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The Positive Impact of the Digital Economy on the Regional Economy

-- Evidence from Chinese Provinces and Municipalities along "The Belt and Road Initiative"

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Abstract

In recent years, the added value of China's digital economy has continued to increase, and the digital economy has become an important driving force for national economy. The article selects the relevant data of 18 Chinese provinces and municipalities along "The Belt and Road Initiative" from 2011 to 2019, uses the Entropy Weight Method to measure the development of digital economy and regional economy, and studies the correlation effect between the two. Suggestions were made to boost regional economic growth.

Keywords

Digital Economy; Regional Economy; "The Belt and Road Initiative".

1. Introduction

Since 2020, COVID-19 has swept the world, with cyclical economic fluctuations, global economic growth has declined. With the normalization of COVID-19 and the intensification of geostrategic game, the international economic environment is severe. Against the background of slowing global economic growth, the digital economy has maintained strong vitality and has become a key driving force for stable economic growth.

2. Literature Review

At present, the research on the digital economy mainly includes the following categories: First, the research status and future prospects of digital economy. For example, He (2021) pointed out that the current level of digitalization in China's manufacturing industry is low, and only few manufacturers have achieved artificial intelligence. [1]Secondly, enterprise management in the context of digital economy. He, et al. (2021) proposed the digital transformation of enterprise risk management in the digital era. In addition, the spatial distribution of urban industries and the digital transformation of industries. [2] Wei, et al. (2021) used delivery and questionnaire data to study the spatial distribution and business model of urban retail, and proposed strategies. [3] Zhan and Tang (2021) reviewed the evolution of urban space, analyzed the impact of the digital economy on the layout of traditional urban space, and discussed coping strategies with examples from Zhejiang Province and Guangzhou City. [4] The link between the digital economy and regional economy is also an important topic. Zuo and Chen (2021) expounded the development advantages of digital economy in China in the post-epidemic era, and made suggestions for the development of digital economy. [5] Fan and Wu (2021) explored the impact mechanism of digitization on high-quality economic development based on China's

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provincial panel data, and further discovered the promotion of education and capital levels on digitization. [6]

3. Research Objects and Index Construction

3.1. Research Objects

This article took Xinjiang, Chongqing, Shaanxi, Gansu, Ningxia, Qinghai, Inner Mongolia, Heilongjiang, Jilin, Liaoning, Guangxi, Yunnan, Tibet, Shanghai, Fujian, Guangdong, Zhejiang, and Hainan, 18 provinces and cities along "The Belt and Road Initiative" as research objects.

3.2. Construction of Evaluation System

3.2.1. Development Level of Digital Economy

Zhang and Qin (2021) studied the correlation between the digital economy and regional economic development in the Yangtze River Economic Belt, and constructed an evaluation index system for the digital economy development level including the digital infrastructure index, the digital application index, and the digital industry development index. [7] The evaluation system of digital economy established in this paper is shown in Table 1.

Table 1. Evaluation System of Digital Economy

First-level indicator	Variable		Second-level indicators	Unit
Investment in digital economy	X_1	X_{11}	Number of people in software industry	People
		X_{12}	Total technical contract	Million RMB
		X_{13}	R&D expenditure of industrial enterprises	Million RMB
Digital economy output	X_2	X_{21}	Total telecom business	Billion RMB
		X_{22}	Number of patents	Piece
		X_{23}	The coverage of digital finance	/
		X_{24}	Online mobile payment level	/
Digital economy development environment	X_3	X_{31}	Mobile phone penetration	Pcs/100 people
		X_{32}	Number of Internet Access Users	Million households
		X_{33}	Number of Internet Access Ports	Million
		X_{34}	Number of Internet Domain Names	Million
		X_{35}	Cable length	Kilometer

3.2.2. Development Level of Regional Economic

Zhang and Zhong (2020) established an evaluation system with a total of 14 indicators including economic development, public services, infrastructure, daily life, and ecological environment from the perspective of the eight comprehensive economic zones. [8] Zhang (2021) established an economic development evaluation system with 23 basic indicators in five aspects, including economic vitality, innovation efficiency, green development, daily life, and social harmony. [9] Referring to the research of previous scholars, this paper establishes an evaluation system of regional economy, as shown in Table 2.

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Table 2. Evaluation System of Regional Economy

First-level indicator	Variable		Second-level indicators	Unit
Economic overview	Y_1	Y_{11}	Regional GDP	Billion
		Y_{12}	Local fiscal revenue	Billion
Economic structure	Y_2	Y_{21}	Secondary industry as a share of GDP	%
		Y_{22}	Tertiary industry as a share of GDP	%
Consumption	Y_3	Y_{31}	GDP per capita	RMB
		Y_{32}	Disposable income per capita	RMB

3.3. Data Sources

The sources of data are: 2011-2019 China Statistical Yearbook, the database of China Academy of Information and Communications Technology.

4. Methods and Model

4.1. Variable Description

The explained variable is the regional economy index, and the explanatory variable is the digital economy index. In addition, this paper selects 3 indicators as the control variables, as shown in Table 3.

Table 3. Control Variables

Variable	First-level indicator	Second-level indicator	Unit
X_4	Government investment	Proportion of government expenditure to GDP	%
X_5	Foreign investment	Number of foreign-invested enterprises	Pcs
X_6	Foreign trade	Proportion of imports and exports to GDP	%

4.2. Method

The Entropy Weight Method is used to calculate the development level of regional economy and digital economy. First, standardize the original data X_{ij}. The calculation formula is $x_{ij} = \frac{X_{ij}-\min(X_{ij})}{\max(X_{ij})-\min(X_{ij})}$. Then, calculate the eights of x_{ij} by using $p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}$, n is the number of research objects. Based on p_{ij}, the entropy value E_j equal to $\ln \sum_{i=1}^{n} p_{ij} \times \ln p_{ij}$. Weights of each indicator W_j can be solved, which is $\frac{1-E_j}{k-\sum E_j}$, k is the number of indicators. Thus, the composite score is $\sum_{j=1}^{k} x_{ij} \times W_j$.

The calculated index weights are shown in Table 4.

Table 4. Weights of Indexes

Secondary indicators	X_{11}	X_{12}	X_{13}	X_{21}	X_{22}	X_{23}
Weights	0.110	0.133	0.122	0.099	0.148	0.021
Secondary indicators	X_{24}	X_{31}	X_{32}	X_{33}	X_{34}	X_{35}
Weights	0.025	0.016	0.059	0.059	0.151	0.055
Secondary indicators	Y_{11}	Y_{12}	Y_{21}	Y_{22}	Y_{31}	Y_{32}
Weights	0.238	0.316	0.046	0.058	0.210	0.131

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According to the evaluation system of digital economy and regional economy, the Entropy Weight Method is used to calculate the scores. "The Belt and Road Initiative" includes "The Silk Road Economic Belt" and "The 21st-century Maritime Silk Road". The development of digital economy and regional economy of the two Silk Road Economic Belts are compared, and the results are shown in Table 7.

Table 5. Comparison of Maritime Silk Road and Land Silk Road

Index	Maritime Silk Road	The Silk Road Economic Belt
Regional economy score	0.399	0.154
Digital economy score	0.262	0.078
Government investment	0.062	0.214
Foreign investment	0.477	0.037
Foreign trade	0.453	0.080

As can be seen from Table 5, in terms of government investment, provinces along the Maritime Silk Road are lower than the provinces along The Silk Road Economic Belt. The reason can be explained that compared with the coastal areas, the infrastructure construction in inland areas is poor, the main source of funds is government investment. In contrast, the coastal areas have a higher degree of openness, the economic environment is better than that of the inland areas, and there is more foreign investment.

4.3. Model

The econometric model is as follows:

$$\ln(\text{Regional economy}) = \alpha \ln(\text{Digital economy}) + \beta X + Z \quad (1)$$

Where, α and β represent the parameters to be estimated, X represents the control variable and Z represents the random disturbance term

5. Empirical Analysis

5.1. Descriptive Statistical Analysis

The following table shows the descriptive statistics of each variable in the data composed of the sample from 2011 to 2019, including the minimum value, maximum value, average value, and standard deviation.

Table 6. Descriptive Analysis Statistics Table

VARIABLE	N	min	mean	max	sd
Regional economy	162	0.0542	0.222	0.777	0.162
Digital economy	162	0.0016	0.129	0.938	0.141
Government investment	162	0	0.172	1	0.207
Foreign investment	162	0	0.159	1	0.264
Foreign trade	162	0	0.184	1	0.220

*Data source: Compiled by the author

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5.2. Regression Results

5.2.1. Model Test

To determine the model used in this article, F-test, LM test, and Hausman test are planned. All three tests have p-values of 0, so fixed effects are better than random effects and mixed effects. All annual dummy variables were tested for joint significance with a P value of 0.0000, so the null hypothesis of no time effect was rejected and a two-way fixed model was used. The regression results are shown in Table 11.

5.2.2. Empirical Result

Based on model 1, the Benchmark regression results is in (1)-(4) of Table 7.

Table 7. Results of Panel Data Regression

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6	(7)	(8)
ln(Digital economy)	0.166*** (4.11)	0.162*** (4.12)	0.192*** (4.10)	0.180*** (4.19)				
L.ln(Digital economy)					0.172*** (4.10)	0.164*** (4.02)	0.197*** (4.08)	0.172*** (3.81)
Government investment		-0.925*** (-3.06)	-0.907*** (-3.00)	-0.900*** (-3.25)		-0.879*** (-2.83)	-0.856*** (-2.76)	-0.783*** (-2.72)
Foreign investment			-0.243 (-1.19)	0.379* (1.70)			-0.293 (-1.29)	0.274 (1.12)
Foreign trade				-0.663*** (-5.14)				-0.639*** (-4.48)
Constant	-1.324*** (-8.68)	-1.265*** (-8.48)	-1.144*** (-6.33)	-1.168*** (-7.05)	-1.192*** (-7.55)	-1.141*** (-7.39)	-1.006*** (-5.41)	-1.084*** (-6.26)
Observations	162	162	162	162	144	144	144	144
R-squared	0.991	0.992	0.992	0.993	0.991	0.992	0.992	0.993
city FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: in the table, ** *, * *, * respectively represent the significance level of 1%, 5% and 10%, the same below.

In this paper, the method of lagging the core explanatory variables by one period is used to test the indigeneity of the model. The results are shown in (5)-(8) of Table 7. The results show that the coefficient of the lag term of the core explanatory variables is still positive, indicating that the level of regional economic development is positively affected by the development level of the digital economy in the previous period. The effect is basically consistent with the main conclusion.

5.3. Discussion

It can be seen from Table 11 that with the sequential addition of control variables, the coefficient of the digital economy development level is still positive, indicating that the positive impact of the digital economy development level on the regional economic development level is more significant. In model (4), the coefficient of the digital economy development level is 0.271, that is, for every 1% increase in the digital economy development level, the regional economic development level increases by 0.271%.

For the level of government investment and foreign trade, there is a significant negative correlation between these two variables and the level of regional economic development. The

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possible reason is that government investment is a long-term process, and it is difficult for the investment to have a positive impact in the short term. In addition, the panel data in this article are data from 2011 to 2019, the time span is short, and negative impacts are normal. In recent years, China's economic development has gradually shifted from high-speed development to high-quality development. The quality and innovation of domestic products have been greatly improved, resulting in a decrease in dependence on imported products. Therefore, the negative correlation between foreign trade dependence and economic level is also can be explained.

5.4. Robustness Check

In order to prove the above research conclusions, this article uses two methods of abbreviating tail processing and replacing core explanatory variables to test the robustness.

In this paper, Winsorize is performed on the data with the main explanatory variables and the explained variables at the 1% and 99% quantiles, so as to reduce the influence of the extreme values of variables on the regression results of the model. The specific regression results are shown in (1)-(4) of Table 8. After removing extreme values, it is found that there is still a significant positive correlation between the explanatory variables and the explained variables, so the model is more robust.

The explanatory variable digital economy development level is replaced by the total telecom business. The results show that there is still a significant positive correlation between the explanatory variable and the explained variable, so the model is robust, and the results are shown in (5)-(8) of Table.

Table 8. The Result of Robustness Check

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6	(7)	(8)
ln(Digital economy)	0.166*** (4.11)	0.162*** (4.12)	0.192*** (4.10)	0.180*** (4.19)	0.166*** (4.11)	0.162*** (4.12)	0.192*** (4.10)	0.180*** (4.19)
ln(Telecom business)					0.062** (2.26)	0.046* (1.68)	0.039 (1.27)	0.062** (2.17)
Government investment		-0.925*** (-3.06)	-0.907*** (-3.00)	-0.900*** (-3.25)		-0.838** (-2.55)	-0.859** (-2.59)	-0.783** (-2.59)
Foreign investment			-0.243 (-1.19)	0.379* (1.70)			0.104 (0.51)	0.697*** (3.24)
Foreign trade				-0.663*** (-5.14)				-0.737*** (-5.40)
Constant	-1.324*** (-8.68)	-1.265*** (-8.48)	-1.144*** (-6.33)	-1.168*** (-7.05)	-1.687*** (-14.39)	-1.682*** (-14.65)	-1.715*** (-13.03)	-1.598*** (-13.16)
Observations	162	162	162	162	161	161	161	161
R-squared	0.991	0.992	0.992	0.993	0.990	0.991	0.991	0.992
city FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

6. Conclusion

This paper selects the regional economic data of 18 Chinese provinces and municipalities along “The Belt and Road Initiative” from 2011 to 2019, in order to study how to better promote the digital economy and regional economy. After the analysis, the following recommendations are given:

Promote the construction of digital economy infrastructure and accelerate the improvement of the digital literacy of the society. Digital economy infrastructure is the cornerstone of the

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development of digital economy. It is necessary to increase the investment and construction. Moreover, the government should improve the environment of digital economy, raise the awareness of digital literacy and vigorously promote digital literacy education.

Promote the development of digital technology and increase investment in digital technology research and development. Digital technology is a key factor restricting the growth of China's digital economy, and it is also an important breakthrough for current digital economy. Therefore, it is necessary to increase financial investment in scientific research, encourage innovation of enterprises, and speed up the construction of digital talent teams.

Promote industrial digital transformation. Firstly, promote the integration of digital economy and cultural tourism, and carry out digital transformation of scenic spots. Secondly, build intelligent government service platform in order to improve efficiency. In addition, build smart factories to realize digital management and production in manufacturing industry. Last but not least, promote the digitization of agricultural production equipment, improve the efficiency and quality of agricultural production.

Improve the legal system of digital economy. Supporting policies should be established in a focused manner to ensure the healthy development of digital economy.

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