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Research on the Impact of Digital Finance Development on ESG Performance of Enterprises

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Abstract: *ESG performance is an important indicator to measure the level of sustainable development of enterprises. Digital finance, as a new financial service model, may be of great significance to ESG performance. Based on the data of China's A-share listed companies from 2011 to 2020, this artical empirically investigates the role of digital finance development on enterprise ESG performance. The study found that digital finance can improve the ESG performance of enterprises. After endogenous treatment and robustness test, the conclusion is still valid. The research in this artical enriches the influence scope and effect of digital finance development, and provides useful thinking for giving play to the practical value of ESG.*

Keywords: *Digital finance; ESG performance; Endogenous test; robustness check*

1. Introduction

China's economy has entered the new normal stage, and the concept of green development and sustainable development has become the new trend of current economic development. Therefore, the evaluation system of non-financial indicators has received more and more attention from all walks of life. ESG indicators integrate public interests into the company's value system by strengthening environmental friendliness, social responsibility and corporate governance, and promote the integration of economic value and social value pursued by enterprises with the concept of sustainable development.

With the development of emerging technologies such as big data, blockchain and Internet of things, traditional financial services and digital technology have been deeply integrated, giving birth to the new model of digital finance. In this context, this artical takes China's A-share listed companies from 2011 to 2020 as the research sample to explore whether the development of digital finance can improve the ESG performance of enterprises. This artical attempts to clarify the relationship between the development of digital finance and the performance of enterprises' ESG, so as to provide empirical reference for listed companies to improve their ESG performance and enhance their sustainable development ability.

2. Literature review

The concept of ESG is derived from ethical investment and responsible investment. After more than 30 years of development, it has gradually been embedded in enterprise development strategy and operation management. Scholars have carried out a lot of theoretical and empirical research. Li Yan et al. (2021) found that there was a significant positive relationship between the environmental disclosure behavior of enterprises and the abnormal return rate of stocks[1]; Xu Lin et al. (2021) found that environmental information disclosure and green innovation activities can slow down corporate financing constraints and enhance corporate development performance[2]; Xia Wenlei et al. (2021) proved that green technology innovation of enterprises can promote the long-term performance of enterprises. At present, most of the domestic and foreign literatures prove that enterprises' improvement of ESG performance has a positive effect on enterprise value.

Scholars have studied the economic consequences of digital finance and digital technology. Zhang Chao et al. (2022) took Zhejiang Province as an example and found that the development of digital finance can significantly promote the high-quality development of real enterprises and play a role in enhancing quality and efficiency[3]. Abbasi et al (2021) found that the application of financial

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technology is conducive to improving the efficiency of enterprises through empirical analysis of SME data from 22 countries[4].

At present, there have been many studies on the economic consequences of enterprise ESG performance, and few literatures have paid attention to the influencing factors of enterprise ESG performance. However, under the requirements of green development, compared with financial performance, the comprehensive reflection of environmental, social and governance levels is more accurate. Based on this, based on the background of China's digital economy, it is of certain theoretical value and practical significance to explore the mechanism and impact path of digital Inclusive Finance Development on enterprise ESG performance.

3. Theoretical analysis and research hypothesis

The enterprise ESG evaluation system includes environment, social responsibility and governance, and focuses on the unified development of the enterprise's internal environment and the social external environment. When the behavior of the enterprise conforms to the value concept and social norms, it can obtain the support of the government, social organizations and other stakeholders, and then obtain more resources to facilitate the development of the enterprise. Therefore, enterprises have the motivation and willingness to practice ESG activities and improve ESG performance.

Finance is an important part of the development of micro enterprises. With the deep coupling of technology and finance, digital finance came into being. Its scientific and technological nature and inclusive nature provide various financial support for real enterprises. Through the innovation of data and financial products, we can lower the financial service threshold of real enterprises, improve the innovative financing environment of enterprises, strengthen the innovation ability of enterprises, increase the investment in green technology research and development, and drive the green transformation and upgrading of enterprises, so as to improve environmental performance.

Based on the above analysis, this paper puts forward the research hypothesis: given other equal conditions, the development of digital finance will promote the performance of enterprise ESG.

4. Research design

4.1. Model establishment

To test the hypothesis, this paper uses the research of Tang Song et al. (2020) for reference, and sets the following OLS regression model to investigate the impact of digital finance development on the ESG performance of enterprises:

$$ESG_{ijt} = \alpha_0 + \alpha_1 Ln(index)_{jt} + \alpha_2 \mathrm{Control}_{it} + \mathrm{year}_t + \mathrm{industry}_u + \varepsilon_{it} \quad (1)$$

In formula (1), subscript i represents the enterprise, J represents the city where the enterprise is located, T represents the year, and u represents the industry; The explained variable ESG_{ijt} is the total score of the enterprise's environment, society and corporate governance, which is used to measure the enterprise's ESG performance; The core explanatory variable $Ln(\mathrm{index})_{jt}$ is the digital inclusive finance index (at the prefecture level), which is used to measure the development level of digital finance in the city where the enterprise is located; The control variable $\mathrm{Control}_{it}$ refers to the variable that may affect the ESG performance of the enterprise, including the enterprise level and the provincial level. year_t is a dummy variable of the year to eliminate the influence of macroeconomic conditions and other factors on the regression results; $\mathrm{industry}_u$ is provide virtual variables for the industry where the enterprise is located to alleviate the interference of industry characteristics on the regression results; ε_{it} is the error term of the model. In addition, in order to absorb the relevant fixed effects, this paper follows the most typical "two-way fixed effect model" for regression estimation, that is, control time and industry dummy variables.

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4.2. Variable selection and description

4.2.1. Explained variable

Enterprise ESG performance (ESG). Since the Huazheng ESG index system is more in line with the situation of China's capital market in terms of evaluation standards, reference indicators, coverage and update frequency, this paper selects the Huazheng ESG rating indicators to measure the performance of enterprises in terms of environment, society and corporate governance. The rating is divided into 9 levels, from high to low, namely AAA, AA, a, BBB, BB, B, CCC, CC and C. in this paper, the above ratings are assigned 9-1 points from high to low.

4.2.2. Explanatory variable

Digital Finance (LN (index)). The digital finance research center of Peking University compiled the digital finance inclusive finance index based on the underlying transaction account data. Therefore, this paper uses this index as the proxy variable of digital financial development. For the convenience of the results, this paper takes natural logarithm to measure the impact of digital inclusive financial development on enterprise ESG performance. In the core empirical part, the natural logarithm of the digital financial development index at the prefecture level is used; In the robustness test, the natural logarithm of the digital financial development index at the provincial level is used.

4.2.3. Control variable

In order to minimize the impact of missing variables on the empirical results, this paper introduces multiple variables at the micro level of the enterprise and the regional macro level, including asset size (size), asset liability ratio (Lev), return on assets (ROA), enterprise growth (growth), equity concentration (Top1), property right nature (state), enterprise age (age) and regional economic level (LN (GDP)). The specific variables are shown in Table 1.

Table 1: Variable definition

Variable type	Variable name	Variable symbols	Measurement method
Explained variable	Enterprise ESG performance	ESG	According to the ESG rating of the China Securities Index, 1-9 points are assigned from C to AAA respectively
Explanatory variable	Digital Finance	Ln(Index)	Peking University Digital inclusive finance index (at the municipal level)
Control variable	Enterprise scale	Size	Natural logarithm of total assets of the enterprise
	Asset liability ratio	Lev	Ratio of total liabilities to total assets
	Return on assets	Roa	Ratio of net profit to total assets
	Enterprise growth	Growth	Growth rate of operating revenue
	Equity concentration	Top1	Shareholding proportion of the largest shareholder
	Property right nature	State	If the enterprise is controlled by the state, the value is 1; otherwise, it is 0
	Enterprise age	Age	The difference between the year of observation and the year of establishment

4.3. Sample selection and data source

This paper selects A-share listed enterprises from 2011 to 2020 as the research object. Among them, the micro enterprise financial indicators, enterprise life cycle and other relevant data are from guotai'an database and Wande database, the enterprise ESG performance scores are from the flush of flowers - Huazheng ESG rating data, and the relevant data of the provinces and cities to which the enterprise belongs are manually compiled from the China urban statistical yearbook, The digital finance index comes from the digital finance inclusive finance index jointly prepared by the digital finance research center of Peking University and ant financial.

According to the digital inclusive financial index of 31 provinces and cities and the city where the listed enterprises are registered, the panel data set from 2011 to 2020 is constructed by searching and matching according to "year city", and the samples are screened as follows: (1) T-type companies such as ST or * ST are excluded; (2) Excluding financial listed companies; (3) Excluding listed companies with serious data loss during the sample period. In order to avoid the interference of extreme values on

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the empirical results, continuous variables are tailed by 1% and 99%. Finally, 1276 enterprises with a total of 12760 sample observations were obtained. Table 2 reports the descriptive statistical characteristics of the main variables.

Table 2: Variable descriptive statistics

Variable	Sign	Sample	Mean	standard	Min	Max
Enterprise ESG performance	ESG	12760	6.715	1.070	2.000	9.000
Digital Finance	Ln(Index)	12760	5.236	0.438	3.926	5.771
Enterprise scale	Size	12760	22.525	1.323	20.180	26.525
Asset liability ratio	Lev	12760	0.425	0.197	0.050	0.839
Return on assets	Roa	12760	0.050	0.046	-0.063	0.210
Enterprise growth	Growth	12760	0.153	0.331	-0.461	2.043
Equity concentration	Top1	12760	0.355	0.150	0.085	0.750
Property right nature	State	12760	0.443	0.497	0.000	1.000
Enterprise age	Age	12760	2.847	0.367	0.693	3.714

5. Analysis of empirical results

Table 3 empirically tests whether the development of digital finance can improve the ESG performance of enterprises. Among them, column (1) is the univariate regression result, and column (2) is the regression result after adding the control variables, both of which control the fixed effects of years and industries.

Table 3: Benchmark regression results

	(1) ESG	(2) ESG
Ln(Index)	0.1608***	0.4039***
	(0.0216)	(0.0785)
Size		0.3320***
		(0.0087)
Lev		-0.5533***
		(0.0627)
Roa		2.0467***
		(0.2245)
Growth		-0.1535***
		(0.0260)
Top1		-0.1210**
		(0.0614)
State		0.3148***
		(0.0201)
Age		0.1444***
		(0.0278)
Ln(gdp)		-0.0450***
		(0.0150)
_cons	5.8736***	-2.2883***
	(0.1135)	(0.3931)
Year	No	Yes
Industry	No	Yes
N	12760	12760
F	55.4376	112.8171
r2	0.0043	0.2217

Note: Standard robust error is in brackets; * * *, * * ** Representing 1%, 5% and 10% respectively.

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6. Robustness check

6.1. Endogenous test

In model causality identification, there may be endogenous problems caused by missing variables. In view of this, this paper refers to the research of Xie Huali et al. (2018) , selects the Internet penetration rate of each province as the tool variable, and uses the two-stage least square method to carry out endogenous processing[5]. The regression results are shown in Table 4.

In the first stage of regression, the explained variable is the digital finance index of the prefecture level city where the enterprise is located, and the explained variable is the Internet penetration rate of the province where the enterprise is located. The results of column (1) show that the estimation coefficient of digital finance is significantly positive, and the p value and F value of the regression in this stage are 0.000 and 7762.67, so there is no weak instrument variable problem. In the second stage regression, the explained variable is the ESG performance of enterprises, and the explained variable is the fitting value of the dependent variable of the first stage regression. The results of column (2) show that the estimation coefficient of digital finance is still significantly positive at the level of 1%, and digital finance has a significant role in promoting the ESG performance of enterprises. The core conclusion of this paper is relatively stable[6]. .

Table 4: Endogenous test

	(1) LnIndex	(2) ESG
IV	0.8066***	
	(0.0159)	
Ln(Index)		0.7269***
		(0.2241)
Size	0.0057***	0.3297***
	(0.0009)	(0.0088)
Lev	-0.0329***	-0.5372***
	(0.0064)	(0.0634)
Roa	-0.0518**	2.0537***
	(0.0234)	(0.2244)
Growth	-0.0011	-0.1529***
	(0.0026)	(0.0260)
Top1	0.0454***	-0.1424**
	(0.0064)	(0.0631)
State	0.0037*	0.3162***
	(0.0021)	(0.0201)
Age	-0.0091***	0.1469***
	(0.0031)	(0.0278)
Ln(gdp)	0.0323***	-0.0637***
	(0.0014)	(0.0193)
_cons	3.7277***	-3.4296***
	(0.0257)	(0.8281)
Year	Yes	Yes
Industry	Yes	Yes
N	12760	12760
F	5101.1842	111.8511
r2	0.9522	0.2209

Note: Standard robust error is in brackets; * * *, * * ** Representing 1%, 5% and 10% respectively.

6.2. Robustness check

On the basis of solving the endogenous problem, this paper adopts the method of changing key variables to test the robustness. Replace the enterprise ESG performance and adopt Hexun online evaluation score; Change the statistical caliber of core explanatory variables and adopt the provincial level. Table 5 regression results show that the estimation coefficient of digital finance is significantly positive at the level of 1%, indicating that the benchmark regression conclusion is robust.

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Table 5: Robustness check

	ESG1
Ln(Index)1	3.9083***
	(0.9322)
DID	
Size	4.0308***
	(0.1335)
Lev	-3.9691***
	(0.8516)
Roa	112.4587***
	(3.1830)
Growth	-1.4192***
	(0.3418)
Top1	-2.6580***
	(0.8637)
State	1.7901***
	(0.2822)
Age	1.3240***
	(0.4237)
Ln(gdp)	-0.0137
	(0.2019)
_cons	-79.0692***
	(4.6499)
Year	Yes
Industry	Yes
N	12760
F	138.4844
r2	0.3325

Note: Standard robust error is in brackets; * * *, * * ** Representing 1%, 5% and 10% respectively.

7. Research conclusion and Enlightenment

Based on the data of China's A-share listed companies from 2011 to 2020, this paper empirically explores the impact of digital Finance on the ESG performance of enterprises. The research found that digital finance can significantly improve the ESG performance of enterprises. After a series of endogenous processing and robustness tests, this conclusion is still tenable. Therefore, enterprises should develop digital finance, give full play to the inclusive nature, abandon the business concept of putting interests first, improve the awareness of environmental protection and social responsibility, implement ESG behavior, and shift from pursuing the maximization of their own interests to pursuing the maximization of social value. So as to establish a good reputation and image and achieve sustainable development.

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