

Research on the Micro-Driving Mechanism of Digital Finance on the Green Technology Innovation of Chinese Enterprises

Yingbo Ma

School of Economics, Yunnan University, Kunming, Yunnan, China

Abstract: Green technology innovation is an important driving force for the sustainable development of Chinese enterprises, and digital finance can play a huge driving role in the green technology innovation of enterprises. Digital finance is the current trend of financial innovation, which can promote the comprehensive development of economy and society. Digital finance has played a certain driving role in the green technology innovation of Chinese enterprises, but there are still many deficiencies. The empirical research discusses the micro driving mechanism of digital finance for green technology innovation of Chinese enterprises, finds the shortcomings and puts forward the direction of improvement, so as to more effectively realize the driving value of digital finance to green technology innovation of enterprises. It is found that the driving function of digital finance is significantly higher than that of digital finance application; digital finance has significant driving function of green design innovation and green product innovation, but green production innovation is weak. The regulating function of digital level and corporate social responsibility exist, but has not been fully played. The digital finance driving function of enterprises in eastern region is significantly higher than that of central and western enterprises, and the digital finance driving function of medium-sized enterprises is significantly higher than that of large and small enterprises.

Keywords: Digital Finance; Green Technology Innovation

1. Introduction

At present, green technology innovation has become the key driving factor for China to promote high-quality development and gain international competitive advantage. The Outline of the 14th Five-Year Plan for National

Economic and Social Development of the People's Republic of China and the 2035 Long-term Goals stresses that Chinese society should vigorously build a market-oriented green technology innovation system and implement public relations actions on green technology innovation. The development of green technology innovation needs strong financial support, which has become the consensus of the Chinese society^[1]. Jointly issued by the National Development and Reform Commission and the Ministry of Science and Technology in the Guidelines on Building a Market-oriented Green Technology Innovation System (2023-2025), it is pointed out that financial innovation needs to be actively carried out to provide support for enterprises' green technology innovation and project financing. In the modern financial innovation system, digital finance is unique and is bursting with great vitality. Digital finance refers to the emerging financial model that provides financial services with cutting-edge or high-end information technology under the tide of digital economy. It is the product of the combination of traditional finance and modern information technology. At present, it mainly includes third-party payment, digital currency, blockchain and other implementation forms^[2]. As a new type of financial model, digital financial has "low threshold, high efficiency, wide coverage" advantage characteristics, not only can effectively expand the boundary of financial services, improve the efficiency of capital supply and demand matching, reduce transaction costs, can also be based on the massive data information direction for enterprise technology innovation, so as to promote the growth of enterprise green technology innovation^[3].

It can be seen that from the micro level, the driving mechanism of digital finance for the green technology innovation of enterprises is relatively complex, and the existing research

has not yet touched a deep driving level, so it is in a black box state. In order to more effectively display enterprise green technology innovation in the formation of the value and role of digital financial, insight into the driving path, in order to find the problems from the micro level, and then to find the improvement strategy, so as to further improve the green effect of digital financial, it is necessary in-depth research of digital financial micro drive of our country enterprise green technology innovation mechanism.

2. Research Model Design of Digital Finance on Green Technology Innovation Driven by Enterprises

2.1 Setting of Research Variables

When studying model design, the three dependent variables of green design innovation, green production innovation, and green consumption innovation are used to measure the green technology innovation system of enterprises, effectively reflecting the progress or status of green technology innovation in different directions. As the goal of this study is to explore the driving mechanism of digital finance on green technology innovation in enterprises, and in a region, the green technology innovation behavior of enterprises is mainly directly influenced by the breadth and

$$\begin{aligned}
 grdesi &= \phi_0 + \alpha_1 ex + \alpha_2 de + \beta_1 nu + \beta_2 re + \beta_3 ex * nu + \beta_4 ex * re + \beta_5 de * nu + \beta_6 de * re \\
 &\quad + \gamma_1 mi + \gamma_2 ea + \delta_1 md + \delta_2 bi + u \\
 grprod &= \phi_0 + \alpha_1 ex + \alpha_2 de + \beta_1 nu + \beta_2 re + \beta_3 ex * nu + \beta_4 ex * re + \beta_5 de * nu + \beta_6 de * re \\
 &\quad + \gamma_1 mi + \gamma_2 ea + \delta_1 md + \delta_2 bi + u \\
 grsump &= \phi_0 + \alpha_1 ex + \alpha_2 de + \beta_1 nu + \beta_2 re + \beta_3 ex * nu + \beta_4 ex * re + \beta_5 de * nu + \beta_6 de * re \\
 &\quad + \gamma_1 mi + \gamma_2 ea + \delta_1 md + \delta_2 bi + u
 \end{aligned} \tag{1}$$

3. Study Model Testing

In this study, data collection takes Chinese enterprises as samples, and the data collection method is a 7-point scale. To ensure sample heterogeneity, only one sample was collected per county or district. According to the variables connotation of Table 1, questions were designed first and then data were investigated. Specific respondents is enterprise executives, because executives of county or district digital financial coverage and application depth has a comprehensive judgment, at the same time this enterprise

depth of digital finance coverage, these two variables are selected as explanatory variables. In addition, in the process of digital finance driving green technology innovation in enterprises, the level of enterprise digitalization and corporate social responsibility play an important regulatory role. Therefore, this study establishes two moderating variables: enterprise digitalization level and corporate social responsibility.

2.2 Establishment of the Research Model

In the research model design, we should consider not only regional differences, but also enterprise size differences. China has a vast territory, and there are some differences in the development level of digital finance in the eastern, central and western regions. At the same time, under the same level of digital finance, there are also differences in the digital level and social responsibility fulfillment degree of enterprises of different scales, such as large, medium and small enterprises.

According to the above analysis, the research model of digital finance on the micro drive of green technology innovation of Chinese enterprises is shown in the following three formulas. It contains 3 explained variables, 2 explanatory variables, 2 regulatory variables, 4 regulatory interaction variables, and 2 binary control variables.

digital level and social responsibility performance also has a relatively clear cognition, of course to the enterprise area and enterprise scale level has the correct recognition. The sample data collection will start from October 6,2023 to December 9,2023. A total of 326 valid samples will be collected nationwide, distributed in the eastern, central and western regions, covering large, medium and small enterprises. Sample survey methods include interview, commission survey, online survey, email survey and other methods. Among the 326 valid samples, 163 samples were randomly selected, and the three study

models were tested separately by using Stata15.0 software. The initial test results are shown in Table 1.

Table 1: Results of the Test of the Study Model

Note: * P <0.05; ** P <0.01; *** P <0.001; N=163

explained variable	Green technology innovation		
	Green design innovation (<i>grdesi</i>)	Green production innovation (<i>grprod</i>)	Green consumption innovation (<i>grsump</i>)
Main independent variables			
Digital financial coverage and breadth of (<i>ex</i>)	0.33***	0.08	0.21**
Digital finance application depth of (<i>de</i>)	0.19**	0.05	0.07
regulated variable			
Enterprise digital level is (<i>nu</i>)	0.11*	0.13**	0.08
Corporate Social Responsibility (<i>re</i>)	0.02	0.09*	0.10**
Digital financial coverage breadth * enterprise digital level (<i>ex * nu</i>)	0.10*	0.09*	0.02
Digital financial coverage and breadth * Corporate social responsibility (<i>ex * re</i>)	0.07	0.05	0.16**
Digital finance application depth * enterprise digital level (<i>de * nu</i>)	0.15**	0.04	0.05
Digital finance application depth * corporate social responsibility (<i>de * re</i>)	0.03	0.06	0.05
controlled variable			
the west area			
middle part (<i>mi</i>)	0.04	0.10*	0.06
east (<i>ea</i>)	0.08	0.12***	0.09*
small business			
medium-lot producer (<i>md</i>)	0.12***	0.10**	0.07
large-lot producer (<i>bi</i>)	0.08*	0.07	0.05
statistics			
R^2	0.71	0.68	0.62
ΔR^2	0.02	0.01	0.02
adjusted R^2	0.73	0.69	0.64
adjusted F Value	77.19	122.19	79.89
P Value	***	**	***

4 Research Conclusions

According to the test results of the research model and combined with the investigation of green technology innovation driven by digital finance, the following research conclusions can be obtained:

First, in the current digital financial drive for enterprise green technology innovation, digital financial coverage has played an important role, but the function of digital financial application depth has not been given full play, which illustrates the digital financial to enterprise

green technology innovation drive is still in the primary stage, there is still a larger development space.

Second, the driving force of digital finance for enterprise green technology innovation is mainly reflected in the two directions of green design innovation and green consumption innovation, especially in the direction of green design innovation, while the direction of green production innovation has not yet played a role. Therefore, in the long run, it will mainly explore the driving function of digital finance for enterprise green production innovation, and seek breakthroughs in green production.

Third, in the process of digital finance driving the green technology innovation of enterprises, the digital level of enterprises and corporate social responsibility have a regulatory role, but these regulatory functions have not been fully played. Therefore, if enterprises further improve the level of digitalization and strengthen the fulfillment of social responsibilities, they can further tap the potential of digital finance to drive enterprise green technology innovation.

Fourth, in the driving of green technology innovation of Chinese enterprises, enterprises in eastern region have achieved remarkable results, significantly higher than those in central China, while enterprises in central region are significantly higher than those in western China. Therefore, the communication should be strengthened between enterprises in different regions, so that the experience of enterprises in the eastern region can be paid attention to by enterprises in the central and western regions.

Fifth, in the drive of digital finance on the green technology innovation of Chinese enterprises, medium-sized enterprises have the most obvious effect, followed by large enterprises, and small enterprises are the weakest. Therefore,

large enterprises and small enterprises should appropriately learn from the experience of medium-sized enterprises in the application of digital finance, and constantly improve their ability to drive green technology innovation.

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