

Internal Mechanism and Empirical Test of Rural Industry Revitalization Driven by Digital Economy in Yangtze River Delta

Zhiyuan Yu, Zhiwei Xu, Lebin Li

School of Economics, Anhui University of Finance and Economics, Bengbu 233000, China

Abstract: Realizing the integrated development of urban and rural areas in the Yangtze River Delta is the inherent requirement of Chinese modernization and the inevitable result of the high development of productive forces. Developing digital economy has become an important means to promote the orderly and free flow of urban and rural elements and rationally allocate resources. In order to explore the influence of digital economy on urban-rural integration in the Yangtze River Delta region, this paper analyzes the direct role of digital economy on urban-rural integration and the intermediary role of factor flow on urban-rural integration in the Yangtze River Delta region by using the intermediary effect model. The research results show that the integration development level of digital economy in the Yangtze River Delta region has obviously improved, and the result effect is remarkable after the robustness test of the model. Digital economy is conducive to promoting the integration of urban and rural development; Digital economy promotes the integration of urban and rural development through the flow of rural labor force. Based on this, it is proposed to improve the sustainable mechanism of urban-rural integration development in the Yangtze River Delta region and promote the basic construction of digital economic facilities.

Keywords: Urban-rural integration, Digital economy, Labor mobility, Mediating effect model, Yangtze river delta region.

1. Introduction

1.1. Research Background

China's rapid urbanization, one-way flow of urban and rural factors, and weak rural development have caused a series of problems since the reform and opening up. Accelerate the docking of rural resource elements in the Yangtze River Delta region with the global market, and make the whole urban-rural integration development mechanism an inevitable requirement for high-quality economic and social development. The development of digital economy has obviously become an important driving force for China's economic and social development. At present, the problems of limited free flow of urban and rural resource elements and uneven basic public services still exist in China, which have become a major problem that must be solved as soon as possible. The integration of urban and rural areas has always been a hot topic in academic circles. It is an inevitable requirement for the development of urban-rural relations to a certain stage and an institutional channel to open up the flow of factors between urban and rural areas. Optimizing the distribution of urban and rural resources and making the market play a decisive role in resource allocation can promote the mutual flow of urban and rural resources and inject vitality into rural revitalization and urban-rural integration and development.

1.2. Research Significance

As the trend of new economic development, digital economy is an important factor and spatial carrier of urban and rural coordinated development, and it has gradually become the focus of cracking new kinetic energy and transformation and development^[1]. However, at present, the empirical study on the influence of digital economy on urban-rural integration is still limited. Digital economy can better promote the integration of urban and rural development in the

Yangtze River Delta region by promoting the optimal allocation of capital and labor factors in space. The digital economy promotes the resources in the fields of production and consumption in a larger spatial scope in urban and rural areas, and the coordinated development of urban and rural industries is strengthened; Adjust the industrial structure, create new and new consumer markets by creating new ones, thus promoting the growth of market economy and promoting the flow of labor from the primary industry to the secondary and tertiary industries. With the development of digital economy, the Internet platform has been continuously upgraded, and digital technology has been applied to the agricultural industry, so that modern agriculture, new industries and modern service industries are organically combined, industrial functions are expanded, and various formats are cultivated; At the same time, it has also prompted a large number of capital elements to flow to agriculture-related industries, realizing multiple values and stimulating new economic development momentum. The digital economy has broken through the geographical space limitation, and the cross-space exchange of urban and rural elements has been realized. Therefore, it is of great significance to actively innovate the road of urban-rural integration and development through digital development.

2. Literature Review

At present, the academic research on the development of urban-rural integration in China is divided into the following categories: First, the influencing factors of urban-rural integration in China are studied through empirical analysis; The second is to study the level of urban-rural integration development in various regions; The third is to study the internal problems of urban-rural integration and development.^[2] Guo Lingxia et al. (2023) indicated that the urbanization index of China province showed an overall upward trend, with the highest in the eastern region, followed by the central

region and the lowest in the western region. The index of urban-rural integration development in China province shows a fluctuating trend, and the eastern region is higher than the central and western regions. [3] Wang Wei and Liu Hui (2023) studied 11 provinces in the demonstration area, analyzed the urbanization rate and the income ratio of urban and rural residents in each province, and analyzed the coordinated development of industrial integration in each demonstration province, pointing out that the problems of large rural population and low urbanization rate still exist, the income gap between urban and rural areas is large, the integration degree of primary and secondary industries is relatively low, and the industrial base is weak. Urban-rural integration is an important content of rural revitalization, which promotes the development of rural revitalization. [4] Wen Jun and Chen Xue (2023) said that the development of urban-rural integration promotes the modernization of state governance. In recent years, the tension of "certainty-uncertainty" in the development of urban-rural integration has been intensified, and the uncertain factors have been growing, and various development opportunities and uncertain challenges of urban-rural integration coexist.

As a new economic model, the digital economy promotes the high-quality development of the economy and promotes the growth of China's economy. Economic growth promotes the development of urban-rural integration in China. Therefore, digital economy helps to narrow the income gap between urban and rural areas and promote urban-rural integration. [5] Hua Xingshun (2021) said that the digital economy is not only a problem of sustained economic and social development, but also a kind of promotion and development of human civilization. The digital economy plays a very important role in the relationship between urban and rural areas and the relationship between workers and peasants. It is necessary to grasp the layout of the digital economy and use digital economy and digital technology to promote the continuous development of urban-rural integration. Yao Yuchun and Zhang Jiashi (2023) explored the different paths of coupling development by constructing the coupling coordination degree and obstacle degree model of "digital economy-rural integration development system", indicating that the overall development progress of digital economy is weaker than that of urban-rural integration development, but the growth rate of digital economy is obviously faster, providing a new development path for urban-rural integration development.

Generally speaking, the research direction of digital economy is very extensive and the research results are rich, but there are few research results on the relationship between digital economy and urban-rural integration in the Yangtze River Delta. The research on digital economy and urban-rural integration is mostly theoretical and empirical. In addition, the previous research did not deeply explore how the digital economy affects the urban-rural integration. Therefore, the research significance of this paper lies in: supplementing the previous theories about digital economy and urban-rural integration; The Yangtze River Delta, a representative region, is selected as the research object to conduct empirical research and provide valuable reference for other regions. Using data model to explore the relationship between digital economy and urban-rural integration, and provide scientific decision-making considerations for the further development of urban-rural integration.

3. Theoretical Analysis

3.1. The Impact of Digital Economy on Urban-Rural Integration

The influence of digital economy on urban-rural integration can be discussed from three aspects: data elements, data industry and data technology. From the perspective of data elements, the application of digital economy makes all kinds of data in production and life more open and shared. Digital elements are different from traditional elements and have strong spillover, involving multiple production links. Taking data as a factor of production into full play, the cost of economic exchange between urban and rural areas has been greatly reduced, bridging the digital gap between urban and rural areas and improving production efficiency. From the perspective of data industry, the development of data industry has eased the dilemma of data shortage in the past, and the characteristics of easy sharing and transmission of data have also provided a new way for urban-rural communication. Combining the data industry with urban and rural development will promote their respective economic development, boost the coordination of urban and rural work and narrow the gap between urban and rural areas.

The uncoordinated regional development and the large gap between urban and rural development are inevitable and persistent problems in the development stages of various countries. China's rural revitalization has made great achievements, but the gap between rural and urban development has not been solved. As a powerful tool for development in the Internet age, data can narrow the regional development gap in many ways by applying it to solve the big gap between urban and rural development.

According to the above analysis, the following assumptions are put forward:

H1: Digital economy is conducive to promoting the integration of urban and rural development.

3.2. The Indirect Impact of Digital Economy On Urban-Rural Integration

The development of urban-rural integration is not only reflected in two aspects, and the application of digital economy in it is often not directly reflected. For example, one of the important links to promote rural development-improving rural infrastructure construction, the application of digital economy in it is not to actually install equipment or build sites on the spot, but to track materials and analyze subsequent data. The digital economy optimizes the industrial structure in many ways, and the development of digital industry pushes back the cultivation of a number of digital economic talents and the development of digital technology. The enrichment of the digital talent team is beneficial to the transformation and optimization of China's talent structure and is more suitable for the development of the times. Talent is a powerful driving force for economic development, and the new change in the composition of the talent team has given new kinetic energy to economic development. The characteristics of digital economy make the interaction and integration between urban and rural areas stronger and promote the integration and development of urban and rural areas.

According to the above analysis, the following assumptions are put forward:

H2: Digital economy promotes the integration of urban and rural development by promoting the flow of rural labor force.

4. Research Design

4.1. Variable Selection

4.1.1. Explained Variable

The Development Level Of Urban-Rural Integration (Y). In terms of index system construction, from three aspects of urban-rural economic integration, urban-rural life integration and urban-rural spatial integration, indicators such as per capita GDP, urban-rural residents' consumption expenditure ratio, number of hospital beds, urbanization rate and forest coverage rate are selected. See Table 1 for the specific index

system.

4.1.2. Explanatory Variable

The Development Level Of Digital Economy (X). In terms of index system construction, refer to the White Paper on Digital Economy Development in China (2022). Starting from three aspects: digital infrastructure, digital industrialization and industrial digitalization, this paper selects indicators such as mobile phone penetration rate and the proportion of mobile Internet users to build an index system, as shown in Table 2.

Table 1. Urban-rural integration system

Primary index	Secondary index	Variable selection	explain
Development level of urban-rural integration	Urban-rural economic integration	Per capita GDP	Gross regional product/resident population at the end of the year
		Consumption ratio of urban and rural residents	Per capita consumption expenditure of urban residents/rural residents
		Income ratio of urban and rural residents	Per capita disposable income of urban residents/rural residents
	Integration of urban and rural life	Number of hospital beds	Wanzhang
		Urbanization rate	%
	Urban-rural spatial integration	Urban spatial expansion	Ten thousand kilometers
		passenger capacity	Crop sown area/built-up area
		forest coverage rate	ten thousand people %

Table 2. Digital economy index system

Primary index	Secondary index	Indicator meaning	unit
Development level of digital economy	Digital infrastructure	Long-distance optical cable line length	kilometre (km)
		Internet penetration	%
		Mobile phone penetration rate	%
		Number of domain names	ten thousand
		Proportion of broadband Internet users	%
	Digital industrialization	Proportion of enterprises with e-commerce transaction activities	%
		Number of websites per 100 enterprises	%
	Industry digitalization	E-commerce purchase amount	hundred million yuan
		Software business income	hundred million yuan
		Electronic commerce sales	hundred million yuan
		The added value of secondary and tertiary industries	hundred million yuan

4.1.3. Control Variables

The development level of urban-rural integration is not only affected by the development level of digital economy, but also affected by the following control variables: industrial structure (x1), measured by the added value of secondary and tertiary industries /GDP; The income gap between urban and rural areas (x2) is measured by the per capita disposable income gap between urban and rural residents.

4.1.4. Intermediary Variable

Regarding the research on the influence of labor transfer on the transformation of urban-rural dual economic structure and the allocation of driving factors of digital economy, the intermediary variable set in this paper is rural labor mobility (ld).

4.2. Model Setting

There is a correlation between digital economy and urban-rural integration. Establish a fixed effect model to estimate the impact of the development level of digital economy on the development of urban-rural integration, with the specific forms as follows:

$$Y_{it} = m_0 + m_1 x_{it} + \lambda x_{it} + v_i + e_t + \epsilon_{it} \quad (1)$$

Where I stands for province and t stands for year. M0 is a constant term, m1 is the regression coefficient of xit to yit, Xit is the set of control variables affecting the urban-rural integration, et represents the time-fixed effect, vi represents the individual fixed effect, and ϵ_{it} is a random disturbance

term.

Considering that the digital economy will affect the inflow of urban and rural factors, promote the flow of rural labor force between urban and rural areas, and then promote the integration of urban and rural development, the intermediary effect model is selected for empirical test, and the measurement model is as follows:

$$Y_{it} = \alpha_0 + \alpha_1 x_{it} + \lambda x_{it} + v_i + e_t + \epsilon_{it} \quad (2)$$

$$Med_{it} = w_0 + w_1 x_{it} + \theta x_{it} + v_i + e_t + \epsilon_{it} \quad (3)$$

Among them, med represents the intermediary variable, that is, the allocation capacity of rural labor flow, and the definitions of other variables remain unchanged. Equation (2) is used to test whether the development level of digital economy has a significant impact on the level of urban-rural integration; Equation (3) is used to test whether the influence of the development level of digital economy on the intermediary variables is significant after the intermediary variables are added.

5. Robustness Test Analysis

In order to make the research results more robust, this paper adopts (1) eliminating some samples: eliminating the data of Shanghai, a municipality directly under the central government, and continuing to use it for regression analysis; (2) Replace the regression method: replace the explained variables to re-estimate the relationship between digital economy and urban-rural integration. Compared with last year, if the development level of urban-rural integration has improved in this year, the value is 1; otherwise, if the development level of urban-rural integration has decreased in this year, the value is 0, so logit and probit regression models are used for measurement and estimation.

Table 3. Robustness analysis results

variable	Reject some	Logit	Probit
	samples	regression	regression
	Model (1)	Model (2)	Model (3)
X	0.129 (1.27)	4.234*** (3.708)	2.750*** (4.630)
X1	0.126 (0.77)	6.141*** (2.750)	4.143 (3.280)
X2	-0.105 (-0.98)	-0.073 (-0.590)	-0.043 (-0.590)
Intercept term	-0.678** (-2.08)	-1.499 (-0.820)	-0.754 (-0.240)
Sample size	128	160	160
R	0.577	0.143	0.071

6. Mechanism Analysis

The previous theoretical research shows that the promotion of the development level of digital economy to the development level of urban-rural integration stems from the degree of rural labor mobility, so the intermediary effect model is selected to test the above mechanism, and Table 4 shows the regression results of rural labor mobility.

Rural labor mobility acts as a partial intermediary in this mechanism, and the digital economy indirectly promotes the development of urban-rural integration by promoting rural labor mobility, which supports hypothesis 2.

Table 4. Intermediary Effect Analysis of Regional Labor Mobility

Variables and statistical parameters	Model 1	Model 2	Model 3
	y	trans	y
X	0.332** (3.25)	0.032** (1.10)	0.147*** (3.65)
ld			0.005 (0.34)
Control variable	control	control	control
Intercept term	-0.576** (-3.83)	2.425*** (33.87)	0.714*** (6.59)
Sample size	160	160	160
R	0.475	0.425	0.675

7. Research Conclusions and Suggestions

Based on the panel data of the Yangtze River Delta region, this paper actually demonstrates and tests the influence of different levels of digital economy in the Yangtze River Delta region on the future development of urban-rural integration and its mechanism. The following are three main conclusions: Conclusion 1. From the perspective of rural migrant labor, the establishment of modern infrastructure such as high-speed rail and trains can promote the labor flow between rural areas and cities, make it easier for farmers to move between urban and rural areas, and significantly increase farmers' income, thus having a positive impact on the development of urban-rural integration. At the same time, the rapid development of digital economy has created new job demands in the market, created new employment opportunities for farmers, promoted the labor flow from rural areas to cities, and further promoted the integrated development of urban and rural areas. From the perspective of resource allocation, digital economy provides a new way of resource allocation, improves its efficiency, provides new energy and new impetus for urban-rural integration development, improves the level of resource allocation, promotes rural development, reduces the gap between urban and rural areas, and further contributes to urban-rural integration development. Second, the digital economy has a positive impact on the integration of urban and rural development. This paper compares the development level of digital economy and urban-rural integration, lists regression equations through data analysis, and verifies that digital economy can really promote the positive development of urban-rural integration. Conclusion 3. The influence of digital economy on the urban-rural integration development in the Yangtze River Delta region is regionally differentiated. Compared with the less developed northern region, digital economy has a more significant positive impact on the urban-rural integration development in the southern region. After analysis and research, it is found that the developed degree of digital economy in the two regions is different, and the region with excellent resource allocation has a larger market scale and a better acceptance of rural migrant workers.

Based on the above three conclusions, the following suggestions are put forward for the digital economy in the Yangtze River Delta to accelerate the development of urban-rural integration:

First, the digital industry is driving. Encourage the transfer of digital industry to rural areas and promote the deep integration of digital technology with traditional agriculture,

manufacturing and service industries. Support the development of digital industries such as Internet, mobile payment and distance education, and promote the interactive and coordinated development of urban and rural economy.

Second, the innovative application of digital technology. Strengthen the application of digital technology in enterprises, education, medical care and other fields, and promote digital transformation. Encourage enterprises to cooperate with universities and scientific research institutions to jointly develop and innovate, and improve the level and efficiency of technology application. At the same time, formulate policies and measures for the application of digital technology to promote the popularization and application of technology to rural areas.

Third, the flow of digital production factors. Strengthen information flow and promote the optimal allocation of capital, talents, technology and other production factors between urban and rural areas. Establish a digital mobile platform for production factors, provide services such as policies, finance and talents, help enterprises and farmers solve problems in capital, technology and talents, and promote urban-rural interaction and optimal allocation of production factors.

Fourth, digital public services have been upgraded. Using digital technology to improve the level of urban and rural public services, including transportation, water conservancy, education, medical care and other fields. Establish a digital traffic information platform to provide real-time traffic information and facilitate travel; Promote the digital water conservancy management system and improve the efficiency

of water resources utilization; Strengthen the sharing of digital educational resources and improve the quality of education; Establish a digital medical system to facilitate farmers' remote medical treatment.

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