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The impact of ESG performance of heavily polluting enterprises on new quality productivity

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Abstract

This paper selects 1454 listed heavy-polluting enterprises from 2009 to 2023 as a sample to empirically investigate the impact of corporate ESG performance on new-quality productivity. The results show that improving corporate ESG per-formance has a positive effect on enhancing the level of new-quality productiv-ity. Mechanism analysis indicates that the shareholding ratio of institutional investors plays a mediating role between the two. Heterogeneity analysis re-veals that the improvement of corporate ESG performance has a more significant effect on new-quality productivity in large-scale enterprises, industries with weak competitiveness, and enterprises with a higher proportion of female man-agement. The findings provide a new perspective for the antecedent research of new-quality productivity and offer empirical evidence for enhancing corporate ESG performance.

Keywords

ESG; New-Quality Productivity; Heavy-Polluting Enterprises

1. Introduction

In September 2023, General Secretary Xi Jinping first proposed the concept of “new-quality productivity” during an inspection in Heilongjiang[1], which repre-sents a new form of productivity consistent with China’s new development philoso-phy. As an advanced productivity paradigm rooted in China’s new development stage and aligned with its new development philosophy, new-quality productivity has already been explored in existing research from dimensions such as digital fi-nance[2], digital economy policies[3], and artificial intelligence[4]. However, despite the strong alignment between Environmental, Social, and Governance (ESG) princi-ples and China’s contemporary context and ESG plays a role as a key metric for cor-porate sustainability, there is a notable scarcity of research examining the relation-ship between ESG and new-quality productivity. This gap is particularly significant for heavy-polluting enterprises, which are characterized by high energy consump-tion, severe pollution, and substantial carbon emissions. Such enterprises face criti-

cal challenges in balancing economic development with environmental protection while enhancing new-quality productivity.

Against this backdrop, this study selects a sample of 1,454 listed heavy-polluting enterprises from 2009 to 2023 to empirically test the relationship between corporate ESG performance and new-quality productivity. The research aims to provide fresh insights into the antecedents of new-quality productivity and address an important theoretical and practical gap in understanding how ESG principles can drive productivity upgrading in environmentally intensive industries.

2. Literature review and hypotheses

2.1. ESG and new quality productivity

ESG originated from socially responsible investment[5]. After the 2008 financial crisis, countries and regions globally recognized the importance of developing ESG. Based on the theory of sustainable development, corporate development must consider not only economic benefits but also social effects, and the ESG concept aligns with the goal of corporate sustainable development. Comprising three dimensions, including Environment, Social, and Governance, providing guidance for corporate sustainable development. Enhancing corporate ESG performance to empower the improvement of new-quality productivity represents an inherent requirement of high-quality development[1].

First, the E (Environment) dimension of ESG mandates that enterprises prioritize environmental protection, energy consumption, and other issues in their development, which is analogous to the connotative requirements of new-quality productivity[6]. Second, the S (Social) dimension emphasizes that enterprises must assume social responsibilities in economic development and focus on relationships with internal and external stakeholders, such as employees, suppliers, and investors, thereby promoting the enhancement of new-quality productivity. Finally, the G (Governance) dimension requires enterprises to improve their corporate governance systems, enhance operational efficiency and resource utilization efficiency in business operations, and thereby drive the advancement of new-quality productivity[7].

Based on this analysis, the following hypothesis is proposed:

H1: Improved corporate ESG performance has a positive impact on new-quality productivity.

2.2. ESG, the shareholding ratio of institutional investors and new quality productivity

Institutional investors are external investors who exert significant influence on corporate development and serve as one of the external supervisory entities for enterprises[8]. ESG is recognized as an evaluation framework for investors to assess a company's sustainable development level, and improving its performance can en-

hance the likelihood of institutional investor investment[9], thereby increasing the shareholding ratio of institutional investors. Institutional investors possess extensive social resources, which can provide financial support for corporate development, alleviate corporate cash flow pressures and thus lay a foundational support for enterprises to enhance their new-quality productivity levels. Additionally, enterprises' proactive improvement of ESG performance and enhancement of ESG information disclosure can mitigate information asymmetry between institutional investors and enterprises, thereby facilitating institutional investors' participation in internal corporate governance, improving the quality of corporate internal control, and further promoting the improvement of new-quality productivity levels.

In summary, enhancing corporate ESG performance can improve corporate reputation, thereby making it easier to gain the trust of institutional investors, increasing the shareholding ratio of institutional investors, and exerting a positive impact on the improvement of new-quality productivity levels.

Based on this, the following hypothesis is proposed:

H2: Improved corporate ESG performance promotes the enhancement of new-quality productivity levels by increasing the shareholding ratio of institutional investors.

3. Prepare Methodology

3.1. Sample and data

Considering the availability of ESG rating data, this study selects data from A-share heavy-polluting enterprises from 2009 to 2023 as the sample, and processes the data as follows:

(1) Financial industry enterprises are excluded;

(2) Enterprises marked as ST, *ST, PT, or insolvent are excluded;

(3) Enterprises with missing values in relevant variables are excluded;

(4) Continuous variables are winsorized at the 1% and 99% levels.

After screening, a total of 7655 annual-enterprise-level panel observations are obtained. The data are sourced from the CSMAR database.

3.2. Abbreviations Measurement of variable

3.2.1 Dependent variable

ESG (ESG). Referring to the research of Song Jia et al.[10], the measurement was conducted using the ESG rating data from Huazheng.

3.2.2 Independent variable

New Quality Productivity (Npro). It is calculated by weighting the labor force and production tools.

3.2.3 Moderating variable

Institutional Investor Holdings (INST). It is measured by the proportion of the to- tal number of shares held by institutional investors to the total shares of the listed company.

3.2.4 Control variables

This article selects the following control variables Including net profit margin on total assets (ROA), enterprise Growth (Growth), asset-liability ratio (Lev), Board size (Board), board independence (Indep), equity concentration (Top), listing age (Listage), management shareholding ratio (Mshare), Dual (Dual), and enterprise Property rights (SOE). In addition, the Year dummy variable (Year) and Industry dummy variable (Industry) have also been added.

The symbols and definitions of the main variables in this article are shown in Table 1.

Table 1. Variable Definition table

Variable type	Variable name	Variable symbol	Variable definition
Independent variable	New quality productivity	Npro	Weighting the labor force and production tools
Dependent variable	ESG	ESG	Huazheng ESG
Moderating variable	Institutional Investor Holdings	INST	The total number of shares held by institutional investors divided by the total number of shares
Control variables	Net profit margin on total assets	ROA	Average balance of net profit divided by total assets
	Enterprise growth potential	Growth	Growth rate of operating income
	Asset-liability ratio	Lev	Total liabilities at the end of the year divided by Total assets at the end of the year
	Board size	Board	The number of board members
	Board independence	Indep	Independent directors divided by the number of directors
	Equity concentration degree	Top	The number of shares held by the top ten shareholders divided by the total number of shares
	Years of listing	Listage	ln(Current year - Listing year +1)
	Management shareholding ratio	Mshare	The number of shares held by directors, supervisors and senior management divided by the total number of shares

	Two positions combined	Dual	If the chairman and the general manager are the same person, it is 1; otherwise, it is 0
	Enterprise property rights	SOE	For state-owned enterprises, it is 1; otherwise, it is 0

3.3. Modeling

To examine the impact of an enterprise's ESG performance on new quality productivity, this paper sets up the following regression model.

Firstly, construct a model for the research on the impact of an enterprise's ESG performance on new quality productivity:

$$ESG_{i,t} = \alpha_0 + \alpha_1 Npro_{i,t} + \alpha_{i,t}\sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

Among them, i represents the enterprise, t represents the year, and $ESG_{i,t}$ represents the ESG performance of the enterprise; $Npro_{i,t}$ For new quality productivity; $Control_{i,t}$ Represent the control variable, $Year$ and $Industry$ are the year and industry fixed effects respectively, and $\varepsilon_{i,t}$ is the error term.

Secondly, construct a model for the research on the impact of an enterprise's ESG performance on institutional investors' shareholding and new quality productivity:

$$INST_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_{i,t}\sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (2)$$

$$Npro_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 INST_{i,t} + \alpha_{i,t}\sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (3)$$

Among them, $INST_{i,t}$ is the shareholding ratio of institutional investors.

4. Results

4.1. Descriptive statistic

The descriptive statistical results of the main variables in this paper are shown in Ta- ble 2. It can be observed that the explained variable, new-quality productivity, has a mean value of 0.007, a standard deviation of 0.009, and extreme values of 0.041 (maximum) and 0.001 (minimum). This indicates relatively small differences in new-quality productivity levels among enterprises in the sample. The explanatory variable, ESG, has a mean of 4.150, a standard deviation of 0.919, and extreme values of 6.250 (maximum) and 1.500 (minimum), suggesting minimal variation in ESG performance across sample enterprises. Additionally, the Variance Inflation Factor (VIF) values for all main variables are below 2, well below the threshold of 10, which indicates reasonable variable selection and the absence of significant multicollinearity issues.

variables	Mean	Sd	mix	max
Npro	0.007	0.009	0.001	0.041
ESG	4.150	0.919	1.500	6.250
ROA	0.052	0.055	-0.130	0.228
Growth	0.105	2.409	-12.154	12.389

Lev	0.378	0.180	0.059	0.804
Board	2.240	0.172	1.792	2.773
Inde	0.373	0.049	0.333	0.538
Top10	0.590	0.146	0.265	0.913
Listage	2.244	0.803	0.693	3.466
Mshare	0.144	0.196	0.000	0.678
SOE	0.311	0.463	0.000	1.000
Dual	0.295	0.456	0.000	1.000

Table 2. Descriptive statistical analysis

4.2. Regression test

The results of multiple regression are shown in Table 3. This paper adopts a bidirectional fixed model to examine the impact of ESG on new quality productivity. Model 1 is the benchmark regression result. Model 2 adds an explanatory variable, corporate ESG performance (ESG), on the basis of Model 1. The results show that the regression coefficient of ESG is positive ($\beta = 0.0003, p < 0.01$), and through the significance test at the 1% level, it indicates that corporate ESG performance positively affects new quality productivity, and Hypothesis H1 is supported. The results of Model 3 and Model 4 show that the ESG performance of enterprises has a positive impact on the shareholding ratio of institutional investors. Moreover, through the significance test at the 1% level, it indicates that the ESG performance of enterprises positively affects new quality productivity by increasing the shareholding ratio of institutional investors in enterprises. Hypothesis H2 is supported.

Table 3. Regression analysis results

	Model 1	Model 2	Model 3	Model4
	Npro	Npro	INST	Npro
ESG		0.000363***	0.00923***	0.000314***
		(4.03)	(6.35)	(3.48)
INST				0.00519***
				(7.31)
_cons	0.00880***	0.00836***	-0.306***	0.0100***
	(4.64)	(4.40)	(-9.99)	(5.25)
Control	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	7655	7655	7647	7647
F	14.538***	14.719***	2331.014***	18.112***
p	0.000	0.000	0.000	0.000
r2	0.396	0.398	0.804	0.402

4.3 Endogeneity test

4.3.1 Replace the explanatory variable

To further test the robustness of the empirical research results, this paper conducts a re-regression after replacing the measurement method of the explained variable. This paper uses Bloomberg ESG rating data to measure ESG. The specific regression results are shown in Table 4. The results indicate that the regression coefficient of

ESG on new quality productivity is significantly positive, which is consistent with the regression results in the previous text.

Table 4. Replace the explanatory variable

	Model 1	Model 2
	Npro	Npro
BloomESG		-0.0000432**
		(-2.48)
_cons	0.0147***	0.0149***
	(5.31)	(5.38)
Control	Yes	Yes
Industry	Yes	Yes
Year	Yes	Yes
N	2687	2687
F	5.419***	5.496***
p	0.000	0.000
r2	0.471	0.472

4.3.2 Eliminate the influence of major events

As the sample time series used in this paper includes the 2019 COVID-19 pandemic, this paper further eliminates the impact of the pandemic for regression tests. After excluding the three years of pandemic impact from 2019 to 2021, the data time span is 2009-2019 and 2022-2023. The specific regression results are shown in Table 5. The results indicate that the regression coefficient of ESG on new quality productivity is significantly positive, which is consistent with the regression results in the previous text.

Table 5. Eliminate the influence of major events

	Model 1	Model 2
	Npro	Npro
ESG		0.000542***
		(4.65)
_cons	0.00898***	0.00834***
	(3.87)	(3.59)
Control	Yes	Yes
Industry	Yes	Yes
Year	Yes	Yes
N	4957	4957
F	9.530***	10.670***
p	0.000	0.000
r2	0.482	0.484

4.4.3 PSM

To solve the endogeneity problem caused by the self-selection bias of explanatory variables, this paper uses the propensity score matching method (PSM) for endogeneity testing. In this paper, the sample enterprises are grouped based on the mean ESG of the sample enterprises. All the control variables mentioned above are selected as covariates. The Logit model is used to score the propensity of ESG to new quality productivity of the sample enterprises. The test is conducted according to the 1:3 nearest neighbor matching principle. After matching, the standardized deviation of most covariates is less than 10%, indicating that the sample matching effect

is good. This paper conducts a regression analysis on the samples after propensity score matching, and the obtained results are shown in Model 3 of Table 6. The results show that the regression coefficient of the enterprise's ESG performance on new quality productivity is 0.0002, and it has passed the significance test at the 5% level, which is consistent with the regression results mentioned above.

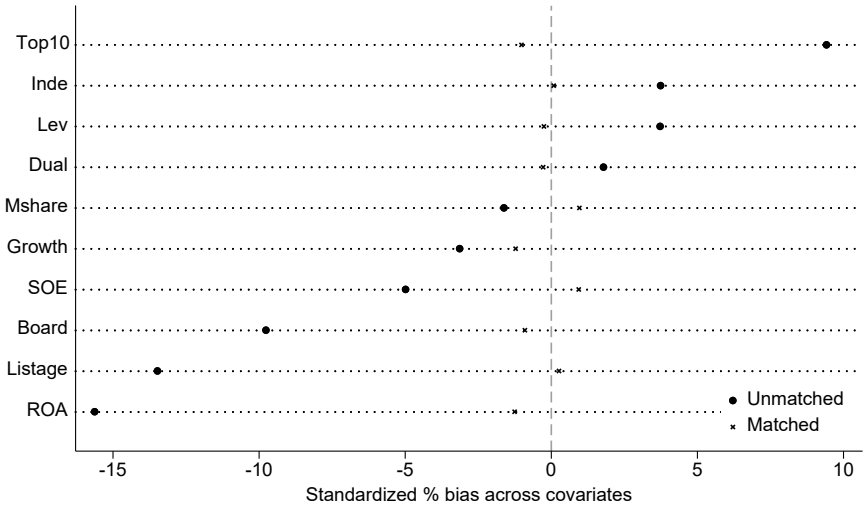

Figure 1. Post-matching propensity score distribution map

Table 6. The regression results of PSM

	Moedl1	Model 2
	Npro	Npro
ESG		0.000270**
		(1.97)
_cons	0.0149***	0.0145***
	(5.06)	(4.91)
Control	Yes	Yes
Industry	Yes	Yes
Year	Yes	Yes
N	2653	2653
F	6.342***	6.124***
p	0.000	0.000
r2	0.412	0.413

4.4 Heterogeneity analysis

1. Heterogeneity in Enterprise Scale

ESG performance varies significantly across enterprises of different scales. Therefore, this study categorizes enterprises into large-scale enterprises and small-and-medium-scale enterprises based on the mean value of enterprise scale. The regression results are presented in Models 1 and 2 of Table 7. Compared with small-and-medium-scale enterprises, the promotion effect of ESG performance on new-quality productivity is more pronounced in large-scale enterprises. A possible reason is that large-scale enterprises have more complete governance systems and invest more in ESG practices, which helps improve the level of new-quality

productivity.

2. Heterogeneity in Industry Competitiveness

Enterprises with significant differences in industry competitiveness exhibit varying levels of ESG investment. This study divides enterprises into high-industry-competition groups and low-industry-competition groups based on the mean value of the Herfindahl Index. The regression results are shown in Models 3 and 4 of Table 7. Compared with enterprises in highly competitive industries, the enhancement effect of ESG on new-quality productivity is more significant in low-competition industries. This may be because these enterprises face less market competition pressure and can flexibly allocate existing resources to promote the improvement of new-quality productivity.

3. Heterogeneity in Proportion of Female Management

The proportion of female managers affects corporate strategic choices. This study classifies enterprises into high-proportion female management groups and low-proportion female management groups based on the standard deviation of the proportion of female management. The regression results are presented in Models 5 and 6 of Table 7. Compared with enterprises with a low proportion of female management, the improvement effect of ESG performance on new-quality productivity is more significant in enterprises with a high proportion of female management. A plausible explanation is that enterprises with more female managers demonstrate stronger empathy and responsibility among female executives, which promotes the implementation of ESG practices and thus enhances new-quality productivity.

Table 7. The regression results of PSM

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Npro	Npro	Npro	Npro	Npro	Npro
ESG	0.0004***	0.000217	0.000167	0.00047***	0.00039***	0.000195
	(4.10)	(1.55)	(1.18)	(4.05)	(3.79)	(1.12)
_cons	0.0092***	0.00817**	0.00828***	0.00949***	0.00840***	0.00899***
	(3.89)	(2.51)	(2.86)	(3.86)	(3.72)	(2.63)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	3562	4093	3016	4639	5975	1680
F	9.469***	5.933***	6.150***	11.514***	14.170***	2.230**
p	0.000	0.000	0.000	0.000	0.000	0.018
r2	0.410	0.394	0.399	0.400	0.385	0.457

5. Conclusion

Both ESG and new-quality productivity align with China's contemporary context and implement the new development philosophy of 'innovation, coordination, greenness, openness, and sharing.' How does improving corporate ESG performance impact

new-quality productivity? This study selects 1,454 listed heavy-polluting enterprises from 2009 to 2023 as a sample to empirically examine the impact of ESG on new-quality productivity. The results show a positive correlation between corporate ESG performance and new-quality productivity. The policy implications of this study for enterprises, the government, and investors are as follows:

1) Enterprises should actively enhance ESG performance. Improving the accuracy and completeness of ESG disclosures can enhance a company's image in the eyes of external stakeholders, enabling it to secure more resources and development space.
2) The government should actively guide enterprises to enhance new-quality productivity. Improving new-quality productivity not only benefits enterprises' long-term development but also contributes to the country's high-quality development. The government should actively guide enterprises to recognize the significance of new-quality productivity for their own growth and national development and provide policy support.
3) Investors should actively pay attention to enterprises' ESG performance and new-quality productivity levels. This can help enterprises improve their governance systems and provide resource support for promoting sustainable development.

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