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The Impact of Digital Economy on Circulation Efficiency: Empirical Evidence from China's Postal Industry

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Abstract: With the rapid development of digital technology, the traditional economic operation mode has been completely changed. Digital economy has become a new driving force for world economic growth. In the context of the new development model, accelerating the development of digital economy, deepening circulation reform and improving circulation efficiency have important theoretical and practical significance for stabilizing the national economic cycle. In order to explore the influence of the development of digital economy on the efficiency of circulation industry, this paper firstly expounds the basis of dividing the circulation industry from the theoretical level based on Marx's circular economy theory, and puts forward the mechanism of the influence of digital economy on the circulation efficiency. The DEA-Malmquist model is used to calculate the productivity of the total factors of the postal industry to represent the circulation efficiency. The regression results show that the development of digital economy has significantly improved the circulation efficiency of China's postal industry.

Keywords: Digital Economy, Circulation Efficiency, China's Postal Industry.

1. Introduction

In the "Proposal of the CPC Central Committee on Formulating the 14th Five-Year Plan for National Economic and Social Development and the Long-range Goals for 2035" issued in March 2021, it is proposed that the digital economy needs to develop vigorously, promote digital industrialization and industrial digitization, and further promote the integration of the digital economy with the real economy and traditional industries, so as to give birth to new industries, new business forms and new models. In addition, the document once again regards circulation as the hub role of production and sales, and its key role in the domestic big cycle has been highlighted.

To construct a new development pattern, we must take the construction of modern circulation system as an important strategic task to grasp. Both domestic and international circulation cannot be separated from an efficient modern circulation system. In the process of social reproduction, circulation efficiency and production efficiency are equally important. Facing the strategic deployment of accelerating the improvement of the high-level socialist market economic system in the new era, there are still a number of questions in the field of circulation in China that need to be answered, and more important, theoretical research should be advanced.

During the period of the 14th Five-Year Plan, we should firmly seize the opportunity to develop the digital economy and push forward the deep integration of the digital economy and the real economy. Through data flow, sharing and cooperation, we will overcome bottlenecks in the upstream and downstream supply chains, overcome shortcomings and raise the overall productivity of factors of production. Encourage potential user demand from user data, provide high-quality, user-centered and market-oriented services, and form a high level of demand dynamic balance by providing and creating demand. Among them, the circulation industry, as the key axis of upstream production and downstream consumption, needs to make good use of digital information technology to promote industrial development, accelerate the improvement of circulation efficiency, and promote the circulation industry to improve quality and efficiency.

The sustainable development of the digital economy has further accelerated the application and penetration of modern information technologies such as mobile Internet, big data and 5G technology in various branch industries of circulation, expanded the scope and space of modern economic activities, and provided new technologies, new business forms and new models for commercial circulation and intelligent logistics systems. The digitalization of the retail industry is not the subversion of the nature of the industry, but the use of digital technology to solve the contradiction of supply and demand mismatch [1]. In the context of digital economy, the adoption of multiple strategies by circulation enterprises may promote the improvement of circulation efficiency [2]. The application of digital technology in circulation enterprises has greatly weakened the information asymmetry, which is conducive to reducing the mismatch of resources and the cost of commodity and factor circulation [3].

In the era of digital economy, circulation efficiency is expected to be further broken through, and become a significant opportunity to break through the plugging point of national economic circulation and promote the new development pattern of double circulation. The current research on the digital economy to promote the circulation efficiency of the mechanism is not clear. Most of the research is only theoretical elaboration, but lack of empirical data test. This paper first establishes the theoretical framework according to Marx's circulation economy theory, then uses the data of China's postal industry to empirically test the mechanism of digital economy affecting circulation efficiency, and finally puts forward corresponding policy suggestions according to the empirical test results.

2. Analysis of Theory and Mechanism

Marx's theory of circulation economy discusses the change of commodity form and value increment in the process of commodity circulation. The social reproduction process can

be understood as the circulation movement process at the whole social level, while the simple Commodity Exchange in the early stage of human society can be understood as the circulation process at the micro level, that is, the circulation to meet the basic needs of people's material life. Marx elaborated the views on the labor nature of commodity circulation, mainly focusing on the specific analysis of circulation costs, commercial capital, commercial interests and other issues. The cost of circulation can be divided into three aspects: pure circulation cost, storage cost and transportation cost. The pure transportation cost is generated in the daily transaction of commodities, which is the deduction of capital other than the cost of physical and chemical labor. The transportation cost and storage cost together can be called "productive circulation cost" [4]. The logistics industry undertakes the main productive labor in the field of circulation, so the efficiency improvement of the logistics industry is an important node to promote the high-quality development of China's economy [5]. The infrastructure construction of the express service industry is an important symbol of the basic ability of the circulation industry to promote the development of the national economy. Based on the background of digital economy, the efficiency reform of the circulation industry is promoted by digital technology in this paper. The reason for the analysis of China Post Express is that postal express is an important representative of China's economic transformation and upgrading, and the industry has complete industrial data at the national level.

The development of digital economy has combined the distribution industry with the "Internet +" mode, effectively improving the management level of the distribution industry, sales and distribution capacity, distribution capacity, and promoting the quality of the modern distribution industry. Through the transformation of industry digitization, digital economy has improved the digitalization and intellectualization of traditional circulation production capacity, saved production costs and improved production efficiency. Therefore, this paper proposes the following hypothesis:

Hypothesis 1: The development of digital economy can significantly promote the improvement of circulation industry efficiency.

3. Data Description and Variable Measurement

3.1. Data description

Since the pilot policy of "Broadband China" strategy was formally proposed in August 2013, this paper selects data from 2014 to 2020 at the provincial level for research and analysis. In this paper, statistical data on postal express delivery are from the State Post Bureau of the People's Republic of China, and other data at the provincial and municipal level are from China Statistical Yearbook.

3.2. Measurement of variables

The selected interpreted variable is the circulation efficiency (eff). This paper refers to the efficiency measurement method used in existing literatures [6], and uses DEA-Malmquist model to measure the circulation efficiency. Since this efficiency measurement method does not need to set production function in advance, it can avoid the problems caused by the wrong setting of function form. In the selection of input-output index, capital and labor are the basic input factors of enterprise operation. Meanwhile, it is considered that the cost generated in the process of enterprise operation will affect efficiency. In this paper, the number of postal industry employees, net fixed assets and postal express business related costs as input indicators. Considering that the income from the main business can comprehensively reflect the operating ability of the enterprise, the income from the express business of China Post is taken as the output index.

The explanatory variable is the level of Digital Economy Development (digl). This paper constructs the digital economy development index by referring to the measurement method [7] of the development level of digital economy in the existing literature. The optical cable line length and the number of Internet broadband access ports are two indicators to measure the infrastructure of digital economy. The penetration rate of mobile phone is used to measure the development of digital economy at the level of individual application, and the number of computers per 100 people at the level of enterprise application is used to measure the number of computers per 100 people. In this paper, the digital economy index constructed above is processed logarithmically, making it as the proxy variable of the development level of digital economy.

This paper mainly controls the influence of time and region on model measurement. Since the operation and development of the circulation industry cannot be closely separated from the production sector and the total amount of commodities in circulation, this paper chooses per capita gross product (rgdp) to represent the level of regional economic development and takes it as the control variable at the regional level.

4. Empirical Analysis

4.1. Benchmark regression model

In order to explore the impact of the development of digital economy on the efficiency of circulation industry, the benchmark regression model is constructed according to the above theoretical analysis as follows:

$$eff_{i,t} = \beta_0 + \beta_1 digl_{i,t} + \beta_2 x_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where, eff is the circulation efficiency, digl is the development level of digital economy, x is the control variable at the provincial level, i represents the province, t represents the year, and ε is the random disturbance term.

4.2. Empirical analysis results

4.2.1. Panel unit root test

In order to reduce the pseudo-regression phenomenon that may occur in panel data, four methods such as LLC, IPS, ADF-Fisher and PP-FFisher are used in this paper to conduct unit root test on panel data, and the analysis results are shown in Table 1. As can be seen from Table 1, the panel data basically meets the panel unit root test and has good stability.

Table 1. Panel unit root test

Variables	IPS	LLC	ADF-Fisher	PP-Fisher
eff	0.28073 * * *	6.2756 * * *	4.7060 * * *	5.1042 * * *
digl	1.8752 * * *	3.3797 * * *	4.0104 * * *	2.21917 * * *
rgdp	1.8975 * * *	2.7646 * * *	7.6949 * * *	8.2379 * * *

Note: Calculated according to eviews software, where *, ** and *** are significant at the level of 0.1, 0.05 and 0.01 respectively.

4.2.2. Analysis of benchmark regression results

In order to explore the impact of the development level of digital economy on the circulation efficiency of the postal industry, after establishing the benchmark regression model, this paper adopts Hausmann test to determine the best choice of model estimation method. Table 2 reports the empirical results of the influence of the development level of digital economy on circulation efficiency after the addition of control variables. According to the test results, the Hausman test rejects the original hypothesis at the significance level of 1%. Therefore, the fixed-plate effect model is selected for analysis in this paper. The specific regression results are shown in Table 2.

Table 2. Baseline regression results

Variables	(1)eff_RE	(2)eff_FE
digl	0.0751 * * *	0.085 * * *
	(1.85)	(2.81)
rgdp	0.0954 * * *	0.0238 * * *
	(2.38)	(3.58)
_cons	1.9054 * * *	1.4602 * * *
	(1.49)	(1.68)
R2	0.1642	0.1472
N	217	217
Hausman chi2	16.9351 * * *	17.8645 * * *
p-value	(0.0000)	(0.0000)

Note: *, ** and *** represent significant correlation at the levels of 0.1, 0.05 and 0.01, respectively, and the Robust is in brackets.

As can be seen from the results of Table 2, after adding control variables and fixed effects, the influence coefficient of the development level of digital economy on circulation efficiency is 1.4602, and the coefficient is significant at the 1% level, indicating that the continuous development of digital economy will promote the circulation efficiency of China's postal industry. In other words, the hypothesis proposed above is proved. From the economic perspective, every 1% increase in the development level of digital economy will increase the circulation efficiency by 1.4602. From the results of control variables, the coefficient of per capita gdp is significant at the 1% level, indicating that economic development is an important guarantee to promote the improvement of circulation efficiency, which is conducive to promoting the improvement of circulation efficiency.

4.2.3. Heterogeneity analysis

This paper divides the data of China's 31 provinces and municipalities into three groups, namely east, central and west, for heterogeneity analysis, in order to explore the impact of the development of digital economy on circulation efficiency from the perspective of different regional development.

The results of regression analysis are shown in Table 3. The development level of digital economy plays a significant role in promoting the eastern, central and western regions, among which, the development level of digital economy plays a more significant role in promoting the eastern and western regions. This paper believes that the eastern region mainly concentrates the high-end scientific and technological manufacturing industry, which promotes the scientific and technological progress of the region. The rise and development of digital economy may be more based on technological innovation to improve the circulation efficiency of the postal industry in this region. The significant promotion of digital economy to the western region may be due to the relatively backward economic development in the western region. Therefore, once digital technology is applied, it will play a more obvious role in promoting the development of this region.

For control variables, per capita national income has positive and negative impacts on circulation efficiency. The impact on the eastern part of the country is negative, possibly because the living standard of residents in the eastern part of the country has been at a higher level, so the economic development has weakened the promotion of circulation efficiency. However, the per capita income level in the west is lower than that in the east and central part of the country, so the economic development has a weak effect on the circulation efficiency, and the improvement of circulation efficiency may mainly come from the construction of digital infrastructure. For the central region, the development level of digital economy is in the middle and upper reaches, and the development of digital economy has significantly promoted the circulation efficiency of the postal industry in this region. In addition, per capita national income also has a significant promoting effect on circulation efficiency.

Table 3. Heterogeneity analysis

Variables	Eastern region	Central region	Western region
digl	0.0811 * * *	0.0389 *	0.0601 * *
	(0.146)	(0.498)	(0.387)
rgdp	0.0239 * * *	0.0210 * * *	0.0621 *
	(0.816)	(0.042)	(0.039)
_cons	1.4907 * * *	1.4967 * * *	1.5494***
	(0.079)	(0.199)	(0.167)
R2	0.197	0.184	0.146
N	96	72	80

Note: *, ** and *** indicate significant correlation at 0.1, 0.05 and 0.01, respectively, and Robust is in parentheses.

5. Conclusion

Based on the above analysis, this paper draws the following conclusions: The development of digital economy has significantly improved the circulation efficiency of the postal industry. With the improvement of social and economic development level, it will promote the development of circulation industry and improve circulation efficiency. From the perspective of different regions, the digital economy has a significant promoting effect on the circulation efficiency of postal industry. The development level of regional economy

has a weak effect on circulation efficiency, or even a negative weakening. Due to its technological advantages over the other two regions, the digital technology innovation in the eastern region is more rapid and the development level of digital economy is also higher than the other two regions. The digital economy construction in the central region is at an upper medium level, and both the development level of digital economy and per capita national income in the region show a significant positive promoting effect. Due to the weak economic foundation, the depth and breadth of the popularization of digital technology in the western region are weaker than the other two regions, but the development of digital economy has significantly improved the circulation level of the postal industry in this region. In addition, the impact of per capita national income on circulation efficiency is weak.

Therefore, the policy suggestions put forward in this paper are as follows: First, the government should continue to improve the construction of national digital economy infrastructure and give play to the network effect of information infrastructure. Then, it is necessary to pay attention to regional differences, adapt to local conditions, promote balanced development at the regional level, increase investment in information infrastructure construction in the west, speed up industrial digitization and digital industrialization in the west, and realize the coordinated development of the east, central and west regions. Finally, the circulation industry needs to accelerate the transformation of informatization and digitalization, and the traditional low efficiency links should be reformed in combination with the digital economy.

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