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Research on the Economic Development Effect of Digital Economy

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Abstract: The digital economy has gradually become an important driving force for economic development. We empirically tested the impact of the digital economy on economic development using inter provincial panel data from 2012 to 2018 in China. Research has found that the digital economy has had a significant positive impact on China's economic development, indicating that it has played a positive role in economic development and also reflecting the enormous opportunities that the digital economy has brought to China's economic development. Therefore, in the future, it is necessary to further improve the new digital infrastructure and strengthen the cultivation of digital information technology talents.

1. Introduction

With the development of modern economy, the crude growth model driven by traditional production factors such as land, capital and labor force has been difficult to adapt to the current economic situation. The new generation of information technology has escorted the development of the digital economy, and the world has entered the era of the digital economy. Compared with developed countries, although China's digital economy transformation started late, the Chinese government has given great support to the digital economy, and the Internet penetration rate has increased significantly in the past ten years, and the digital economy has developed rapidly. China is sparing no effort in vigorously developing the digital economy and promoting the integration of the digital economy and the real economy, accelerating the transformation of old and new driving forces, thereby promoting high-quality economic development. China has become the world's second largest digital economy, and its late-comer advantage has gradually become prominent.

Due to the importance of the digital economy, fruitful research results have been generated around it. De *et al.*(2008)[1] pointed out that the digital economy has an impact on many areas of society, increasing potential employment opportunities and improving the efficiency of matching market supply and demand, and directly improving the income level of workers. Han Haiyan et al. (2017)[2] found that the internet can reduce the Gini coefficient of society, thereby optimizing income distribution and becoming an important source of income for Chinese residents. Jorgenson et al.(2007)[3] believes that digital technology has greatly improved the total factor productivity of the market by transforming and upgrading the informatization and digitalization of enterprises. Basu & Fernald (2007)[4] pointed out that digital economy not only improves total factor productivity, but

also reduces information asymmetry and improves market operation efficiency. Guo Meichen (2019)[5] believes that the digital economy can transform traditional industrial sectors through informatization and achieve industrial transformation and upgrading. The research by Liu Yang and Chen Xiaodong (2021)[6] indicates that the digital economy promotes the advancement and rationalization of industrial structure. Xu Xianchun et al. (2019)[7] pointed out that big data technology can improve the ability to integrate social resources and monitor the environment, providing technical support for green production, green life, and green development.

Through a summary of relevant literature, it can be concluded that the digital economy is indeed an important driving force for economic development. Technological innovation is a strategic support for improving social productivity and comprehensive national strength. The fundamental way for China to maintain stable economic growth has shifted from being driven by factors and investment to being driven by innovation. Therefore, we cannot help but ask whether the digital economy can boost economic development? Therefore, this article will conduct empirical analysis on how the digital economy affects economic development.

2. Theoretical analysis and research hypotheses

From a micro perspective, the digital economy can reduce the marginal costs of enterprises and achieve economies of scale. According to economic theory, enterprises need to reduce their long-term average costs to the lowest point in order to achieve economies of scale. However, in the industrial era, due to factors such as transaction costs, the average cost of enterprises shows a trend of first decreasing and then increasing, which greatly limits the development of enterprise scale (Pei Changhong et al., 2018)[8]. In the digital economy environment, enterprise costs have new characteristics of high fixed costs and low marginal costs. High fixed costs are inevitable due to the need to invest a large amount of funds, manpower, and other resources in early research and development, as well as the construction of corresponding infrastructure. Moreover, companies may provide consumer subsidies in order to attract consumers. However, the cost of data storage is relatively low, with advantages such as easy replication, non-exclusivity, and low loss, which makes the marginal cost of enterprises very low. Once a product is produced, it can be replicated almost at zero cost (Jing Wenjun and Sun Baowen, 2019)[9]. This low marginal cost will gradually reduce the average cost of the enterprise, ultimately achieving economies of scale in production and increasing production, which is conducive to efficient economic operation.

From a macro perspective, the core of the digital economy is data, which is both the final output and an input factor. Data has always existed in our lives, but it was not considered a factor of production before. After entering the era of digital economy, data has shown explosive growth. With the addition of computer technology, data has increasingly demonstrated the ability to allocate resources and improve efficiency, playing an important role in value creation in production. Data has become a new production factor for economic development. With the increase in data volume and value, data will exhibit a characteristic of increasing marginal returns (Fei Fangyu et al., 2018)[10], which undoubtedly brings huge impetus to economic development. Moreover, the development of the digital economy inevitably promotes the transformation and upgrading of some traditional industries. By utilizing digital technology to change the production mode of traditional industries and shift towards intelligent production mode, it significantly improves the resource utilization and production efficiency of traditional industries. At the same time, the digital economy has also driven a large number of emerging industries such as new energy, new materials, high-end equipment, and biopharmaceuticals. The role of digital economy in promoting the transformation and upgrading of traditional industries and driving emerging industries directly promotes economic development. Xu Xiang and Zhao Mofei (2020)[11] incorporated digital capital into the endogenous growth model and

found that data capital has a direct spillover effect on economic growth, and compared to traditional production factors, data production factors play a more important role in the high-quality development of China's economy. Ge Heping and Wu Fuxiang (2021)[12] constructed a two sector model of traditional economy and digital economy to analyze the impact of digital economy on high-quality economic development, and concluded that digital economy can directly empower high-quality economic development. Therefore, based on the above analysis, the following research hypotheses are proposed:

Research hypothesis H: The digital economy has a significant promoting effect on China's economic development, and the degree of impact is significantly heterogeneous in the East, West, and Central regions.

3. Empirical design

3.1 Econometric model

The purpose of this study is to empirically test the impact of the digital economy on China's economic development. Therefore, the following benchmark measurement model is constructed:

$$PGDPit = \alpha 0 + \alpha 1DEit + X' it \beta + \mu I + \varepsilon It \quad (1)$$

Among them, PGDPit represents the economic development level of province i in year t. DEit is the digital economy development level of province i in year t, and its coefficient α 1 is the core parameter of concern in this article. Xit is another control variable that affects economic development, μ I is an individual fixed effect, ε It is a random perturbation term.

3.2 Variable selection

3.2.1 Measurement of main variables

The explanatory variable for this article is Economic Development (PGDP), which uses the per capita real GDP after eliminating inflation factors as a measure of economic development. The per capita real GDP is calculated based on 1999. The core explanatory variable of this article is the digital economy (DE). Considering the availability of data, this article uses the digital economy development index of Caixin Think Tank and BBD Digital Alliance as the core explanatory variables.

3.2.2 Selection of control variables

Economic development is not only influenced by the digital economy, but also by many other factors. Therefore, it is necessary to include some other variables that affect economic development in the model to reduce estimation bias caused by missing variables. Referring to existing research literature, this article selected the following control variables: urbanization rate (Urban), human capital level (Hc), financial development (Finance), population structure (Pop), industrial structure upgrading (Is), infrastructure (Infra), and degree of foreign trade (Trade). The urbanization rate is measured by the proportion of urban population to the total population; Human capital is represented by the average number of years of education received; Financial development is measured by the proportion of deposit and loan balances to GDP; The population structure is measured by the proportion of the population aged 65 and above to the total population; The upgrading of industrial structure is characterized by the proportion of the output value of the tertiary industry to GDP; Infrastructure is measured using per capita road area; The degree of foreign trade is expressed as the proportion of the total import and export of goods by foreign-invested enterprises to GDP. Subsequent analysis also needs to examine the mechanism and role of technological innovation. This article uses

the per capita number of patent applications accepted to measure the level of technological innovation.

3.3 Data source

This article selected panel data from 30 provinces/municipalities/autonomous regions (excluding Tibet) from 2012 to 2018. The digital economy index was obtained from the Caixin Think Tank, while other data was obtained from the China Statistical Yearbook, China Science and Technology Statistical Yearbook, and statistical yearbooks of various provinces (municipalities, autonomous regions). Finally, a balanced panel data of 210 samples was obtained.

4. Empirical results and analysis

Table 1: The Impact of the Digital Economy on Economic Development

Variable	OLS				FE		
	(1)	(2)	(3)		(4)	(5)	(6)
DE	0.0210***	0.0059***	0.0063***		0.0134***	0.0078***	0.0066***
	(0.0015)	(0.0008)	(0.0008)		(0.0009)	(0.0013)	(0.0012)
Urban		0.0367***	0.0362***			0.0239***	0.0214***
		(0.0019)	(0.0018)			(0.0050)	(0.0045)
Hc		-0.0960***	-0.0250			0.0660**	0.0603***
		(0.0297)	(0.0198)			(0.0254)	(0.0208)
Finance			-0.0762***				0.0270
			(0.0138)				(0.0270)
Pop			0.0199***				0.0025
			(0.0045)				(0.0073)
Is			-0.0034*				0.0018
			(0.0019)				(0.0029)
Infra			0.0063**				0.0028
			(0.0026)				(0.0035)
Trade			0.0018				0.0004
			(0.0012)				(0.0014)
C	9.8403***	9.0208***	8.4751***		10.0495***	8.2227***	8.2075***
	(0.0436)	(0.1971)	(0.1264)		(0.0246)	(0.2442)	(0.2781)
Obs	210	210	210		210	210	210
F-test	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000
R2	0.548	0.884	0.939		0.905	0.952	0.958

Note: The brackets indicate robust standard error* P<0.1 * * p<0.05 * * * p<0.01; The F-test report shows the p-value; The R2 in the OLS regression report is adjusted R2, while the fixed effects FE regression report is intra group R2.

The benchmark regression results are shown in Table 1, with columns (1) - (3) showing the mixed OLS estimation results, and columns (4) - (6) showing the estimated results within the fixed effects group of panel data. Among them, columns (1) and (4) are the estimated results of the digital economy on economic development when no control variables are added to the model. The second and fifth columns are the estimated results after introducing two control variables, urbanization rate and human capital. Columns (3) and (6) further incorporate variables such as financial development, population

structure, upgrading of industrial structure, infrastructure, and degree of foreign trade into the model. From the OLS estimation results, regardless of how the control variables change, the estimation coefficients of the digital economy on economic development are all positive and significant at the 1% significance level, indicating that the digital economy has a positive effect on China's economic development. Moreover, from columns (1) to (3), the adjusted R^2 continues to increase, indicating that as more control variables are included, the model's fit to the observed values becomes better. However, for panel data models, the OLS estimation method does not consider individual effects, which may lead to biased estimation results. Therefore, it is necessary to use a fixed effect intra group estimation method for estimation. From the empirical results in columns (4) to (6), it can be seen that the fixed effect estimator of the impact of the digital economy on economic development is similar to the OLS results, still positive, and has passed the statistical test at the 1% significance level, indicating that the positive effect of the digital economy on China's economic development still exists.

In summary, regardless of the method used to estimate the panel data model, the estimation results are significantly positive, indicating that the digital economy has a significant promoting effect on China's economic development. Research hypothesis H has been validated. Based on the estimation results in column (6), it can be seen that the regression coefficient of the digital economy is 0.0066, indicating that after controlling for a series of control variables, the development level of the digital economy will increase by 1%, and the economic development level will increase by 0.66 percentage points.

5. Conclusion and inspiration

This article empirically analyzes how the digital economy affects economic development. Research shows that the digital economy has a significant positive impact on China's economic development, indicating that China's digital economy has promoted economic development. Therefore, in the future, it is necessary to further improve the new digital infrastructure, strengthen the cultivation of digital information technology talents, and continue to improve the development level of the digital economy. New digital infrastructure is an important foundation and prerequisite for promoting digital development. In the future, it is necessary to further increase the construction of new digital infrastructure such as big data centers, 5G, AI, blockchain, and enrich the application scenarios of digital information technology. At the same time, it is necessary to strengthen the digital information technology talent training system. Without relevant talent support, new technologies cannot be developed. We need to start by formulating talent development plans and introducing excellent talents from around the world, creating a good policy environment for them, and establishing a comprehensive service supporting system.

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