HAS ESG PERFORMANCE IMPROVED THE TOTAL FACTOR PRODUCTIVITY OF CHINESE ENTERPRISES? FROM THE PERSPECTIVE OF RESOURCE CONCERTOS

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Abstract

Addressing environmental, social, and governance (ESG) issues has become a critical part of resource strategies. Based on the "sustainable" development strategy, using Chinese listed companies from 2009 to 2020 as the research sample, this study explores the impact of corporate ESG performance on total factor productivity. The results show that an enterprise's ESG performance boosts total factor productivity and forms an ESG "suction effect." From a resource coordination perspective, ESG performance adjusts its resource allocation structure through market attention and financing constraints and bundles resources through innovative investment. These paths affect the high-quality development of enterprises. Further research has found that the abovementioned mechanisms have a more significant effect on state-owned enterprises, enterprises with higher levels of marketization, heavily polluting enterprises. The research conclusion enriches the strategic level of sustainable development from the research perspective and provides policy inspiration to promote the high-quality enterprise development.

Keywords: Resource orchestration; environmental, social, and governance; ESG; China enterprises; total factor productivity

INTRODUCTION

The green economy has become a new driving force for global economic development, and sustainable strategies and high-quality economic development have become the focus of economic research. To actively respond to the trend of sustainable development, China has proposed the green development concept of "innovation, coordination, green, openness, and sharing," thereby fully demonstrating its role as a responsible country. The growth trend of total factor productivity (TFP) is considered by neoclassical growth theory as the sustainability of the economic growth model(Young, 2003). A large body of the literature has reached the consensus that the transformation of China's economic growth model in the new normal depends, to a great extent, on the high-quality development of individual enterprises (Wang & Kong, 2019; Zhang & Liu, 2017; Zhengge & Renjun, 2017).

The environmental, social, and governance (ESG) framework was first proposed by the United Nations Global Compact Organization of the Environmental Planning and Finance Action Agency. This represents a new sustainable concept of balancing the environment, social responsibility, and corporate governance(Li & Wu, 2020). Notably, ESG research is limited in terms of the literature on the TFP of enterprises, but there is a rich research basis on the impact of sustainable development strategies on TFP, and the underlying logic of both is consistent. The government promotes sustainable development strategies through environmental regulation (Cicchiello, Marrazza, & Perdichizzi, 2022), green market mechanisms (Yao, Fei, Wang, Yao, & Yang, 2023), and other measures, thereby guiding resource flow to efficient enterprises and phasing out inefficient ones (Chahed, 2021). From the perspective of the enterprise itself, ESG endorses efficient management and green operations (Zeng, Li, & Zeng, 2022). Moreover, ESG has solved the awkward situation of difficult conversion between research and development (R&D) investment and green operations by promoting the influx of green innovation elements into enterprises (Zhou, Liu, & Luo, 2022).

The research highlighted above is limited to the impact of the external environment (environmental regulation), corporate governance (management level), and social responsibility (value creation) on TFP. Few studies have explored these three microscopic features using a single research system. Assuming that an enterprise's ESG performance is an interactive mechanism for integrating sustainable development strategies with the ecological environment, social ethics, and value creation, maximizing its value is also worthy of considerable attention.

According to resource-based theory, resource concerto simultaneously considers both enterprise resource acquisition and management behavior and explains why enterprises with similar resources but different high-quality development processes vary from a dynamic

perspective (Zeng, et al., 2022). Sustainable development strategies promote resource allocation efficiency by reshaping enterprise value (Shen Zhong, 2022). Managers can enhance enterprise resource allocation efficiency by focusing on long-term value and improving disclosure quality through corporate governance measures (Zhong, Zhao, & Yin, 2023).

Based on the abovementioned viewpoints, this study makes the following contributions: first, it integrates the ESG framework into a research system, providing the latest evidence that ESG performance contributes to the high-quality development of enterprises as a whole. Second, existing research is limited to horizontal differentiation, such as funding difficulties and short-sighted management, without revealing the underlying logic from a vertical logic perspective. This study uses the theory of resource concertos, which provides further theoretical supplementation. Third, based on the aforementioned research perspectives, this article further clarifies the transmission mechanism of ESG performance that affects the TFP of enterprises. This conclusion reconciles the contradiction between enterprise cross-sectional heterogeneity and productivity constraints, and it extends the interactive mechanism of sustainable concepts for enterprise production behavior.

LITERATURE AND HYPOTHESES
ESG Performance of Enterprises and Total Factor Productivity

In recent years, a vast amount of research has measured TFP as the core element of enterprise high-quality development from a micro-level perspective (Kong, Peng, Ruijia, & Wong, 2021). However, ESG has gradually become a core indicator for evaluating the sustainable development ability of enterprises (Ye, et al., 2022), and exploring the "black box" of TFP through ESG is of great significance.

Evidently, sustainable development has a positive impact on the high-quality development of enterprises. Adner and Zemsky (2006) propose the classic "productivity dilemma" theory, arguing that the success of enterprises depends not only on the improvement of investment efficiency but also on disruptive innovation and sustainable win-win situations (Adner & Zemsky, 2006). According to resource dependence theory, the ability of enterprises to obtain and maintain critical resources through management efficiency quality (G) is a core issue for the high-quality development of enterprises (Harymawan, Nasih, Agustia, Putra, & Djajadikerta, 2022). Hsieh and Klenow (2009) define enterprise resource allocation efficiency as whether an enterprise invests limited resources in projects with high return rates. Based on the structural dividend hypothesis, Miranti et al. (2014) posit that productivity can be promoted by improving management skills and optimizing element allocation. The ESG concept is gradually changing enterprise management goals (Mio, 2015), and traditional enterprises pursue only the

maximization of net present value as an investment standard. Managers will reduce investment in high-risk but high-value investment projects, form a defense mechanism, and deviate from sustainable development. Through value reshaping (S), ESG calls on enterprises to actively fulfill their ESG responsibilities, and by designing internal governance mechanisms to supervise and provide feedback, it can improve corporate governance transparency, correct management defense mechanisms that deliberately avoid risk, improve internal resource allocation efficiency, and create a "governance effect"(B. Cheng, Ioannou, & Serafeim, 2014).

However, innovation is regarded as an important strategic resource for enterprises (Eisenhardt, 1996). Increasing R&D investment is a leading factor in determining green strategies and environmental development (E) for enterprises, including issues related to organizational structure, technological and environmental strategy innovation (Shi & Yang, 2022). Enterprises acquire knowledge resources through multifaceted networks with consumers and investors, thereby forming a logical chain of "enterprise innovation–R&D investment–green resource flow–TFP improvement" (Shi & Yang, 2022). In addition, enterprise sustainable orientation is not only an upgrade of innovation capability in production and operation but also a new combination of production factors and enterprise values, leading to a "resource effect" (Long, Feng, Gong, & Chang, 2023).

Evidently, the impact of ESG performance on the TFP of Chinese enterprises is not straightforward. According to Ilyas, Mian, and Suleman (2022), ESG, as a strategic resource, does not always promote the sustainable development of enterprises. It has a delayed effect over time. In the early stages of enterprise entrepreneurship, ESG input will inevitably compete with enterprise cost, exclude other production factors, reduce enterprise profit, and thus lead to lower productivity, resulting in a "cost effect" (M. M. Cheng, Green, & Chi Wa Ko, 2015). Notably, ESG performance has governance, resource, and cost effects. As the level of ESG disclosure changes, these three effects will appear in a state of mutual influence, thereby affecting the high-quality development of private enterprises. Therefore, herein, we propose the following hypothesis:

Hypothesis 1. From a long-term perspective, ESG performance improves the total factor productivity of enterprises

According to the agency theory, ESG investment helps establish a good social reputation and create personal business empires (Harjoto & Salas, 2017). Due to the limited resources of enterprises, investment in environmental governance or social capital will occupy a portion of operating funds. The return on investment for this part of the investment, "hidden profits," can only be realized over time (Barko, Cremers, & Renneboog, 2021). Even if enterprises have "rational" managers, they may feel helpless in sticking to ESG because of

financial limitations. Due to changes in the competition logic of enterprises, enterprises with strong comprehensive capabilities are more willing and able to improve their ESG performance compared to those with poor performance (DasGupta, 2022). In the long run, they will receive the dividends of sustainable strategies and form ESG "suction" effects. Based on this, the following conclusion can be drawn:

Hypothesis 2. ESG performance forms a "suction effect", and enterprises with good ESG performance have a more significant effect on promoting total factor productivity.

Study of Influence Mechanisms

Resource concerto includes resource structuring (external environment resource acquisition) and resource bundling (internal resource absorption) (Liu, Kwong, Kim, & Liu, 2021). The ESG performance of enterprises cannot be separated from the support of resource collaboration. Zhang Jichang et al. believe that enterprises should be based on "integrity" and strengthen the synergistic integration and capacity matching between resources, capabilities, and relationships. They should adopt a "resource and capability-driven" mechanism (Morgan, Miocevic, & Herhausen, 2019). The effectiveness of enterprise ESG depends on external resource acquisition (scientific and technological innovation) and internal resource allocation.

Mediation of Resource Structuring

(1) Market Attention

Based on signal transmission theory, enterprise ESG ratings release signals to the outside world of their willingness to comply with green operations and actively fulfill social responsibility(Morgan, et al., 2019), thereby gaining more recognition from government and consumers and establishing stable and solid cooperative relationships with stakeholders. On the one hand, market attention can be regarded as a disguised push for resource allocation in the market, helping enterprises obtain critical resources that are beneficial to their development and achieving the transformation of social capital to physical capital(Dhingra & Morrow, 2019). On the other hand, market attention can be seen as an ESG industry advantage: resource investment attracted by industry attention reduces the agency costs of enterprises(Zhou, et al., 2022), provides space for increasing profits by reducing costs, and thus improves TFP of enterprises. Based on this, the following conclusion can be drawn:

Hypothesis 3. Enterprise ESG performance improves total factor productivity by gaining more market attention.

(2) Financing Constraints

ESG is an important way to improve enterprise financing channels and its effects are more significant in countries with weaker credit markets (Huebel, 2022). Enterprise ESG performance mitigates financing constraints by reducing financing costs (Zhai, et al., 2022), but there is a significant difference between external and internal financing: the reduction of internal financing constraints has a positive effect on the TFP of any enterprise, while the reduction of external financing constraints only improves non-state-owned enterprises (Du, Huang, Hong, & Wu, 2022). On the one hand, the mechanism of enterprises entering and exiting the market is distorted by financing constraints, indirectly resulting in an imbalance in TFP. On the other hand, improving enterprise ESG performance is an important means of reducing financing costs. ESG has the inherent characteristics of reducing information barriers, which mitigates the information asymmetry between enterprises and creditors, reduces credit risk, and thereby lowers the required return on investment. Creditors are also willing to provide financing to enterprises with high ESG ratings at a lower cost of capital(Park & Oh, 2022). Based on this, the following hypothesis is proposed:

Hypothesis 4. Enterprise ESG performance improves total factor productivity by reducing financing constraints.

Mediation of Innovation Resources

From the factor flow perspective, mainstream theories have reached a consensus: sustainable strategies can promote the flow of innovative factors and achieve a win-win situation of environmental performance and productivity through innovation complementarity effects. Innovation is the leading factor that determines enterprise strategy and development scale, including organizational structure innovation, technological innovation, and strategic innovation. Enterprises provide necessary support for ESG through technology, and ESG performance also reflects the ability and enthusiasm of enterprise innovation (Song, Wang, Li, & Li, 2018). Good institutional quality is an important guarantee for enterprise R&D processes, and enterprise technological innovations are easier to aggregate in areas with higher institutional quality. Enterprises acquire knowledge resources through diversified and networked relationships with consumers and investors, forming a logical chain of "enterprise innovation, R&D investment, resource flow, and improvement of TFP" (Zheng, Feng, Jiang, & Chang, 2023). In addition, a sustainable orientation for enterprises is not just an upgrade in innovation capabilities in production and operation, but also a new combination between production factors and enterprise values(Chang, 2023). ESG performance can mitigate short-sighted behavior of enterprises, guide innovation investment towards sustainable development and long-term value

projects, reduce resource misallocation, and improve TFP. Based on this, the following hypothesis is proposed:

Hypothesis 5. Enterprise ESG performance improves total factor productivity by increasing investment in innovative factors.
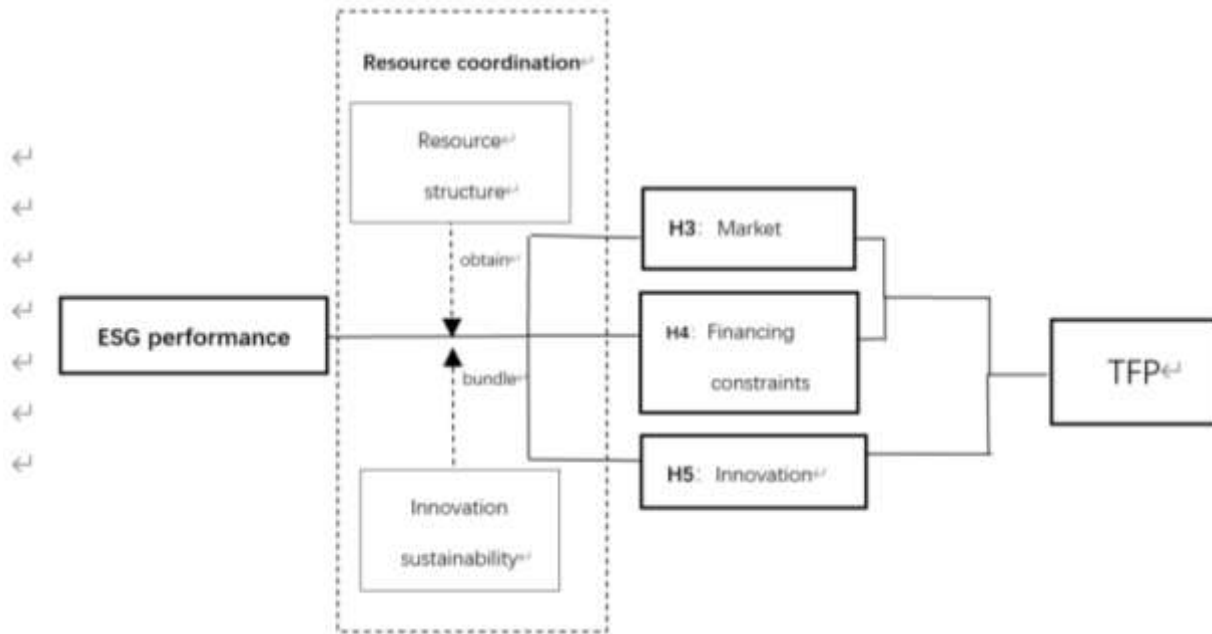

Figure 1 Theoretical Framework

RESEARCH DESIGN

Model Construction

Firstly, to explore the impact of enterprise ESG performance on TFP of enterprises, based on the theoretical analysis above, the author constructs a panel regression model with two-way fixed effects at the enterprise level:

$$TFP_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (1)$$

In the model, TFP represents total factor productivity of enterprises, ESG represents enterprise ESG performance, CV represents a series of control variables at the company level. μ and θ represent year and company fixed effects, ε represents the random disturbance term, and robust standard errors are at the company aggregation level. Among them, α_1 is the key reference coefficient. If the coefficient is positive and significant, it indicates that enterprise ESG performance can improve TFP of enterprises. If the coefficient is negative and significant, it indicates that enterprise ESG performance inhibits TFP of enterprises.

Variable Selection

TFP of Enterprises

The classic method for estimating TFP is to use two semi-parametric methods - OLS (Ordinary Least Squares) and LP (Local Projection). However, both these methods suffer from the problem of collinearity in estimating labor production in the first stage, when using the traditional OLS estimation of the CD production function. In this article, we adopt the ACF (Ackerberg et al., 2015) method of estimating TFP of enterprises, which includes labor as an intermediate variable in the correlated function and thus avoids the drawbacks of non-uniformity in production functions. Our estimation method combines dynamic (GMM) and static (OLS) approaches, which relax the stringent conditions for adjusting factors and fully consider the estimations of individual decisions made by micro-enterprises.

To calculate the TFP of enterprises, we need to start with the Cobb-Douglas production function, which is formalized as:

$$Y_{it} = A_{it}L_{it}^{\alpha}K_{it}^{\beta} \qquad (2)$$

In the above equation, Y_{it} represents the output, A_{it} represents the TFP, and L_{it}^{α} and K_{it}^{β} represent labor and capital inputs, respectively. Taking the logarithm of equation (2), it can be transformed into the following linear form:

$$y_{it} = al_{it} + \beta k_{it} + \varepsilon_{it} \qquad (3)$$

The residual term ε_{it} in the equation represents the logarithmic form of TFP. Estimating equation (3) yields an estimate of TFP. The functional form of TFP for the enterprise can be derived from equation (3).

$$lnY_{it} = \alpha_{0it} + \alpha_{1it}lnL_{it} + \alpha_{2it}lnk_{it} + \alpha_{3it}lnM_{it} + \varepsilon_{it} \qquad (4)$$

Data was obtained from the WIND database and annual reports of various companies, which were cleaned and classified according to the industry classification codes published by the China Securities Regulatory Commission. The main business income of listed companies was used as the total output variable, Y_{it} represents net fixed assets as a variable of capital investment,lnk_{it} Labor input was measured as cash paid by the enterprise for labor, lnL_{it}, while intermediate input was measured as M_{it}, which is equal to operating costs plus finance expenses, sales expenses, management expenses, current depreciation expenses, minus current payable staff salaries, and intangible asset amortization expenses. State variables were generated for companies entering or exiting the industry using the 2002 CIC industry coding. TFP was then calculated using a two-stage GMM method. The OP method was also used to calculate the per capita output as a proxy indicator for enterprise rate, which improved the robustness of the empirical results.

Corporate ESG Performance (ESG)

In this study, the Huazheng ESG rating system[1] was used to evaluate corporate ESG performance. The system ranks ESG performance on a scale of nine levels (AAA to CCC) and assigns scores, with higher scores indicating better ESG performance.

Control Variables

The study used various enterprise characteristics as control variables, including firm size (Lnscale), leverage ratio (LEV), cash flow ratio (ATO), institutional investor ownership (INST), management expense ratio (Mfee), Tobin's Q value (TobinQ), and number of directors (Board). Table 1 lists the variable names, characters, and definitions:

Table 1 Variable Definition Table

	Variable Name	Variable Code	Definition
Dependent Variable	Enterprise Total Factor Productivity	TFP_{acf}	Enterprise total factor productivity estimated using ACF method
		TFP_{OP}	Enterprise total factor productivity estimated using OP method
Independent Variable	ESG Performance	$Score$	Score assigned according to the Huazheng ESG rating system
	Enterprise Age	Age	Logarithm of the time since the enterprise was established
Control Variables	Leverage Ratio	LEV	Debt divided by owner's equity
	Cash Flow Ratio	ATO	Operating cash flow divided by total assets
	Institutional Investor Ownership	$INST$	Proportion of institutional investor's contributions to the registered capital
	Management Expense Ratio	$Mfee$	Operating expenses divided by main business income
	Tobin's Q	$TobinQ$	Total market value of the enterprise divided by total assets
	Number of Directors on Board	$Board$	Total number of members on the enterprise's board
	Industry Effects	ind	Industry virtual variable
	Time Effects	$year$	Time virtual variable

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[1] Shanghai Huazheng Index Information Service Co., Ltd. is a professional index and index service company. Huazheng ESG rating has the characteristics of being close to the Chinese market, wide coverage, and high timeliness. Its application scenarios include various fields such as ESG index construction, portfolio risk management, ESG evaluation of asset management products, and quantitative strategy research and development.

Sample Data Source and Descriptive Statistics

On September 30, 2018, the revised "Governance Standards for Listed Companies" by the China Securities Regulatory Commission added content on environmental protection and social responsibility, establishing the basic framework for ESG information disclosure. Therefore, the sample for this study consists of listed companies from 2009 to 2020. The year 2009 was also a year when ESG officially developed in Chinese enterprises.

According to data availability this study used data from WIND Database from 2009 to 2020 for A-share listed companies. Finally, enterprises with incomplete data and ST type enterprises remove and eliminate 1% of outlier. Descriptive statistics are presented as in the table 2.

Table 2   Descriptive Statistics, Correlation Analysis, and VIF

	Obs	Mean	Std. Dev.	Min	Max	Correlation	VIF
TFPacf	23516	8.583	2.664	3.005	12.99		
TFPOP	23516	7.059	1.024	2.81	11.72		
Esg	23516	6.421	1.084	1	9	0.024***	1.08
Lnscale	23516	4.202	1.960	0.020	6.6772	0.988***	1.24
LEV	23516	0.407	0.205	0.007	2.362	0.650***	1.33
ATO	23516	0.637	0.452	0.005	10.813	0.764***	1.06
INST	23516	0.365	0.244	0	3.267	0.180***	1.16
Mfee	23516	0.095	0.093	0.002	7.284	-1.019***	1.00
TobinQ	23516	2.043	1.250	0.673	22.035	-0.047***	1.07
Board	23516	2.134	0.198	1.100	2.289	5.621***	1.08

As shown in Table 2, the lowest ESG score is 1 point, which corresponds to a CCC rating, and the highest score is 9 points, which corresponds to an AAA rating, with an average score of 6.421, indicating that most enterprises fall within the BBB rating. The correlation coefficient between ESG performance and total factor productivity measured by ACF is 0.024, which is statistically significant at the 1% level, and the correlation of other main control variables is consistent with that discussed in the following text. The maximum value of VIF is 1.33, which is significantly less than the reference value of 10, indicating that there is no serious problem of multicollinearity in the data.

EMPIRICAL ANALYSIS

Benchmark Regression Results

Table 3 reports the regression results of the impact of corporate ESG performance onTFP, controlling for individual and time fixed effects in columns (1)-(4), and performing robust standard error clustering at the company level. TFP is measured using the ACF method. The results in column (1) show that the ESG coefficient is positive and significant, indicating that corporate ESG performance can improve productivity. Columns (2)-(4) divide the entire sample into three groups of A-rated, B-rated and C-rated companies, with all three groups having positive ESG coefficients, providing further support for hypothesis 1.

The impact coefficient of ESG performance on the A-rated group is the highest (0.0627), indicating that ESG performance and productivity form a positive cycle, creating a "siphon effect" of ESG on TFP. The B-rated companies make up 60% of the sample, representing the basic level of companies, with the ESG coefficient in the third column significant but lower than that of A-rated companies. The C-rated companies have positive coefficients but are not significant, possibly due to extreme performance and a smaller sample size. High-rated companies with good ESG performance significantly improve productivity, while the effect of sustainable concepts in low-rated companies is slightly weaker. This indirectly confirms hypothesis 2 that sustainable development concepts are an important way for companies to increase productivity.

Table 3 Relationship between ESG Performance and Total Factor Productivity of Enterprises

	ESG Performance	A-rated Companies	B-rated Companies	C-rated Companies
ESG	0.0406***	0.0627***	0.0190*	0.0263
	（9.13）	（4.96）	（1.77）	（0.87）
Lnscale	0.8681***	1.081***	0.833***	0.1552
	（15.05）	（8.39）	（11.41）	（0.814）
LEV	0.9491***	1.304***	0.9522***	0.4362
	（28.12）	（19.58）	（21.65）	（0.68）
ATO	0.5074***	0.4900***	0.510***	0.6145
	（30.99）	（18.56）	（22.07）	（1.38）
INST	0.3408***	0.2455***	0.375***	0.242
	（13.41）	（5.66）	（10.88）	（0.45）
Mfee	-1.458***	-1.825***	-1.246***	-2.176
	（-32.77）	（-16.61）	（-24.19）	（-1.86）

TobinQ	-0.086***	-0.0704***	-0.1014***	-0.0294	Table 3...
	(-24.32)	(-11.02)	(-19.96)	(-0.90)	
Board	0.2635***	0.1578***	0.270***	0.1663	
	(86.17)	(2.75)	(5.64)	(0.28)	
cons	7.062***	6.3724***	7.508***	7.515***	
	(86.17)	(38.51)	(62.08)	(4.73)	
year	control	control	control	Control	
id	control	control	control	Control	
N	23516	8352	13812	1352	
Adj R^2	0.9622	0.9719	0.9578	0.9802	

Note: *** p<0.01, ** p<0.05, * p<0.1; values in parentheses represent t-statistics; standard errors are adjusted with robust clustering at the company level, as indicated

Robustness Tests

Endogeneity Analysis

Although the benchmark regression controls for a range of factors that affect TFP and company-specific features, to avoid endogeneity issues caused by reverse causality, this study uses difference GMM and system GMM to conduct endogeneity tests. The p-values of the AR(1) test in columns (4) and (5) of Table 3 are both 0 (less than 0.1), while the p-values of AR(2) are all greater than 0.1, indicating that the tests of serial correlation are passed. The Sargan test produces p-values greater than 0.1, indicating that the instruments used in both models are valid. The coefficients of ESG performance under both measures are also positive and significant, consistent with the main regression results, providing robustness to the above conclusions.

Model Replacement and Core Variable Replacement

This study conducts robustness tests by changing the fixed effect model and replacing the core variables. Considering that the regression model controls for the joint fixed effects of companies and years, to avoid the influence of omitted variables, this study compares the results with main regression by separately controlling for the fixed effects of time and companies. The coefficients of ESG performance are both positive and significant, consistent with the main conclusions. To avoid estimation bias caused by the measurement of the dependent variable, Lu Xiaodong and Lian Yujun's OP method (2012) is used to replace the core variable measurement. As shown in column (3) of Table 4, the coefficient of ESG is 0.056

and significant, indicating that the performance of ESG is still positively correlated with TFP, further supporting the robustness of the results.

Variable Exclusion

The empirical analysis above shows that the lowest-rated group does not significantly affect TFP, as the lowest-rated companies are still in the early stage of development with a primary goal of profitability, which does not represent the basic features of enterprises. Therefore, this study removed the lowest-rated "CCC" group, as well as the best-performing "AAA" rating, and conducted the regression again. The results are shown in columns (6) and (7) of the table. Regardless of whether ACF or OP is used to measure ESG, the coefficient of ESG performance remains positive and significant, further supporting the unbiasedness of the results.

Table 4 Robustness Tests

variable	Model replacement Core Variable Replacement			Endogeneity Analysis		Outlier Exclusion	
	Cluster			DIF_GMM	SYS_GMM	Cluster	
	$TFP_{\_acf}$	$TFP_{\_acf}$	$TFP_{\_op}$	$TFP_{\_acf}$	$TFP_{\_acf}$	$TFP_{\_acf}$	$TFP_{\_op}$
L. TFP				0.907***	0.842***		
				(85.58)	(269.2)		
ESG	0.197***	0.048***	0.056***	0.018***	0.007*	0.037***	0.016***
	(5.85)	(4.01)	(5.85)	(4.46)	(1.99)	(7.64)	(5.69)
Lnscale	1.114***	3.184***	0.703***	1.479	1.047***	0.927***	0.698***
	(24.37)	(19.65)	(19.5)	(9.05)	(9.39)	(15.46)	(19.25)
LEV	0.536***	-1.24***	0.3459***	0.129	0.097	1.02***	0.348***
	(3.88)	(-13.4)	(16.7)	(1.36)	(1.27)	(20.45)	(16.60)
ATO	0.341***	1.319***	0.718***	0.577***	0.481***	0.497***	0.721***
	(25.55)	(29.93)	(72.5)	(8.94)	(10.35)	(30.01)	(71.97)
INST	0.142***	-1.347***	0.098***	-0.036	0.005	0.330***	0.098***
	(6.78)	(-19.8)	(6.43)	(-0.99)	(0.16)	(12.89)	(6.34)
Mfee	-0.894***	0.4498***	-0.983***	-0.501***	-0.637***	-1.409***	-0.960***
	(-25.9)	(3.72)	(-36)	(-4.80)	(-8.47)	- (31.15)	(-35.11)
TobinQ	-0.042***	-0.006	-0.313***	-0.022***	-0.017	-0.864**	-0.031***
	(-15.7)	(-0.70)	(-14)	(-3.14)	(-0.32)	(-24.07)	(-14.39)
Board	0.016***	2.31***	0.156***	0.327***	-0.026	0.250***	0.148***
	(6.20)	(24.4)	(7.40)	(6.14)	(0.74)	(7.06)	(6.93)

cons	1.950***	3.2***	3.631***	4.081***	1.452	7.125***	3.63***	Table 4…
	（25.65）	（14.3）	（73.1）	（4.25）	（-13.23）	（85.29）	（71.87）	
year	control		control				control	
id		control	control	control	control	control	control	
N	23516	23516	23516	23516	23516	22833	22833	
Adj R^2	0.969	0.757	0.867			0.962	0.8658	
AR(1)				0.000	0.000			
AR(2)				0.699	0.740			
Sugan				0.286	0.389			

Note: * * *, * *, * respectively represent significant levels of 1%, 5%, and 10%, with corresponding standard errors in parentheses; AR (1), AR (2), and Sargan tests provide p-values, respectively; L. Representing the lag period of a variable

Mechanism Testing

Based on the theoretical framework presented earlier, good ESG performance by a company represents an endorsement of sustainable development, which leads to increased attention from the industry and ultimately drives the firm's TFP. Beyond the impact of external environmental information, a company's ESG performance can also affect its TFP through external inputs of innovative factors, as well as internal financing channels. This paper examines the internal pathways of the impact of a company's ESG performance on its TFP from the perspectives of industry attention, input of innovative factors, and financing constraints.

To explore how a company's ESG performance enhances its TFP through factors such as industry attention, financing constraints, and R&D input, the author employs the three-stage mediate effect testing method proposed by Wen (2004), and builds models (2)-(7). First, we examine the impact of a company's ESG performance on its TFP (the baseline regression results have been presented), checking whether the α_1 coefficient is significant. The second step involves testing the impact of a company's ESG performance on the mediating variables, and checking whether the α_3、α_5 and α_7 coefficients are significant. In the third step, we add the mediating variables to the regression model from step one and focus on the coefficients and signs of the mediating variables and ESG, to determine whether the mediating effect is effective. If any of the coefficients α_3、α_5、α_7 and β_1、β_2、β_3 are not significant, a Sobel test should be conducted to further determine whether mediation exists.

Perspective based on Market Attention

Good ESG performance sends a more positive signal to capital markets: a strong sense of social responsibility and environmental protection, as well as a relatively sound mechanism for restriction and supervision. It is evident that China's capital markets prefer ESG responsibility, and the industry's attention to a company's ESG performance serves as a supplement to reputational spillover. Industry attention weakens the barriers to information transmission, enhances the disclosure of firm-specific information, optimizes resource allocation, and improves TFP. This paper assigns grades based on the disclosure evaluation results of listed company information released by the Shanghai Stock Exchange, and measures market attention using the number of tracking analysts as analyzed by(Guo, Perez-Castrillo, & Toldra-Simats, 2019):

$Anna_{i,t} = \ln(1 + the\ number\ of\ tracking\ analysts)$, with the model constructed as follows:

$$nna_{i,t} = \alpha_0 + \alpha_2 ESG_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (5)$$

$$TFP_{i,t} = \alpha_0 + \alpha_3 ESG_{i,t} + \beta_1 Anna_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \quad (6)$$

Table 5 presents the regression results of the mediating variables. Column (1) shows that the coefficient of ESG performance on market attention is significant and positive, indicating that good ESG performance can lead to better market attention. Column (2) shows that the dependent variable is TFP measured by the ACF method, and both ESG and Anna coefficients are positive and significant, indicating that market attention plays a mediating role in the relationship between ESG performance and TFP. Specifically, good ESG performance leads to higher market attention, which in turn optimizes resource allocation and improves TFP.

Perspective based on Financing Constraints

This paper uses the SA index formula proposed by Ju et al. (2009) and Liu et al. (2009) to measure the degree of financing constraints: $SA = -0.737 * Size + 0.043 * Size^2 - 0.04 * Age$. This index uses firm size and length of listing as variables, and eliminates endogenous financing variables, making it more robust. The SA index is negative and the larger its absolute value, the more severe the financing constraints on the company. For ease of interpretation, this paper has taken the absolute value of the SA index(Hadlock & Pierce, 2010). The model is constructed as follows:

$$SA_{i,t} = \alpha_0 + \alpha_4 ESG_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (7)$$

$$TFP_{i,t} = \alpha_0 + \alpha_5 ESG_{i,t} + \beta_2 SA_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (8)$$

As shown in column (3) of Table 5, the coefficient of ESG performance is negative and significant, indicating that good ESG performance of a company helps to alleviate its financing

constraints. In column (4), the SA coefficient is negative and significant, indicating that as the financing constraints of a company decrease, its production scale expands to a reasonable range, resulting in an increase in TFP due to increased production scale. Therefore, alleviating financing constraints is an important way for a company's ESG performance to improve its TFP.

Perspective based on Input of Innovative Factors

ESG performance is oriented towards creating corporate value, with sustainable development as its institutional foundation. Good corporate governance promotes the integration of innovation resources for investment. As mentioned earlier, this paper measures innovation expenditure by using R&D expenditure, as proposed by (Wagner, 2007)and takes the logarithm of the R&D expenditure. Furthermore, due to the lag effect of innovation, the paper uses the lagged variable as the innovation input variable. The model is constructed as follows:

$$L. \ln R D_{i,t} = \alpha_0 + \alpha_4 ESG_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (9)$$

$$TFP_{i,t} = \alpha_0 + \alpha_5 ESG_{i,t} + \beta_2 L. \ln R D_{i,t} + \gamma_j CV_{i,t} + \mu + \theta + \varepsilon_{i,t} \qquad (10)$$

As shown in column (5) of Table 5, the coefficient of ESG is positive and significant, indicating that ESG performance can prompt a company to focus on value creation and stimulate management to increase input of innovative factors. From the perspective of resource allocation, in column (6), the ESG coefficient is positive and significant, but less significant than in column (5). This indicates that innovation can guide the reasonable flow of resources, diverting them from low-efficiency projects to high-efficiency ones. Overall, good ESG performance can improve a company's TFP by increasing its input of innovative factors.

Table 5 Intermediary Mechanism

variable	Industry attention		Industry attention		Industry attention	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ana	TFP_{acf}	SA	TFP_{acf}	$L. \ln RD$	TFP_{acf}
ESG	0.3667***	0.0297***	-0.004***	0.0378**	0.3972***	0.0245**
	(7.13)	(6.77)	(10.0)	(8.51)	(6.27)	(5.54)
Ana		0.1483***				
		(24.86)				
SA				-0.585***		
				(-9.19)		
L. ln RD						0.189**
						(108.2)

Lnscale	17.756***	0.6435***	0.0005	-0.927***	-1.313	-0.957***
	（26.53）	（10.78）	（9.39）	（15.63）	（-1.52）	（15.82）
LEV	1.5166***	0.9846***	0.0593***	0.9731***	0.2179***	0.9371***
	（3.88）	（29.14）	（15.71）	（28.26）	（4.06）	（24.92）
ATO	0.8798***	0.4887***	-0.006***	0.4969***	0.0220	0.5587***
	（4.64）	（30.34）	（3.81）	（30.45）	（0.8）	（28.90）
INST	5.6249***	0.2532***	0.0258***	0.3216***	0.0887*	0.2124
	（19.12）	（10.06）	（9.26）	（12.75）	（2.18）	（7.46）
Mfee	-2.744***	-1.381***	-0.042***	-1.390***	-0.3621***	-1.045***
	（-5.33）	（-31.4）	（-8.74）	（-31.1）	（-5.95）	（-24.5）
TobinQ	0.6866***	-0.097***	-0.004***	-0.0849	-0.034**	-0.0523
	（16.6）	（-27.6）	（-11.4）	（-23.8）	（-6.47）	（-14.3）
Board	2.2852***	0.230***	0.0167***	-0.2536*	0.3413***	0.2975*
	（5.65）	（6.7）	（4.36）	（7.29）	（6.47）	（8.05）
cons	-4.566***	7.143***	3.13***	5.246***	16.682***	3.798***
	（-4.81）	（88.41）	（346.41）	（24.30）	（136.28）	（28.90）
year	control	control	control	control	control	control
id	control	control	control	control	control	control
N	23516	23516	23516	23516	20480	20480
Adj R^2	0.6394	0.9637	0.9261	0.9761	0.8170	0.9677

Table 5…

FURTHER ANALYSIS

Based on Property Rights Heterogeneity Analysis

Discussions on the binary structure of state-owned enterprises and private enterprises have been a frequent topic in sustainable development research. Based on the Chinese system, state-owned enterprises are naturally backed by strong government-enterprise relationships and therefore bear the heavy responsibility of fulfilling social responsibilities at the national level, while private enterprises mostly play the role of rational management personnel with the aim of improving enterprise operating profits. Hence, there are significant differences between the two in terms of corporate governance policies, environmental protection strategy implementation, and resource allocation efficiency. To further analyze this, the sample enterprises are divided into state-owned enterprises and private enterprises according to their different property rights in this paper. This is in an attempt to explore the impact of enterprise ESG performance on TFP from the perspective of property rights heterogeneity. As seen from Table 5 (1) and (2), the ESG coefficient of state-owned enterprises is higher than that of privide enterprises and is positive.

State owned enterprises have resource allocation advantages, and their compliance with social responsibility is mandatory and policy driven. This means that in contrast, the willingness of private enterprises to fulfill their responsibilities is relatively negative. In public, the inherent driving force of state-owned enterprises towards sustainable management can better stimulate social acceptance, which enables them to outperform non-state-owned enterprises in terms of productivity when ESG performance is at a high level.

Based on Analysis of Internal Control Quality

Corporate internal control is the core of corporate governance and the main entity to develop corporate strategies. Enterprises optimize their management system through contractual arrangements and allocate the rights and responsibilities of various stakeholders to ensure effective supervision of rights and balance decision-making that may harm shareholder interests due to personal interests of managers. From the perspective of operational mechanisms, although government audits can control internal control decisions based on their compulsory and authoritative nature, if there are managers who act in their own interests, the supervision and balance mechanisms of internal control will also be destroyed. High-quality internal control can alleviate the strategic deviation caused by information asymmetry and avoid unnecessary diversification of business projects, thereby improving capital allocation efficiency and productivity of enterprises. The perfect internal control system is a necessary approach to improve the ESG performance of enterprises. Based on this, this paper divides the samples into the high and low internal control groups, and it can be inferred from Table 5 (3) and (4) that companies with high internal control have a significant and positive ESG coefficient, while those in the low control group did not pass the significant test. This indicates that perfect internal control is a fundamental guarantee for improving the productivity of sustainable development of enterprises. According to the agency relationship, the misalignment mechanism of maximizing shareholder incentives as the measured target bears higher agency costs, which further inhibits the TFP of enterprises. The perfect internal control mechanism can reduce the negative impact of incentive misalignment on the productivity of enterprises.

Based on Analysis of Environmental Sensitivity in Polluting Industries

Due to environmental constraints, structural problems such as overcapacity, etc., the mismatch of resources in regional heterogeneity and industry characteristics is becoming increasingly apparent. Macro mismatches and capital secondary mismatches caused by credit discrimination, coupled with the horizontal inflow of green innovation technology, have resulted in differences in the impact of enterprise ESG performance on productivity in industries with

different sensitivities. This paper uses whether the enterprise is in the heavy polluting industry as the criteria for evaluating the enterprise's sensitivity to the industry, to further explore the differences in the impact of different industry sensitivity on enterprise ESG performance and productivity. As shown in Table 5 (5) and (6), the ESG performance coefficient of both polluting and non-polluting industries is positive, but the significance of polluting industries is better, which is consistent with the main conclusion of the previous sections. The effect of ESG performance on enterprise productivity is higher in polluting industries than in non-polluting industries. This is mainly due to the higher emphasis on social responsibility for companies in polluting industries, and the endorsement of ESG sends a positive signal of green transformation to the market. Therefore, such companies can improve their sustainable development performance, which in turn leads to more significant improvements in productivity.

Table 6 Heterogeneity Test Results

variable	(1)	(2)	(3)	(4)	(5)	(6)
	Non state-owned enterprise	state-owned enterprises	High internal control quality	Low internal control quality	Contaminated enterprise	Non polluting enterprises
ESG	0.0295***	0.0474***	0.0378***	0.0332	0.0485***	0.0250*
	(5.34)	(8.72)	(8.32)	(1.22)	(6.28)	(1.68)
Lnscale	0.4633***	0.8604***	0.9615***	0.3154*	0.9532***	0.3873*
	(3.07)	(13.66)	(14.99)	(1.66)	(8.55)	(8.55)
Lev	0.6803***	0.9116***	1.0378***	0.4156***	0.8541***	0.48572***
	(10.14)	(23.03)	(28.31)	(3.3)	(13.47)	(3.83)
ATO	0.3510***	0.4911***	0.4926***	0.4652***	0.4108***	0.4376***
	(12.55)	(24.63)	(28.52)	(7.08)	(13.56)	(6.67)
Inst	0.·1440***	0.3808***	0.3021***	0.2057*	0.3466***	0.2741*
	(3.15)	(12.69)	(11.46)	(1.69)	(7.19)	(2.24)
Mfee	-5.211***	-1.257***	-1.438***	-1.300***	-1.288***	-1.310***
	(-25.3)	(-27.0)	(-30.6)	(-8.2)	(-19.61)	(-8.19)
TobinQ	-0.951***	-0.833***	-0.750***	-0.201***	-0.148***	-0.214***
	(-11.3)	(-20.9)	(-20.5)	(-10.7)	(6.55)	(-11.29)
Board	0.1340***	0.2922***	-0.2475***	0.1752	0.3612***	0.1905
	(2.32)	(6.74)	(-6.84)	(1.04)	(5.84)	(1.13)

cons	6.4289***	7.684***	7.1916***	6.3652***	6.861***	6.230***	Table 6…
	（43.46）	（77.84）	（85.08）	（15.3）	（45.7）	（15.06）	
Year	control	control	control	control	control	control	
Id	control	control	control	control	control	control	
N	7438	16078	21032	2484	18700	4816	
Adj. R^2	0.9689	0.9543	0.9641	0.9595	0.9684	0.9579	

CONCLUSION AND ENLIGHTENMENT

With the increasing pursuit of sustainability in various countries, China's economy is undergoing a transition from quantitative to qualitative change. ESG is a new concept that emphasizes the coordinated development of environmental protection, social responsibility, and corporate governance. It integrates environmental, social and corporate governance factors into an organic whole, and reflects the comprehensive development of macroeconomic high quality and micro-enterprise sustainability. From the perspective of resource coordination, this article explores the impact of sustainable strategies on the high-quality development of companies from a micro perspective, introduces macro resources into the micro-level, enriches the strategic level of sustainable development from a research perspective, and draws the following conclusions.

First, this article integrates the three aspects of environmental protection, social responsibility, and corporate governance (ESG) into a research system, expands the interactive mechanism of the sustainable concept on enterprise production behavior, and provides the latest evidence for the overall empowerment of ESG performance for the high-quality development of enterprises. The results indicate that ESG performance promotes the development of TFP of enterprises, and forms a "siphon effect" of ESG for resources, which indirectly verifies that sustainable development is a long-term solution for enterprises to improve production capacity.

Second, after clarifying that ESG performance can promote the development of TFP of enterprises, this article further clarifies the transmission mechanism of ESG performance affecting TFP of enterprises. Based on the theory of resource orchestration, innovation investment is an important way for enterprises to bundle resources, positively regulating the impact of ESG performance on enterprise productivity. Financing constraints and market attention have adjusted the resource structure of enterprises. Market attention has broken down barriers to information transmission, deepened the disclosure of enterprise characteristic information, optimized resource allocation, and improved the total factor productivity of

enterprises. Financing constraints limit the expansion of enterprise production scale within a reasonable range, while production scale limitations reduce total factor productivity.

Third, there are significant differences in the above conclusions among companies with different ownership, whether they are polluting companies, and whether they are strong internal control companies. The internal driving force of sustainable management awareness of state-owned enterprises can better stimulate social recognition, and social capital can boost the ESG performance of mergers and acquisitions, showing that high-level ESG performance of private enterprises has stronger productivity. The impact of ESG performance on enterprise productivity in the pollution industry is higher than that in non-polluting industries. The endorsement of ESG sends a positive signal of green transformation to the market, and the intensity of improving productivity is more significant in return. High-quality internal control can alleviate the strategic deviation caused by information asymmetry and avoid unnecessary diversified business projects, improving capital allocation efficiency and thus improving the production capacity of enterprises. Companies with high marketization levels occupy regions with high resource allocation.

Governments, investors, and companies themselves are increasingly paying attention to the development of ESG, and more and more companies are practicing ESG concepts in their production decisions. This article provides the following insights for the overall empowerment of enterprise high-quality development based on ESG performance: Firstly, from the perspective of the government, as micro subjects of economic operation, how enterprises respond to the call and operate effectively is the key to achieving high-quality transformation and upgrading of the economy. Therefore, the government should increase the implementation of environmental protection policies, ensure the autonomous and effective participation of market entities in sustainable strategies, and remove barriers to factor flow such as credit discrimination and resource misallocation. Furthermore, the government needs to increase the punishment for false disclosure of ESG information by enterprises, increase the cost of disclosing false information, drive objective and true ESG scores, establish correct and long-term corporate business policies, and pay particular attention to helping to guide resources from low-efficiency enterprises to high-efficiency ones within the heavily-polluting industries, to precisely encourage companies to reduce emissions.

Secondly, from the perspective of the enterprise, innovation as a resource complementarity effect is an important way for sustainable development to promote high-quality development of the enterprise. Enterprises should pay attention to the importance of green innovation strategies for sustainable development, actively integrate green concepts into production processes and green production lines, and transform from "light green production" to

"deep green production" based on green innovation practices. Enterprises should strengthen internal control construction, cultivate and appoint leaders with environmental ethics, incorporate ESG performance into performance management assessment requirements, and weaken the negative impact of incentive misalignment on enterprise productivity. Enterprises should also strengthen ESG construction, build trust with the government, establish sound communication channels with customers, increase industry attention, improve ESG performance, and promote sustainable economic and environmental development.

REFERENCES

Adner, R., & Zemsky, P. (2006). A demand-based perspective on sustainable competitive advantage. *Strategic Management Journal, 27*, 215-239.

Barko, T., Cremers, M., & Renneboog, L. (2021). Shareholder Engagement on Environmental, Social, and Governance Performance. *Journal of Business Ethics, Vol.180*, 1-36.

Chahed, Y. (2021). Words and Numbers: Financialization and Accounting Standard Setting in the United Kingdom. *Contemporary Accounting Research, Vol.38*, 302-337.

Chang, C.-C. (2023). The impact of quality of institutions on firm performance: A global analysis. *International Review of Economics & Finance, 83*, 694-716.

Cheng, B., Ioannou, I., & Serafeim, G. (2014). CORPORATE SOCIAL RESPONSIBILITY AND ACCESS TO FINANCE. *Strategic Management Journal, Vol.35*, 1-23.

Cheng, M. M., Green, W. J., & Chi Wa Ko, J. (2015). The Impact of Strategic Relevance and Assurance of Sustainability Indicators on Investors' Decisions. *AUDITING-A JOURNAL OF PRACTICE & THEORY, Vol.34*, 131-162.

Cicchiello, A. F., Marrazza, F., & Perdichizzi, S. (2022). Non-financial disclosure regulation and environmental, social, and governance (ESG) performance: The case of EU and US firms. *Corporate Social Responsibility & Environmental Management*, 1.

DasGupta, R. (2022). Financial performance shortfall, ESG controversies, and ESG performance: Evidence from firms around the world. *Finance Research Letters, 46*.

Dhingra, S., & Morrow, J. (2019). Monopolistic Competition and Optimum Product Diversity under Firm Heterogeneity. *Journal of Political Economy, 127*, 196-232.

Du, P., Huang, S., Hong, Y., & Wu, W. (2022). Can FinTech improve corporate environmental, social, and governance performance?-A study based on the dual path of internal financing constraints and external fiscal incentives. *Frontiers in Environmental Science, 10*.

Eisenhardt, K. M. S., Claudia Bird. (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science, Vol.7*, 136-150.

Guo, B., Perez-Castrillo, D., & Toldra-Simats, A. (2019). Firms' innovation strategy under the shadow of analyst coverage. *Journal of Financial Economics, 131*, 456-483.

Hadlock, C. J., & Pierce, J. R. (2010). New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. *Review of Financial Studies, 23*, 1909-1940.

Harjoto, M. A., & Salas, J. (2017). Strategic and institutional sustainability: corporate social responsibility, brand value, and Interbrand listing. *Journal of Product & Brand Management, Vol.26*, 545-558.

Harymawan, I., Nasih, M., Agustia, D., Putra, F. K. G., & Djajadikerta, H. G. (2022). Investment efficiency and environmental, social, and governance reporting: Perspective from corporate integration management. *Corporate Social Responsibility & Environmental Management, Vol.29*, 1.

Huebel, B. (2022). Do markets value ESG risks in sovereign credit curves? *Quarterly Review of Economics and Finance, 85*, 134-148.

Kong, Q., Peng, D., Ruijia, Z., & Wong, Z. (2021). Resource misallocation, production efficiency and outward foreign direct investment decisions of Chinese enterprises. *Research in International Business and Finance, Vol.55*, 101343.

Li, J., & Wu, D. (2020). Do Corporate Social Responsibility Engagements Lead to Real Environmental, Social, and Governance Impact? *Management Science, Vol.66*, 2564-2588.

Liu, W., Kwong, C. C. Y., Kim, Y.-A., & Liu, H. (2021). The more the better vs. less is more: Strategic alliances, bricolage and social performance in social enterprises. *Journal of Business Research, 137*, 128-142.

Long, H., Feng, G. F., Gong, Q., & Chang, C. P. (2023). ESG performance and green innovation: An investigation based on quantile regression. *Business Strategy & the Environment (John Wiley & Sons, Inc)*, 1.

Mio, C., Venturelli, A., Leopizzi, R.Email Author View Correspondence. (2015). Management by objectives and corporate social responsibility disclosure: First results from Italy(Article). *Accounting, Auditing and Accountability Journal, Vol.28*, 325-364.

Morgan, R. E., Miocevic, D., & Herhausen, D. (2019). Capability-driven industrial firms: Considering resources, capabilities, and competencies for marketing developments. *Industrial Marketing Management, 83*, 1-7.

Park, S. R., & Oh, K.-S. (2022). Integration of ESG Information Into Individual Investors' Corporate Investment Decisions: Utilizing the UTAUT Framework. *Frontiers in psychology, 13*.

Shen Zhong, J. H., Junwei Li, Wei Gao. (2022). Exploring the relationship of ESG score and firm value using fsQCA method: Cases of the Chinese manufacturing enterprises. *Frontiers in psychology, Vol.13*, 1019469.

Shi, Y., & Yang, C. (2022). How does multidimensional R&D investment affect green innovation? Evidence from China. *Frontiers in psychology, Vol.13*, 947108.

Song, Y., Wang, Q., Li, H., & Li, G. (2018). Modeling and simulation of enterprise innovation investment decision based on system dynamics. *Systems Engineering-Theory & Practice, 38*, 3097-3108.

Wagner, M. (2007). On the relationship between environmental management, environmental innovation and patenting: Evidence from German manufacturing firms. *Research Policy, 36*, 1587-1602.

Wang, Y., & Kong, Q. (2019). Financial Constraints, Institutions, and Firm Productivity: Evidence from China. *EMERGING MARKETS FINANCE AND TRADE, Vol.55*, 2652-2667.

Yao, R., Fei, Y., Wang, Z., Yao, X., & Yang, S. (2023). The Impact of China's ETS on Corporate Green Governance Based on the Perspective of Corporate ESG Performance. *International journal of environmental research and public health, Vol.20*, 2292.

Ye, J., Moslehpour, M., Tu, Y.-T., Vinh, N. T., Ngo, T. Q., & Nguyen, S. V. (2022). Investment on environmental social and governance activities and its impact on achieving sustainable development goals: evidence from Chinese manufacturing firms. *Economic Research-Ekonomska Istrazivanja*, 1-24.

Young, A. (2003). Gold into base metals: Productivity growth in the People's Republic of China during the reform period. *Journal of Political Economy, 111*, 1220-1261.

Zeng, H., Li, R. Y. M., & Zeng, L. (2022). Evaluating green supply chain performance based on ESG and financial indicators. *Frontiers in Environmental Science, Vol.10*.

Zhai, Y., Cai, Z., Lin, H., Yuan, M., Mao, Y., & Yu, M. (2022). Does better environmental, social, and governance induce better corporate green innovation: The mediating role of financing constraints. *Corporate Social Responsibility and Environmental Management, 29*, 1513-1526.

Zhang, D., & Liu, D. (2017). Determinants of the capital structure of Chinese non-listed enterprises: Is TFP efficient? *Economic Systems, Vol.41*, 179-202.

Zheng, M., Feng, G.-F., Jiang, R.-A., & Chang, C.-P. (2023). Does environmental, social, and governance performance move together with corporate green innovation in China? *Business Strategy and the Environment, 32*, 1670-1679.

Zhengge, T., & Renjun, S. (2017). Productivity growth in China's large industrial firms: patterns, causes, and implications. *Journal of Chinese Studies, Vol.2*, 1-16.

Zhong, Y. J., Zhao, H. Y., & Yin, T. B. (2023). Resource Bundling: How Does Enterprise Digital Transformation Affect Enterprise ESG Development? *Sustainability, 15*.

Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment, 31*, 3371-3387.