



Analysis on the Effect of Digital Economy on the Integration of Rural Three Industries

Fengmao Xian⁴, Bingtong Lin², Huimin Shao³, Liangyan Lu^{1,*}, Yihang Guo²,
Qing Wang²

¹Accounting and Finance Department, Yunnan College of Business Management, No.296, Haitun Road, Wuhua District, Kunming, 650000, Yunnan, China

²School of Economics, Yunnan Normal University, No.768, Juxian Street, Chenggong District, Kunming, Yunnan 650000, Yunnan, China

³School of Management, Yunnan Normal University, No.768, Juxian Street, Chenggong District, Kunming, Yunnan 650000, Yunnan, China

⁴Faculty of Electrical and Information Engineering, Oxbridge College, KunMing University of Science and Technology, Kunming, 650000, Yunnan, China

*Corresponding author: lly@ynjgy.edu.cn

Abstract. The integration of three industries in rural areas is the key to building a modern agricultural system and helping China's high-quality economic development. The digital economy has become a new driving force for China's high-quality economic development, and its development has brought new opportunities and challenges to the deep integration of rural tertiary industries in China. In this paper, panel data of 30 provinces in China from 2015 to 2021 are selected to explore their influence by using the intermediary effect. The results show that the digital economy promotes the integration of rural three industries through agricultural technology innovation and social consumption upgrading. Among the four major economic zones, the digital economy has the most significant impact on the western region, followed by the eastern and central regions, and the north-east is not significant. To provide theoretical and data support for the digital economy to the integration of rural three industries.

Keywords: Digital economy; Rural three industry integration; Mediating effect; heterogeneity

1 Introduction

Digital economy and rural tertiary industry integration have inherent compatibility in theory and practice, and some researchers have actively advocated the use of digital economy to promote rural tertiary industry integration [1]. From the perspective of the division of labor theory, although the digital economy promotes non-agricultural employment in rural areas, it may accelerate the outflow of agricultural labor force, which is not conducive to the three-industry integration based on agriculture [2]. In addition, the integration of three industries is practiced in rural areas, and its devel-

opment is affected by economic foundation, resources, and technology, so the effectiveness of rural digital economy is limited. So can the digital economy promote the integration of rural three industries? This paper plans to select panel data from 30 provinces in China from 2015 to 2021 to empirically explore the direct and indirect mechanisms of digital economy affecting rural tertiary industry integration.

Innovations: 1) Clarify the specific mechanism of digital economy on the integration of rural three industries, and provide references for researchers related to industrial integration theory and digital economy theory; 2) Help the government to explore the path of digital economy to promote the integration and optimization of rural three industries.

2 Existing Research Basis

In recent years, the academic community has paid more attention to the exploration of digital economy to promote the integration of rural three industries, and the research content has continued to innovate. Xie Kang et al. took data as a key production factor to explore the integration mechanism between agriculture and digital economy industry [3]. Li Jingyu analyzed the practice path of digitalization driving the integration of rural three industries [4]. Jiang Changyun proposed that the digital economy could drive the integration of rural three industries by reducing costs and expanding space [5]. From the perspective of technological innovation and urban-rural connection, Huang Wanting et al. analyzed the impact of digital economy on the integration of rural tertiary industries by using intermediary effect and spatial metrology [6].

3 Theoretical Basis and Research Hypothesis

3.1 The Direct Mechanism of Digital Economy Affecting the Integration of Rural Three Industries

With the support of data, digital technology and network platform, it rapidly develops the integration of rural three industries, changes the agricultural production mode, improves the processing efficiency of agricultural products, and extends the agricultural industry chain. At present, most studies focus on digital economy to promote the development of agricultural division model by using the economic effect of division of labor to increase the return of economic effect [6]. Based on the industrial integration theory, the inclusive nature of digital economy promotes the flow of rural surplus labor to non-agricultural sectors to improve marginal efficiency, improve the utilization rate of rural resources, and promote diversified agricultural comprehensive development models [7]. Therefore, hypothesis 1 is proposed. Hypothesis 1: The development of digital economy can effectively promote the integration of rural three industries.

3.2 Indirect Mechanism of Digital Economy Affecting Rural Three-Industry Integration

Agricultural technology innovation is of great significance to the process of rural three-production integration. On the one hand, based on the theory of technological innovation diffusion, agricultural technological innovation can bridge the technological gap, improve the level of rural agricultural mechanization, promote agricultural large-scale production, and strengthen the internal power of rural three-production integration [8]. On the other hand, green innovation in agricultural technology innovation can reduce agricultural pollution, build green ecological and circular agriculture, and promote the integrated development of agricultural economy and ecological functions [9]. This leads to hypothesis 2. Hypothesis 2: Digital economy promotes the integrated development of rural three industries through agricultural technology innovation.

The upgrading of social consumption adds impetus to the integration of agriculture and three industries. Based on the demand theory, market consumption demand can promote the transformation of agricultural industry, and agricultural business entities are bound to extend along the industrial chain and promote the development of new business forms that integrate with agriculture [10]. In addition, the upgrading of social consumption has spawned sales channels such as e-commerce and community group buying, which has expanded market space for the integration of rural tertiary industries [11]. Therefore, hypothesis 3 is proposed. Hypothesis 3: The digital economy promotes the integrated development of rural three industries through the upgrading of social consumption.

4 Research Design

4.1 Variable Selection

Dependent variable: rural three-industry integration (CON). The index is constructed from three aspects: extension of agricultural industry chain, multi-function development and integrated development of new business forms.

Explanatory variable: Digital economy level (DE). The index is constructed from the four dimensions of digital infrastructure, digital industrialization, digital industrialization and digital development environment and is valued by entropy weight method.

Mediating variables:

(1) agricultural science and technology innovation (AS). The number of agricultural patents is measured logarithmically.

(2) The improvement of social consumption level (CU). Measured as the logarithm of per capita disposable income.

Control variable: The actual human capital level of rural labor force measured by J-F method is taken as logarithm.

(2) Urbanization rate (UR). It is measured by the ratio of urban population to total population in each province.

(3) Marketization level (ML). Use Fan Gang's marketization index to measure.

(4) Degree of economic Openness (EO). Measured by the value of imports and exports of goods as a proportion of GDP.

4.2 Data is Derived from Samples

The data in this paper are from China Statistical Yearbook, China Agricultural Yearbook, China Agricultural Machinery Industry Yearbook, China Rural Statistical Yearbook, China Tertiary Industry Statistical Yearbook and provincial statistical Yearbook, and linear interpolation method is used to fill in the missing values.

4.3 Model Construction

In order to test the above research hypothesis, a benchmark regression model is constructed to carry out empirical analysis. The specific formula is as follows:

$$CON_{it} = \alpha_0 + \beta_0 DE_{it} + \gamma_0 \sum Control_{it} + V_t + V_i + \varepsilon_{it}$$

Where, represents the coefficient of focus in regression, Control is the set of control variables, t and i represent time fixed effect and region fixed effect respectively, and ϵ represents the random disturbance term. Hypothesis 1 is validated using the model (1).

5 Conclusion Analysis

5.1 Descriptive Analysis

The mean value, maximum value 0.551 and minimum value 0.036 of the rural three industries integration of the dependent variable are 0.146, highlighting the significant differences in the development level across China. The core explanatory variable digital economy has an average value of 0.148, a maximum value of 0.747, and a minimum value of 0.015, once again reflecting its regional development imbalance, basically showing a trend of strong east and weak west.

5.2 Regression Analysis

Before the baseline regression, the multicollinearity test is performed first. The result of the inflation factor VIF is 4.42, which is less than 5, thus eliminating the possible multicollinearity problem between explanatory variables. The P value of the Hausmann test of the model is 0.0116, which is significant at the 5% level. Therefore, the fixed effect model is selected as the benchmark regression model, and the results are shown in columns (1) and (2) of Table 1 below.

The results were significant at the 1% level both before and after the addition of control variables. This shows that the digital economy can significantly promote the integration of rural industries, and hypothesis H1 is verified.

Table 1. Results of baseline regression.

Variable	(1) Full sample	(2) Full sam- ple	(3) East	(4) Middle part	(5) Wes t	(6) Northeast
DE	0.598*** (0.176)	0.623*** (0.165)	0.523*** (0.102)	0.334* (0.192)	0.592** (0.227)	0.442 (0.363)
RHC		-0.075 (0.080)	-0.279** (0.105)	0.180*** (0.062)	0.063 (0.038)	-0.197 (0.191)
UR		0.355 (0.497)	0.915* (0.509)	0.627** (0.300)	-2.007*** (0.464)	2.040*** (0.451)
ML		0.008 (0.007)	0.005 (0.008)	-0.002 (0.006)	0.010** (0.005)	-0.002 (0.005)
EO		0.161 (0.111)	0.156** (0.072)	-0.287** (0.121)	-0.094 (0.111)	-0.167 (0.092)
Time-fixed effect	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Regional fixed effect	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
R ²	0.700	0.864	0.861	0.681	0.982	0.700

Note: The standard error of regression coefficient is shown in brackets. ***, ** and * are significant at 1%, 5% and 10% levels respectively.

5.3 Heterogeneity Analysis

In order to further investigate the impact of digital economy on the integrated development of rural tertiary industries in different regions, this paper further divides the total sample into eastern, central, western and northeastern regions based on China's four major economic regions to carry out regional heterogeneity analysis. The test results are shown in column (3- (6) of Table 1. Except for Northeast China, the impact of digital economy on the integration of rural three industries in different regions is significantly positive, with differences only in the magnitude of the impact. The reasons for the lack of significant impact in Northeast China are as follows: the overall digital literacy of rural residents in Northeast China is generally low, and most enterprises have weak awareness of digital transformation. Insufficient investment in digital infrastructure. To solve this problem, the government has introduced preferential policies to attract digital technology talents to work in rural areas. Establishing digitalized demonstration parks for agricultural industry; Cooperation between government and private capital.

5.4 Robustness Test

The measurement indicators of digital economy are diversified. In addition, there may be mutual cause and effect between digital economy and tertiary industry integration, which will cause endogenous problems and make the estimation of the model inaccurate. In order to ensure the reliability of the research results, this paper mainly uses the replacement of core explanatory variables, instrumental variables and lagging variables to perform robustness tests to verify the rationality of the core conclusions. As can be seen from Table 2, compared with the benchmark regression, the coefficient is only different in value, and the positive and negative values are unchanged, indicating that the research conclusion is robust.

Table 2. Results of robustness.

Variable	CON (1)	CON (2)	CON (3)	CON (4)
DE	0.000** (0.000)	0.713*** (0.252)	0.609*** (0.183)	
L.DE				0.488*** (0.144)
Control variable	Control	Control	Control	Control
Time-fixed effect	Fixed	Fixed	Fixed	Fixed
Regional fixed effect	Fixed	Fixed	Fixed	Fixed
R ²	0.580	0.664	0.633	0.944

5.5 Mediation Effect Test

Based on columns 2 and 3 of Table 3, agricultural science and technology innovation and social consumption upgrading are introduced into the equation as intermediary variables, and the impact of digital economy on the integration of rural three industries is still significant at the level of 1% and 5%, but the impact of agricultural science and technology innovation and social consumption upgrading on the integration of rural three industries is not significant. In order to determine the existence of intermediary effect, this paper further takes agricultural technological innovation and social consumption upgrading as intermediary variables and conducts bootstrap test. The test results are shown in Table 4. Taking agricultural science and technology innovation as the mediating variable, the lower limit of 95% confidence interval is 0.0632 and the upper limit is 0.1778, without 0, indicating the existence of such mediating effect. H2 is assumed to be confirmed. Taking social consumption upgrading as the mediating variable, the lower limit of 95% confidence interval is 0.1086 and the upper limit is 0.348, excluding 0, indicating the existence of the mediating effect. Hypothesis H3 is verified.

Table 3. Results of mediation effect test.

Variable	(1)	(2)	(3)	(4)
	AS	CON	CU	CON
DE	-1.252 (0.995)	0.619*** (0.162)	0.223** (0.103)	0.574*** (0.144)
RHC	-0.486 (0.839)	-0.077 (0.081)	0.063 (0.065)	-0.089 (0.083)
UR	6.429 (4.706)	0.376 (0.510)	0.942** (0.368)	0.149 (0.454)
ML	-0.043 (0.079)	0.007 (0.007)	0.001 (0.004)	0.007 (0.006)
EO	-2.136*** (0.684)	0.155 (0.105)	-0.034 (0.048)	0.169 (0.117)
AS		-0.003 (0.006)		
CU				0.219 (0.195)
_cons	7.821*** (2.172)	0.187 (0.258)	9.010*** (0.248)	-1.810 (1.779)
R ²	0.679	0.701	0.994	0.707

Table 4. bootstrap test.

Variable	Path	Coef.	Bias.	Std. Err.	[95% Conf Interval]	
AS	indirect effect	0.1103	0.0006	0.0295	0.0591	0.1755
					0.0632	0.1778
CU	direct effect	0.1918	-0.0031	0.0553	0.0982	0.3176
					0.1086	0.3480

6 Conclusion

This paper takes a total of 30 provinces in China except Tibet and Hong Kong, Macao and Taiwan as research fields during the period of 2015-2021. Based on panel data, this paper empirically examines the direct and indirect mechanisms of digital economy on the integration of rural tertiary industries by using two-way fixed and intermediary effect models. Two conclusions are drawn: First, digital economy significantly promotes the integration of rural three industries; Second, the digital economy promotes the integration of rural three industries through the power of agricultural technology innovation and market consumption upgrading.

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