Impact of ESG Controversies on Corporate Valuation

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Abstract. The purpose of this study is to investigate the impact of ESG controversies on corporate valuation, with a focus on providing insights for effective ESG management to optimize financial performance and fulfill social responsibility. Empirical data from the CSI 300 Index was utilized, and both fixed effects and Random Forest models were employed to analyze the influence of ESG controversy scores on the price-to-book ratio and explore the underlying mechanisms. The results of the study indicate a significant and nonlinear impact of ESG controversies on PB, with social controversies exhibiting a U-shaped relationship, environmental controversies showing significant effects at high scores, and governance controversies demonstrating a consistently positive impact. These findings underscore the importance of strategic ESG management in enhancing firm value by prioritizing high environmental scores, effectively addressing social controversies to achieve optimal performance, and consistently improving governance practices to build investor confidence.

Keywords: ESG Controversy Scores; Price-to-Book Ratio; Random Forest.

1 Introduction

Environmental, Social, and Governance (ESG) factors have become increasingly vital as sustainability gains global prominence. ESG controversies, such as environmental violations and governance failures, significantly impact corporate reputation, financial stability, market value, and investor confidence. In China's dynamic financial markets, these controversies are especially relevant due to the nation's 2060 carbon neutrality goal. Although institutions like Tonghuashun have developed ESG rating systems, research on the impact of ESG controversies on key financial metrics in China remains limited. This study addresses this gap by analyzing the effect of ESG controversy scores on the price-to-book ratio (PB) using fixed effects and Random Forest models to capture nonlinear relationships.[6][9]

2 Related Literature

Research indicates a link between strong ESG performance and positive financial outcomes, though the relationship is complex. High ESG scores are generally associated

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with improved profitability and risk management, as companies manage environmental, social, and governance issues more effectively. For companies listed on the CSI 300 Index, strong governance improves the impact of environmental and social efforts on value. In contrast, ESG controversies—like environmental scandals or governance failures—often lead to negative financial impacts, such as increased costs and lower investor confidence. Weak governance and poor resource management contribute to these controversies, while board diversity, particularly more women, can reduce incidents. The ESG landscape remains inconsistent, with different rating agencies offering divergent assessments, making investment decisions challenging. This inconsistency highlights the evolving nature of ESG metrics and their varying impact on financial outcomes.[2][10][12]

3 Data and Variables

This study uses data of the CSI 300 Index from iFind, including enough industries to represent the mainstream Chinese stock market, excluding financial firms. The summary of model variables is listed in Table 1.[4]

Table 1. Description of Variables and Their Definitions

PB	The price-to-book ratio.
ESG_E	The environmental aspect score of ESG for firm
ESG_S	The social aspect score of ESG for firm.
ESG_G	The governance aspect score of ESG for firm.
value	The logarithm of enterprise value EV1.
assets_loan	The ratio of assets to loans.
ROE	Return on equity.
SHIBOR	Shanghai Interbank Offered Rate.
ind	Industry dummy variables.

4 Research Methodology

4.1 Fixed Effects Model Construction

The Fixed Effects Model (FEM) is employed here mainly because it can deal with unobserved heterogeneity across firms that stays the same over time. It's well-suited for capturing some individual differences that might otherwise distort the relationship between ESG controversy scores—covering environmental (ESG_E), social (ESG_S), and governance (ESG_G) dimensions—and the price-to-book (PB) ratio.[3]

$$PB_{it} = \beta_1 ESG_{E,it} + \beta_2 ESG_{S,it} + \beta_3 ESG_{G,it} + \beta_4 value + \beta_5 assets_loan + \beta_6 ROE + \beta_7 shibor + \sum_{j=1}^{31} \beta_{7+j}\, ind_j + \alpha_i + \lambda_t + \epsilon_{it}$$

Where PB_{it} is the firm's PB ratio, and the ESG variables reflect specific controversy scores, with α_i and λ_t managing the firm and time effects, and the remaining variables are control variables.

4.2 Random Forest Model Construction

To address the limitations of the linear FEM, a Random Forest model is adopted. Unlike FEM, Random Forest doesn't need the data to fit some predefined distribution and linear, which is useful since ESG scores can vary quite a bit and don't always play nice with normality.

$$PB \sim ESG_E + ESG_S + ESG_G + value + assets\_loan + ROE + shibor + ind$$

Hyperparameter Tuning is carried out through GridSearchCV. This process aims at finding the best setup, but the focus remains on the ability of Random Forest to capture what a more rigid econometric model might miss.

5 Empirical Results and Analysis

5.1 Descriptive Statistics

Descriptive statistics reveal substantial variation across ESG scores and PB ratios, which reflects diverse ESG practices and differing market valuations among firms. Variables like firm value, assets-to-loans ratio, and ROE show expected variability for large firms. The results of descriptive statistics is shown in Table 2.

Table 2. Results of Descriptive Statistics

	PB	ESG_E	ESG_S	ESG_G	value	assets_loan	ROE	shibor
obs	166847	166847	166847	166847	166847	166847	166847	168847
mean	5.27	94.90	93.72	87.29	7.13	46.94	9.25	1.65
std	5.68	12.13	7.09	10.09	0.83	19.49	10.39	0.38
min	0.41	30.00	49.01	15.96	3.70	-14.80	-75.23	0.44
max	109.15	100	100	100	10.26	93.72	105.60	2.46

5.2 Correlation Analysis and Multicollinearity Check

Moderate correlations among variables in Table 4, particularly between firm value and ESG scores, suggested multicollinearity. According to Table 3, VIF calculations confirmed this issue, motivating the use of Random Forest for its robustness against multicollinearity.

Table 3. VIF Results of Variables

variables	ESG_E	ESG_S	ESG_G	value	assets_loan	ROE	shibor
VIF	71.14	149.70	77.53	60.25	8.07	1.85	19.59

Table 4. Correlation Matrix among Variables

variables	PB	ESG_E	ESG_S	ESG_G	value	assets_loan	ROE	shibor
PB	1							
ESG_E	0.200	1						
ESG_S	0.219	0.390	1					
ESG_G	0.016	0.021	0.262	1				
value	-0.020	-0.190	-0.296	-0.012	1			
assets_loan	-0.241	-0.215	-0.281	-0.094	0.346	1		
ROE	0.391	0.100	0.092	0.016	0.028	-0.136	1	
shibor	0.117	0.059	0.038	0.0360	0.022	0.003	0.064	1

5.3 Fixed Effects Model Results

The dummy industry variables and SHIBOR are considered as absorbed variables and dropped. According to Table 5, social controversies had a significant negative effect on PB, while environmental and governance factors were not significant. Multicollinearity and limited ability to capture nonlinear relationships made FEM results not persuasive enough.

Table 5. Fixed Effects Model Results

variables	parameters	P-value	**R-squared**
ESG_E	-0.0125	0.1006	
ESG_S	-0.0302 **	0.0397	0.3047
ESG_G	0.0001	0.9886	**F-test for Poolability**
value	6.8831 ***	0.0000	
assets_loan	0.0927 ***	0.0016	690.27
ROE	-0.0037	0.8351	**P-value:** 0.0000

5.4 Random Forest Model Results

The Random Forest model, optimized using hyperparameters (n_estimators=300, max_depth=30), showed a Mean Squared Error (MSE) of 0.2053, demonstrating solid predictive accuracy. Feature importance analysis highlighted firm value (0.188) and assets-to-loans ratio (0.235) as key predictors. Among ESG scores, social controversies were the most impactful (0.073), environmental (0.040) and governance (0.060) factors had smaller but notable influences.

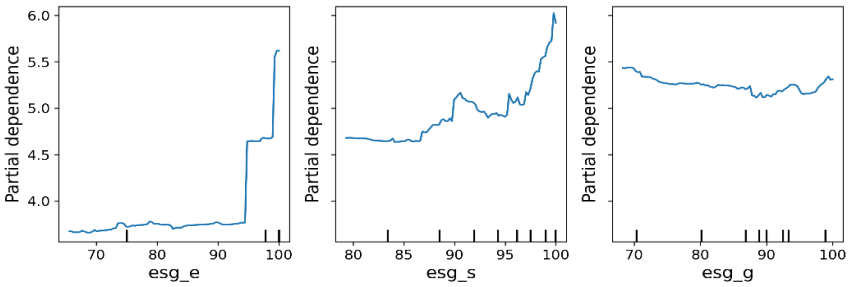

Fig. 1. Partial Dependence Plots

The feature importance analysis and Partial Dependence Plots in Fig.1. reveals a nonlinear relationship between the environmental controversy score and PB. In the score range of 70 to 90, PB remains relatively stable, indicating that basic compliance with environmental standards does not significantly influence company valuation or stock price. However, when the score surpasses 90, a noticeable positive impact on PB emerges, especially as the score approaches 100. This suggests that only exceptional environmental performance substantially enhances PB.[8]

The underlying mechanism can be attributed to the perception of investors and the market. Companies with scores above 90 are viewed as leaders in environmental sustainability. This leadership not only enhances the company's brand reputation but also signals reduced compliance and operational risks. Investors anticipate long-term benefits from such companies, including potential cost savings from efficient resource use and avoidance of environmental liabilities. Consequently, the market assigns a premium to these companies, reflecting in higher valuations or stock prices.[5]

The social controversy score exhibits a complex nonlinear relationship with PB, characterized by a U-shaped curve in the 90 to 100 score range. Between scores of 80 and 90, PB increases sharply with rising scores, indicating that initial investments in social responsibility positively impact financial performance. This can be attributed to improvements in employee morale, customer loyalty, and overall brand image, which collectively enhance profitability.[1]

However, in the score range of 90 to 95, PB declines despite higher scores. This suggests that beyond a certain point, the marginal benefits of additional social investments decrease while the costs increase, leading to concerns about short-term profitability among investors. The company may be perceived as over-investing in social initiatives at the expense of financial returns.[7][11]

Interestingly, when the score exceeds 95, PB rises rapidly again. This rebound indicates that achieving an exceptional level of social performance restores investor confidence and attracts capital, particularly from ESG-focused investors. The company's outstanding reputation in social responsibility begins to generate substantial intangible assets, such as enhanced brand equity and stronger stakeholder relationships, which are valued by the market and reflected in improved valuations or stock prices.

This U-shaped relationship implies that companies need to strategically manage their social responsibility investments. While initial investments yield significant returns,

there is a critical point where additional spending may not be cost-effective. Beyond this point, only exceptional performance that sets the company apart can lead to renewed financial benefits. Therefore, balancing social initiatives with financial objectives is crucial to maximize the positive impact on PB.

The governance controversy score demonstrates a steady positive correlation with PB across the entire score range from 70 to 100. This linear relationship indicates that continuous improvements in corporate governance consistently enhance company valuation or stock price. Strong governance practices improve decision-making processes, enhance transparency, and strengthen internal controls, all of which contribute to increased investor confidence.

Investors view good corporate governance as a sign of lower risk and greater reliability, leading to a lower cost of capital and higher valuations. Effective governance reduces the likelihood of fraud, mismanagement, and legal issues, safeguarding the company's assets and reputation. Therefore, consistent improvements in positively influence PB by building a solid foundation for sustainable growth.

The steady nature of this relationship suggests that unlike environmental and social scores, where significant impacts are observed only at high-performance levels or specific score ranges, governance improvements consistently contribute to value creation. Companies should therefore prioritize governance enhancements as a fundamental strategy for long-term financial performance.

6 Conclusion

This study finds that ESG controversy scores significantly and nonlinearly affect PB. The social controversy score has the strongest impact, exhibiting a U-shaped relationship: PB rises with score initially, dips later due to diminishing returns, then rises again with exceptional social performance. The environmental score influences PB notably only when scores are high enough, indicating a threshold effect. The governance score consistently and positively affects PB across all levels. These findings suggest that the influence of ESG controversy factors on firm value depends on performance levels within each dimension, highlighting the importance of strategically managing ESG practices to optimize both financial performance and social responsibility.

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