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# The Impact of ESG Performance on Corporate Financial Performance: The Moderating Effect of Digital Level

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**Abstract**

In response to economic development, companies are striving to improve their financial performance in order to seek long-term growth and development. As a major player in market economic activities, corporations are constantly undergoing digital transformation. Its qualities

of technology, innovation, intelligence and uniqueness can enable companies to gain new competitive advantages and gradually become one of the important factors influencing ESG practices. The current study examines how ESG performance affects corporate financial performance using a two-way fixed-effects method employing a moderating effects framework. This study uses panel data from listed companies on the Shanghai and Shenzhen stock exchanges between 2014 and 2022 to investigate whether ESG performance could enhance corporate financial performance. The statistical results show that, the impact of ESG performance on corporate financial performance is moderated by three dimensions of digital level. Digital strategy, digital investment and digital staff all have significant, beneficial moderating effect on the relationship between ESG performance and corporate financial performance. The study adds to the body of knowledge in ESG performance and corporate financial performance by providing insights into the moderating effect of digital level that improve their financial performance.

**Keywords:** ESG performance, corporate financial performance, digital level, Two-way fixed effects model

## 1. Introduction

### *1.1 Introduction*

Countries around the world pay more and more attention to the performance of corporations in Environmental, Social and Governance aspects, namely corporate ESG performance (Chen et al., 2019). ESG conveys the sustainable development concept of corporations pursuing the unity of economic interests and social values, and provides a theoretical framework for corporations to realize their own sustainable development (Li et al., 2021).

In July 2018, China made the first legal requirement for ESG disclosure, requiring Chinese listed companies to disclose environmental, social and corporate governance information. Starting from 2020, the Chinese government has continued to publish *China ESG Development white paper*. It actively advocates the concept of responsible investment and promotes the development of ESG practices, which in turn promotes the green and sustainable development of China's economy. Existing studies have shown that good ESG performance enhances corporate financial performance (Atan et al., 2018) and corporate value (Aboud & Diab, 2018).

Driven by a number of ESG-related policy documents from the Chinese government, starting from 2022, a wave of ESG disclosures will be made by Chinese listed companies. As of October 2022, among A-share listed companies, a total of 1,467 companies disclosed ESG reports, sustainability reports, or social responsibility reports, accounting for about 30% of A-share listed companies (2022 China A-share company ESG rating analysis report, 2022). This shows that there is still a lot of room for progress in ESG disclosure for Chinese listed companies.

In July 2015, the implementation of *the State Council's Guiding Opinions on Actively*

*Promoting the "Internet Plus" Initiative* officially marked China's entry into a new era of digital development. In 2022, the scale of China's digital economy reached 50.2 trillion yuan, the total amount of which ranked second in the world, and has become an important engine for China to stabilize growth and promote transformation (Digital China Development Report (2022), 2023). With the continuous emergence of new technologies, new models and new business models, digitalization has gradually become an important factor in driving corporate ESG performance.

Therefore, this study investigates the impact of ESG performance on corporate financial performance based on Chinese listed companies, using digital level as the moderating variable. Does ESG performance have an impact on corporate financial performance? Does digital level have a moderating effect on the relationship between ESG performance and corporate financial performance? These are issues that need to be urgently explored by companies in the process of sustainable development.

### *1.2 Research Gap*

Most previous studies have focused on the relationship between ESG performance and corporate financial performance. However, there is less literature linking digital level and the two. At present, there is no effective consensus on the mechanism of digitalization to promote corporate financial performance, which provides a new research perspective for this study.

This study examines the moderating effect of digital level on the relationship between ESG performance and corporate financial performance, so as to continuously supplement and enrich the research on financial performance. Moreover, it innovatively discusses the moderating effect of digital level from three dimensions: digital strategy, digital investment and digital staff. This further deepens the research on the relationship between ESG performance and corporate financial performance, and also provides certain reference and guiding significance for corporate digital transformation and ESG investment.

### *1.3 Research Questions*

This study investigates the relationship between ESG performance and corporate financial performance based on the moderating effect of digital level. It has four main research questions as follows:

(1) Does ESG performance affect corporate financial performance?

(2) Is there a moderating effect of digital strategy on the relationship between ESG performance and corporate financial performance?

(3) Is there a moderating effect of digital investment on the relationship between ESG performance and corporate financial performance?

(4) Is there a moderating effect of digital staff on the relationship between ESG performance and corporate financial performance?

## 2. Literature Review and Hypotheses Development

### *2.1 The Impact of ESG Performance on Corporate Financial Performance*

Empirical research on ESG dates back to the 1870s. Earlier studies concluded that the impact of ESG on corporate financial performance and value is uncertain or even negative. Friedman (1970) indicates that environmental investments or social responsibility activities that exceed legally binding minimum standards will incur additional costs and thus reduce corporate value. Some scholars have also suggested that the relationship between ESG and corporate performance is not significant (Aupperle, Carroll & Hatfield, 1985; Griffin & Mahon,1997; Van Beurden & Gössling, 2008; Hoepner & McMillan, 2009). By combing through more than 2,000 empirical studies and a number of review studies on the relationship between environmental, social, and governance (ESG) and corporate financial performance since the 1970s, Friede, Busch and Bassen (2015) find that the results of about 90% of the studies show a non-negative relationship between ESG and corporate financial performance.

According to Aboud (2018), listed companies with higher ESG index have higher financial performance, and ESG index ranking is positively correlated with corporate financial performance. Ionescu, Firoiu and Pirvu (2019) use a sample of 73 listed tourism companies around the world, and the results of the study support the value enhancement theory, which states that environmental, social, and governance factors are conducive to improving corporate financial performance.

The sustainability theory suggests that the development model pursued by the ESG concept is consistent with sustainable development. Attig, Driss (2020) argue that ESG performance not only positively contributes to a company's credit rating, but also improves the availability of capital and promotes its sustainability. Bruna, Loprevite and Raucci (2022) examine the impact of environmental, social and governance performance on financial performance using a time-lagged panel regression model, collecting data from 350 European listed companies from 2014 to 2019 for regression analysis, and finding a significant positive correlation between ESG performance of listed companies and their financial performance.

Stakeholder theory suggests that active corporate social responsibility contributes to a favorable image and reputation, reduces overall transaction costs, and increases stakeholder satisfaction, which in turn improves financial performance (Martos, Cortes & Jimenez, 2019; Ali, Danish & Asrar, 2020). Similarly, Zhang and Wei (2021) empirically investigate the impact of corporate social responsibility on corporate performance by utilizing the panel data of 342 Chinese A-share listed companies from 2010 to 2017, and the results showed that corporate social responsibility is conducive to the accumulation of intangible capitals, such as reputation and brand, which in turn enhances the comprehensive competitiveness of companies, and thus significantly improves their financial performance. Based on the discussion above, the following hypothesis is proposed:

H1:ESG performance is positively correlated with corporate financial performance.

### *2.2 The Moderating Impact of Digital Level*

Technological innovation theory suggests that equipment and technology upgrades brought about by digital transformation can help companies establish resource barriers and form sustainable competitive advantages (Cao, Li & Hu, 2023). Digital technology can effectively help corporations record and process information in production and operation, thereby continuously improving their ESG performance and ultimately their financial performance and sustained competitiveness.

Principal-agent theory suggests that digital transformation contributes to the quality of internal control in corporations (Zhang & Yang, 2022). Companies with good ESG performance have more legally compliant investment and operating systems. The management of corporations that take the initiative to carry out environmental risk management has a strong sense of environmental protection, and managers and shareholders will make decisions on the basis of the strategic goal of long-term development, thus reducing the principal-agent risk (Li et al., 2021).

Stakeholder theory suggests that digital transformation can improve the quality, authenticity, and timeliness of ESG disclosure (Qi & Xu, 2023; Hu, Han & Zhong, 2023), which can help stakeholders to have timely and comprehensive information about the firms, which can in turn alleviate their financing constraints. In order to retain more long-term investors, digitization further improves the ways and means for corporate investors to access relevant information and promotes the transparency and standardization of ESG disclosure.

Corporate digital transformation is a higher stage of information technology transformation, mostly manifested in three aspects: digital development strategy, digital capital investment and digital human capital construction. In this study, with reference to Li (2021), Shi (2020) and Wang et al. (2017), corporate digital level is classified into three dimensions: digital strategy, digital investment and digital staff. Hence, it leads to the following hypothesis:

H2: Digital strategy has a positive moderating effect on the relationship between ESG performance and corporate financial performance.

H3: Digital investment has a positive moderating effect on the relationship between ESG performance and corporate financial performance.

H4: Digital staff has a positive moderating effect on the relationship between ESG performance and corporate financial performance.

### *2.3 Research Framework*

Figure 1 shows the research framework formed in this study by reviewing past theoretical and empirical research.

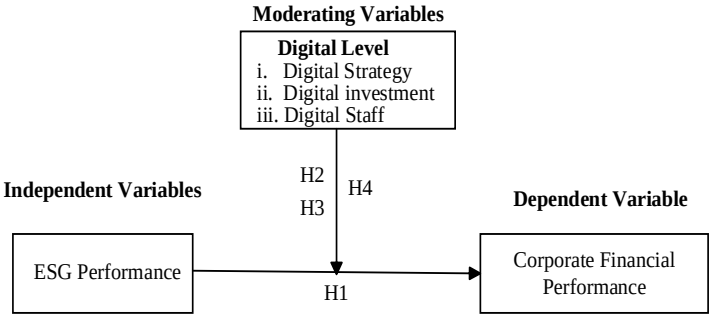


Figure 1. Research Framework

## 3. Research Methodology

### *3.1 Data and Sample*

This study took A-share listed companies in the Shanghai and Shenzhen stock markets from 2014 to 2022 as the research sample. The secondary data were collected from Wind Database and CSMAR Database.

The industry of listed companies shall be determined according to the industry code and industry category code stipulated in the *Guidelines for Industry Classification of Listed Companies (Revised in 2012)* of the CSRC.

The following is how the data were handled: the sample of listed companies in the financial industry were disqualified; *ST, ST corporations were disqualified; samples with missing data were disqualified; samples with asset-liability ratio greater than 1 were disqualified; All continuous variables were winsorized at the 1% and 99% levels.

Finally, there were 22 191 observations were finally obtained , which in turn led to the construction of panel data. The study employs Stata18 software for regression analysis.

### *3.2 Variable Measurement*

The dependent variable in this study is corporate financial performance (CFP). Measured by Return on assets (ROA) with reference to Chen (2022), Duque-Grisales, E. and Aguilera-Caracuel, J. (2019).

The dependent variable is ESG performance (ESG). With reference to the data sources of Xie et al. (2022), Wang et al. (2022) and Song et al. (2022), the data are assigned the score of 1-9 based on the Huazheng ESG ratings of nine grades, from next to best, namely, C, CC, CCC, B, BB, BBB, A, AA, and AAA.

The moderating variable is digital level. Its three dimensions are digital strategy (DSY), digital investment (DIT) and digital staff (DSF). Among them, digital strategy mainly refers to the treatments of Yin et al. (2023), Wu et al. (2021) and Chen et al. (2020); digital investment mainly refers to the treatment of Huang (2021); digital staff mainly refers to Li

(2021) and Shi (2020).

Control variables include corporate size (SIZE), corporate growth (GRO), financial leverage (LEV), listed years (AGE), loss or not (LOSS) and property nature (PN). All variables are summarized and defined in Table 1.

Table 1. Description of the Variables

| Variables | Variables Definitions | Symbols | Source |
|---|---|---|---|
| *Dependent Variable* | Corporate Financial Performance | CFP | Return on assets (ROA) |
| *Independent Variable* | ESG Performance | ESG | Assignment based on Huazheng ESG ratings |
| | Digital Strategy | DSY | By calculating the total frequency of words in the text dictionary of "AI Technology", "Big Data Technology", "Blockchain Technology", "Cloud Computing Technology", and "Digital Technology Applications", add 1 and take logarithmic processing. |
| Moderating Variables | Digital Investment | DIT | Digital-related intangible assets/intangible assets |
| | Digital Staff | DSF | R&D technicians/number of corporate employees* 100% |
| Control Variables | Corporate Size | SIZE | LN (Total company assets) |
| | Corporate Growth | GRO | increase rate of business revenue |
| | Financial Leverage | LEV | Total liabilities/total assets |
| | Listed Years | AGE | LN (current year – listing year + 1) |
| | Loss or Not | LOSS | 1 indicates Loss-making company, 0 indicates paying company |
| | Property Nature | PN | 1 indicates SOEs, 0 indicates non-state-owned enterprises |

### *3.3 Models Specification*

This study uses fixed effects model to go for regression. Considering the large number of individuals in the sample, the use of individual fixed effects in the model results in the loss of

more degrees of freedom and may lead to biased regression results. Therefore, industry fixed effects and year fixed effects are added to the model with reference to Wang et al. (2022) and Xie et al. (2022).

In order to investigate if there is a positive correlation between ESG performance and corporate financial performance and the moderating effect of digital level, this study develops the following research paradigm.

$$CFP_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 Control_{i,t} + u + v + \varepsilon_{i,t} \quad \text{.....(1)}$$

$$CFP_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 DSY_{i,t} + a_3 ESG_{i,t} * DSY_{i,t} + \alpha_4 Control_{i,t} + u + v + \varepsilon_{i,t} \text{.....(2)}$$

$$CFP_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 DIT_{i,t} + a_3 ESG_{i,t} * DIT_{i,t} + \alpha_4 Control_{i,t} + u + v + \varepsilon_{i,t} \text{.....(3)}$$

$$CFP_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 DIT_{i,t} + a_3 ESG_{i,t} * DIT_{i,t} + \alpha_4 Control_{i,t} + u + v + \varepsilon_{i,t} \text{.....(4)}$$

where

$CFP_{i,t}$ denotes the financial performance of corporation i in year t; $ESG_{i,t}$ denotes the ESG performance of corporation i in year t; $DSY_{i,t}$ denotes the digital strategy of corporation i in year t; $ESG_{i,t}$*$DSY_{i,t}$ denotes the interaction term between ESG performance and digital strategy of corporation i in year t; $DIT_{i,t}$ denotes the digital investment of corporation i in year t; $ESG_{i,t}$*$DIT_{i,t}$ denotes the interaction term between ESG performance and digital investment of corporation i in year t; $DSF_{i,t}$ denotes the digital staff of corporation i in year t; $ESG_{i,t}$*$DSF_{i,t}$ denotes the interaction term between ESG performance and digital staff of corporation i in year t; $Control_{i,t}$ denotes all control variables (including corporate size, corporate growth, financial leverage, listed years, loss or not and property nature) of corporation i in year t; u is the industry dummy variable; v is the yearly dummy variable; $a_0$ denotes the intercept of the equation; a1-a4 denote the coefficients of each variable; and $\varepsilon_{i,t}$ is the error term.

## 4. Analysis and Results

### *4.1 Descriptive Statistics*

The descriptive statistics for all variables are shown in Table 2. For dependent variable, corporate financial performance (CFP) has a mean of 0.0389 and a median of 0.0399, with a standard deviation of 0.0646. This suggests that financial performance of different listed

companies varies significantly.

For independent variable, ESG performance (ESG) shows a standard deviation of 1.0882 along with a median and mean of 4 and 4.1737, correspondingly. This suggests that among the sample companies, they have different levels of acceptance of ESG concepts, resulting in differences in the level of corporate ESG disclosure.

For moderating variables, the maximum and minimum values of digital strategy (DSY) are 5.2883 and 0, and the median and mean values are 1.6094 and 1.7414, respectively. These indicate that the overall level of digital strategy of the sample companies is low and varies widely. Especially for companies that lack the relevant resources and technology, it is necessary to continuously improve digital level. The maximum and mean values of digital investment (DIT) are 1 and 0.0955 respectively. This implies that the overall level of digital investment in the sample companies is low. The maximum and minimum values of digital staff (DSF) are 0.6890 and 0.0032, and the median and mean values are 0.1296 and 0.1611, respectively. This represents that the digital staff of the sample companies are quite different.

For control variables, the mean value of corporate size (SIZE) is 22.2577 with a standard deviation of 1.2581, showing that the true size gap between companies is reduced by taking logarithms. The standard deviation of listed years (AGE) is 0.9084. The main reason is that China's A-share market only has a history of more than 30 years, and the age of each sample company is closer after the data is taken in logarithmic terms. Corporate growth (GRO) shows that the growth rate of business revenue per year, with an average of 0.1436 and a standard deviations of 0.3003. all of other control variables are within a reasonable range.

Table 2. Results of Descriptive Statistics

| Variables | N | Mean | SD | Min | Median | Max |
|---|---|---|---|---|---|---|
| CFP | 22 191 | 0.0389 | 0.0646 | -0.2524 | 0.0399 | 0.2047 |
| ESG | 22 191 | 4.1737 | 1.0882 | 1 | 4 | 8 |
| DSY | 22 191 | 1.7414 | 1.4346 | 0 | 1.6094 | 5.2883 |
| DIT | 22 191 | 0.0955 | 0.2087 | 0 | 0.0175 | 1 |
| DSF | 22 191 | 0.1611 | 0.1313 | 0.0032 | 0.1296 | 0.6890 |
| SIZE | 22 191 | 22.2577 | 1.2581 | 20.1071 | 22.0639 | 26.2090 |
| AGE | 22 191 | 2.0288 | 0.9084 | 0 | 2.1972 | 3.3673 |
| GRO | 22 191 | 0.1436 | 0.3003 | -0.4864 | 0.1043 | 1.4803 |
| LEV | 22 191 | 0.4015 | 0.1901 | 0.0628 | 0.3934 | 0.8608 |
| LOSS | 22 191 | 0.1141 | 0.3179 | 0 | 0 | 1 |
| PN | 22 191 | 0.2720 | 0.4450 | 0 | 0 | 1 |

### *4.2 Correlation Analysis*

Considering the possible problem of multicollinearity in examining the impact of ESG performance on corporate financial performance, correlation analysis is conducted in this study. The coefficients for correlation between each of the variables are presented in Table 3. From the results of the correlation test, it can be seen that the correlation coefficients between the variables are low and do not exceed the maximum limit of 0.80. As a result, the variables chosen have less impact on the disturbance of the regression results.

Table 3. Coefficient of the Correlation

| | CFP | ESG | DSY | DIT | DSF | SIZE | AGE | GRO | LEV | LOSS | PN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CFP | 1 | | | | | | | | | | |
| ESG | 0.225*** | 1 | | | | | | | | | |
| DSY | -0.053*** | 0.071*** | 1 | | | | | | | | |
| DIT | -0.051*** | -0.0110 | 0.362*** | 1 | | | | | | | |
| DSF | -0.006 | 0.020*** | 0.371*** | 0.292*** | 1 | | | | | | |
| SIZE | 0.010 | 0.171*** | 0.057*** | -0.118*** | -0.199*** | 1 | | | | | |
| AGE | -0.221*** | -0.109*** | 0.018*** | -0.089*** | -0.119*** | 0.467*** | 1 | | | | |
| GRO | 0.300*** | 0.040*** | 0.013* | 0 | 0.034*** | 0.032*** | -0.113*** | 1 | | | |
| LEV | -0.350*** | -0.084*** | 0.003 | -0.058*** | -0.196*** | 0.508*** | 0.332*** | 0.019*** | 1 | | |
| LOSS | -0.688*** | -0.172*** | 0.044*** | 0.039*** | 0.027*** | -0.057*** | 0.137*** | -0.231*** | 0.183*** | 1 | |
| PN | -0.084*** | 0.062*** | -0.082*** | -0.056*** | -0.141*** | 0.386*** | 0.429*** | -0.095*** | 0.270*** | 0.010 | 1 |

Note: * p <0.1, ** p < 0.05, *** p < 0.01

### *4.3 Regression Results and Analysis*

#### 4.3.1 The Impact of ESG Performance on Corporate Financial Performance

Fixed Effects Model (FEM) was used in this study to examine the assumptions. Table 4 shows the regression analysis results of the impact of ESG performance on corporate financial performance. The direct impact of ESG performance on corporate financial performance is represented by Model (1) in Table 4.

ESG performance has a statistically significant, beneficial impact on corporate financial performance at the 1% level and the coefficient of ESG is 0.0037. it means 1% increase in ESG performance leads to 0.0037% increase in corporate financial performance. better ESG performance will create higher corporate financial performance. The reason for this is that companies with good ESG performance send good signals to the workforce, which in turn has better talent; by signaling to customers that the company has a good reputation and is actively

taking responsibility, it is easier to gain their trust and thus win a larger share of the market. ESG performance and corporate financial performance are significantly and positively correlated, testing hypothesis H1.

4.3.2 The Moderating Impact of Digital Level

The moderating impact of digital level on the relationship between ESG performance and corporate financial performance is represented by Model (2) to Model (4) in Table 4.

Model (2) represents regression analysis with the moderating variable of digital strategy. Digital strategy has statistically significant, beneficial moderating effect on the relationship between ESG performance and corporate financial performance. Companies implement digital strategies to improve the way investors access corporate information. This promotes standardization and transparency of ESG disclosure and increases the reputational advantage of corporations, thus further improving their financial performance. Digital strategy has a positive moderating effect on the relationship between ESG performance and corporate financial performance, testing hypothesis H2.

Model (3) shows regression analysis with the moderating variable of digital investment. Digital investment has statistically significant, beneficial moderating effect on the relationship between ESG performance and corporate financial performance. Companies make digital investments to further enhance the authenticity of their ESG information, which is favored by various external stakeholders. For example, obtaining the recognition of the bank can reduce the cost of financing and improve the financing ability of the corporations, which in turn provides the corporation with a potential comparative advantage (Ma et al., 2017; Tan et al., 2013), thus improving corporate financial performance. Digital investment has a positive moderating effect on the relationship between ESG performance and corporate financial performance, testing hypothesis H3.

Model (4) demonstrates regression analysis with the moderating variable of digital staff. Digital staff has statistically significant, beneficial moderating effect on the relationship between ESG performance and corporate financial performance. The role of ESG performance in improving corporate financial performance is stronger for corporations with higher digital staff. Digital staff has a positive moderating effect on the relationship between ESG performance and corporate financial performance, testing hypothesis H4.

Table 4. Main Tests of Regression and Moderation

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | CFP | CFP | CFP | CFP |
| ESG | 0.0037*** | 0.0038*** | 0.0037*** | 0.0038*** |
| | (9.6009) | (7.9468) | (7.9691) | (8.2779) |
| DSY | | -0.0014*** | | |
| | | (-10.0087) | | |
| ESGDSY | | 0.0005** | | |
| | | (2.3191) | | |
| DIT | | | -0.0031** | |
| | | | (-2.2865) | |
| ESGDIT | | | 0.0030*** | |
| | | | (3.8444) | |
| DSF | | | | -0.0123 |
| | | | | (-1.6805) |
| ESGDSF | | | | 0.0067*** |
| | | | | (2.9823) |
| SIZE | 0.0082*** | 0.0084*** | 0.0082*** | 0.0082*** |
| | (7.6468) | (7.9574) | (7.5976) | (8.0230) |
| GRO | 0.0341*** | 0.0342*** | 0.0340*** | 0.0343*** |
| | (9.6563) | (9.8600) | (9.6151) | (9.3411) |
| LEV | -0.0989*** | -0.0988*** | -0.0988*** | -0.0998*** |
| | (-8.9402) | (-8.9423) | (-8.9319) | (-8.8820) |
| AGE | -0.0067*** | -0.0067*** | -0.0068*** | -0.0068*** |
| | (-15.8836) | (-16.3385) | (-15.7358) | (-16.2235) |
| LOSS | -0.1152*** | -0.1149*** | -0.1151*** | -0.1150*** |
| | (-19.8204) | (-19.6689) | (-19.8489) | (-19.5813) |
| PN | -0.0002 | -0.0006 | -0.0002 | -0.0003 |
| | (-0.2416) | (-1.0414) | (-0.3064) | (-0.4023) |
| _cons | -0.0980*** | -0.1002*** | -0.0970*** | -0.0942*** |
| | (-4.5397) | (-4.6183) | (-4.3852) | (-4.7823) |
| Time effect | yes | yes | yes | yes |
| Industry effect | yes | yes | yes | yes |
| *N* | 22191 | 22191 | 22191 | 22191 |
| adj. $R^2$ | 0.580 | 0.581 | 0.580 | 0.581 |

Note: t statistics in parentheses; * p <0.1, ** p < 0.05, *** p < 0.01

*4.4 Robustness Tests*

4.4.1 Endogeneity Test

This study used the instrumental variable estimation technique to explore the potential endogeneity between ESG performance and corporate financial performance. In accordance with previous studies, the instrumental variable that were used for the regression calculation was the lagging one-period ESG (L.ESG). In this study, two-stage least squares (2SLS) regression was adopted, and the regression results of the first and second stages are shown in Table 6.

The regression results of the first stage show that the instrumental variable is significantly positively correlated with corporate ESG performance at the 1% level, and the regression coefficient of the second stage of the regression of ESG performance is still significantly positive at the 1% level.

For the lagging one-period the ESG (L.ESG) , there is no over identifying constraints and weak indirect factors, demonstrating the instrumental variable is effective for the current research. This suggests that the results that ESG performance has a positive impact on corporate financial performance still holds after considering endogeneity issues.

Table 6. Endogeneity Test

| | (1) | (2) |
|---|---|---|
| | First Stage | 2SLS |
| ESG | | 0.004*** |
| | | (5.73) |
| L.ESG | 0.582*** | |
| | (89.29) | |
| Control Variables | Yes | Yes |
| Time effect | Yes | Yes |
| Industry effect | Yes | Yes |
| N | 18068 | 18068 |
| Adj. $R^2$ | 0.440 | 0.576 |
| Kleibergen-paap rk LM statistics (p-Val) | | 0 |
| Kleibergen-paap rk Wald F statistics | | 7973.03 |
| Hansed J statistics | | 0 |

4.4.2 Alternative Measurement for Dependent Variable

In order to ensure the authenticity and robustness of the above findings, this study further selects Return on equity (ROE) as an alternative dependent variable for testing.

The results of empirical research, which satisfy the 1% statistical significance test, are displayed in Model (1) of Table 5. They suggest that ESG performance can have an advantageous effect on corporate financial performance. This is consistent with the above findings.

As shown in Model (2) to Model (4) of Table 5, digital strategy, digital investment and digital staff all have statistically significant, beneficial moderating effect on the relationship between ESG performance and corporate financial performance at the 1% level. This supports the above findings.

Table 5. Alternative Measurement for Dependent Variable

| | (1) CFP | (2) CFP | (3) CFP | (4) CFP |
|---|---|---|---|---|
| ESG | 0.0064*** | 0.0065*** | 0.0065*** | 0.0065*** |
| | (12.0455) | (11.1059) | (9.8579) | (12.7982) |
| DSY | | -0.0014*** | | |
| | | (-3.6802) | | |
| ESGDSY | | 0.0015*** | | |
| | | (3.8847) | | |
| DIT | | | -0.0004 | |
| | | | (-0.1854) | |
| ESGDIT | | | 0.0124*** | |
| | | | (4.5965) | |
| DSF | | | | -0.0232* |
| | | | | (-1.7765) |
| ESGDSF | | | | 0.0176*** |
| | | | | (4.4569) |
| SIZE | 0.0192*** | 0.0193*** | 0.0192*** | 0.0190*** |
| | (16.9434) | (17.8454) | (17.3806) | (19.0730) |
| GRO | 0.0699*** | 0.0702*** | 0.0699*** | 0.0704*** |
| | (9.4670) | (9.5483) | (9.4143) | (9.2013) |
| LEV | -0.1075*** | -0.1076*** | -0.1075*** | -0.1093*** |
| | (-10.9480) | (-10.8038) | (-11.0073) | (-10.7238) |
| AGE | -0.0137*** | -0.0138*** | -0.0137*** | -0.0138*** |
| | (-19.1889) | (-19.8465) | (-18.6928) | (-19.8344) |
| LOSS | -0.2409*** | -0.2405*** | -0.2409*** | -0.2405*** |
| | (-20.8850) | (-20.7929) | (-20.9275) | (-20.7943) |
| PN | -0.0053*** | -0.0058*** | -0.0055*** | -0.0054*** |
| | (-3.3938) | (-3.9848) | (-3.6001) | (-3.6049) |
| _cons | -0.2966*** | -0.2984*** | -0.2974*** | -0.2898*** |
| | (-12.7960) | (-12.6948) | (-12.1452) | (-14.8575) |
| Time effect | yes | yes | yes | yes |
| Industry effect | yes | yes | yes | yes |
| *N* | 22232 | 22232 | 22232 | 22232 |
| adj. $R^2$ | 0.566 | 0.567 | 0.567 | 0.567 |

Note: t statistics in parentheses; * p <0.1, ** p < 0.05, *** p < 0.01

### *4.5 Additional Research: Analysis of Heterogeneity*

This section classifies corporations according to region, property nature, high technology and pollutants. It utilizes subsample regression models to explore the various effects of ESG performance on the financial performance of each type of corporations.

#### 4.5.1 Regional Heterogeneity Analysis

Since the reform and opening up, China has implemented a regional economic policy tilted towards the east, given the good foundation and high investment efficiency of the eastern region.

As a result, corporations in the eastern region have a more significant and positive impact on corporate financial performance in terms of ESG performance. As seen in Table 7, model (1) and (2) of panel A present the empirical research's results, which are statistically significant at the 1% level and 5% level, respectively.

Table 7. Regional Heterogeneity Assessment

| Panel A | (1) East | (2) West | (3) State-Owned | (4) Non-State-Owned |
|---|---|---|---|---|
| ESG | 0.0035*** | 0.0027** | 0.0010 | 0.0044*** |
| | (6.1418) | (2.0629) | (1.0946) | (7.6276) |
| Cons | -0.1136*** | -0.1699*** | -0.1016*** | -0.1662*** |
| | (-7.5225) | (-4.2801) | (-4.2093) | (-9.4434) |
| Control Variables | Yes | Yes | Yes | Yes |
| Time effect | Yes | Yes | Yes | Yes |
| Industry effect | Yes | Yes | Yes | Yes |
| N | 16342 | 3328 | 6047 | 16206 |
| Adj. $R^2$ | 0.541 | 0.494 | 0.473 | 0.546 |

| Panel B | (1) High-Tech | (2) Non-High-Tech | (3) Polluting | (4) Non-Polluting |
|---|---|---|---|---|
| ESG | 0.0041*** | 0.0017** | 0.0016 | 0.0041*** |
| | (6.9073) | (1.9857) | (1.6153) | (7.2880) |
| Cons | -0.1040*** | -0.1824*** | -0.1456*** | -0.1177*** |
| | (-6.6438) | (-7.3775) | (-5.9714) | (-7.2013) |
| Control Variables | Yes | Yes | Yes | Yes |
| Time effect | Yes | Yes | Yes | Yes |
| Industry effect | Yes | Yes | Yes | Yes |
| N | 14985 | 7268 | 4960 | 17294 |
| Adj. $R^2$ | 0.532 | 0.532 | 0.505 | 0.537 |

Note: t statistics in parentheses; * p <0.1, ** p < 0.05, *** p < 0.01

### 4.5.2 Heterogeneity Analysis of Property Nature

Regression analysis is done in the present research following classifying companies into either state-owned or non-state-owned based on property nature. Model (3) and (4) of panel A in Table 7 present the results. It shows that ESG performance improves corporate financial performance in the non-state-owned enterprises at the 1% level. Nevertheless, among state-owned enterprises, ESG performance has no statistically significant effect on corporate financial performance. Possibly because of their natural ties with the government, state-owned enterprises are more likely to receive government funding support and loans from financial institutions, and their financing costs are lower. However, non-state-owned enterprises can only work on ESG performance in an attempt to send positive signals to the outside world, alleviate financing constraints, and thus improve corporate financial performance.

### 4.5.3 Heterogeneity Analysis of High-Tech Level

In order to further examine whether the impact of ESG on corporate financial performance presents industry differences, this study divides the sample into high-tech companies and non-high-tech companies and conducts a subsample regression. Model (1) and (2) of panel B in Table 7 present the results. The empirical findings indicate that the correlation coefficients of ESG performance are substantially positive at the 1% and 5% levels, respectively. These suggest

that ESG performance supports the financial performance of two kinds of companies. Moreover, ESG performance enhances the financial performance of high-tech group more significantly than that of non-high-tech group. The high-tech industry, with its long payback period and high product barriers, has a higher sensitivity to ESG performance driving corporate financial performance.

4.5.4 Heterogeneity Analysis of Pollution Level

The study classifies the sample into polluting and non-polluting companies and performs a subsample regression. Model (3) and (4) of panel B in Table 7 present the results. The empirical findings demonstrate that the coefficient of ESG performance is positive and significant at the 1% level for non-polluting companies. But for polluting groups, the effect is not significant. In the context of ecological civilization construction, compared with polluting group, non-pollution group has more energy and funds to optimize their environmental management strategies, improve their ESG performance, and thus improve their financial performance.

## 5. Discussion and Conclusion

The study took 3 839 Chinese A-share listed companies in Shanghai and Shenzhen from 2014 to 2022 as the research sample. It examined the relationship between ESG performance and corporate financial performance using panel data. The conclusions of the study are as follows. First, ESG performance has a positive effect on corporate financial performance. Second, digital strategy has a positive moderating effect on the relationship between ESG performance and corporate financial performance. Third, digital investment has a positive moderating effect on the relationship between ESG performance and corporate financial performance. Fourth, digital staff has a positive moderating effect on the relationship between ESG performance and corporate financial performance. Fifth, there are other aspects that determine the way ESG performance influences corporate financial performance, including the region, property nature, high-tech level and pollution level. More impacted than other groups are the eastern area, non-state-owned, high-tech and non-polluting companies.

The study offers empirical support for the claim that corporate financial performance can be enhanced by the improvement of ESG performance with the moderating effect of digital level. Corporations can use this finding as a guide to implement corporate financial performance and carry out digital transformation. ESG is an effective path to promote the coordinated development of economy and ecological environment, and it is also a key driving force to realize the “dual carbon” goal. According to the requirement of sustainability, improving corporate ESG performance and digital transformation is becoming more and more important. Additionally, the study provides empirical support for policy measures intended to encourage company ESG advances and sustainability economic growth.

There are some limitations of the study: First, due to the availability of data, this study only takes Chinese A-share listed companies in Shanghai and Shenzhen as samples, and does not study non-listed companies. China's non-listed companies are also very large and their ESG

performance is not necessarily inferior to that of listed companies. Second, each country has a different economic situation and the results of this study may not be applicable to other countries. Nonetheless, we have always argued that there is a link between ESG performance, digital level and financial performance of corporations in different countries.

Based on the findings, this study suggests the sample could be expanded in future research. It includes listed companies from different countries in order to compare and analyze the relationship between ESG performance and corporate financial performance of listed companies from different countries. Moreover, the independent, dependent and moderating variables in this study are all corporation-level variables, which are relatively micro. Future research could examine the impact of macro factors on ESG performance and corporate financial performance.

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**Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## Data sharing statement

No additional data are available.

## Open access



## Copyrights



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