The Impact of the Registration System Reform on Corporate ESG Ratings: An Empirical Analysis Based on Public Data from the Growth Enterprise Market

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Abstract. Using public data from GEM listed companies from 2015 to 2022 as research samples, the author performs an empirical test in this paper. The impact of registered restructuring on the ESG performance of GEM enterprises is investigated, and the dependent variable is replaced with a multiple regression model, grouped regression, and endogeneity test instead of the robustness test. Research findings: Institutional investors' IPO shares skyrocketed when the GEM registration procedure was redesigned, which significantly improved the firms' ESG performance. The ESG scores of low-carbon firms have significantly improved, and the "reform of the registration system" has the potential to enhance the overall ESG score of enterprises in developed coastal urban areas. The author provides an in-depth analysis of how the GEM registration system influences enterprise ESG ratings, suggesting that reforming this system could lead to better ESG performance among businesses. Furthermore, the author presents both theoretical and empirical justifications for reforming the comprehensive registration system within China's capital market by exploring the internal mechanisms through which changes to the GEM enrolment system impact enterprise ESG ratings from a unique perspective.

1 Introduction

In order to harness the capital market for further development, more privately owned companies are choosing to enter the securities market through initial public offerings (IPOs) as a result of China's capital market's ongoing expansion. To regulate the growing number of listed companies, China's capital market requires a more rational and efficient listing process and stock issuance system. Investors may now more accurately evaluate a company's development state thanks to the registration system's improved disclosure quality of corporate information, including accounting data, which also strengthens the market's capacity for self-optimization and elimination [1]. Research indicates that the registration system has significantly shortened the IPO audit cycle for listed companies, improving the resource

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allocation efficiency of the capital market [2]. ESG ratings aim to comprehensively evaluate corporate value across the dimensions of environment (E), social responsibility (S), and governance (G), providing investors with references and guidance for formulating investment strategies. In recent years, a growing number of investors have regarded corporate ESG ratings as a key indicator for determining asset allocation and investment proportions [3].

The registration system reform carries significant implications and importance for corporate ESG ratings. This reform not only transforms the listing mechanism for companies but also mandates greater disclosure of information. Such changes create a conducive environment for the implementation of ESG ratings. For instance, heightened transparency in information disclosure and the adoption of legalized management practices facilitate the integration of ESG rating standards, enabling companies to address the complexities of ESG assessments more effectively [4]. Under this more transparent regulatory framework, corporate ESG ratings are expected to undergo changes. Moreover, this study contributes to aligning China's capital market with international standards, thereby enhancing the global image and competitiveness of Chinese enterprises.

In order to assess how the registration-based IPO reform has affected corporate ESG ratings, this study mainly looks at companies that are listed on the GEM. Since the GEM began implementing registration-based reform in 2020, a significant number of businesses have completed listings through this mechanism. The resulting dataset demonstrates high reliability and comprehensiveness, rendering it a robust sample for empirical analysis. By leveraging this representative cohort, the research aims to derive statistically significant conclusions regarding the reform's influence on ESG performance metrics.

Given the circumstances, the author characterizes the reform of the GEM registration system as an "external shock" [5]. The study collects data on Sino securities both prior to and following the implementation of this registration system for A-share GEM from 2015 to 2022. Subsequently, a regression model is developed to investigate the impact of the GEM registration system reform on corporate ESG ratings. The author empirically examines how changes in the GEM registration system affect businesses' ESG ratings and conducts regression analysis by treating the registration system reform as a dummy variable.

The following are the important marginal contributions included in this paper: In order to fill the study vacuum on the effect of the registration system on the ESG of enterprises, it first investigates how the GEM registration system affects the ESG ratings of the businesses. Second, in order to make processing and measuring control variables easier, this work integrates the regression approach with the use of dummy variables in the research methodologies. Thirdly, from the distinct viewpoint that offers the theoretical and empirical backing for the reform of the comprehensive registration system in China's capital market, the author examines the internal mechanism of the impact of GEM registration system reform on the ESG rating of the enterprises.

2 Method

2.1 Description of variables

2.1.1 Explained variable

The variable explained in this paper is enterprise ESG performance (comprehensive score). *ESG* The data of Sino-security ESG rating system is adopted with reference of methods of Xie Hongjun and Lyu Xue [6]. Sino-security ESG rating data can more accurately depict the ESG level of Chinese firms and the market's current state of development. In addition, Sino-security ESG rating system reflects the management practice level of the enterprises with

several specific indicators under three dimensions of environment, society and governance. The author believes that the evaluation system takes the ESG performance of enterprises under different circumstances into account, and it reflects the enterprise's bearing capacity on social responsibilities accurately.

2.1.2 Explaining variable

This paper's primary explanatory variable is whether the company reforms its registration system; a dummy variable is also presented. Assume that there were zero businesses listed prior to the GEM registration system reform and one following it. D_{rf}

2.1.3 Control variable

With reference to Chu Kejia and Tian Yu's paper on the impact of the registration system reform on the GEM IPO pricing efficiency [6], the factors at the enterprise level that affect the ESG rating of enterprises are added in this paper to prevent the interference of missing variables with the estimated results. (1) Size is calculated using the annual natural logarithm of total assets; (2) Return on net assets (ROE) is calculated by dividing net profits by the average balance of shareholders' equity; (3) Gross profit is calculated by subtracting operating expenses from revenue; (4) Physical assets: Calculate the logarithm of physical assets; The growth is determined by the rate of operating revenue growth. (5) TobinQ: TobinQ is calculated by multiplying the market value of circulating stock plus the number of non-circulating shares by the total net assets per share plus the carrying amount of liabilities, divided by total assets. The greater the value, the more robust the growth potential.

2.2 Data source

The corporate ESG rating is assessed using the full scores provided by Sino-security ESG rating, and the public data of GEM listed firms from 2015 to 2022 is chosen for examination in this article. Table 1 displays the descriptive statistics of the pertinent variables, and there are 6040 data points that meet the requirements.

Table 1. Statistical description of variables

Variable	Sample	Average	Standard	Min.	Max
Drf	6117	0.106	0.308	0	1
ESG	6117	72.922	5.233	44.67	87.85
Size	6117	21.533	0.843	19.779	24.368
ROE	6113	0.056	0.141	-0.636	0.354
Grossprofit	6117	0.355	0.173	0.022	0.835
Tangible	6117	0.906	0.103	0.563	0.1
TobinQ	6040	2.372	1.308	0.958	7.780
Growth	6116	0.191	0.380	-0.573	2.213

2.3 Method introduction

Firstly, to analyze the impact of the reform of registration system on the corporate ESG performance, the baseline regression model is constructed:

$$ESG_{it} = \alpha_0 + \alpha_1 D_{rf} + \alpha_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

In the formula (1), ESG_{it} represents the ESG performance of the enterprise i in the year t and D_{rf} shows whether the enterprise undergoes the reform of registration system. X_{it} is the control variables selected in this paper. α_0 is the intercept term, α_1 and α_2 represent the reform of registration system and the parameter estimates of the control parameters on ESG. This paper focuses on whether the enterprise is listed before or after the reform of the registration system; The impact on ESG performance, i.e., value of α_1. μ_i and λ_t represent the enterprise industry effect and time fixed effect. ε_{it} shows the stochastic perturbation terms.

3 Results and Discussion

3.1 Regression results

3.1.1 Baseline regression results

This paper primarily investigates the changes in ESG ratings of companies listed on the GEM before and after the registration system reform. The study employs regression analysis using corporate data from 2015 to 2022, with some samples undergoing winsorization to mitigate the impact of outliers. Additionally, the heterogeneity of years (time fixed effects) and industries (industry fixed effects) is controlled sequentially. The baseline regression results are presented in Table 2.

Table 2. Basic regression model

	(1)	(2)	(3)	(4)	(5)
	ESG	ESG	ESG	ESG	ESG
Drf	2.137***	1.257***	0.949***	1.271***	1.003***
	(0.193)	(0.217)	(0.216)	(0.205)	(0.230)
Size		0.683***	0.392***	0.430***	0.664***
		(0.135)	(0.147)	(0.138)	(0.144)
ROE		9.042***	9.743***	9.549***	9.167***
		(0.742)	(0.788)	(0.780)	（0.746）
GrossProfit		3.396***	2.597***	2.582***	3.436***
		(0.765)	(0.726)	(0.713)	（0.777）
Tangible		3.906***	3.663***	3.970***	3.751***
		(1.079)	(1.215)	(1.171)	（1.131）
TobinQ		-0.308***	-0.321***	-0.345***	-0.291***
		(0.0715)	(0.0853)	(0.0744)	（0.0817）
Growth		-0.589***	-0.486**	-0.542**	-0.550***
		(0.214)	(0.220)	(0.217)	（0.217）
constant	72.72***	53.69***	60.46***	59.43***	5.20***
	(0.141)	(3.307)	(3.598)	(3.338)	(3.564)
industry	false	true	false	false	true
time fixed	false	false	true	false	true
sample size	6,117	6,033	6,035	6,035	6033

Note：With standard errors enclosed in parenthesis, the symbols ∗, ∗∗, and ∗∗∗indicate

Table 2 presents the regression results of the corporate ESG composite score against various variables. Without accounting for temporal or industry fixed effects, the first column

just examines how the registration system reform affects the ESG composite score, excluding all other control variables. The registration system change has a significant positive impact on the composite score at the 1% significance level, as indicated by the regression results, which show a coefficient of 2.137. This suggests that companies listed after the registration system reform exhibit higher composite scores compared to those listed before the reform. To further investigate how the registration system change affects the ESG composite score, columns (2) and (3) include control variables and account for industry fixed effects and temporal fixed effects, respectively. The findings show that the change of the registration mechanism significantly improves the composite score. Additionally, where control variables are present and industry and time-fixed effects are either fully or partially controlled, the influence of the registration system modification on the ESG composite score is investigated in columns (4) and (5). The results consistently show that the coefficient for the registration system reform remains significantly positive. These findings underscore that the registration system reform plays a highly significant role in enhancing the ESG ratings of listed companies. Moreover, company size (Size), return on equity (ROE), gross profit margin (GrossProfit), and tangible asset ratio (Tangible) exhibit a significant positive correlation with the composite score, all at the 1% significance level. This implies that higher values in these corporate metrics are associated with elevated ESG composite scores. In contrast, Tobin's Q (TobinQ) and growth capability (Growth) are negatively correlated with the composite score.

3.1.2 Exclusion of policy interference

This study further investigates the potential influence of other major policies implemented in 2020, such as the new Securities Law, the green bond directory, and the "dual carbon" goals. Theoretical analysis reveals the following:(1)The global regulatory effect of the new Securities Law has been absorbed by the time fixed effects.(2)The impact of green finance policies is confined to specific industries, whereas the registration system reform exerts a universal effect on ESG improvement across all industries.(3)The implementation of policy instruments for the "dual carbon" goals lags behind, and their industry heterogeneity does not align with the conclusions of this study.(4)Pandemic prevention and control policies are short-term in nature, while ESG ratings reflect long-term capabilities, and their interference has been accounted for by the control variables.Consequently, the registration system reform emerges as the core exogenous shock driving the improvement in ESG ratings, with other policies not significantly interfering with the results.

3.2 Heterogeneity analysis

3.2.1 Heterogeneity Analysis of Corporate Carbon Emissions

The following justifies the analysis of company carbon emissions' heterogeneity: Businesses with varying carbon emissions are thought to be affected differently by the registration system reform, and this is also thought to have varying effects on corporate ESG performance. if the company in the GEM is regarded by its industry as a low-carbon or high-carbon organization. Paper and paper product companies, petroleum, coking, and nuclear fuel processing companies, chemical raw material and product manufacturing companies, nonmetallic mineral product manufacturing companies, ferrous and nonferrous metal smelting and rolling companies, electric power, heat production and supply companies, gas production and supply companies, and the aviation sector are all categorized as high-carbon enterprises, and the enterprises in other industries are considered as the low-carbon

enterprises. The first and second columns of Table 3 show heterogeneity analysis based on corporate carbon emissions. It is observed from the inspection results that the estimated coefficient of the registration system reform for low-carbon enterprises is significantly positive, while that of the high-carbon enterprises is not significant. The possible causes: The reform of registration system improves the market transparency and financing convenience and the information disclosure is more comprehensive. Investors are more prepared to pay for the ESG performance of businesses in the low-carbon industries and encourage them to pay attention to and enhance ESG performance since the low-carbon industry demonstrates its strength in sustainable development with such attributes.

3.2.2 Heterogeneity analysis of enterprise location

Reasons for Conducting Heterogeneity Analysis Based on Enterprise Location: Considering that enterprises in different regions exhibit varying degrees of response to the registration-based reform policy, which in turn results in differential impacts on their ESG performance, it is posited that the influence on enterprises in developed coastal cities may be more pronounced than that on those in less-developed coastal cities. For the purpose of this analysis, developed coastal cities are defined as Shanghai, Shenzhen, Guangzhou, Tianjin, Hangzhou, Ningbo, Xiamen, Qingdao, Zhuhai, and Dongguan; other locations are categorized as less-developed coastal cities.

Columns (3) – (4) in Table 3 present the heterogeneity analysis conducted based on enterprise location. The influence of the "registration-based reform" on the "composite score" of developed and less-developed coastal cities differs significantly, according to statistical tests (p-value = 0.0051619).This implies that developed coastal cities are much more affected by the "registration-based reform" than their less developed counterparts.Potential reasons for this disparity include: developed coastal cities may possess more sophisticated financial markets, higher levels of information transparency, and stronger resource allocation capabilities [7], thereby enabling the "registration-based reform" to more effectively enhance the "composite score" in these regions; Although the "registration-based reform" has good benefits on less developed coastal cities as well, the impact is somewhat smaller because of variations in environmental conditions and market fundamentals.

Table 3. Heterogeneity analysis

	(1)	(2)	(3)	(4)
	Enterprise carbon emission		Enterprise location	
	High-carbon enterprise	Low-carbon enterprise	Developed coastal city	Non-developed coastal city
Drf	0.323	1.10***	1.91***	0.91***
	(0.540)	(0.205)	(0.277)	(0.253)
cons	61.062***	53.088***	64.294***	62.071***
	(6.118)	(2.405)	(3.931)	(3.050)
Control variable	Control	Control	Control	Control
Fixed effect of the individual	Yes	Yes	Yes	Yes
Temporal fixed effect	Yes	Yes	Yes	Yes
Sample size	637	5396	2085	3950

3.3 Mechanism test of registration system reform on ESG performance of enterprise

To further investigate the impact of registration system reform on ESG performance of enterprises and refer to Jiang Ting [8] , construct the following regression model based on the model (1):

$$SII_{it} = \gamma_0 + \gamma_1 D_{rf} + \gamma_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (2)$$

In formula (2), SII_{it} refers to the mechanism variable and it means the IPO shares of the institutional investors for the enterprise i in the year t. In particular, it is calculated by splitting the real entirety of shares issued by the company by the disparity between the real amount of units issued by the public and the enterprise. It won't be repeated because the remaining variables are the same as in model (1).

Through institutional investors' IPO shares, the registration system reform may have an impact on the ESG performance level of businesses. First, it influences the IPO share of institutional investors, which in turn impacts the ESG performance of businesses. On the one hand, the market becomes more standardized and transparent, and the supervision and other systems are strengthened as a result of the enterprise's improved information disclosure and improved supervision following the registration system reform [9]. It attracts the institutional investors to add investment and obtain more shares in IPO; On the other hand, the registration system reform promotes the market-based pricing from the investors' perspective [10]. The institutional investors can play a greater role in the pricing process with their professional research and investment capabilities, more accurately evaluate the value of the enterprise, and thus obtain more IPO shares that match their own quotes. Institutional investors' ownership of company ESG performance is positively correlated with several factors, including corporate governance (G), social responsibility (S), and the environment (E), according to particular studies [11].

Table 4 displays the specific findings of the inspection, which is carried out using the empirical model in accordance with the theoretical analysis mentioned above. First, the estimated effects of the registration system reform on institutional investors' IPO shares are displayed in table (2). It is discovered that the registration system reform's coefficient value is significantly positive, suggesting that it significantly improves institutional investors' IPO shares. It indicates that institutional investors' IPO shares will rise somewhat following the overhaul of the registration system. It is possible to draw the conclusion that the reform of the registration procedure led to a rise in the IPO shares of institutional investors, which significantly improved the ESG rating.

Table 4. Influence mechanism test

	(1) ESG	(2) SII
Drf	1.003***	0.257***
	(0.230)	(0.013)
cons	5.20***	0.152***
	(3.564)	(0.00340)
Control variable	Control	Control
Fixed effect of the individual	Yes	Yes
Temporal fixed effect	Yes	Yes
Sample size	6024	6108

3.4 Robustness checks

3.4.1 Endogeneity test

Endogeneity problems may come up when analyzing how registration-based change affects corporate comprehensive scores. These issues could stem from omitted variables, measurement errors, or reverse causality. To ascertain the presence of endogeneity, this study conducted a Durbin-Wu-Hausman test.

Firstly, to address potential endogeneity, the following instrumental variables were selected:

(1) Reform Timing: This variable is set to 1 if the observed year is 2020 or later; otherwise, it is 0. It reflects policy changes over time, is highly correlated with the implementation of the registration-based reform, and is unrelated to the error term.

(2) Industry Reform: This variable is set to 1 if the observed firm operates in specified industries (such as paper manufacturing, oil processing, chemical production, etc.) and the year is 2020 or later; otherwise, it is 0. These industries are key targets of the registration-based reform, highly correlated with its implementation, and unrelated to the error term.

(3) Regional Reform: This variable is set to 1 if the observed city is among the pilot regions for the registration-based reform (including Shanghai, Shenzhen, Guangzhou, Tianjin, Hangzhou, Ningbo, Xiamen, Qingdao, Zhuhai, Dongguan) and the year is 2020 or later; otherwise, it is 0. These cities are highly correlated with the implementation of the registration-based reform and unrelated to the error term.

All things considered, these three instrumental variables meet the requirements for effective instrumental variables since they have a strong correlation with the endogenous variable (registration-based reform) and have no relationship to the error term.

Second, the endogenous variable (registration-based reform) was first regressed on the instrumental variables and additional exogenous variables in the study. The initial regression model for the second stage of regression was then modified to include the residuals from the first stage (resid) as an explanatory variable.

Finally, a Durbin-Wu-Hausman test was conducted, with the specific results presented in Table 5.

Table 5. Test results

Item	Statistic	Value
Significance of Residuals	Coefficient of resid	0.013355
	Standard Error	0.6706854
	z-value	0.02
	p-value	0.984
Validity of Instrumental	Weak Instrument Test (Cragg-Donald Wald F-statistic)	296.312
	Overidentification Test (Hansen J-statistic)	p-value = 0.3957
Endogeneity Test	Durbin-Wu-Hausman Test p-value	0.9511

Based on the data in Table 5, the following conclusions are drawn:

(1)   Significance of Residuals: The coefficient of resid is 0.013355, with a z-value of 0.02, a standard error of 0.6706854, and a p-value of 0.984. These results illustrate that there is no endogeneity problem because there is no correlation between the error term and the endogenous variable (registration-based reform).

(2)   Weak Instrument Test: There is no weak instrument issue because the Cragg-Donald Wald F-statistic of 296.312 is much higher than the crucial value of 10. This suggests that there is a substantial connection between the instrumental and endogenous variables.

(3)   Overidentification Test: The Hansen J-statistic p-value of 0.3957, which illustrates that the null hypothesis that all instrumental factors are exogenous cannot be rejected, validates the validity of the instrumental variables.

(4)   Endogeneity Test:Since the registration-based reform variable has no significant endogeneity issues, the null hypothesis that it is a variable that is endogenous cannot be rejected, according to the Durbin-Wu-Hausman test p-value of 0.9511.

The Durbin-Wu-Hausman test's findings indicate that there are no notable endogeneity problems with the registration-based reform variable. The weak instrument and overidentification tests have been passed, and the instrumental variables have been chosen in a reasonable manner. Therefore, it can be concluded that the model's estimation results are reliable and that the registration-based reform's effect on comprehensive scores is exogenous.

3.4.2 Alternative dependent variable

The dependent variable was altered in order to carry out a robustness check and confirm the validity of the study findings. Specifically, the original corporate ESG rating (comprehensive score from Huazheng ESG Rating) was replaced with an alternative ESG score, calculated as (E score + S score + G score) / 3 from Huazheng ESG Rating. Table 6 compares the regression results before and after the replacement:

Table 6. Comparison of regression results before and after dependent variable replacement

ESG	(1) Original ESG Score	(2) Alternative ESG Score
Registration-based Reform	1.003***	0.731***
	(0.230)	(0.234)
Size	0.664***	0.884***
	(0.144)	(0.146)
ROE	9.167***	7.994***
	(0.746)	(0.732)
Gross Profit	3.436***	1.611**
	(0.777)	(0.801)
Tangible	3.751***	2.281*
	(1.131)	(1.164)
TobinQ	-0.291***	-0.311***
	(0.0817)	(0.0847)
Growth	-0.550***	-0.453**
	(0.217)	(0.211)
Constant	5.20***	49.91***
	(3.564)	(3.602)
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Sample Size	6,033	6,033

The registration-based reform's coefficients in the regressions utilizing the original and alternative ESG scores are 1.003 and 0.731, respectively, and both are significant at the 1% level (p-value < 0.01). This indicates that the core explanatory variable (registration-based reform) has a significant impact on ESG ratings across different measurement methods, demonstrating the robustness of the results. Other explanatory variables (such as firm size, ROE, gross profit margin, etc.) also show good robustness. This further validates the reliability and credibility of the research findings.

4 Conclusion

This study investigates the ESG ratings of companies listed before and after the registration system reform and reveals that the reform significantly promotes the enhancement of corporate ESG ratings. Specifically, companies listed following the reform are more likely to achieve higher ESG scores compared to those listed prior to the reform. This indicates that the more transparent and legally robust market environment established by the registration system reform is more conducive to elevating the value of listed companies. Clear metrics, coupled with more comprehensive and accurate information disclosure, contribute to standardizing ESG rating criteria, encouraging companies to address their deficiencies and thereby increase their overall value. This study bridges the research gap between institutional change and ESG corporate rating mechanisms, and improves the Chinese capital market's perception of the registration system, making it realize that it is an essential and significant beneficial change.This article only focuses on the reform of the registration system of the GEM, and does not provide further in-depth analysis of the Main Board.While the registration system reform demonstrates a clear positive effect on ESG ratings overall, certain intricacies merit further exploration. To assess the precise effects of the registration system reform on each dimension, future research might examine the environmental (E), social (S), and governance (G) components of ESG independently.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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