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Research on the Mediating Effect of Digital Transformation between Equity Incentives and ESG Performance

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Abstract: This paper focuses on the relationship among equity incentives, digital transformation, and ESG performance. Taking Chinese listed companies as the research object, it deeply explores the mediating role of digital transformation in the impact of equity incentives on ESG performance. The research finds that equity incentives can significantly promote the digital transformation of enterprises, and digital transformation in turn has a positive effect on ESG performance. Moreover, digital transformation plays a partial mediating role between equity incentives and ESG performance. This research provides new theoretical basis and practical directions for enterprises to optimize incentive mechanisms and improve ESG performance.

Keywords: Equity Incentives; ESG Performance; Digital Transformation; Mediating effect

1. Introduction

In the current context where the concept of global sustainable development has gained wide acceptance, the ESG performance of enterprises has received increasing attention. ESG encompasses three key dimensions: Environment, Social Responsibility, and Corporate Governance, and it is an important indicator for measuring the sustainable development ability of enterprises. At the same time, with the rapid development of digital technology, digital transformation has become a crucial strategic choice for enterprises to seek survival and development in the fierce market competition. As an important corporate governance mechanism, equity incentives aim to coordinate the interests of shareholders and management, prompting management to strive for the long - term goals of the enterprise. Existing studies have separately explored the impacts of equity incentives on corporate performance, digital transformation on corporate performance, and the influencing factors of ESG performance. However, the way in which equity incentives affect ESG performance and the role of digital transformation in this process have not been fully studied. An in - depth analysis of the relationship among these three is of great theoretical and practical significance for enterprises to formulate scientific and reasonable development strategies and enhance their sustainable development capabilities.

2. Theoretical Analysis and Research Hypotheses

2.1 Equity Incentives and ESG Performance

The principal - agent theory points out that there are problems of information asymmetry and inconsistent interests between shareholders and management in enterprises. As a long - term incentive method, equity incentives enable management to participate in corporate decision - making and profit distribution as shareholders, thus effectively reducing agency costs and making management pay more attention to the long - term development of the enterprise. Consequently, they have a stronger motivation to improve the enterprise's ESG performance. The signaling theory holds that the implementation of equity incentives sends a positive signal to the market that the enterprise is confident about its future development, which helps to enhance the enterprise's reputation and image, attract more ESG - focused investors, and prompt the enterprise to take positive actions in the aspects of environment, society, and corporate governance to meet the expectations of investors. Based on this, Hypothesis H1 is proposed: Equity incentives have a significant positive impact on the ESG performance of enterprises.

2.2 Equity Incentives and Digital Transformation

Equity incentives can alleviate the principal - agent conflict between shareholders and management, prompting management to make decisions from the perspective of the long - term interests of the enterprise. Although digital transformation requires a large amount of investment in capital, technology, and human resources in the short term, in the long run, it helps to improve the enterprise's operational efficiency, innovation ability, and market competitiveness, which is in line with the long - term development strategy of the enterprise. Therefore, management with equity incentives is more likely to actively promote the digital transformation of the enterprise. The resource - based theory believes that the competitive advantage of an enterprise stems from its unique combination of resources and capabilities. The implementation of equity incentives can encourage management to fully integrate and utilize internal and external resources of the enterprise, providing necessary support for digital transformation. During the process of digital transformation, enterprises need to invest a large amount of capital in technology research and development, equipment update, and talent cultivation. Equity incentives enable management to allocate resources more actively to ensure the smooth progress of digital transformation. Thus, Hypothesis H2 is proposed: Equity incentives have a significant positive impact on the digital transformation of enterprises.

2.3 Digital Transformation and ESG Performance

In the environmental dimension, the application of digital technologies such as big data, artificial intelligence, and the Internet of Things can help enterprises achieve precise energy management and optimal resource allocation, improve energy utilization efficiency, and reduce energy consumption and pollutant emissions. In the social responsibility dimension, digital transformation helps enterprises strengthen communication and interaction with stakeholders. Through digital channels such as social media and online platforms, enterprises can more timely understand the needs and feedback of consumers, improve product and service quality, and protect consumer rights. In the corporate governance dimension, digital technologies provide enterprises with more efficient management tools and decision - support systems. The application of enterprise resource planning (ERP) systems, financial management software, etc., can realize the real - time sharing of internal information and collaborative office work in enterprises, improving management efficiency and the scientific nature of decision - making. Based on the above analysis, Hypothesis H3 is proposed: Digital transformation has a significant positive impact on the ESG performance of enterprises.

2.4 The Mediating Effect of Digital Transformation

According to the previous theoretical analysis, equity incentives can promote the digital transformation of enterprises, and digital transformation helps to improve the ESG performance of enterprises. Therefore, digital transformation is likely to play a mediating role between equity incentives and ESG performance. That is, equity incentives indirectly improve the ESG performance of enterprises by promoting digital transformation. Thus, Hypothesis H4 is proposed: Digital transformation plays a mediating role between equity incentives and ESG performance.

3. Research Design

3.1 Data source and Sample Selection

The data of A - share listed companies in Shanghai and Shenzhen stock markets in China from 2015 to 2023 were selected as the research sample. The data mainly came from the CSMAR database, Wind database, and the annual reports and social responsibility reports published on the official websites of enterprises. To ensure the effectiveness and reliability of the data, the sample data were processed as follows: (1) Samples of companies with abnormal financial conditions such as ST and *ST were excluded; (2) Samples of financial industry companies were excluded because the business characteristics and regulatory requirements of the financial industry are quite different from those of other industries; (3) Samples with missing key variable data were excluded; (4) A 1% winsorization treatment was performed on all continuous variables to eliminate the influence of extreme values. After the above processing, a balanced panel data containing 365 observations of 56 listed companies was finally

obtained.

3.2 Variable Definition

Explained Variable: ESG Performance (ESG). Referring to the rating systems of domestic and foreign authoritative ESG rating agencies, such as the ESG rating of Bloomberg and the ESG rating of SynTao Green Finance, a comprehensive evaluation index was constructed to measure the ESG performance of enterprises. Multiple specific indicators were selected from the three dimensions of environment, social responsibility, and corporate governance, such as carbon emission intensity, employee rights protection, and board independence. The principal component analysis method was used to determine the weights of each indicator, and then the ESG performance score of the enterprise was calculated. The higher the score, the better the ESG performance of the enterprise.

Explanatory Variable: Equity Incentives (EquityIncentive). Taking the companies that implemented the equity incentive plan as samples, the intensity of equity incentives was measured by the proportion of equity incentives granted to senior executives in the total share capital of the company. For companies that did not implement equity incentives, this variable was valued at 0.

Mediating Variable: Digital Transformation (DigitalTransformation). Drawing on existing research, indicators were selected from two aspects of enterprise digital investment and digital application to measure it. Digital investment indicators included the proportion of the enterprise's investment in information technology research and development and digital equipment purchase in its operating income; digital application indicators included whether the enterprise applied big data analysis technology, artificial intelligence technology, cloud computing technology, etc. A dummy variable was used for assignment. If the enterprise applied the corresponding technology, it was assigned a value of 1, otherwise 0. By comprehensively considering these indicators, a digital transformation index was constructed using the principal component analysis method. The higher the index, the higher the degree of digital transformation of the enterprise.

Control Variables: A series of control variables that may affect the ESG performance of enterprises were selected, including enterprise size (Size), measured by the natural logarithm of total assets; asset - liability ratio (Lev), reflecting the enterprise's solvency; profitability (Roa), measured by return on total assets; enterprise growth (Growth), measured by the growth rate of operating income; ownership concentration (Top1), measured by the shareholding ratio of the largest shareholder; board size (Board), measured by the natural logarithm of the number of board members; proportion of independent directors (Indep), measured by the proportion of the number of independent directors in the total number of board members. At the same time, industry (Industry) and year (Year) fixed effects were controlled to eliminate the influence of industry differences and time trends on the research results.

3.3 Model Design

In order to test hypothesis H1, that is, the impact of equity incentives on corporate ESG performance, the following regression model is constructed:

$$\text{ESG}_{i,t} = \alpha_0 + \alpha_1 \text{EquityIncentive}_{i,t} + \sum_j \beta_j \text{Controls}_{i,t} + \sum_{\text{Industry}} + \sum_{Year} + \varepsilon_{i,t}$$

In order to test hypothesis H2, that is, the impact of equity incentives on enterprise digital transformation, the following regression model is constructed:

$$\text{DigitalTransformation}_{i,t} = \alpha_0 + \alpha_1 \text{EquityIncentive}_{i,t} + \sum_j \beta_j \text{Controls}_{i,t} + \sum_{\text{Indus}}$$

In order to test hypothesis H3, that is, the impact of digital transformation on corporate ESG performance, the following regression model is constructed:

$$\text{ESG}_{i,t} = \alpha_0 + \alpha_1 \text{DigitalTransformation}_{i,t} + \sum_j \beta_j \text{Controls}_{i,t} + \sum_{\text{Industry}} + \sum_{\text{Year}} + \varepsilon$$

In order to test hypothesis H4, that is, the mediating effect of digital transformation between equity incentives and ESG performance, the mediating effect test process proposed by Wen Zhonglin and Ye Baojuan (2014) is adopted. On the basis of the above model, the

following mediating effect test model is constructed:

$$\text{ESG}_{i,t} = \alpha_0 + \alpha_1 \text{EquityIncentive}_{i,t} + \alpha_2 \text{DigitalTransformation}_{i,t} + \sum_j \beta_j \text{Contr}$$

Among them, ESGi,t represents the ESG performance of the ith company in the tth year, EquityIncentivei,t represents the equity incentive level of the ith company in the tth year, DigitalTransformationit represents the degree of digital transformation of the ith company in the tth year, Controls represents a series of control variables, a0 is the intercept term, a1, a2 and βj are regression coefficients, and ε is the random error term.

4. Empirical Results and Analysis

4.1 Descriptive Analysis

Descriptive statistics were performed on the main variables. The results showed that the mean value of the ESG performance score was 1.023, and the standard deviation was 0.031, indicating that there were certain differences in the ESG performance of different enterprises. Some enterprises performed well in ESG, while others had much room for improvement. The mean value of the equity incentive ratio was 1.51, the minimum value was 1.39, and the maximum value was 1.92 , indicating that the implementation of equity incentives in Chinese listed companies was uneven. Some companies had a large intensity of equity incentives, while some companies had not implemented equity incentives yet. The mean value of the digital transformation index was 0.85, and the standard deviation was 0.18, reflecting that there were obvious differences in the degree of digital transformation among enterprises. Some enterprises had made significant progress in digital transformation, while others were still in the initial stage.

4.2 Correlation Analysis

Pearson correlation analysis was performed on each variable. The results showed that there was a significant positive correlation between equity incentives and ESG performance, initially supporting Hypothesis H1; there was a significant positive correlation between equity incentives and digital transformation, initially supporting Hypothesis H2; and there was also a significant positive correlation between digital transformation and ESG performance, initially supporting Hypothesis H3. At the same time, there was a certain correlation between each control variable and the explained variable, explanatory variable, and mediating variable, indicating that the selected control variables were reasonable.

4.3 Regression Results Analysis

Table 1. Results of Multiple Regression Tests on Equity Incentives and Digital Transformation

Variables	Test 1		Test 2		Test 3		Test 4	
	ESG		DT		ESG		ESG	
	β	t	β	t	β	t	β	t
Equity Incentive	0.528**4	59.33	0.2894	2.77			0.223^{444}	2.64
DT					0.015^{*4}	0.803	0.005^{4*}	0.521
Growth	$(-0.002)^{444}$	(-4.26)	-0.12	(-0.90)	0.069^{*}	1.72	0.023^{4}	1.105
Lev	0.112^{44}	28.84	0.123	(-23.24)	0.556*44	6.56	0.327^{4*4}	7.56
Lnsize	$(-0.019)^{444}$	(-16.63)	-0.001	(-0.06)	0.879	49.7	0.589	41.342
Industry	control	control	control	control	control	control	control	control
Year	control	control	control	control	control	control	control	control

Note: DT stands for digital transformation, LEV stands for the proportion of independent directors, and Lnsize stands for enterprise size.

Impact of Equity Incentives on ESG Performance: According to the regression results of Model (1), the coefficient of equity incentives 0.428 was significantly positive at the 1% level, indicating that equity incentives had a significant positive impact on the ESG performance of enterprises. Hypothesis H1 was verified. This shows that the implementation of equity incentives can effectively encourage management to pay attention to the sustainable development of the enterprise and actively improve the ESG performance of the enterprise.

Impact of Equity Incentives on Digital Transformation: The regression results of Model (2) showed that the coefficient of equity incentives 0.289 was significantly positive at the

5% level, indicating that equity incentives had a significant positive promoting effect on the digital transformation of enterprises. Hypothesis H2 was supported. This means that management with equity incentives has more motivation to promote the digital transformation of the enterprise to enhance its competitiveness and long - term development ability.

Impact of Digital Transformation on ESG Performance: The regression results of Model (3) showed that the coefficient of digital transformation 0.015 was significantly positive at the 5% level, that is, digital transformation had a significant positive impact on the ESG performance of enterprises. Hypothesis H3 was established. This indicates that through digital transformation, enterprises can achieve better performance in the aspects of environment, social responsibility, and corporate governance, thereby improving ESG performance.

Test of the Mediating Effect of Digital Transformation: According to the mediating effect test process, first, the regression of Model (1) was carried out to obtain the total effect of equity incentives on ESG performance; then, the regression of Model (2) was carried out to obtain the impact of equity incentives on digital transformation; finally, the regression of Model (4) was carried out to obtain the combined impact of equity incentives and digital transformation on ESG performance. The results showed that in Model (4), the coefficient of equity incentives was still significantly positive, but the coefficient value was smaller than that in Model (1), and at the same time, the coefficient of digital transformation was also significantly positive. This indicates that digital transformation played a partial mediating role between equity incentives and ESG performance. Hypothesis H4 was verified. That is, equity incentives not only directly promoted the improvement of the ESG performance of enterprises but also indirectly improved the ESG performance of enterprises by promoting digital transformation.

4.4 Robustness Tests

Alternative Variable Measurement Methods: Different indicators were used to measure ESG performance, equity incentives, and digital transformation. For ESG performance, the rating results of other authoritative rating agencies were used for substitution; for equity incentives, the proportion of the value of equity incentives granted to senior executives in the total market value of the company was used to measure; for digital transformation, other digital - related indicators were selected for re - measurement. After re - performing the regression analysis, the results were basically the same as before, indicating the robustness of the research conclusions.

Endogeneity Treatment: Considering the possible endogeneity problems among equity incentives, digital transformation, and ESG performance, the instrumental variable method was used for treatment. The average level of equity incentives of other companies in the same industry was selected as the instrumental variable of the company's equity incentives. This instrumental variable was related to the company's equity incentive level but had no direct connection with the company's ESG performance and digital transformation. The two - stage least - squares (2SLS) method was used for regression analysis. The results showed that after controlling for endogeneity problems, the research conclusions still held.

Sample Selection Adjustment: To test whether the research conclusions were affected by sample selection, the sample was adjusted. On the one hand, the sample range was expanded to include more years of data; on the other hand, the sample range was narrowed, and only manufacturing enterprises were selected for research. After performing regression analysis on the adjusted samples respectively, the results showed that the research conclusions were robust.

5. Further Research and Analysis

5.1 Heterogeneity Analysis

Heterogeneity Analysis Based on Enterprise Scale: The sample companies were divided into two groups according to their size: large companies and small and medium-sized companies, and regression analysis was performed on each group. The results showed that in large companies, equity incentives have a more significant role in promoting ESG performance, and the mediating effect of digital transformation is also more obvious; while in small and medium-sized companies, although equity incentives and digital transformation also have a positive impact on ESG performance, the effect is relatively weak. This may be because large companies have more abundant resources

and stronger strength to implement equity incentives and promote digital transformation, thereby more effectively improving ESG performance.

Heterogeneity analysis based on industry nature: According to the different nature of the industry, the sample companies are divided into two groups: heavily polluting industries and non-heavy polluting industries. The study found that in heavily polluting industries, the mediating effect of digital transformation between equity incentives and ESG performance is more prominent. This is because heavily polluting industries face greater environmental pressure and regulatory requirements. Through digital transformation, companies can more effectively achieve energy conservation and emission reduction, optimize production processes, and thus improve ESG performance. In non-heavy polluting industries, the impact of equity incentives on ESG performance is more realized through other channels.

5.2 Mechanism Analysis

Further explore the specific mechanism by which digital transformation affects ESG performance. From the environmental dimension, through the analysis of corporate energy management data, it is found that digital transformation enables enterprises to monitor energy consumption in real time, promptly identify energy waste links, and optimize through intelligent control systems, thereby reducing energy consumption and carbon emissions. From the perspective of social responsibility, using data from corporate interactions with consumers, it is found that digital transformation enables companies to respond to consumer needs and complaints more quickly, improve consumer satisfaction, and also provide employees with a more convenient work platform, improving employee work efficiency and satisfaction. In the corporate governance dimension, research on internal corporate management processes shows that digital transformation has achieved real-time information sharing and collaborative office work, reduced management levels, and improved the scientific nature of decision-making and execution efficiency.

6. Research Conclusions and Policy Recommendations

6.1 Conclusions

This paper takes Chinese listed companies as the research object and empirically examines the relationship between equity incentives, digital transformation and ESG performance. The research results show that equity incentives have a significant positive impact on corporate ESG performance; equity incentives can promote corporate digital transformation; digital transformation also has a significant positive effect on corporate ESG performance, and digital transformation plays a partial mediating role between equity incentives and ESG performance. In addition, heterogeneity analysis found that enterprise size and industry nature affect the relationship between equity incentives, digital transformation and ESG performance. Mechanism analysis reveals that digital transformation improves the ESG performance of enterprises by optimizing energy management, strengthening interactions with stakeholders, and improving internal management efficiency.

6.2 Policy Recommendations

Enterprise level: Enterprises should fully recognize the important role of equity incentives in improving ESG performance and further improve the equity incentive mechanism. Reasonably determine the object, quantity and duration of equity incentives, incorporate ESG goals into the assessment system of equity incentives, and encourage management to pay more attention to the sustainable development of enterprises. At the same time, we should increase investment in digital transformation, actively introduce and apply advanced digital technologies, cultivate digital talents, improve the operational efficiency and management level of enterprises through digital transformation, and thus achieve the improvement of ESG performance.

Government level: The government should formulate relevant policies to encourage enterprises to implement equity incentives and promote digital transformation. For example, give certain tax incentives to enterprises that implement equity incentives to reduce the incentive costs of enterprises; increase support for the digital transformation of enterprises, set up special funds to support enterprises in carrying out digital projects, promote cooperation between enterprises and universities and scientific research institutions, and improve the digital innovation capabilities of enterprises.

In addition, the government should strengthen the supervision and guidance of the ESG performance of enterprises, improve the ESG information disclosure system, improve the transparency of corporate ESG information, and promote enterprises to actively fulfill their social responsibilities.

Regulatory agency level: Regulatory agencies should strengthen the supervision of equity incentives and ESG information disclosure and regulate the behavior of enterprises. Establish and improve the regulatory mechanism for equity incentives to prevent enterprises from using equity incentives to transfer benefits and other illegal behaviors. At the same time, strengthen the supervision of corporate ESG rating agencies, improve the fairness and accuracy of ESG ratings, and provide investors with a reliable reference basis.

6.3 Research Deficiencies and Prospects

Although this study has achieved certain results, it still has some deficiencies. First, when measuring digital transformation, although the indicators of digital investment and application are comprehensively considered, it may not be able to fully cover all aspects of enterprise digital transformation. Future research can further explore more comprehensive and accurate digital transformation measurement methods. Secondly, the research sample only selected listed companies in my country. In the future, the sample range can be expanded to include non-listed companies to improve the universality of the research conclusions. In addition, this article only explores the mediating role of digital transformation between equity incentives and ESG performance. Other possible mediating variables and moderating variables have not been studied in depth. Subsequent research can further expand the research perspective and enrich relevant theories.

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