Research on the Impact of Digital Financial Inclusion Development on Green Total Factor Productivity

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Abstract

With the gradual attention to the ecological environment, the improvement of green total factor productivity has been put on the agenda. The empirical results show that R&D investment and opening to the outside world can improve green total factor productivity in recent years. The development of digital inclusive finance can not only reduce the threshold and cost of financial services, improve the breadth and efficiency of financial services, but also improve the total factor productivity of green regions by promoting the upgrading of industrial structure. But at the same time, it is necessary to further strengthen the reasonable allocation of resources between industries to promote the promotion of green total factor productivity.

Key words *Digital financial inclusion Green total factor productivity The mediation model*

1. INTRODUCTION

China's economy has developed by leaps and bounds, driven by domestic reform and opening-up. But economic growth is largely dependent on high input, high consumption and high emissions as the main characteristics of the traditional industrial production, the low efficiency of economic development model costs a lot of natural resources, caused serious environmental pollution problems, in order to better achieve sustainable development, meet the needs of the people a better life. During the 18th and 19th CPC National Congress, ecological civilization and green development were taken as social development tasks respectively, in order to improve the sustainability of economic development. The quality of economic development has become the focus of the current academia, mainly used to measure the quality of high development is currently single factor input and output ratio and total factor productivity, by measuring input and output of condition to find depend on the path of economic growth, to solve the problems in the process of economic growth, and for social development in our country. As the country gradually to the development of green, the pollution factors considering the calculation of total factor productivity of formation of the green total factor productivity is becoming a research hot spot, the index can not only reflects the progress of technology, also can reflect the energy conservation and emissions reduction and resource allocation efficiency, provide reliable Suggestions for our country's green sustainable development。

The G20 High-level Principles on Digital Financial Inclusion issued at the G20 Summit in 2016 is a major milestone in the development of digital financial inclusion, marking financial inclusion with the brand of digital technology. In the white paper published by the Global Partnership for Financial Inclusion (GPFI), digital financial inclusion is broadly defined as all actions that promote financial inclusion through the use of digital financial services. digital financial inclusion as a combination of financial technology and digital financial inclusion, as a new form has changed the traditional financial service mode, reduce the information asymmetry phenomenon also improves the financial availability, to help the low-income groups solve the difficulties and solve the problem of financing problems of small micro enterprise financial services, enhance resource allocation efficiency, promote the industry development, especially carbon emissions and reducing pollution It can not be ignored for the promotion of green total factor productivity. Therefore, under the current situation of China's efforts to improve green total factor productivity, it is of great practical significance to study whether digital inclusive finance can effectively improve green total factor productivity and to what extent it plays a role.

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2. LITERATURE REVIEW

Digital inclusive finance is a new form of inclusive finance. Compared with traditional finance, digital finance, with its advantages of low threshold, low cost and wide coverage, enables underdeveloped areas in central and western China and middle and low-income groups to enjoy better financial services. On the economic effect of the development of digital inclusive finance, it is mainly analyzed from four aspects. First, Song Xiaoling (2017), Liang Shuanglu, and Liu Peipei (2019) made an empirical analysis that digital finance can significantly narrow the urban-rural income gap [1, 2]. Li Muchen (2020) et al. further pointed out that the convergence effect of digital inclusive finance development on the urban-rural income gap is mainly reflected in the impact of coverage breadth and use depth. The derivation function has the opposite effect [3]. Second, a Yi Xingjian Zhou Li (2018) and zou crescent, Wang Wang (2020) argue that the development of digital pratt &whitney financial significantly promoted the residents' consumption, promote more obvious effect for low-income groups and the Midwest region [4, 5], Jiang Zhuyuan (2020) further analysis for promoting urban and rural residents' consumption are set up, and to narrow the gap between urban and rural consumption [6], Jiang Hongli and Jiang Pengcheng (2020) pointed out that digital inclusive finance not only improves residents' consumption level, but also optimizes residents' consumption structure [7]. Third, Huang Qian et al. (2019), Liu Jinyi and Liu Chunyang (2020) found that digital inclusive finance mainly reduces poverty by promoting income growth and improving income distribution, which has direct and indirect effects. At present, it is necessary to further increase the financial accessibility of poor peasant households [8, 9]. Qian Pengsui and Sun Shu (2019) found that the development of digital inclusive finance had spatial spillover effect on poverty reduction in the short term, but the spillover effect was not significant in the long term [10]. Fourth, Tang Wenjin et al. (2019) and Du Jinmin et al. (2020) believe that digital inclusive finance plays a significant role in promoting the upgrading of industrial structure. The coverage breadth of digital inclusive finance in sub-dimensions has a long-term significant effect, and the sub-region has a strong effect on the central and western regions [11, 12].

The existing literature on the impact mechanism of digital financial inclusion on economic growth is mostly analyzed from the perspectives of easing liquidity constraints, lowering the threshold of financial services, and risks and supervision in the development process of financial inclusion. There is no literature on the impact of digital financial inclusion development on green total factor productivity. On the other hand, on the study of green total factor productivity, there are many scholars from the perspective of environmental regulation. Based on the above analysis, this paper proposes the following research hypothesis: as a kind of technological progress, the development of digital inclusive finance promotes economic development, optimizes industrial structure, reduces pollution emission, improves green total factor productivity and has regional heterogeneity. This paper will use the provincial level Peking University Digital Financial Inclusion Index and two-way fixed effect panel data model to empirically test the impact of the development of digital financial inclusion on green total factor productivity.

3. VARIABLE SELECTION AND MODEL CONSTRUCTION

3.1. Explained variable

Green total factor productivity (GTFP). The non-parametric method of output-oriented DEA-Malmquist index is used to measure the level of green total factor productivity, which consists of two dimensions: technical efficiency and technological progress. The input index includes three dimensions of provincial capital stock, labor employment and energy consumption during 2011-2018. Specifically, the physical capital stock follows the practice of Zhang Jun]. The number of employees in each province at the end of the year was used as the labor input index. Labor consumption uses the energy consumption of each province as the energy input index.

Output index is divided into expected output and non-expected output. Expected output takes the gross regional product of each province as proxy variable, and takes 2000 as the base period to deflate by price index. Based on data availability and representativeness, undesired output is measured by the use of industrial sulphur dioxide emissions from "industrial wastes".

3.2. Core explanatory variable

Digital Financial Inclusion Index (DIFI). The digital financial inclusion index of Peking University was selected as the proxy variable of the development level of regional digital financial inclusion. The second phase of the index was jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services. It measures the development level of digital inclusive finance in provinces and municipalities from 2011 to 2018 from three dimensions of coverage breadth, usage depth and digitalization degree.

3.3. Control variables

The following variables were used as control variables. (1) Economic development (PGDP): an indicator of local economic development measured by per capita GDP. (2) R&D investment (RDP): the proportion of R&D expenditure and GDP of each region

is used to reflect the local R&D investment. (3) Human capital (HR): it is measured by Li Haizheng's per capita human capital at the provincial level based on JF income method and extended. (4) Foreign direct investment (FDP): the proportion of the total amount of foreign investment actually utilized in a region in the region's GDP is used to measure foreign direct investment.

3.4. Model specification

As can be seen from the above literature, digital inclusive finance can have an impact on the upgrading of industrial structure, which in turn will have an impact on green total factor productivity. The benchmark model is set up as follows,

$$gtfp_{i,t}=\alpha_0+\alpha_1 difi_{i,t}+\alpha_2 x_{it}+\theta_i+u_t+\varepsilon_{i,t} \quad (1)$$

In the formula, subscript i and t represent provinces and years, θ_i and u_t represent unobservable individuals and time-fixed effects, $\varepsilon_{i,t}$ are random error terms. DIFI represents the digital financial inclusion index, GTFP represents the green total factor productivity, x is the control variable, α is the constant term, and β is the variable coefficient.

3.5. Data sources and descriptive statistics

The explained variables and controlled variables were selected from China Statistical Yearbook, China Labor Statistical Yearbook, China Energy Statistical Yearbook and China Human Capital Report 2020 of 29 provinces and regions of China (in consideration of data incompleteness and stability, excluding Hong Kong, Macao, Taiwan, Xinjiang and Tibet) from 2011 to 2018. The digital financial inclusion development index is derived from the second issue of the Peking University Digital Financial Inclusion Index released by the Digital Finance Research Center of Peking University. In order to solve the endogenity estimated by the model, the Internet penetration rate *netrate* is selected as the instrumental variable of digital financial inclusion. The data are from "China Internet Development Statistics Report". Further, the advanced industrial structure and the rationalization of industrial structure were selected as mediating variables to verify whether the development of regional inclusive finance affects green total factor productivity by promoting the optimization of industrial structure. To keep the data consistent, divide the digital financial inclusion index and average human capital by 100 and the per capita GDP by 10,000. Descriptive statistics are shown in Table 1.

TABLE 1 DESCRIPTIVE STATISTICS

variable name	observations	mean	standard deviation	minimum value	median	maximum value
Green total factor productivity	232	1.02	0.041	0.8453	1.0220	1.2104
Digital Financial Inclusion	232	1.89	0.851	0.18	2.04	3.78
Per capita GDP	232	5.33	2.507	1.6413	4.58845	14.0211
R&d Investment	232	0.01	0.006	0.0003	0.0059	0.0313
Human capital	232	3.69	1.601	1.39	3.29	9.49
Foreign direct investment	232	0.04	0.037	0.0002	0.0270	0.1942

4. ANALYSIS OF EMPIRICAL RESULTS

First, Hausman test was used to determine the results of the panel fixed effect model. Ignoring the effects of unobservable factors will lead to errors in the model estimation results. The bidirectional fixed effect model can control the regional unobservable factors by using the difference method to improve the estimation accuracy of the model. Model (1) is an individual fixed effect model, and Model (2) is a bidirectional fixed effect model. The results are shown in Table 2.

TABLE 2 REGRESSION RESULTS OF INDIVIDUAL FIXATION EFFECT AND BIDIRECTIONAL FIXATION EFFECT

	(1) fe1	(2) fet1
DIFI	0.0242***	0.170*
	(0.00717)	(0.106)

PGDP	0.0119*	0.0190*
	(0.00621)	(0.00938)
RDP	1.280**	0.700**
	(2.095)	(2.212)
HR	-0.0000693***	-0.0000598***
	(0.00000988)	(0.0000140)
OPEN	0.262***	0.274***
	(0.0857)	(0.0988)
C	1.020***	1.000***
	(0.0193)	(0.0256)
region	yes	yes
time	no	yes
sample number	232	232
R^2	0.165	0.318

Note: Standard deviation in parentheses. *, ** and *** represent significant at the significance level of 1%, 5% and 10% respectively, the same as below.

The estimation results of column (1) and (2) show that the development of digital financial inclusion has a significant positive impact on the improvement of regional green total factor productivity. In Model (2), after introducing the control variables of regional economic characteristics such as per capita GDP, R&D input, human capital and openness, the total factor productivity will increase by 0.17 unit on average for each unit increase in regional digital financial inclusion development. In terms of regional economic characteristics, the coefficient of per capita GDP is also significantly positive, indicating that the local financial industry with a high level of economic development is developed, and it is easy for enterprises to obtain sufficient funds at a lower cost for green production, thus improving the local green total factor productivity. The increase of R&D investment can provide strong financial support for technological innovation, promote the progress of enterprises' production technology, and thus drive the improvement of green total factors. Human capital does not improve green total factor productivity, and even has a negative effect. This is mainly because the accumulation of human capital has not been effectively transformed into the source of technological innovation, so it does not have a significant impact on the improvement of total factor productivity.

5. Results

The research findings are as follows :(1) The development of digital financial inclusion reduces the threshold and cost of financial services, improves the breadth and efficiency of financial services, and thus enhances green total factor productivity; (2) Research and development input and foreign investment have a significant effect on the improvement of green total factor productivity, so the transformation of human capital needs to be further strengthened, and "industry-university-research" needs to be further integrated.

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