A study of the impact of the digital economy on the degree of openness of the productive services sector

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Abstract. The opening-up of productive services is an important initiative to promote the high-quality development of China's economy. The digital economy is driven by technological innovation, building digital platforms to realize data delivery and guaranteeing a stable supply of productive services. Based on China provincial data from 2011 to 2020, this paper empirically examines the impact of the digital economy on the opening-up of productive services and the related mechanism of action of using multidimensional panel fixed effects regression model. The study finds that the digital economy can raise the level of openness in the productive services.

Keywords: Digital economy, Productive services, Digital technology

1 Introduction

China as the world's production and manufacturing power is in the stage of transformation to a manufacturing power, the productive service industry for industrial production escort, the degree of its openness to development is particularly important for China to enter the stage of high-quality development [1-3]. China's productive service industry is constrained by the level of technological innovation, and the lack of high-end production factors has led to the lack of international competitiveness [4-6]. The digital economy can not only realize the value co-creation of service industry, data empowerment and service creation [7], but also promote the high-quality development of service industry by reducing the production and transaction costs [8], which has a significant empowering effect on the productivity of service industry [9-10].

The innovation of this paper lies in the influence path of the new development mode of digital economy on the opening up of productive service industry, and tries to build a mechanism framework of digital economy to promote the opening up of productive service industry and carry out empirical test, in order to find a new path to realize high-quality and high-level opening up through the development of digital economy.

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2 Theoretical Analysis and Research Assumptions

Accompanied by the innovation of new digital technologies, the new development mode of digital economy stimulates the upgrading potential of the traditional productive service industry, and further improves the level of opening up of China's productive service industry to the outside world. In this paper, we will analyze the impact mechanism of the digital economy to promote the opening up of production services from three aspects:

The rapid development of the digital economy puts higher demands on the advancement of digital technology. 5G, Internet of Things, Artificial Intelligence, and Industrial Internet technologies have been gradually applied to the productive service industry, which can significantly enhance the competitiveness of the enterprises, make up for the shortcomings of the development, and optimize the internal structure of the industry. Ultimately, the international competitiveness of the productive service industry will be improved, and the level of opening up to the outside world will be raised.

Digital platform services can give full play to the advantages of intensification and optimize the market business environment of productive service industries. On the one hand, they improve market efficiency by increasing the efficiency of market information collection, reducing economic intermediate links and streamlining the transaction process; on the other hand, they reduce the costly information barriers for enterprises to conduct international trade in services.

The development of the digital economy has prompted traditional productive service industries, such as logistics, finance and information services, to gradually apply digital technology, realize intelligent and digital development, and thus improve their service level. Integration and sharing of information resources and data, based on the needs of users to improve the level of comprehensive services, and promote the opening up of the productive service industry. Hypothesis 1 proposes that the digital economy promotes the expansion and opening up of the productive service industry.

3 Research Design

Data from 2011-2020 of 30 provinces and cities in China (Tibet, Hong Kong, Macao and Taiwan are not included) are selected as the sample for examination.

3.1 Model Setting

In order to test the impact of the development of the digital economy on the opening up of the productive service industry in each province, this paper constructs the following benchmark regression model:

$$\mathrm{pso}_{it} = \alpha_0 + \alpha_1 \mathrm{szjj}_{it} + \alpha \mathrm{X}_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (1)$$

where: i and t represent provinces and years; pso (producer services open) denotes the degree of openness of the productive services industry in each province; szjj denotes the development of the digital economy in each province, and X represents the control

variables; μ and γ denote the year and province fixed effects, respectively; ε is the random error term; α_1 is the marginal effect size of the role of the digital economy in the size of the marginal effect of the opening up of the productive service industry; α is the marginal effect of each control variable on the opening up of the productive service industry; α_0 is a constant term.

3.2 Description of variables

Explained Variables.

The degree of foreign investment dependence in productive services is used to represent the degree of openness of productive services (pso), with the following formula:

$$\mathrm{pso_{it}} = \mathrm{PSFDI_{it}}/\mathrm{TFDI_{it}V} \tag{2}$$

Where PSFDIit represents the amount of actually utilized FDI in productive service industry of province i in period t; TFDIit represents the total amount of actually utilized FDI in province i in period t. The data of the indicators come from the statistical yearbooks of each province and city.

Explanatory Variables.

Core explanatory variable: the level of digital economy development (szjj). Factor analysis is used to measure the level of digital economy development from four aspects: digital infrastructure, digital technology innovation level, digital industrialization development level and industrial digitalization development level. The specific measurement indexes are shown in Table 1

Table 1. Indicators for measuring the level of development of the digital economy

Level 1 indicators	Level 2 indicators
Digital infrastructure	Number of Internet access ports (10,000)
	Length of long-distance fiber-optic cable lines (10,000 kilometers)
	Internet broadband accession users (ten thousand)
Level of innovation in digital technolo	Domestic Patent Application Authorization (item)
	Full-time Equivalent of R&D Personnel of Industrial Enterprises Above Scale (person-years)
	Research and Experimental Development (R&D) Expenditures (billion yuan)
Level of development of digital industrialization	Revenue from information technology services (million yuan)
	Employment in urban units of the information transmission, software and information technology services industry (10,000 persons)
	Software business income (million yuan)

Level of industrial digitalization development	E-commerce sales (billion yuan)Number of enterprises conducting e-commerce activities (number)
	Number of websites owned by enterprises (number)

Control variables.

The control variables are: the level of economic development (rgdp, the GDP growth rate); the degree of industrialization (di, the share of value added of the secondary industry in GDP); the degree of specialization and division of labor (ds, the share of value added of the industry in GDP); and the degree of government intervention in the economy (gc, the proportion of government consumption in final consumption).

Data description and processing

The data of 30 provinces and cities in China (Tibet, Hong Kong, Macao and Taiwan are not included due to missing data) from 2011 to 2020 are selected as samples for examination, and missing data of individual years in some provinces are filled in by the trend method, and as the amount of foreign direct investment in the service industry is not given in the statistical yearbooks of individual years in Jilin, Sichuan, and Xinjiang, the value added of the service industry as a percentage of regional GDP for the same period is used as an approximate substitute. The proportion of service sector added value to regional GDP in the same period is used here as an approximate substitute. Considering the possible impact of outliers on the regression results, the Winsorize method is used to shrink the variables at the 1st and 99th percentiles.

4 Analysis of empirical results

The results of the benchmark regression are shown in Table 2. Column (1), the province fixed-effects regression column (2) and the year and province fixed-effects regression results column (3) are given at the same time, and the regression results are basically the same, which indicates that the results are robust. From the regression result column (3), the regression coefficient of digital economy is 0.0577 and significant, indicating that the development of digital economy has a significant promotion effect on the opening up of productive service industry.

Table 2. Regression results

variable	(1)	(2)	（3）
szjj	0.0704*** [0.0180]	0.0713*** [0.0235]	0.0577** [0.0253]
rgdp	-0.00481 [0.0036]	-0.0118** [0.0055]	-0.00656 [0.0081]
di	-1.114* [0.5809]	-3.677* [2.1156]	-3.490** [1.4273]

ds	0.561 [0.5691]	3.494 [2.1701]	3.562** [1.4124]
gc	0.0280 [0.2081]	0.246 [0.1566]	0.281 [0.2566]
constant	1.013*** [0.3414]	1.767*** [0.5921]	1.094 [0.8812]
Year fixed	N	N	Y
Province Fixed	N	Y	Y
R^2	-	0.4992	0.4927
Observations	300	300	300

Exegesis: *p<0.1,**p<0.05,***p<0.0. Values in parentheses are standard errors.

5 Conclusion and Policy Recommendations

Based on the sample data of 30 provinces and cities in China from 2011 to 2020, the results show that the development of the digital economy can significantly promote the opening-up of the productive service industry. Based on the research in this paper, the following countermeasures are proposed:

First, strengthening the construction of digital platforms to improve market efficiency and increase market vitality. In the digital economy to promote the opening up of productive service industry, the bridge role of digital platform construction is more prominent than the other two, it can be seen that through the construction of digital platform to renew the new vitality of the productive service market is to promote the opening up of China's productive service industry is an important measure. Therefore, the government should help China's digital platform enterprise construction, improve the relevant regulatory regulations and platform operation rules, digital platform enterprises themselves to do a good job of technical maintenance and updating, improve the quality of digital platform.

Secondly, accelerating the promotion and application of digital technologies focuses on accelerating the digital transformation of productive service industries. Focusing on promoting the proliferation, application and integration of new-generation digital technologies and accelerating the development of digital transformation in the productive service industry, it is specifically possible to realize the personalized application of digital technologies in accordance with the characteristic features and technological needs of the subdivided industries, and to fully tap and make use of the potential energy of digital information technologies.

Thirdly, optimizing and upgrading digital infrastructure and building a national arithmetic network. Promoting the intelligent upgrading of information network infrastructure is a fundamental condition and important support for the development of the digital economy, and building a national arithmetic network system is the future direction and important guarantee for the development of the digital economy.

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