuation of China's A-share listed manufacturing companies linked to their ESG performance? 2) To which extent impacts the heterogeneity of ESG ratings the company valuation? At the end of the paper, this study presents conclusions and suggestions for company developments, investors, and government agencies drawn from the empirical results.

3. Research Target

ESG is a value concept that focuses on environmental, social, and corporate governance performance, which are the three major variables determining the company's sustainable and ethical investment strategies. It belongs to a disclosure framework for the company's non-financial information and it is an expansion of responsible and green investment. Specifically, the letter "E" stands for environment, which focuses on the resources required by the company, the energy utilized, the trash generated, the environmental effect of the enterprise's operational activities and investment behaviors. The key components are climate change, natural resources, pollution, waste, and ecological opportunity. "S" stands for social, and it focuses on the firm's internal and external interactions with its stakeholders. Its core content includes human capital, product responsibility, interest-related opinions, and equal opportunities in society. "G" stands for corporate governance, including the standardization of internal mechanisms such as corporate structure, management compensation, and business ethics. It is mainly manifested as board structure, executive compensation, ownership as well as control, accounting system, and so on.

The prototype of the ESG originated from ethical investment in the 1950s to 1960s, which means, investors give priority to exclude companies with moral flaws when making decisions, such as companies that exploit employees and damage the environment. By the middle of the 20th century, European and American countries began to realize that the development model at the expense

of the environment had exposed human beings to existential threats. Hence, investments that emphasized environmental protection and social responsibility emerged. The first United Nations Conference on the Human Environment was held in Stockholm in 1972, at which the Declaration on the Human Environment was read out for the first time. This international conference was an important turning point in the development of ESG concepts. In 1997, the United Nations Environmental Program (CERES) and the US Alliance for Environmentally Responsible Economics established the Global Reporting Initiative (GRI), which was the first organization to formulate sustainability reporting standards in the world (Krantz & Krantz, 2024). In China, sustainable development thinking and green development thinking have been integrated into the ESG concept. The quantity of research on the financial effects of ESG and ESG ratings has increased along with the adoption of ESG practices in businesses. Globally renowned market leaders include Sustainalytics, FTSE Russell, and Morgan Stanley Capital International (MSCI). Although China starts relatively late in ESG-related matters and lags far behind other countries, ESG rating agencies have gradually taken shape in recent years, such as SynTao Green Finance, Hexun.com, and Sino-Security ESG Index which come from the Wind financial database.

This paper employs ESG rating scores from the Sino-Security ESG index to illustrate the ESG performance of listed Chinese manufacturing companies and empirically studies the impact of ESG performance on the valuation of these listed manufacturing companies. It provides information for stakeholders, corporations, and government agencies to identify the impact of sustainable development on corporation value creation.

4. Literature Review

Global public issues are becoming increasingly prominent, especially the unprecedented impact brought by the COVID-19 and climate change epidemic. Researchers have realized the significance of ESG to the sustainable development of companies. In recent years, there have been a lot of debates over the link between ESG responsibility and corporate performance as well as documents that ESG information is associated with numerous economic effects.

Giese et al. (2019) discovered that shifts in an organization's ESG traits might serve as a helpful financial indication. The use of ESG ratings into financial assessments and policy standards may also be appropriate. Cheng et al. (2013) discovered that ESG disclosures are associated with lower capital constraints. Dhaliwal et al. (2011) thought ESG disclosures are associated with lower costs of capital and Grewal et al. (2019) researched stock price movements around mandatory ESG disclosure regulation.

Scholars who use data from different countries, based on local national economic development, social systems, and industries, have also studied the impact of environmental, social, and governance (ESG) performance on corporate fi-

nancial success.

In India, according to Ghosh's (2013) research, organizations with higher sustainability performance also have higher financial success, which can be measured using both market and accounting metrics.

Almeyda and Darmansya's (2019) research, gathered samples of companies in the real estate sector during 2014-2018 from seven countries, the G7. Using ROA, ROC, Stock price and PE to measure financial performance, finally, the research indicates that there is no statistically significant correlation between the financial performance of a corporation and the Social and Governance factors, but discovered a statistically significant positive correlation between the stock price, ROC and the environmental element. Bagh et al. (2024) made an empirical analysis and then found that ESG practices nonlinearly affected corporate value and turned corporate value trajectory from positive to negative by using data on 52,220 listed US and Chinese companies from 2018 to 2022.

In China, several researchers have studied the relationship between ESG and the corporate financial performance of Chinese listed companies. Yu and Wang's (2021) research found that environmental performance was negatively related to company's financial performance. Tang and Xia (2019) found a "U"-shaped relationship between them. Feng et al. (2016) examined the effects of social performance and social responsibility information disclosure of listed companies on corporate financing constraints from the perspective of corporate social responsibility. Pertinent data from Shanghai and Shenzhen A-share non-financial insurance listed companies were used. The findings demonstrated that a bundle of financial limitations may be lessened by effective corporate social responsibility performance.

5. Research Methodology

5.1. Research Hypothesis

5.1.1. Based on Three Theories

There are three theories that we are considered: 1) Sustainable development theory; 2) Stakeholder theory; 3) Information asymmetry theory.

According to the sustainable development theory, it was first proposed by the World Commission on Environment and Development in March 1987 (Shi et al., 2019). The central idea is that enterprise development must not only conform to the overall economic interests of the viewed country but also not cause adverse effects on future generations. ESG reports apply the idea of sustainable development in the design of the indicator system, especially with regard to social and environmental aspects. As a micro unit of economic development companies should balance the relationship between their own interests, environmental benefits, and social interests.

According to the stakeholder theory, Freeman and McVea (2001) defined stakeholders as "any individual or group that can affect the achievement of corporate goals, or can be affected by the process of achieving corporate goals." The

stakeholder theory believes that a company is an interest group of stakeholders, and managers of the company are responsible for all stakeholders, such as investors, providers of production factors, and consumers who purchase the products. The company should coordinate the conflicts of interests of all parties and align its needs with the company's development. Companies should maximize the interests of their stakeholders. Companies that fulfill timely disclosure of ESG rating information can provide stakeholders with more information and help them gain recognition from stakeholders.

According to the information asymmetry theory, Spence (1973) suggests people have varying perceptions of significant information about market economic activity. Those with higher knowledge are frequently in a better position, while those with less information are in a bad position. Regarding the disclosure of ESG information, there is an information asymmetry between listed companies in China, which can easily lead to adverse selection and moral hazard.

In summary, the mechanism by which ESG performance affects corporate valuation is shown below (cf. Table 1).

According to the three theories above, the first hypothesis is reviewed:

Hypothesis 1: The ESG performance of listed manufacturing companies in China has a significant positive impact on their company valuations.

5.1.2. Based on Different Industries

According to the Ministry of Ecology and Environment of China's definition of high energy-consuming and high-pollution sectors based on data in April 2021, and the Shanghai Environment and Energy Exchange's Announcement on Matters Related to China's Carbon Emissions Trading issued in June 2021 there are eight industries: 1) automotive manufacturing; 2) metal smelting industry; 3) transportation and aviation; 4) chemical products manufacturing; 5) pharmaceutical industry; 6) electrical machinery manufacturing; 7) steel, nonferrous metals; 8) papermaking and clothing industry which are all included in high carbon industries. Therefore, this paper defines the companies belonging to these eight industries in the sample as high polluting companies, and the remaining companies as low polluting companies. This paper believes that low-polluting companies themselves have less impact on the environment and have better ESG performance. They have gained a positive image with high expectations in the minds of investors, government, and consumers. However, heavy-polluting companies produce higher environmental pollution. If these companies focus on ESG performance they are taking the initiative to enhance related responsibilities and achieve a certain degree of transformation. The initiative will be favored by investors and consumers, and further support its corporate valuations. Therefore the second hypothesis is reviewed:

Hypothesis 2: Improving the ESG performance of listed manufacturing companies in high-polluting industries will have significant positive impact on company valuation.

Table 1. The mechanism by which ESG performance affects corporate value (own depiction).

	Environmental Performance	Sustainable development theory	Improve reputation	Increase	
ESG Performance	Social Performance	Stakeholder theory Information asymmetry theory	Shorten information gap	Increase	Corporate valuation
	Governance Performance	Stakeholder theory	Identify risks & gain recogination	Increase	

5.1.3. Based on Different Regions

China possesses vast land area and a rapidly developing economy. It is divided into 23 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions, categorized into eastern, middle, western, and northeastern parts. The eastern region, situated along the coast, exhibits the highest levels of economic development and population density. In contrast, the western region, abundant in natural resources, lags behind economically. The middle region serves as a transition zone, with lower economic development compared to the east. The northeastern region is characterized by heavy industry. Economic disparities among these regions result in variations in policy and market environments. Favorable economic conditions within a region encourage listed companies to increase investments in ESG performance. Developed regions typically have more comprehensive ESG policies and incentive mechanisms, making policy implementation easier.

According to the different regions the third hypothesis is reviewed:

Hypothesis **3**: Compared with the middle, western and northeastern regions, listed manufacturing companies in the eastern regions will have more obvious impact to corporate valuation when they improve their ESG performance.

5.2. Research Design

5.2.1. Sample Selection and Data Sources

The paper uses some data of China's A-share listed manufacturing companies from 2012 to 2022 as research samples and analyzes the relationship between their ESG ratings and valuation results. The paper selects and screens the original data according to the following measures: 1) Select China's A-share listed manufacturing companies' financial data and their ESG rating. Original financial data come from Wind Financial Terminal (Wind Information Network, n.d.), RESSET Database (Resset Data, n.d.) and CSMAR Database (CSMAR, n.d.). ESG rating stems from Sino-Security Index (Sino Security Terminal-Wind Information Network, n.d.); 2) Eliminate some manufacturing companies with missing ESG rating or financial data; 3) Remove some insolvent and nearly bankrupt manufacturing companies; 4) Eliminate some companies with "special treatment" (ST) or "delisting warning" (*ST) in the stock market which means if a company has suffered losses for two consecutive years or its net assets are lower than the face value of the stock as well as the daily price limit exceeds 5%. ST la-

bel will be added before its stock name. Finally, there are 11,033 data set which were obtained for 1003 listed manufacturing companies. The preparation downloads the required variables from the database, using excel to process the screened data into panel data, and then using Sata 17 to execute an empirical regression analysis and test of the relevant models. Moreover, to avoid the adverse effects of outliers on the empirical results this paper adopts a 1% upper and winsorizes for all continuous variables.

5.2.2. Model Design and Variable Selection

To verify the above hypotheses, the paper constructs the following regression models for the panel data (standard formulas):

$$PB_i = a_1 + \beta_1 \text{ESG}_{i,t} + \sum \beta \text{Control}_{i,t} + \varepsilon i_t \tag{1}$$

$$PB_i = a_2 + \beta_2 \text{Environment}_{i,t} + \sum \beta \text{Control}_{i,t} + \varepsilon i_t \tag{2}$$

$$PB_i = a_3 + \beta_3 \text{Social}_{i,t} + \sum \beta \text{Control}_{i,t} + \varepsilon i_t \tag{3}$$

$$PB_i = a_4 + \beta_4 \text{Governance}_{i,t} + \sum \beta \text{Control}_{i,t} + \varepsilon i_t \tag{4}$$

These models are used to examine the impact of ESG performance, environment performance, social performance, and governance performance on corporate value measured by price to book ratio (PB), where the control variables are total asset turnover, net profit growth rate, debt to assets ratio, and current ratio.

a_1, a_2, a_3, a_4 stands for constant; β_1, β_2, β_3, β_4 stands for coefficient of independent variable; β stands for coefficient of control variable; t stands for time; i stands for company; ε stands for errors terms.

Dependent variables

According to the research above, there are many valuation approaches and indicators that can be used to represent the corporate valuation. In this paper, the author chooses to use the PB ratio to represent the corporate valuation. PB is the ratio of a company's market capitalization to its net assets, which is total assets minus total liabilities. This empirical analysis chooses PB ratio as the dependent variable, mainly due to: firstly, PB ratio is more suitable for the valuation of heavy-asset industries, which includes industries that belong to heavy industrial manufacturing, such as coal, oil, steel, non-ferrous metals, air transportation, mechanical equipment and other industries which are in line with the research samples of this paper. Secondly, PB ratio is calculated by net assets per share. This indicator is more stable than earnings per share and can better reflect the valuation changes of listed companies.

Independent variables

To guarantee the accuracy and consistency of the data this paper selects the third-party rating data as the explanatory independent variables. It chooses Sino-Security ESG Index from Wind financial database. Sino-Security ESG Ratings systematically calculates the ESG levels of all Chinese A-share listed companies and more than 100 bond entities through a combination of quarterly regular evaluations and dynamic tracking and has more than 20 million ESG rating data

since 2009. And correspondingly, there are nine grades given to "C-AAA", from low to high, they are C, CC, CCC, B, BB, BBB, A, AA, AAA. This paper assigns ESG performance according to these nine grades as one to nine, that is C is one and AAA is nine. The higher the value, the better the ESG rating performance of the company. The core independent variables are described in details below.

ESG rating

ESG is the sum of the scores of corporate governance, environment, and social responsibility. Suppliers, consumer rights duties, employee responsibilities, and shareholder responsibilities are all examples of corporate governance responsibilities. Shareholder responsibility accounts for 15% of the whole ESG world, suppliers, consumer, and employee responsibility contribute 15% separately, social responsibility accounts for 20%, and environmental responsibility accounts for 20%.

Environment performance rating

Environment responsibility is mainly analyzed from the aspect of environment, governance, including types of energy conservation, environmental management system certification, types of sewage discharge, awareness of environmental responsibility and funds invested in environmental protection.

a) Social performance rating

Social responsibility is mainly analyzed in terms of contribution value, including the ratio of income tax to total profits and the amount of charity donations.

b) Governance performance rating

Corporate governance responsibilities include supplier, consumer right responsibilities, employee responsibilities and shareholder responsibilities.

Control variables

To guarantee the robustness of the empirical results, this paper chooses four control variables: Total asset turnover; Net profit growth rate; Current ratio; Debt to asset ratio.

a) Total asset turnover is the ratio of a company's sales revenue to its average total assets over a specific time that reflects whether or not the company's total assets are efficient in real operations. The higher the value, the more quickly the company's overall asset turnover and sales capacity will increase.

b) Net profit growth rate is the rate at which the current period's net profit grows in comparison to the preceding period's net profit and is an essential indicator for evaluating a company's growth. The greater the indicator, the greater the company's profitability.

c) The working capital ratio is another name for the current ratio. It is the ratio of a company's total current assets to its total current liabilities. It is used to measure a company's ability to convert current assets into cash and repay liabilities before short-term borrowing matures. The current ratio of around 2:1 is commonly regarded to be acceptable. Current assets are thus worth twice as much as current liabilities. Even if half of the existing assets do not become available soon, all current liabilities can be repaid.

d) Debt to asset ratio analyzes a company's debt status. The ratio is used to assess an enterprise's capacity to use creditors to generate cash for operating expenses and to represent the safety of creditor loans. It is calculated by comparing the enterprise's total liabilities to its total assets.

According to the variables mentioned above, we can summarize the procedure in the following table (cf. Table 2).

6. Empirical Research

6.1. Data Analysis and Benchmark Regression

6.1.1. Descriptive Analysis

The paper conducts descriptive statistical analysis on 11,033 data sets, which included 1003 listed manufacturing companies. It applies descriptive statistical analysis focusing on five aspects: sample size (N), mean, standard deviation, minimum value, and maximum value. The results are (cf. Table 3).

6.1.2. Pearson Correlation Analysis

Pearson correlation analysis on the data is conducted (cf. Table 4).

The correlation coefficient between corporate value PB and ESG is 0.054, which means ESG is positively related to corporate value PB. It provides first preliminary explanation that the better the ESG performance, the better the corporate valuation. By looking at the coefficients of the variables again, if the correlation coefficient is less than 0.850, it will not cause significant interference to the regression results. Looking at the data in the table, all correlation coefficients are far less than 0.850 except social performance which is 0.934 to the ESG value, so they meet the requirements and will not cause interference to the regression. The reliability of the conclusion is tested by adding control variables. Regarding other control variables' growth, TAT and CR are all significantly positively related to corporate value PB; the DA ratio is negatively related to corporate value PB, which implies that the control variables selected in this paper are appropriate. What is more, to ensure that there will be no collinearity problems in this study, this paper also conducted a multicollinearity test.

6.1.3. Multicollinearity Test

To ensure that there will be no collinearity problems in this study, this paper also conducted a VIF test; VIF is the ratio of the variance of the regression coefficient estimator to the variance when it is assumed that the independent variables are not linearly related.

The test results are as follows (cf. Tables 5-8) (own calculations by using Stata 17).

Table 5 is the VIF test for model (a), which means independent variable is ESG.

Table 6 is the VIF test for model (b), which means independent variable is E.

Table 7 is the VIF test for model (c), which means independent variable is S.

Table 8 is the VIF test for model (d), which means independent variable is G.

Table 2. Selection and definition of variables (own depiction).

Variable types	Variable name	Variable code	Variable definitions
Dependent variables	Price to book ratio	PB	Market value/book value of equity
Independent variables	ESG performance	ESG rating	Converted by the company's ESG rating (C-AAA)
		Environment rating	
		Social rating	
		Governance rating	
Control variables	Total asset turnover	TAT	Net operating income/total average assets
	Net profit growth rate	Growth	Net profit growth/net profit of last year
	Current ratio	CR	Current assets/current liabilities
	Debt asset ratio	DA ratio	Total debt/total assets

Table 3. Descriptive analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)	(5)
Variables	N	Mean.	Sd.	Min.	Max.
PB	11033	3.214	2.347	0.432	27.21
ESG	11033	3.977	1.105	1	8
E	11033	2.386	1.206	1	8
S	11033	4.048	1.134	1	8
G	11033	4.744	1.502	1	8
Growth	11033	10.81	21.91	−48.85	119.7
DA ratio	11033	40.38	17.73	2.740	82.61
TAT	11033	0.699	0.403	0.0700	4.761
CR	11033	2.367	2.322	0.169	30.04

Table 4. Pearson correlation (own calculations by using Stata 17).

	PB	ESG	E	S	G	Growth	DA ratio	TAT	CR
PB	1								
ESG	0.054***	1							
E	0.070***	0.436***	1						
S	0.030***	0.934***	0.414***	1					
G	0.076***	0.605***	0.043***	0.571***	1				
Growth	0.126***	0.067***	0.017*	0.046***	0.035***	1			
DA ratio	−0.093***	−0.058***	0.027***	−0.037***	−0.061***	−0.00500	1		
TAT	0.001***	0.005***	0.001***	0.004***	0.057***	0.133***	0.203***	1	
CR	0.099***	0.058***	0.00800	0.045***	0.038***	−0.019*	−0.652***	−0.174***	1

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Table 5. Model (1) VIF test.

Variable name	ESG	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.02	1.77	1.07	1.75	1.32
1/VIF	0.991196	0.976368	0.565347	0.937923	0.572355	

Table 6. Model (2) VIF test.

Variable name	E	Growth	DA ratio	TAT	CR	Mean
VIF	1.00	1.02	1.77	1.07	1.75	1.32
1/VIF	0.997765	0.980315	0.564672	0.937971	0.572198	

Table 7. Model (3) VIF test.

Variable name	S	Growth	DA ratio	TAT	CR	Mean
VIF	1.00	1.02	1.77	1.07	1.75	1.32
1/VIF	0.995647	0.978627	0.565665	0.937958	0.572390	

Table 8. Model (4) VIF Test.

Variable name	G	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.02	1.77	1.07	1.75	1.32
1/VIF	0.990520	0.980030	0.564007	0.933764	0.572848	

As can be seen from the above table, the VIF values are all greater than 1 and less than 2, and much less than 10, indicating that there is no collinearity problem. In addition, the selected sample data all passed the Unit Root Test, which means a statistical method used to determine whether a time series dataset exhibits a stochastic trend or is stationary.

6.1.4. White Test

Before performing the regression on the panel data, the first thing to do is to use the heteroskedasticity test to determine whether there are significant individual random effects in the sample, and then determine whether the mixed regression test method can be used. This paper uses the White test, and the basic assumption of the test is: when the individual intercept terms are all 0, there is no individual effect, and a mixed regression model can be used. The test results are as follows (cf. Table 9).

As can be seen from the table, the p $0.00 < 0.01$, so the null hypothesis is rejected at the 1% significance level, which indicates the existence of heteroskedasticity. Thus, the mixed regression model cannot be selected. To solve the problem of heteroskedasticity, OLS plus robust test is performed.

6.1.5. Regression Analysis

After solving the heteroskedasticity problem and passing the Hausman test, this

Table 9. White test (own calculations by using Stata 17).

White's test			
H0: Homoskedasticity			
Ha: Unrestricted heteroskedasticity			
chi2(44) = 365.12			
Prob > chi2 = 0.0000			
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroskedasticity	365.12	44	0.0000
Skewness	160.72	8	0.0000
Kurtosis	32.87	1	0.0648
Total	558.71	53	0.0000

paper selects the fixed effects model for regression analysis. The regression results are as follows (cf. Table 10).

As shown in the table, the square of R is about 28.5%, indicating a high degree of fit. The model used can explain the correlation between the ESG performance and the valuation of listed companies in the Chinese manufacturing industry. Among them, the total score of ESG performance, environment performance and governance performance is significantly related to PB at the 1% level, since the coefficient is positive, indicating that the overall ESG performance, environment performance and governance performance of listed companies will have a significantly positive impact on the valuation of listed companies. The social responsibility score is also significantly related to corporate valuation at the 5% level and has a positive impact on company valuation. The above results support hypothesis 1 (see Table 10).

This paper concludes that listed companies are paying attention to ESG performance, which is in line with China's policies on energy conservation and emission reduction and they can therefore get strong support from the government. If the listed companies reduce risks, they will have more sustainable development capabilities. At the same time, listed companies with good ESG performance are more important to their shareholders, employees, and investors. Company can enhance their reputation, gain public recognition, and improve their competitiveness by increasing their valuations. Moreover, listed companies with good ESG performance will achieve positive effects by resisting risks. Investors holding stocks of listed companies with good ESG performance are protecting their funds by having higher valuations. Regarding control variables growth, TAT, and CR, all of them have a significant positive correlation with company valuation. It implies the company achieves better performance and higher company valuation.

Table 10. Regression analysis (own calculations by using Stata 17).

Variables	(1) PB	(2) PB	(3) PB	(4) PB
ESG	0.083*** (4.04)			
E		0.133*** (5.78)		
S			0.039** (2.01)	
G				0.103*** (7.20)
Growth	0.013*** (11.85)	0.013*** (11.98)	0.013*** (12.04)	0.013*** (11.97)
DA ratio	−0.006*** (−3.31)	−0.007*** (−3.70)	−0.006*** (−3.38)	−0.006*** (−3.06)
TAT	0.032*** (0.61)	0.037*** (0.69)	0.034*** (0.63)	0.008*** (0.15)
CR	0.071*** (4.91)	0.069*** (4.85)	0.072*** (4.96)	0.072*** (5.02)
Constant	2.797*** (21.57)	2.836*** (24.88)	2.970*** (23.34)	2.633*** (22.07)
Observations	11033	11033	11033	11033
Adjusted R-squared	0.29	0.32	0.28	0.32
r2_a	0.285	0.317	0.274	0.313
F	52.90	57.35	50.05	59.61

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

6.2. Heterogeneity Analysis

6.2.1. Based on Different Industries (High Polluting Industries & Low Polluting Industries)

According to the previous theoretical analysis, different industries may have different attitudes and practices toward environmental responsibilities; the impact on valuations will therefore be different. It is necessary to study the listed manufacturing companies belonging to high-pollution or low-pollution industries, to see whether their ESG performance has different impacts on valuations or not. The analysis is based on the definition of high energy-consuming and high-pollution industries by the Ministry of Ecology and Environment of China in April 2021, and *Announcement on Matters related to National Carbon Emissions Trading* by the Shanghai Environment and Energy Exchange in June 2021. There are eight high-energy-consuming industries included in the Chinese carbon market, comprising automotive manufacturing, metal smelting industry, transportation & aviation, chemical products manufacturing, pharmaceutical industry, electrical machinery manufacturing, steel & nonferrous metals, and

papermaking & clothing industry. This paper differentiates the enterprises in these eight industries in the sample as high-carbon emission (high-pollution) enterprises, and the remaining enterprises as low-carbon emission (low-pollution) enterprises.

1) Empirical analysis

A) High pollution industries empirical analysis

The data set consists of 7018 corporates, which includes 638 listed manufacturing companies.

a) Description statistics (cf. Table 11)

It can be seen in the sample that the maximum value of PB is 27.21 and the minimum value is 0.432. There is a large gap between the valuations of companies in heavily polluting industries. The average of social performance and governance performance in ESG is greater than the average of environmental performance. The maximum value of Growth is 119.2, and the minimum value is −48.85. The gap is large, indicating that the quality and growth performance of companies in heavily polluting industries are uneven. The gap between the maximum and minimum values of debt asset ratio is also large. It is concluded that some companies with high debt-to-asset ratios may need to borrow money to finance their business expansion due to relatively low profit levels (see Table 11).

b) Pearson analysis (cf. Table 12)

Passing the preliminary correlation test, it can be concluded that ESG, E, S, and G all have a positive significant relationship with the company's valuation PB. Debt-asset ratio has a negative significant relationship with PB; a higher debt-asset ratio negatively impacts the company's valuation (see Table 12).

c) Multicollinearity test (cf. Tables 13-16) (own calculations by using Stata 17)

Through the above multicollinearity test, the variance inflation factor (VIF) value is obtained. The values of the above models are all greater than 1 and less than 2, and much less than 10, indicating that there is no collinearity problem.

d) White test (cf. Table 17)

White's test tells us whether the data obey a normal distribution which is required to confirm the null hypothesis; $p = 0.00 < 0.01$, indicates the existence of heteroskedasticity, so a robustness test is required.

e) Regression analysis (cf. Table 18)

From the above regression analysis results, it is known that there is a strong and positive significant correlation between ESG score and company valuation PB. The regression results for companies in high-pollution industries will be explained in detail below (see Table 18).

B) Low pollution industries empirical analysis

There are 4015 data set including 365 listed manufacturing companies.

Regression analysis (cf. Table 19)

From the above regression data of high-pollution and low-pollution industries, it is concluded that the coefficient of the total ESG score of low-pollution

Table 11. Descriptive statistics (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)	(5)
Variables	N	Mean	Sd.	Min.	Max.
PB	7018	2.983	2.198	0.432	27.21
ESG	7018	3.962	1.132	1	8
E	7018	2.403	1.230	1	8
S	7018	4.039	1.158	1	8
G	7018	4.715	1.515	1	8
Growth	7018	10.54	21.48	−48.85	119.2
DA ratio	7018	41.53	17.81	2.889	82.61
TAT	7018	0.730	0.404	0.0700	4.761
CR	7018	2.175	2.168	0.169	29.64

Table 12. Pearson analysis (own calculations by using Stata 17).

	PB	ESG	E	S	G	Growth	DA ratio	TAT	CR
PB	1								
ESG	0.072***	1							
E	0.086***	0.468***	1						
S	0.049***	0.936***	0.445***	1					
G	0.075***	0.622***	0.069***	0.588***	1				
Growth	0.111***	0.081***	0.025**	0.064***	0.059***	1			
DA ratio	−0.063***	−0.072***	0.031***	−0.059***	−0.080***	−0.0160	1		
TAT	0.013***	0.005***	0.012***	0.006***	0.056***	0.128***	0.179***	1	
CR	0.091***	0.065***	−0.021*	0.058***	0.068***	−0.00900	−0.630***	−0.131***	1

Table 13. Model (1) VIF test.

Variable name	ESG	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.03	1.69	1.05	1.66	1.29
1/VIF	0.987609	0.975535	0.591045	0.950344	0.601432	

Table 14. Model (2) VIF test.

Variable name	E	Growth	DA ratio	TAT	CR	Mean
VIF	1.00	1.02	1.69	1.05	1.66	1.28
1/VIF	0.998347	0.981050	0.591603	0.950392	0.601895	

Table 15. Model (3) VIF test.

Variable name	S	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.02	1.69	1.05	1.66	1.29
1/VIF	0.991696	0.977886	0.591476	0.950329	0.601386	

Table 16. Model (4) VIF test.

Variable name	G	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.02	1.69	1.06	1.66	1.29
1/VIF	0.985507	0.979297	0.590164	0.946378	0.601495	

Table 17. White test (own calculations by using Stata 17).

White's test			
H0: Homoskedasticity			
Ha: Unrestricted heteroskedasticity			
chi2(44) = 252.99			
Prob > chi2 = 0.0000			
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroskedasticity	252.99	44	0.0000
Skewness	94.68	8	0.0000
Kurtosis	16.50	1	0.0648
Total	364.17	53	0.0000

Table 18. Regression analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.112***			
	(4.73)			
E		0.153***		
		(5.78)		
S			0.069***	
			(3.05)	
G				0.093***
				(5.37)
Growth	0.011***	0.011***	0.011***	0.011***
	(8.69)	(8.90)	(8.90)	(8.81)
DA ratio	0.000	0.001	0.000	0.000
	(0.00)	(0.30)	(0.08)	(0.10)
TAT	0.088	0.087	0.087	0.108
	(1.32)	(1.30)	(1.31)	(1.63)
CR	0.087***	0.089***	0.088***	0.087***
	(4.99)	(5.12)	(5.03)	（5.00)
Constant	2.295***	2.391***	2.463***	2.304***
	(15.57)	(18.25)	(16.70)	(16.86)
Observations	7018	7018	7018	7018
Adjusted R-squared	0.24	0.28	0.22	0.25
r2_a	0.236	0.277	0.217	0.244
F	28.82	30.60	25.66	32.00

Robust t-statistics in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

Table 19. Regression analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.023 (0.59)			
E		0.121*** (2.75)		
S			−0.014 (−0.40)	
G				0.109*** (4.10)
Growth	0.015*** (7.65)	0.015*** (7.63)	0.015*** (7.69)	0.016*** (8.91)
DA ratio	−0.018*** (−5.44)	−0.019*** (−5.80)	−0.018*** (−5.42)	−0.017*** (−5.55)
TAT	0.431*** (4.84)	0.441*** (4.99)	0.432*** (4.85)	0.401*** (3.86)
CR	0.015 (0.63)	0.009 (0.37)	0.016 (0.66)	0.019 (0.87)
Constant	3.720*** (15.23)	3.571*** (16.90)	3.863*** (16.67)	3.271*** (14.81)
Observations	4015	4015	4015	4015
Adjusted R-squared	0.39	0.42	0.39	0.43
r2_a	0.383	0.412	0.382	0.422
F	28.28	32.14	28.01	36.37

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

industries is 0.023, and it is not significant to the company's value PB. The coefficient of environmental performance is 0.121, which is positively significant for PB. The social responsibility score is −0.014, which is not significant for PB. The correlation coefficient of the corporate governance score is 0.109, which is positively significant for PB. But overall, the emphasis on ESG performance by listed manufacturing companies in low-pollution industries does not have a significant impact on company valuations (see Table 19).

From the above regression analysis results of enterprises in highly polluting industries, we found out that the coefficient of the total ESG score of heavily polluting industries is 0.112, the coefficient of environmental performance is 0.153, the coefficient of social responsibility score is 0.069, and the score of corporate governance is 0.093 (see Table 18). All of them are positively related to the company's valuation PB. The regression results support the previous Hypothesis 2. Improvements in ESG performance of listed manufacturing companies in high-polluting industries will have a significant positive impact on company valuations.

This shows that the better the overall ESG performance of listed companies in heavily polluting industries, the higher the valuation of listed manufacturing companies. According to the coefficient, environmental responsibility makes the greatest contribution to the ESG performance of heavily polluting industries, while corporate governance performance and social responsibility performance have a relatively weak positive impact on their valuation. However, the ESG of companies in low-pollution industries has no significant relationship with company valuation. It is concluded that listed companies in low-pollution industries have focused largely on environment performances all the time, thus its overall ESG performance will not have much additional impact on valuations. Companies in highly polluting industries have negative impact on their environment performance due their production activities. Once companies strive to transform and improve the company's ESG performance, the company's valuation will also increase as well.

6.2.2. Based on Different Regions (East, Middle, West, Northeast)

1) Empirical analysis

A) Eastern region

There are 7370 data sets with 670 listed manufacturing companies.

a) Descriptive analysis (cf. Table 20)

From the above descriptive analysis, we can see that the average values of social performance and governance performance are greater than the average value of environment performance. There is a big gap between the maximum and minimum growth values of enterprises in the eastern region (see Table 20).

b) Pearson analysis (cf. Table 21)

From the above table, we can see that ESG, environment, social and governance performance all have a positively significant relationship with the company's valuation PB. The correlation between TAT and ESG here is 0, which means that there is no linear relationship between TAT and ESG. It is concluded that TAT and ESG may have a nonlinear relationship or other randomness. The relationship between TAT and ESG may be affected by other variables or factors that are masked, which also results in the unclear correlation between the two (see Table 21).

c) Multicollinearity test (cf. Tables 22-25)

Examining the multicollinearity data obtained above, the conclusion is no multicollinearity.

d) White test (cf. Table 26)

It can be seen from the White test that p = 0.00, indicating that the null hypothesis is rejected and the data have heteroscedasticity. The robustness test is applied.

e) Regression analysis (cf. Table 27)

In the eastern region of China, ESG, E, S and G variables are all significant positively related to corporate valuation PB.

B) Middle region

Table 20. Descriptive analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)	(5)
Variables	N	Mean	Sd	Min	Max
PB	7370	3.277	2.371	0.455	27.21
ESG	7370	4.027	1.094	1	8
E	7370	2.448	1.227	1	8
S	7370	4.092	1.120	1	8
G	7370	4.788	1.479	1	8
Growth	7370	11.12	22.00	−48.85	119.6
DA ratio	7370	39.47	17.67	2.766	82.61
TAT	7370	0.695	0.374	0.0934	4.179
CR	7370	2.436	2.311	0.169	28.03

Table 21. Pearson analysis (own calculations by using Stata 17).

	PB	ESG	E	S	G	Growth	DA ratio	TAT	CR
PB	1								
ESG	0.031***	1							
E	0.063***	0.434***	1						
S	0.007***	0.936***	0.410***	1					
G	0.058***	0.583***	0.028**	0.555***	1				
Growth	0.134***	0.071***	0.0160	0.047***	0.033***	1			
DA ratio	−0.047***	−0.038***	0.052***	−0.0170	−0.055***	0.00600	1		
TAT	0.029**	0	−0.0160	−0.00200	0.074***	0.151***	0.220***	1	
CR	0.069***	0.028**	−0.0130	0.0160	0.032***	−0.029**	−0.664***	−0.180***	1

Table 22. Model (1) VIF test.

Variable name	ESG	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.03	1.83	1.08	1.79	1.35
1/VIF	0.993396	0.970781	0.547263	0.927528	0.557372	

Table 23. Model (2) VIF test.

Variable name	E	Growth	DA ratio	TAT	CR	Mean
VIF	1.00	1.03	1.83	1.08	1.80	1.35
1/VIF	0.995348	0.975326	0.545495	0.926691	0.556976	

Table 24. Model (3) VIF test.

Variable name	S	Growth	DA ratio	TAT	CR	Mean
VIF	1.00	1.03	1.83	1.08	1.79	1.35
1/VIF	0.997402	0.973527	0.547537	0.927507	0.557368	

Table 25. Model (4) VIF test.

Variable name	G	Growth	DA ratio	TAT	CR	Mean
VIF	1.01	1.03	1.83	1.09	1.79	1.35
1/VIF	0.988760	0.975358	0.545830	0.920935	0.557398	

Table 26. White test (own calculations by using Stata 17).

White's test			
H0: Homoskedasticity			
Ha: Unrestricted heteroskedasticity			
chi2(44) = 296.80			
Prob > chi2 = 0.0000			
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroskedasticity	296.80	44	0.0000
Skewness	102.71	8	0.0000
Kurtosis	22.79	1	0.0000
Total	422.30	53	0.0000

Table 27. Regression analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.142***			
	(1.65)			
E		0.121***		
		(4.38)		
S			0.053***	
			(2.86)	
G				0.081***
				(4.38)
Growth	0.014***	0.014***	0.014***	0.014***
	(10.14)	(10.16)	(10.28)	(10.21)
DA ratio	−0.000	−0.001	−0.000	0.000
	(−0.16)	(−0.47)	(−0.19)	(0.01)
TAT	0.147**	0.160**	0.147**	0.119
	(2.02)	(2.17)	(2.01)	(1.63)
CR	0.076***	0.074***	0.076***	0.076***
	(3.86)	(3.79)	(3.87)	(3.88)
Constant	2.677***	2.579***	2.849***	2.463***
	(15.57)	(17.01)	(16.88)	(15.72)
Observations	7370	7370	7370	7370
Adjusted R-squared	0.24	0.28	0.24	0.24
r2_a	0.234	0.269	0.230	0.255
F	27.94	31.56	27.53	30.50

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

There are 1783 data sets with 162 listed manufacturing companies (cf. Table 28).

The above regression results show that only governance performance has a positive correlation with PB, while ESG, E, S and G do not have correlation with PB indicating that environment and social performance have no obvious relationship with the valuation of listed companies.

B) West region

There are 1485 data sets with 135 listed manufacturing companies (cf. Table 29).

In the western region of China, ESG and environment performance have an obviously significant positive relationship with corporate valuation PB, while social and governance performance have no significant relationship (see Table 29).

C) Northeast region

There are 396 data sets with 36 listed manufacturing companies (cf. Table 30).

ESG has a significant positive relationship with the company's valuation PB, whereas E, S, and G do not have a significant correlation with it. Based on the regression results of the above in four regions, it can be concluded that the correlation coefficient of ESG to company value PB in the eastern region is 0.142, the regression coefficient of environment performance to PB is 0.121, the regression coefficient of social performance to PB is 0.053, and the regression coefficient of governance performance to PB is 0.081. ESG, E, S and G all show a significant positive relationship with the company's valuation PB (see Table 27).

In the middle region, the regression coefficient of ESG on company value PB is 0.019, showing a significant positive impact. Other ESG, E and S do not have significance on the company's valuation PB (see Table 28).

The regression coefficient of ESG on company value PB in the western region is 0.019, and the regression coefficient of environment performance on company value PB is 0.032, both showing significant positive effects. S and G do not generate a correlation with PB (see Table 29).

The regression coefficient between ESG and company valuation PB in the Northeast region is 0.220, and the remaining E, S and G are not significant (see Table 30).

The more developed the economy, the more obvious is the impact of the ESG performance of listed manufacturing companies on the company's value PB. The regression results support the previous hypothesis 3.

6.3. Robustness Check

To ensure the robustness of the benchmark regression results of this study, the previously dependent variable PB data is replaced with Tobin's Q which is the market value divided by total assets. Tobin's Q is a financial ratio that compares the market value of a company's assets to their replacement cost, providing insight into investment efficiency and potential market mispricing. The robustness test results after replacing the explained variables are shown in the table.

Table 28. Regression analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.071			
	(1.44)			
E		0.085		
		(1.25)		
S			0.043	
			(0.92)	
G				0.052*
				(1.66)
Growth	0.011***	0.011***	0.011***	0.011***
	(4.13)	(4.16)	(4.16)	(4.11)
DA ratio	−0.017***	−0.017***	−0.017***	−0.017***
	(−4.30)	(−4.36)	(−4.33)	(−4.27)
TAT	−0.153	−0.159	−0.151	−0.157
	(−1.25)	(−1.29)	(−1.23)	(−1.27)
CR	0.023	0.026	0.025	0.027
	(0.96)	(1.07)	(1.02)	(1.13)
Constant	3.462***	3.552***	3.569***	3.489***
	(11.95)	(14.03)	(12.68)	(13.08)
Observations	1783	1783	1783	1783
Adjusted R-squared	0.41	0.42	0.41	0.41
r2_a	0.387	0.393	0.380	0.387
F	12.80	12.83	12.51	13.44

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 29. Regression analysis (own calculations by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.019***			
	(1.55)			
E		0.032***		
		(1.28)		
S			0.037	
			(2.66)	
G				0.021
				(1.18)
Growth	0.010***	0.010***	0.010***	0.010***
	(3.24)	(3.30)	(3.36)	(3.44)
DA ratio	−0.013***	−0.014***	−0.013***	−0.012***
	(−3.39)	(−3.62)	(−3.40)	(−3.24)
TAT	−0.055	−0.032	−0.047	−0.075
	(−0.49)	(−0.28)	(−0.41)	(−0.667
CR	0.114***	0.108***	0.116***	0.113***
	(3.92)	(3.68)	(3.94)	(3.79)

Continued

Constant	2.659***	2.995***	2.843***	2.363***
	(9.94)	(13.29)	(10.76)	（9.50)
Observations	1485	1485	1485	1485
Adjusted R-squared	0.53	0.54	0.49	0.65
r2_a	0.496	0.510	0.450	0.618
F	16.27	16.50	15.01	22.09

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 30. Regression analysis (own calculation by using Stata 17).

	(1)	(2)	(3)	(4)
Variables	PB	PB	PB	PB
ESG	0.220***			
	(2.17)			
E		0.092		
		(0.60)		
S			0.131	
			(1.37)	
G				0.103
				(1.51)
Growth	0.013***	0.014***	0.013***	0.013***
	(3.15)	(3.19)	(3.20)	(3.15)
DA ratio	−0.028***	−0.030***	−0.029***	−0.028***
	(−2.92)	(−3.13)	(−3.05)	(−2.95)
TAT	−0.334**	−0.388**	−0.358**	−0.1370**
	(−2.12)	(−2.39)	(−2.25)	(−2.33)
CR	0.144	0.137	0.140	0.141
	(1.32)	(1.27)	(1.30)	(1.33)
Constant	3.041***	3.790***	3.428***	3.439***
	(3.94)	(5.28)	(4.51)	(4.52)
Observations	396	396	396	396
Adjusted R-squared	0.144	0.135	0.133	0.138
r2_a	0.133	0.124	0.127	0.127
F	10.50	10.88	10.41	10.78

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

a) Regression analysis (cf. Table 31)

The regression analysis demonstrates that ESG, E, S and G have a significantly positive correlation with the company's valuation. The regression results are basically consistent when replacing the dependent variables. Among them, the total ESG score, corporate governance score, environment performance score, and social responsibility score of listed companies are still significantly positive at the 1% level, thus indicating the benchmark regression of this paper is stable.

Table 31. Regression analysis (own calculation by using Stata 17).

Variables	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q
ESG	0.029*** (2.55)			
E		0.055*** (4.59)		
S			0.017*** (1.55)	
G				0.052*** (6.37)
Growth	0.005*** (8.23)	0.005*** (8.29)	0.005*** (8.26)	0.005*** (8.24)
DA ratio	−0.020*** (−23.70)	−0.020*** (−23.92)	−0.022*** (−30.73)	−0.020*** (23.83)
TAT	0.043* (1.69)	0.045*** (1.76)	0.038* (1.48)	0.065** (2.51)
CR	0.025*** (2.86)	0.024*** (2.79)	0.025*** (2.89)	0.024*** (2.78)
Constant	2.457*** (37.24)	2.542*** (43.02)	2.744*** (47.32)	2.450*** (38.87)
Observations	11033	11033	11033	11033
Adjusted R-squared	0.99	0.90	0.97	0.96
r2_a	0.983	0.900	0.968	0.954
F	225.2	225.4	261.8	269.9

Robust t-statistics in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

7. Results

Presently environmental deterioration has become a worldwide problem. Countries are paying increasing attention to ESG performance, and national policies are also directing towards green finance growth. China has also officially included ESG information disclosure into business rules in recent years, encouraging listed firms to proactively report ESG-related information and steadily increasing the focus on companies' ESG performance. This study selects the ESG performance sub-data and financial data of 1003 companies listed on the Shanghai and Shenzhen A-share markets from 2012 to 2022 as the research object. It refers to the research of past scholars and is based on sustainable development theory, stakeholder theory, information asymmetry theory and relative valuation method. It adopts the empirical method of two-way fixed effects, using the ESG rating performance of CSI as the data source, and use PB as an indicator to measure the valuation of companies to study the influence of ESG on the

corporate valuation of listed manufacturing companies in China. The empirical results support the previous hypotheses and also pass the robustness test. In addition, this paper further studies the impact of enterprise heterogeneity from two aspects: different industries, that is, high-pollution or low-pollution industries, and different regions, that is, the eastern, middle, western and northeast region. Based on the previous research results, this paper summarizes the conclusions below.

Firstly, the better the ESG performance of China's manufacturing listed companies, the higher the valuation, among which environment performance and governance performance play major roles. The robustness check supports the research conclusions obtained from the baseline regression. This paper assumes that listed manufacturing companies' focus on ESG performance which is in line with the current development situation based on support from the government and banks. At the same time it can reduce operating risks and enable the company to enhance long-term and sustainable competitiveness. Moreover, when a company is responsible to its stakeholders, it can support its corporate reputation, gain the trust of investors, and make employees cohesive, so its valuation will also increase accordingly. Furthermore, listed manufacturing companies' focus on ESG performance will reduce the risk of encountering negative events. To preserve investment funds, investors are more inclined to invest in the stocks of listed companies with better ESG performance.

Secondly, the better the ESG performance of listed manufacturing companies in heavily polluting industries, the higher the valuation, in which environment performance and governance performance play major roles; the ESG performance of listed manufacturing companies in low-polluting industries has a relatively weak impact on valuation. This paper assumes that companies in low-pollution industries are accustomed to focus on ESG performance. A fixed image and psychological expectations have been created in the minds of investors, so increasing investment in ESG will not gain much additional economic benefits. The environmental transformation of enterprises in heavily polluting industries is in line with national policy guidance and will enhance the sustainability of their development.

Thirdly, when listed manufacturing companies are categorized based on their registered address, it can be observed when listed companies in the eastern region improve their ESG performance their corporate valuation also rises simultaneously. What is more, their environmental and social performance play a significant role. However, if listed manufacturing companies located in middle, western and northeastern regions improve their ESG performance the impact on their valuation is limited. This might be due that economically developed areas place greater emphasis on ESG performance and have stricter policy enforcement. Economically developed regions have a higher degree of marketization and better operational conditions for listed manufacturing companies. They have surplus funds to enhance their ESG performance and their ESG ratings will

accordingly be higher. In contrast, middle, western and northeastern regions, especially western and northeastern areas belonging to developing regions. They tend to place less emphasis on ESG issues, and investors as well as shareholders may prioritize short-term economic interests. More importantly, transparency and availability of ESG information in these developing regions are comparatively low, making it more challenging for investors and shareholders to support the company's ESG performance. In turn, making the impact of ESG factors on corporate valuation are weaker. Additionally, government policies and regulations in these areas are relatively weak and government have fewer measures to encourage or request companies to pay more attention to ESG issues. These reasons may collectively result in the ESG performance of listed manufacturing companies in economically underdeveloped regions having no significant impact on their corporate valuations.

8. Conclusion

The development of the green economy and the further advancement of ecological civilization require the supply of high-quality carbon information. To increase the emphasis that companies place on the quality of carbon information disclosure, companies need to be made aware of the value of the quality of carbon information disclosure. ESG is the core concept for evaluating the sustainable ability of corporate value creation.

The paper utilizes the CSI ESG rating performance as data source, and measures corporate valuation using PB as an indicator. The empirical results support the preceding hypotheses and pass the robustness test.

It draws the following conclusions:

a) Environmental performance and governance performance are key factors in the valuation of China's listed industrial enterprises; the better their ESG performance, the higher the valuations of these companies.

b) Listed companies in highly polluted industrial sectors are benefitting from higher ESG performance.

c) Eastern manufacturing companies improve their corporate values in line with their ESG performance. Their performances in the social and environmental spheres are also noteworthy.

d) Improvements in the ESG performance of the manufacturing listed enterprises in the Middle, Midwest and Northeast, however, do not have a substantial impact on their valuations.

9. Suggestions

The following policy suggestions are based on the findings of the paper's study.

a) Government

Government should improve the uniformity and operability of carbon information disclosure standards. China has successively introduced relevant regulations on environmental information disclosure, but there are still industry limi-

tations and operational difficulties. The government should further improve carbon information disclosure standards, provide more detailed disclosure requirements, effectively guide, and help companies realize carbon information disclosure and strengthen carbon risk management, and at the same time provide comprehensive, consistent, and comparable carbon information to stakeholders

b) Company

ESG is highly consistent with the concept of sustainable development, and it plays a positive role in promoting corporate transformation and upgrading, improving product and service quality and efficiency, increasing stakeholder satisfaction, effectively controlling environmental and social risks, and increasing corporate valuation. Enterprises should gradually realize that investing in social responsibility, ecological environment protection, and improved corporate governance does not add to their overall costs; rather, it strengthens their competitive edge and successfully removes funding barriers to support more adequate R&D. In addition to coordinating connections with stakeholders and promoting the sustainable growth of firms, financial support may raise investment in research and development to promote high-quality development.

c) Society

Investors should pay attention to the environmental performance of enterprises, focus on the carbon information disclosure status of listed companies, conduct a comprehensive evaluation of whether they disclose carbon information and the quality of disclosure, fully consider the environmental performance of enterprises, and fully assess the potential environment that enterprises may face when making investment decisions. risks, thereby guiding market capital flows. It is necessary to give full play to the intermediary role of investors in the incentive mechanism for corporate value creation through carbon information disclosure, and guide companies to build a high-quality carbon information disclosure system.

d) Further research

Krishnamoorthy (2021) mentioned, the study of ESG, ESG investing and corporate valuation is a new field and needs more systematic research. There are three types of research which are very important. For example, some research shows a strong relationship between ESG investing and business growth in revenues, margins, and investor value. Other research focus on social issues or the research emphasizes the ESG impact over a sustained period rather than a short period.

Moreover, investors expect ESG targets related to positive screening and active ownership to become more important in the future. Thus, interesting opportunities for research lie in valuation and corporate governance. How does increasing positive screening affect the cost of capital and market valuation of companies that perform well on material ESG issues? Similarly, how does active ownership change companies' governance, managerial practices, performance and ESG guidance? Many additional research topics are worth to be developed.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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