

ESG Performance and Corporate Specialization

Jiamiao Zhao^{1, *, #}, Yunpeng Chu^{2, #}, Jiaxi Li^{3, #}

¹ School of Economics, Southwest Minzu University, Chengdu, China, 610225

² School of Finance, Capital University of Economic and Business, Beijing, China, 100070

³ International Business College, Dongbei University of Finance and Economics, Dalian, China, 116025

* Corresponding Author Email: mlzj956@163.com

#These authors contributed equally.

Abstract. Specialized division of labor can help hasten the creation of a new development pattern while also increasing the endogenous power and reliability of the domestic cycle. Based on research data from A-share listed company in Shanghai and Shenzhen from 2012 to 2022, this paper develops a two-way fixed-effects model to evaluate the impact of ESG performance on the division of labor specialization. The findings indicate that (1) ESG performance has a positive and significant effect on the division of specialization, and the result remains significant after the robustness and endogeneity tests. (2) ESG performance influences the division of specialization via two channels: governance and knowledge transfer effects. (3) Heterogeneity analysis reveals that the aforementioned effects are more pronounced for state-owned enterprises and those in the central and eastern areas. This report contributes to the research on the economic effects of ESG by providing empirical evidence for enterprise specialization.

Keywords: ESG, specialization division of labor, transaction costs.

1. Introduction

Since 2020, global economic and social development has been severely hit by the impact of the new crown epidemic, which has led to a surge in unemployment, poverty, and hunger. In addition, the planet is being swept by climate change, environmental pollution, public health, and other issues. Therefore, ESG development continues to heat up in such a social context, and actively implementing the concept of ESG development has become the proposition of the times. The main definition of ESG was first put forward by the United Nations Global Compact in 2004, and the development of ESG in China, compared with foreign countries, started late and is still in the trial stage and the early stage of development. In September 2020, China proposed for the first time in the 75th United Nations General Assembly the "dual carbon" concept. "In July 2023, General Secretary Xi Jinping emphasized at the National Conference on Ecological Environmental Protection that the next five years would be an important period for the construction of a beautiful China, and that the construction of a beautiful China should be placed in a prominent position in the construction of a strong nation and the rejuvenation of the nation, supporting high-quality development with a high-quality ecological environment, and accelerating the advancement of the modernization of a harmonious coexistence between human beings and nature. Modernization. High-quality development, harmonious coexistence of human beings and nature, common prosperity, and the "dual-carbon" goal are highly compatible with the core concepts of ESG, which lays an important top-level design foundation for the development of China's ESG and also clarifies the direction of China's future ESG development [1].

At the moment, China's specialized division of labor is deepening and developing, and an increasing number of firms are focusing on it to boost efficiency and competitiveness [2]. In 2022, the 14th Five-Year Plan for the Construction of a Modern Circulation System stated that the construction of a modern circulation system should strengthen the support of domestic and international double cycles, promote the deepening of the division of labor, and participate in global economic governance through the value and industrial chains. However, there are several obstacles

and challenges in practice. Firstly, the specialized division of labor places more demands on an organization's management, coordination, and communication skills as it forces fine division of labor and collaboration. Ineffective coordination and management within businesses can result in issues like decreased output and inconsistent product quality. To sustain their competitive advantages, businesses are compelled by the specialized division of labor to consistently innovate their technologies and upgrade their products. However other businesses struggle with product innovation and technical innovation, which could also hinder the growth of the specialized division of labor. Large-scale enterprise investment and building are necessary for the specialized division of labor, and these endeavors demand substantial financial and resource support. Due to financial and resource restrictions, several SMEs find it difficult to implement large-scale specialized divisions of labor and production. Many Chinese enterprises are embracing ESG at a rapid speed, prompted by policies such as the New Development Concept, high-quality development, and the "dual-carbon" aim, as well as the demands of international markets and the common concerns of other stakeholders. ESG, as a solution, can address the aforementioned concerns to some level.

The fundamental concept of the state to establish "specialized, special and new" enterprises is the specialized division of labor, which is also essential for China to manage the significant transformations in the new development stage that have not been witnessed in a century [3]. Therefore, investigating the factors that influence division of labor and ways to strengthen collaboration and division of labor is extremely important from a practical standpoint. While much of the existing literature focuses on the international division of labor at the national level and the intra-product division of labor at the industrial level, there is also a more detailed study of the factors influencing the division of labor of firms' specialization at the firm level, focusing on the aspects of tax reform (Chen Zhao and Yang Wang, 2016)[4], infrastructure construction (Shi Bingzhan and Li Jiantong, 2020)[5], and the digital economy (Dou Jianmin et al., 2023)[6]. However, no research has focused on the mechanisms underlying business ESG performance. According to the transaction cost theory, deepening the division of labor can help to reduce external transaction costs (You, Bi-Ying et al., 2023) [7], and ESG performance can improve market power by lowering enterprise transaction costs (Shi, Xiaohong, et al., 2023) [8]. So, can corporate ESG help reduce transaction costs and promote firm specialization? Related literature has examined the relationship between ESG performance and economic policy (Xu Subo and Wang Guoqing, 2023) [9], and financial performance (Yang Ruibo, 2023) [10], which provides a wealth of references for future research; however, there are few studies on how firms' ESG performance affects the division of specialization, which requires further investigation. This aspect requires further investigation.

Based on this, this study builds a two-way fixed effects model and empirically investigates the influence of ESG performance on the division of specialty using data of A-share listed businesses on the Shanghai and Shenzhen stock markets from 2012 to 2022. Research indicates that the division of specialization can be facilitated by the ESG performance of businesses, which can lower transaction costs through governance and knowledge transfer effects. Furthermore, the impact of this performance is greater for state-owned and Middle Eastern businesses.

The potential marginal contributions of this paper are as follows: (1) In terms of research substance, it contributes to and expands the literature on the economic impacts of ESG performance in organizations. Existing literature focuses on investigating the extent to which factors such as economic policies, infrastructure construction, and asset specialization influence enterprise specialization and division of labor, whereas no research has yet been conducted to incorporate ESG performance into the framework of enterprise specialization and division of labor as an effective governance tool. (2) In terms of study mechanism, based on transaction costs, this work investigates the mechanism of enterprise ESG performance on the division of specialization, thus augmenting the influencing factors of enterprise specialization and division of labor. (3) This paper examines the two pathways of the governance effect and information transfer effect of ESG to establish the foundation for the promotion effect of good ESG performance on the division of specialization of enterprises and

to offer guidelines for the establishment of enterprises following the national strategy of high-quality development and modernization in the Chinese way.

2. Theoretical analysis and research hypotheses

What determines the division of labor in businesses? Most experts in today's academic world support an explanation based on division of labor theory and transaction cost theory. According to the division of labor theory, people work together with a fixed professional division of social organization, and thus it began directly for material production, in order to meet the natural needs of people, and set up, specializing in the provision of a certain product manufacturers will only appear when a certain level of demand is reached. As the market's scope expands, more producers participate in competition, producing a more specialized production system, and the social division of labor is further perfected [11]. According to transaction cost theory, the level of enterprise specialization is directly impacted by both internal control costs and external transaction costs. An organization's organizational effectiveness and capacity for innovation can be enhanced by appropriate internal control, which will also lower internal operating costs and increase economic efficiency. This will encourage the organization to specialize and divide labor to a greater extent. Enterprises' ability to increase their level of specialization will be negatively impacted by rising transaction costs when they trade in the market.

This is because increased transaction costs lower firms' market competitiveness, making it difficult for them to secure further business opportunities and resources in the market. To avoid external transaction costs, firms will seek to carry out transactions within the enterprise, with the enterprise's internal authority relationship dominating resource allocation and factor flow rather than the market price mechanism [12]. As the level of vertical integration increases, so will the internal control costs of enterprises. When the internal control costs exceed the external transaction costs, the enterprise will prefer to place the transaction in the market, i.e., to carry out the specialized division of labor with other enterprises [13]. The trade-off between external transaction costs and internal control costs influences the extent of the specialized division of labor. To help businesses achieve their goal of reducing costs and increasing efficiency, the ESG evaluation system for sustainable investment aims to enable them to "internalize" the "externalities" caused by their own business behaviors to the environment and society as much as possible into their costs in the process of maximizing profits [14]. As a result, this article presents the following fundamental hypotheses and uses transaction cost theory to examine how corporate ESG affects the division of labor through the governance and knowledge transmission effects.

H1: ESG performance can contribute to the level of firm specialization and division of labor.

2.1. Governance effect

Companies with strong ESG performance tend to have superior corporate governance structures and practices, which have a substantial impact on labor division. Good governance contributes to the establishment of clear lines of authority and responsibility, standardized decision-making procedures, and effective monitoring mechanisms, all of which improve internal management efficiency and effectiveness. On the one hand, the governance effect can encourage businesses to collaborate with more counterparties with strong ESG performance and broaden their trading network. On the other hand, high ESG performance can boost an enterprise's competitiveness and allow it to gain an advantage in market competition [15]. Furthermore, ESG governance can encourage corporate innovation and improvement. For example, businesses can use sustainable manufacturing processes and implement several initiatives to reduce environmental impacts, enhance resource use efficiency, and improve production efficiency and quality. These innovations and upgrades have the potential to lower corporate production and transaction costs while also promoting specialized labor divisions [16]. The relationship between shareholders and management, as well as shareholders and creditors, frequently exhibits an agency problem during firm operation [17]. Shareholders want management to

act in the best interests of shareholders, while management frequently prioritizes its interests. Similarly, there is an agency problem between shareholders and creditors, in which shareholders want creditors to have minimal liability while creditors want shareholders to have more obligation. Such agency issues, if not addressed appropriately, can pose operational and legal dangers to the organization while also increasing transaction costs. Good corporate governance can cut transaction costs, improve decision-making efficiency, reduce risks, strengthen partnerships, safeguard shareholders' interests, and encourage the deployment of specialized divisions of labor by eliminating agency difficulties. Therefore, this paper suggests the following hypotheses:

H2: ESG can enhance specialization by reducing transaction costs.

2.2. Messaging effect

ESG reshapes corporate value, steers businesses toward greater economic efficiency, and encourages sustainable development. Two major aspects of the ESG "value chain" are information and capital. Information is the basis for evaluating the sustainable development capabilities of economic organizations, while money symbolizes resource allocation. The "value chain" moves according to the following rules: ESG data comes from businesses and travels a certain path to reach resource allocators. The "value chain" moves according to the following rules: ESG information begins from firms, travels a specific transmission path, and eventually reaches resource allocators; the beginning point of ESG information is disclosure, and enterprises reveal objective and subjective ESG information by particular criteria. ESG rating agencies arrange and incorporate ESG information. Finally, ESG information reaches resource allocators, who use it as a key reference for allocation choices. Based on the outcomes of the ESG review, the resource allocator adjusts the resource allocation structure to guide labor and practice specialization and sustainable development, with capital serving as the primary carrier of resource allocation [18]. In a market economy, knowledge asymmetry is frequent, increasing the risks and costs encountered by all market participants [19]. ESG not only influences investor and partner decision-making through transparent disclosure of corporate information, but it also significantly shapes the enterprise's image in the eyes of consumers, allowing transactions to be conducted safely, lowering transaction costs, and facilitating the deepening of the division of labor [20]. On the one hand, ESG leading practices can increase the influence and voice of enterprises in the industry and industrial chain, and ESG evaluation results can convey richer corporate information to investors, which can help investors not only observe and analyze financial indicators and other information, but also reduce the cost of obtaining corporate information based on the information disclosed by ESG indicators, to observe and analyze the long-term investment. In addition to analyzing financial indicators and other information, investors and partners can use ESG indicators to lower the cost of obtaining corporate information, view and analyze long-term investment opportunities from a broader perspective, optimize resource allocation, deepen the division of labor, and improve investment decision success rates. On the other hand, disclosing ESG information sends positive image signals. Consumers are more likely to choose a company that exhibits concern for the environment, society, and governance through ESG practices because the decision is more than just buying goods or services; it is also an identification with a value. This identification reduces information asymmetry between firms and consumers, creates a more transparent and trusting relationship, improves customer loyalty and stability, increases consumer preferences, smoothes transactions, lowers transaction costs in external markets, and has a positive impact on the division of specialization [21]. Accordingly, this paper proposes the following hypotheses:

H3: ESG can promote specialization by reducing the risk of information asymmetry between firms and stakeholders.

3. Research design

3.1. Data sources

This article uses the A-share listed businesses in Shanghai and Shenzhen from 2012 to 2022 as the research sample due to data availability. To reduce the estimation bias resulting from outliers, the data are prepared in the following manner: removing companies that are identified as ST, PT, or *ST; (2) shrink-tailing the samples at the 1% and 99% levels; and (3) omitting the samples that have missing variable observations. Collation yields the final unbalanced panel data with 24784 sample observations. The ESG rating data comes from the China Securities Ratings Agency (CSRA), while the financial statistics mostly come from the CSMAR database.

3.2. Variable selection

3.2.1. Core explanatory variables

Corporate ESG performance. Investors have steadily increased their emphasis on the ESG notion as ethical and socially responsible investment concepts emerge. The CSI ESG grading uses the industry-weighted average technique to evaluate ESG, and based on percentage scores, it assigns nine grades of "AAA-C": AAA, AA, A, BBB, BB, B, CCC, CC, and C. This paper relates to current studies [22] and assigns values to ESG based on a grading scale of 1 to 9.

3.2.2. Explanatory variable

Enterprise-specialized division of labor (V_{si}). In related academic research, enterprise specialization (V_{si}) and vertical integration (V_{as}) are viewed as opposed indicators, with an increase in one resulting in a drop in the other. This paper defines the precise relationship between the two using Zhang's (2004) [23] study as follows:

$$V_{si} = 1 - V_{as} \quad (1)$$

Referring to the research results of Buzzell (1983) [24], Fan Ziyang, Peng Fei (2017) [25], and Yuan Chun, et al. (2021) [26], this paper uses the modified Value Added to Sales (Vas_{adj}) technique to estimate the degree of vertical integration of enterprises. The exact calculations are as follows:

$$\begin{aligned} Vas_{adj} &= \frac{\text{Value added} - \text{Net Profit} + \text{Normal profit}}{\text{Main business income} - \text{Net Income} + \text{Normal profit}} \\ &= \frac{\text{Value added} - \text{Net Profit} + \text{Net asset} \times \text{Average ROE}}{\text{Main business income} - \text{Net Income} + \text{Net asset} \times \text{Average ROE}} \end{aligned} \quad (2)$$

$$\text{Value added} = \text{Enterprise sales amount} - \text{Purchase amount} \quad (3)$$

$$\begin{aligned} \text{Purchase amount} &= [(\text{Cash paid for purchase or services received} + \text{Prepayment} \\ &\quad \text{at the beginning of the period} - \text{Prepayment at the end of the} \\ &\quad \text{period} + \text{Accounts payable at the end of the period} - \text{Accounts} \\ &\quad \text{payable at the beginning of the period} + \text{Notes payable at the} \\ &\quad \text{end of the period} - \text{Notes payable at the beginning of the period}) \\ &\quad / (1 + \text{VAT rate on purchases})] + \text{Inventory at the beginning of} \\ &\quad \text{the period} - \text{Inventory at the end of the period} \end{aligned} \quad (4)$$

In the equation above, the average return on net assets is calculated using the average value of the firm's industry for the previous three years. To ensure the measure's correctness, this paper uses Fan

Ziying and Peng Fei (2017) [25] and Yuan Chun et al. (2021) [26] to remove samples of *Vsi* observations that fall beyond the tolerable value range of [0,1].

3.2.3. Control variable

Drawing on the study of Zeng Jianghong et al. (2023) [27], this paper provides the necessary controls for the important determinants of firms' specialization and division of labor by selecting firm size (*Size*), capital intensity (*Capital*), listing age (*Age*), gearing ratio (*Lev*), return on total assets (*Roa*), market capitalization book-to-bill ratio (*mb*), growth rate of operating income (*Growth*), degree of marketization (*Market*), and cash holdings (*Cash*) as the control variables. See Table 1 for more information.

Table 1. Variable Selection and Measurement Approache

Variable type	Variable name	Variable symbol	Variable Definition
Explanatory variable	Degree of enterprise specialization	<i>Vsi</i>	Indicators derived from the modified value added approach, as described earlier
Explanatory variable	Corporate ESG performance	<i>ESG</i>	as indicated above
Control variable	Enterprise size	<i>Size</i>	Natural logarithm of total assets at the end of the period
	Capital intensity	<i>Capital</i>	ln (fixed assets of the enterprise/number of employees)
	Age	<i>Age</i>	Age of listing
	Gearing	<i>Lev</i>	Total liabilities/net assets at end of period
	Return on total assets	<i>Roa</i>	Net profit/total assets at the end of the period
	Market value to book ratio	<i>BM</i>	Total market value of the enterprise/book value
	Revenue growth rate	<i>Growth</i>	Revenue growth/total operating income of the previous year
	Marketability	<i>Market</i>	Fan et al. (2010) [28] China's marketization index by province
	Cash holdings	<i>Cash</i>	Cash and equivalents/total assets at end of period

3.3. Modeling

A regression model (5) is developed to investigate the impact of enterprises' ESG performance on their specialization. Controls denote relevant control variables, *Ind* denotes industry, subscript *i* denotes company, and subscript *t* represents time.

$$Vsi_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \sum Controls + \sum Year + \sum Ind + \varepsilon_{i,t} \quad (5)$$

3.4. Descriptive statistics

Table 2 displays the descriptive statistics of the main variables, which show that the mean value of *Vsi* is 0.569, the standard deviation is 0.189, the minimum value is 0.254, and the maximum value is 0.870, indicating that there is an imbalance in the degree of specialization of different firms. *ESG* performance has a mean value of 4.172 and a standard deviation of 0.752, indicating that there is a difference in ESG performance across the sample. The mean value of ESG performance is 4.172, with a standard deviation of 0.752, showing that ESG performance varies between the examined samples. The statistical results for other control variables are largely comparable with earlier research.

Table 2. Descriptive statistics

	Mean	Std	Min	Max
<i>Vsi</i>	0.569	0.189	0.254	0.870
<i>ESG</i>	4.172	0.752	3.000	5.000
<i>Size</i>	9.693	0.592	6.763	12.430
<i>Capital</i>	12.610	1.116	4.127	19.230
<i>Age</i>	2.073	0.892	0.000	3.466
<i>Lev</i>	0.439	0.200	0.008	1.698
<i>Roa</i>	0.038	0.066	-0.987	0.675
<i>Growth</i>	0.137	0.253	-0.263	0.776
<i>BM</i>	0.638	0.249	0.004	1.601
<i>Market</i>	8.760	2.330	-0.161	12.860
<i>Cash</i>	0.178	0.122	0.000	1.000

4. Analysis of empirical results

4.1. Benchmark regression results

This research uses benchmark regression on the observed samples to investigate the association between enterprises' ESG performance and their specialization and division of labor. Table 3 displays the regression results, with column (1) controlling simply for year and industry-fixed effects and column (2) introducing a series of additional control factors. The data results show that the coefficient of ESG is 0.004 after all the control variables are introduced, indicating that ESG can increase the level of specialization by 0.004 units, which is smaller than that without all the control variables, but overall, the coefficients of the explanatory variables of ESG are significantly positive at the 10% level. That is, ESG can greatly increase the level of specialization, and the empirical results corroborate the paper's central claim.

Table 3. Benchmark regression model results

	(1)	(2)
<i>ESG</i>	0.006** (0.002)	0.004* (0.002)
<i>Size</i>		0.034*** (0.010)
<i>Capital</i>		0.000 (0.003)
<i>Age</i>		-0.015** (0.007)
<i>Lev</i>		0.087*** (0.016)
<i>Roa</i>		-0.465*** (0.029)
<i>Growth</i>		0.005 (0.005)
<i>BM</i>		0.027** (0.010)
<i>Market</i>		-0.004 (0.003)
<i>Cash</i>		-0.014 (0.016)
<i>Cons</i>	0.705*** (0.032)	0.360*** (0.098)
<i>Industry effects</i>	Yes	Yes
<i>Year effects</i>	Yes	Yes
<i>N</i>	18903	18903
<i>R²</i>	0.027	0.095

Note: *, **, and *** indicate significant at the 10%, 5%, and 1% levels, respectively, as below.

4.2. Endogeneity test

The validity of the benchmark regression may be compromised by two-way causality endogeneity, which implies that firms with a higher degree of specialization and division of labor are more eager to improve their own ESG construction. To address the aforementioned endogeneity bias, this paper uses the instrumental variable method to solve the problem, using the *meanESG* of ESG assignment scores in the same industry in the same year as an instrumental variable and the two-stage least squares method to conduct the regression. The rationale for selecting this instrumental variable is as follows: First, it is compatible with the significance. Because listed companies in the same industry share common external and internal conditions, such as industry characteristics, macroeconomic environment, policies and regulations, and management, a company's ESG performance is correlated with the industry's average ESG value. Second, it is exogenous. The average ESG value of the industry has little effect on the practice of specialization by individual firms, and consequently has no impact on firm specialization. The results are presented in Table 4. In the first stage regression, the instrumental variable *meanESG* is strongly positively related to company specialization, which is consistent with the paper's expectations. In the second stage of regression, the ESG coefficient remains considerably positive at the 1% level. The findings show that even after controlling for two-way causality, the association between firms' ESG performance and specialization remains positive and significant.

Table 4. Endogeneity test

	(1)	(2)
	<i>ESG</i>	<i>Vsi</i>
<i>meanESG</i>	0.922*** (0.006)	
<i>ESG</i>		0.030*** (0.003)
Controls	Yes	Yes
<i>Constant</i>	-1.474*** (0.006)	0.364*** (0.036)
<i>N</i>	17701	17701
<i>R</i> ²	0.687	0.321

4.3. Robustness check

4.3.1. Replacement of the dependent variable

In this paper, we refer to Yu Xiaoyue et al. (2023) [29] to alter the measure of the degree of firm specialization by reducing the VAT collection rate from 17% to 13% and regressing the recalculated level of firm specialization defined as *Vsi2*. The data results, as given in column (1) of Table 5, reveal that even after substituting the dependent variable, the coefficient of the explanatory variable ESG remains considerably positive at the 10% level. The conclusion of this paper is still valid.

4.3.2. Replacement of independent variables

In addition to company ESG ratings, CSI gives percentage ESG composite scores, which are then used to replace the explanatory variables in this paper. According to column (2) of Table 5, after adjusting the ESG measure, the regression result is positive and significant at the 5% level, which supports the preceding discussion's conclusion.

4.3.3. Adding control variables

In the model building, considering the influence of omitted variables, this research refers to the study of Xu Ziyao and Zhang Lisha (2022) [30] and further incorporates price-to-book ratio (*PB*) and business complexity (*Seg*) to expand the control variables for the model robustness test. As shown in

column (3) of Table 5, the ESG coefficient remains significantly positive at the 10% level even after accounting for additional influential parameters, confirming the model's robustness and stability.

Table 5. Robustness test

	(1) <i>Vsi2</i>	(2) <i>Vsi</i>	(3) <i>Vsi</i>
<i>ESG</i>	0.004*		0.004*
	(0.002)		(0.002)
<i>ESG2</i>		0.002**	
		(0.000)	
<i>PB</i>			-0.000***
			(0.000)
<i>Seg</i>			-0.004*
			(0.003)
Controls	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
<i>Cons</i>	0.366***	0.348**	0.361***
	(0.100)	(0.118)	(0.099)
<i>N</i>	17701	17701	17575
<i>R</i> ²	0.096	0.095	0.099

4.4. Mechanism testing

ESG can encourage firms to make environmental, social, and governance improvements to achieve sustainable development; good ESG performance can influence the level of specialization and division of labor of enterprises; nevertheless, its mechanism of action must be studied further. According to the theoretical analysis in the preceding section, based on the research of Wen Zhonglin and Ye Baojuan (2014) [31], models (6) and (7) are utilized to further develop and examine the mechanism by which corporate ESG functions primarily by lowering transaction costs.

$$M_{i,t} = \theta_0 + \theta_1 ESG_{i,t} + \sum Controls + \sum Year + \sum Ind + \varepsilon_{i,t} \quad (6)$$

$$Vsi_{i,t} = \eta_0 + \eta_1 M_{i,t} + \eta_2 ESG_{i,t} + \sum Controls + \sum Year + \sum Ind + \varepsilon_{i,t} \quad (7)$$

Where $M_{i,t}$ is mediating variables and the rest of the variables are unchanged from the baseline regression model.

4.4.1. Mechanism test based on management costs

In the theoretical analysis portion, the article speculates that ESG can improve company governance, lowering transaction costs and encouraging labor specialization. Firms that improve their ESG governance will see a decrease in their administrative expenses. As a result, this section anticipates that changes in management costs will affect transaction costs, which will then affect the degree of specialization. To verify this speculation, this work relies on Tang Yaojia et al. (2022) [32] and uses the administrative cost ratio to current sales as a measure. The regression results are provided in Table 6, columns (1) and (2). The results show that the coefficient of the variable *Mfee* is negatively significant at the 1% level, indicating that high overhead costs lead to an increase in transaction costs, because increased overhead costs imply inefficiencies in the governance structure and decision-making process, making transactions within the firm more complex and costly. In this situation, organizations respond to high transaction costs by focusing on more efficient specialization to reduce internal transactions. This provides additional support for Hypothesis 2.

4.4.2. Mechanism test based on asset specificity

In the theoretical analysis above, this study contends that ESG can lower the danger of information asymmetry between enterprises and stakeholders while increasing the level of specialization. This section is intended to put this speculation to the test. Asset specialization is the applicability of an asset for a certain purpose. Highly specialized assets can hamper effective information transfer, increasing stakeholder uncertainty and the possibility of information asymmetry, making transactions more complex and costly [33]. In this work, we follow the approach of Zou Chong and Yao Shanji (2023) [34], who quantify a firm's level of asset exclusivity (*IA*) by the ratio of intangible assets to total assets, with bigger ratios indicating a higher level of *IA*. The regression findings are displayed in columns (3) and (4) of Table 6, and the coefficient of variable *IA* is considerably negative, showing that reducing asset specialization improves business specialization. The empirical findings support Hypothesis 3 of this research.

Table 6. Mechanism tests

	Mediating variable: <i>Mfee</i>		Mediating variable: <i>IA</i>	
	(1) <i>Mfee</i>	(2) <i>Vsi</i>	(3) <i>IA</i>	(4) <i>Vsi</i>
<i>ESG</i>	0.005*** (0.000)	0.004** (0.002)	-0.001* (0.000)	0.004** (0.002)
<i>IA</i>				-0.078* (0.064)
<i>Mfee</i>		-0.736*** (0.136)		
Controls	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Cons	0.177*** (0.010)	0.491*** (0.100)	0.082*** (0.029)	0.409*** (0.100)
<i>N</i>	17701	17701	17095	17095
<i>R</i> ²	0.380	0.099	0.063	0.101

5. Further analysis

5.1. The impact of the region where the enterprise is located on the specialization of division of labor

Market demand, resource endowment, and industrial structure vary by geography, which has a direct impact on company specialization. On the one hand, Middle Eastern firms do better in terms of ESG performance, owing to their more comprehensive ESG management systems and more standardized ESG information disclosure methods. These firms typically establish specific ESG management departments to promote ESG management and issue ESG reports or sustainability reports regularly to inform the public about their environmental, social, and governance performance and outcomes. In contrast, organizations in the Middle East have a more precise division of labor in terms. This is mostly due to the Middle East region's more developed industrial system and more complete industrial chain, as well as firms' specialized division of labor, which allows them to better fulfill market demand and increase production efficiency. At the same time, firms in the central and eastern areas typically have a larger focus on technological innovation and research and development, which can boost industrial upgrading, transformation, and growth.

In summary, this study finds that an organization's specialized division of labor can be influenced by the area in which it is situated. Consequently, when developing their specialized plan, businesses must take the circumstances of the area in which they operate into careful consideration. In this study, the dummy variable for listed firms situated in the western area is set to 1, while the dummy variable for firms located in the middle and eastern regions is set to 0. Table 7 presents the findings. Firms situated in the eastern and central regions exhibit positive and statistically significant ESG

coefficients at the 10% level, whereas the western region exhibits no significant coefficients. In contrast to the economic growth of the central and eastern regions, the western region has invested relatively little in ESG construction. This can be attributed to several factors, including geographic constraints, cultural background, ideological beliefs, and the degree of scientific and technological advancement that impacts the specialized division of labor within businesses. In conclusion, the ESG performance of businesses in the eastern and central areas is more favorable to the specialized division of labor when compared to the western region.

5.2. The effect of enterprise property rights on the distribution of labor according to specialization

This study uses sample data from both state-owned and non-state-owned firms depending on the types of property rights of enterprises, in order to conduct the group test. Table 6 (3) (4) is a list of the correlation test results. While the non-state-owned enterprises' ESG coefficient is 0.004, which is not significant, the state-owned enterprises' ESG coefficient is 0.006, which is significant at the 10% level. This suggests that the degree of specialization and division of labor is more likely to be influenced by the improved ESG performance of SOEs than by that of non-SOEs. Meanwhile, Due to commercial tactics, private companies might prioritize short-term profits and economic benefits, while SOEs might prioritize social benefits and long-term development. Conversely, SOEs may benefit from more policy support and resource advantages as a result of resource allocation, whereas private businesses may be subject to greater market risks and governmental constraints. These factors may affect the specialized division of labor in a firm.

Table 7. Heterogeneity analysis

	Area		Nature of property rights	
	(1) Western	(2) Middle East	(3) State-owned enterprises	(4) Non-state enterprises
<i>ESG</i>	0.001	0.004*	0.006*	0.004
	(0.008)	(0.002)	(0.004)	(0.003)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Industry effects</i>	Yes	Yes	Yes	Yes
<i>Cons</i>	0.692**	0.374***	0.281	0.213*
	(0.322)	(0.093)	(0.197)	(0.114)
<i>N</i>	1676	16025	6267	11382
<i>R</i> ²	0.186	0.093	0.110	0.106

6. Conclusions and recommendations

ESG investment is tightly linked to national policies and macroeconomic development concepts, with a focus on fostering high-quality development and a commitment to sustainability. This paper uses data from A-share listed companies in Shanghai and Shenzhen from 2012 to 2022 as its research sample, employs a two-way fixed effect model, and conducts a series of robustness, mechanism, and heterogeneity tests to investigate the mechanism of corporate ESG performance on the division of labor in specialization. Following the research, the key conclusions are as follows:

- (1) Corporate ESG performance is positively correlated with the division of expertise.
- (2) Corporate ESG performance can help to divide specialization in two ways: through governance and knowledge transmission effects.
- (3) Further analysis reveals that corporate ESG performance benefits the Middle East area and state-owned firms in terms of labor division specialization.

Based on the above findings, this paper can get the following suggestions:

First, firms should strengthen and refine their ESG procedures to maximize the benefits of specialization. They should incorporate ESG aspects into their strategic decisions and business processes that are consistent with national high-quality development and China-style modernization objectives, as well as take advantage of regulatory laws and the trend of opening up the capital market

to the outside world. They should also establish and develop ESG performance assessment systems, as well as regularly monitor and review their ESG performance, to guarantee that ESG aspects are integrated and applied in the division of specialization.

Second, corporate governance should be improved and the disclosure and transparency of ESG Information should be improved to guarantee that ESG values are properly reflected in decision-making and to reduce trading uncertainties. At the same time, the government should strengthen the establishment of ESG-related organizations, as the development of ESG necessitates a strong leadership organization to take the lead. The government should build a four-pronged approach: a strong authority, an executive body, a regulatory body, and a research body, as well as increase the synergy and coupling among the institutions, to support the methodical development of ESG. The authority is in charge of developing ESG policies and directing ESG development; the executive body is in charge of putting those policies into action; the regulatory body is in charge of creating a feedback mechanism for ESG implementation; and the research body provides basic research findings on ESG development and construction, so each has a specific role to play. Research institutes provide foundational research findings for ESG development and building. Each of them performs a unique role in establishing a systematic organizational system with mutual power limits and mutual activity promotion.

Finally, based on enterprise reality and the implementation of the "dual-carbon" policy, the government should provide key financial assistance and policy support to non-state-owned enterprises located in economically underdeveloped areas, guiding these enterprises to make more efficient use of ESG while also improving their own specialization.

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