Research on the Policy Effect and Impact Path of Big Data Comprehensive Pilot area on Digital Trade

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Abstract. In order to study the impact of building a comprehensive big data pilot zone on regional digital trade, a comprehensive evaluation index system for the development level of digital trade was constructed based on the panel data of 21 provinces in my country from 2012 to 2020, and the scores of the digital trade development level of each province were obtained. On this basis, the multi-period DID model is used to test the policy effect. The research results show that the construction of a big data comprehensive pilot zone will significantly promote the development of regional digital trade. On the basis of the analysis of policy effects, taking the application of big data technology as the starting point, and taking direct information service and technology integration service as the main path, this paper explores the impact of the big data comprehensive pilot zone on the production, distribution and development direction of digital trade. Finally, put forward development suggestions in three aspects: actively promoting the big data comprehensive pilot zone policy, improve the digital trade environment and developing big data.

Keywords: Digital Trade, Multi-period DID Model, The Big Data Comprehensive Pilot Area, Big Data

1 INTRODUCTION

Today, with the rapid development of modern Internet and information technology, countries around the world are entering a wave of globalization centered on digital trade, international trade has begun to be highly digitalized, and many countries have gradually elevated the development of digital trade to the level of national strategic development. The report of the 19th National Congress of the Communist Party of China also emphasized the construction of "digital China". As a new economic form, many scholars have carried out research on digital trade, especially the measurement of development level and economic effects. Zheng Xiaoyu (2021) [1] divides the development level of digital trade into five aspects: Internet environment, industry and technology integration, and digital talent pool, and decomposes and measures the development level of digital trade. Wang Xue (2021) [2] conducted research through factor analysis and concluded that R&D investment, R&D human resources, industrial structure and environmental factors have a greater impact on China's digital trade. The research of Yang

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Huiying and Yang Hongju (2021) shows that digital trade has the effect of promoting the rise of the country's global value chain[3] and the upgrading of the industrial structure[4].

To closely follow the opportunities of the digital age, China proposed a strategic plan to establish a comprehensive pilot area for big data in 2016. At present, there are a total of eight big data comprehensive experimental areas in China. They are the Guizhou National Big Data Comprehensive Experimental Area, the Beijing-Tianjin-Hebei (Beijing, Tianjin and Hebei) National Big Data Comprehensive Experimental Area, and the Pearl River Delta (Guangdong) National Big Data Comprehensive Experimental Area, Shanghai Big Data Comprehensive Experimental Area, Henan Big Data Comprehensive Experimental Area, Chongqing Big Data Comprehensive Experimental Area, Inner Mongolia Big Data Comprehensive Experimental Area, and Shenyang Big Data Comprehensive Experimental Area. On the whole, the big data comprehensive pilot area is deployed across the country, and its regional selection needs to comprehensively measure the economic development, infrastructure, human environment and other elements of the region, and its function is to make advance practice for the development of my country's digital economy. However, as another innovative regional economic policy, the National Big Data Comprehensive Pilot Zone is still in its initial stage and needs further research.

The construction of the National Big Data Comprehensive Experimental Zone reflects the important position of big data technology in modern economic development. Big data refers to a large-scale data collection that greatly exceeds the capabilities of traditional database software tools in terms of acquisition, storage, management, and analysis. It has massive data scale, rapid data flow, diverse data types and low value density. Four characteristics. The key to realizing the value of big data technology is to improve the "processing ability" of data and realize the "value-added" of data through "processing". Digital trade is an important way to process and add value to big data. The impact path of big data on digital trade is also one of the key issues of research.

2 RESEARCH DESIGN

2.1 Explained variable

This paper selects the regional digital trade development level score (SC) as the explained variable, and constructs an evaluation system that includes three elements: Internet environment, digital trade logistics, and digital and industrial integration. The elements of the Internet environment include three indicators: the number of domain names in the province, the number of Internet broadband access ports, and the limit length of long-distance optical cables. The elements of digital trade logistics include the total length of postal routes and express business income. The elements of digital and industrial integration include three indicators: e-commerce sales, total telecom business and software business income. The specific evaluation process is as follows:

Step1: Obtain the value xit of all indicators X of the regional digital trade development level, where X_{it} is the actual value of the indicator X, t is the year, and i is the province.

Step2: Because the index is a benefit-type index, the bigger the better, so formula (1) is selected for standardization.

$$Xit = \frac{X - X\min}{X\max - X\min} \times 100 \tag{1}$$

Step3: Determine indicator weights.

$$Wj = 1/n \tag{2}$$

n is the number of secondary indicators

The specific index system is shown in table 1

Step4: Calculate the score using formula four

$$SCit = \sum_{j}^{n} Xit \times Wj \tag{3}$$

The following results are calculated from Equations (1)、 (2)and (3):

Table1 Index System

	First-level	Weight	Second-level	Weight
SC of digital trade	Internet environment	0.375	Number of domain names	0.125
			Number of Internet Broadband Access Ports	0.125
	Digital trade logistics	0.25	Long-distance optical cable line length	0.125
			Total length of postal route	0.125
			Express business income	0.125
	Digital and Industrial Convergence	0.375	E-commerce sales	0.125
			Total telecom business	0.125
			Software business revenue	0.125

2.2 Explanatory variables

Policy Variable (Treat): The national-level big data comprehensive experimental area is established in two batches, so the traditional double difference model is not applicable, that is, the interaction term of the experimental area establishment variable and time variable cannot be simply used as an explanatory variable. (Vairable Treat) is handled as follows: if province i is

set up as a national-level big data comprehensive experimental area in year t, its $Treated_it=1$; otherwise, $Treated_{it}=0$.

Time Variable (Time): The calculation method of the age (Time) of a province being established as a national big data and experimental area is: t is the reporting year of the data, s is the year when the i province was established as the experimental area, if t>s, then $Time_{it}= 1$; otherwise $Time_{it}=0$.

Control Variable:GDP per capita represents the level of regional economic development, and also shows the development potential of regional infrastructure investment and digital trade to a certain extent. Therefore, the logarithm of per capita GDP (Lnpgdp) is selected as one of the control variables. The proportion of the tertiary industry in the total GDP reflects the regional industrial structure to a certain extent, and the industrial structure also has an important impact on digital trade. Therefore, the proportion of the tertiary industry in GDP is selected as the control variable (Ic). The development level of regional digital trade is closely related to the construction of regional information transportation and other infrastructure, so the logarithm of fixed asset investment in the information transportation industry (Lninvest) is selected as the control variable. In addition, government general fiscal expenditure (Lngov) is also included as a control variable

2.3 Econometric model

Since the national-level big data comprehensive experimental area is approved for construction in two batches, and the traditional double-difference model is based on the model setting of a single time point, the multi-phase double-difference model should be selected for empirical analysis. At the same time, the fixed-effect asymptotic double-difference model is applied to avoid the influence errors of individual effects and time effects. Specifically, as shown in formula (4):

$$SC\mathrm{it} = \beta 0 + \beta 1 TreaTit + \beta 2 Timeit + \beta 3 \mathrm{Controlit} + \varepsilon \mathrm{it} + \mu \mathrm{i} + \gamma t \tag{4}$$

Control can represent control variables such as Lnpdgp, Lninvest, Lngov, and Ic, respectively; γt, μi, and εit represent time fixed effects, individual (provinces) fixed effects, and random error terms, respectively.β1 is the effect of the establishment of the pilot area on the regional digital trade level; β2 is the effect of the establishment of the pilot area on the regional digital trade development level; β3 is the impact evaluation of the control variable on the regional digital trade development level.

2.4 Variable data description

In order to study the impact of the comprehensive experimental area of big data on the development level of regional digital trade, this paper selects the data of 20 provinces in the country from 2012 to 2020 for research, and selects Guizhou, Beijing, Tianjin, Hebei, Guangdong, Shanghai, Chongqing, and Henan as the experiments. Group, the rest are control group, because Shenyang is a sub-provincial city, it is counted in the experimental group together with Liaoning Province. Statistical data come from the "*China Statistical Yearbook*"

and the statistical yearbooks of each province. Table 2 shows the descriptive statistics of each variable.

Table2: Variable Descriptive Statistics.

Variable	Obs	Std	Max	Min
SC	189	13.75	95.7	2.9
Lnpgdp	189	0.45	12.1	9.9
Lninvest	189	0.97	7.6	0.693
Lngov	189	0.50	9.8	7.1
Ic	189	10.52	83.8	30.9

3 EMPIRICAL ANALYSIS

A multi-period double-difference model is used to conduct benchmark regression analysis to explore the impact of policies in the big data comprehensive pilot area, and to conduct parallel trend tests, placebo tests, and regional heterogeneity tests.

3.1 Benchmark regression

Stata16.0 software was used to perform regression analysis on the double difference model to test the policy effect of the establishment of the national-level big data comprehensive pilot area on the development level of regional digital trade. The results are shown in Table 3. A represents the regression results without adding control variables and fixed effects, and B represents the regression results without adding control variables but considering the fixed effects. C represents the regression result with the addition of control variables but without considering the fixed effects. D represents the regression result after adding control variables and considering fixed effects. In all three cases, β1 is significantly positive, but decreases with the addition of control variables and fixed effects. This shows that control variables also have an impact on the development of regional digital trade.

Table3: Benchmark regression results

Variable	A	B	C	D
Treat	13.46***	4.67**	5.89***	4.18**
Lnpgdp			7,74**	4.59*
Lninvest			-2.19***	-0.21**
Lngov			22.98***	20.91**
Ic			-0.71*	-0.41*
γ	No	Yes	No	Yes
μ	NO	Yes	No	Yes
Obs	189	189	189	189
R^2	0.12	0.19	0.69	0.59

***, **, and * indicate significance at the 1%, 5%, and 10% statistical levels in turn

3.2 Parallel Trend Test

The assumption of parallel trends or common trends is an important condition for using the difference-in-difference method. This condition requires that before a certain policy is implemented, the digital trade of the treatment group and the control group must maintain a common development trend. This paper uses the parallel trend test method of Beck et al. (2010)[5] to test the parallel trend of digital trade between the treatment group and the control group before the establishment of the big data comprehensive experimental area. The result is shown in Figure 1:

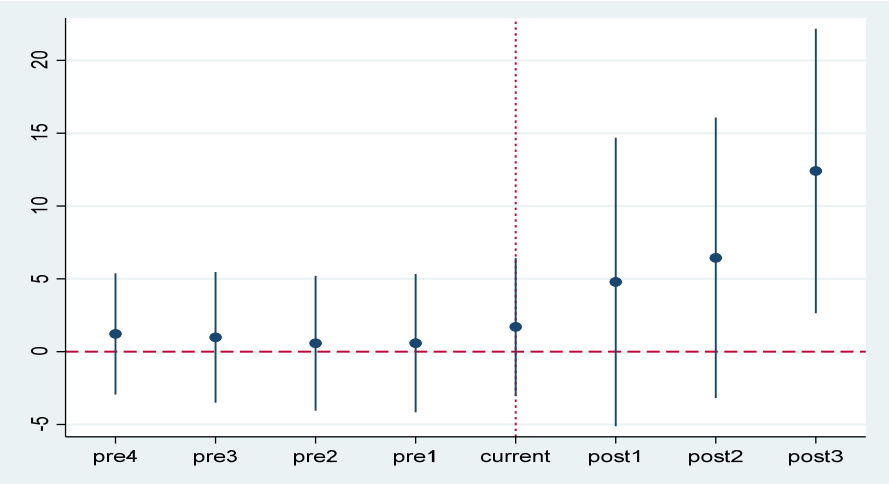

Figure1: Parallel Trend Test Results

It can be seen from the results of the parallel trend test that in the first four years of the policy implementation, that is, at pre1, pre2, pre3 and pre4 on the horizontal axis of Figure 1, the regression coefficient is almost 0, and the confidence interval of the regression coefficient is not significant. However, after the implementation of the policy, the regression coefficient increases year by year, and the confidence interval of post 3 in Figure 1 is completely significant in the third year of the policy implementation, so it passes the parallel trend test.

3.3 Placebo test

This paper adopts the placebo test method of Chen Gang (2012)[6]. In 2014, there was no big data comprehensive experimental area in my country, but through the placebo test, this paper assumes that a big data comprehensive experimental area was established before 2014, and uses this to study its policy effects. By changing the time when the big data comprehensive experimental area is established to conduct a placebo test, the impact of some other policy factors on regional digital trade can be clarified and controlled. The test results are shown in Table 4：

Table4: Placebo Test Results

	2016	2013	2012
Treat	4.18	1.71	1.45
Lngdp	4.59	5.71	5.7
Lninvest	-2.06	-1.79	-1.81
Lngov	20.91	18.89	19.25
Ic	-0.41	-0.45	-0.47

It can be seen from the data in Table 4 that if the policy is advanced to 2013 or 2012, the significance of policy variables will decrease significantly year by year. However, since various provinces have adopted policies to encourage the development of digital trade in recent years, the effects of explanatory variables cannot be completely excluded, so the significance cannot be reduced to zero after changing the policy timing, but it can still confirm the robustness of the model and benchmark regression.

3.4 Regional heterogeneity test

For the convenience of research, the sample areas are divided into eastern (Liaoning, Hebei, Beijing, Tianjin, Shandong, Shanghai, Jiangsu, Guangdong), central (Heilongjiang, Jilin, Shanxi, Inner Mongolia, Anhui, Henan, Jiangxi) and western (Xinjiang, Gansu) , Qinghai, Ningxia, Chongqing, Yunnan, and Guizhou) 3 groups, each group was regressed according to formula (4) using the fixed-effect asymptotic double model, and the results are shown in Table 5.

Table5: Regional heterogeneity test

	East	Central	West
Treat	3.03	3.46	0.59
Lngdp	20.81	9.21	16.99
Lninvest	-4.23	0.28	-0.65
Lngov	15.60	14.52	19.25
Ic	-1.09	0.26	2.14

From the results of the regional heterogeneity test, it can be seen that the policy of the big data comprehensive pilot zone has the smallest effect in the west, which is mainly restricted by the backward economic development in the west. It is relatively affected by other control variables.

4 IMPACT PATH

The impact of the big data comprehensive experimental area on digital trade is mainly realized through big data technology. There are two main ways that big data technology affects digital trade: one is to directly affect the development of digital trade through information services; the other is to affect digital trade through the integration with other Internet technologies. Specifically as shown in Figure 2.

Affecting digital trade through information services is mainly achieved through industrial digitization and digital industrialization. Industrial digitalization mainly refers to the application of digital information technology in the field of production and distribution. For example, in the field of production, existing data and information resources can be used to improve resource allocation, industrial structure and production methods; in the field of sales distribution, the e-commerce model supported by big data and modern Internet technology has emerged, and the sales volume of e-commerce has increased year by year. . Production is the basis of distribution, and distribution will also have an impact on production. Big data provides information services for each link of production and distribution, which in turn affects the development of digital trade. Digital industrialization mainly refers to the Internet industry, electronic information manufacturing industry, communication industry and software service industry. These industries use technologies such as big data, 5G, blockchain and cloud computing, which are an important part of digital trade, and more importantly, digital The focus of future development of trade.

The integration of big data and other technologies is mainly represented by artificial intelligence and the Internet of Things. The integration of artificial intelligence and big data technology can allow digital trade enterprises to break away from the traditional business-driven model, gradually move closer to the data-driven direction, and make scientific decisions. In addition, big data and artificial intelligence can also be applied in many digital trade-related fields such as network data security and modern logistics. The combination of the Internet of Things and big data enables logistics companies to flexibly control each node of the logistics link, reducing logistics costs and improving logistics efficiency, which has far-reaching significance to the logistics industry. Logistics is an important part of e-commerce, and efficient logistics can promote the development of e-commerce.

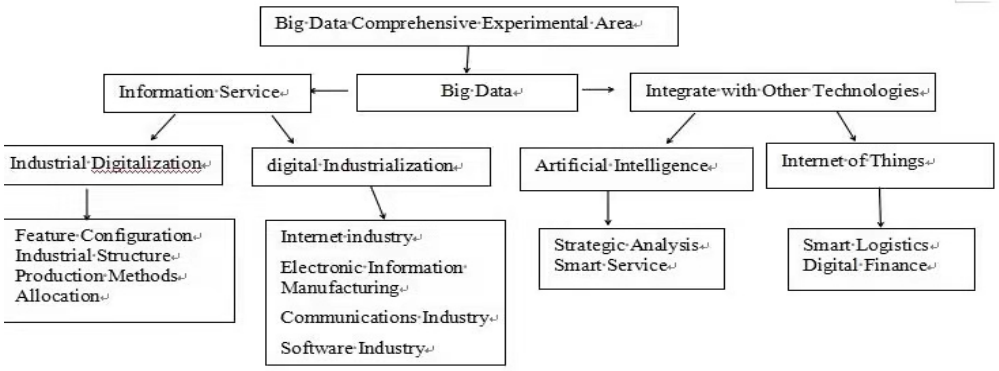

Figure 2: Impact Path

5 CONCLUSION AND ADVICE

Digital trade is an important driving force for the modern economy, and accelerating the development of digital trade has become the focus of government work. The establishment of the big data comprehensive pilot zone is an important measure for the country to attach

importance to the development of digital trade. Therefore, the implementation effect of the policy must be comprehensively tested. By constructing a multi-period double-difference model, it is found that the establishment of the big data comprehensive pilot area does have a positive impact on regional digital trade, but it is subject to various factors such as the level of economic development, industrial structure, and government support. There are differences in different regions. The impact of the big data comprehensive experimental area on digital trade is mainly realized through modern Internet and computer technology represented by big data. These technologies act on all aspects of production, circulation and distribution, and ultimately have a profound impact on the development of digital trade. Based on the above research conclusions, some policy recommendations are put forward as follows:

Fully implement and promote the construction of a comprehensive pilot area for big data. The first is to continue to develop the digital economy and digital trade in the big data comprehensive pilot zone that has been established, to give play to the positive role of digital trade in industrial upgrading, and to cultivate new momentum for economic development. The second is to deploy strategic plans for the development of big data and digital trade in provinces that have not yet established big data comprehensive experimental zones based on their economic development infrastructure and industrial structure. Strengthen inter-regional cooperation in data, information and technology, and give play to the leading and radiating role of advanced regions.

Actively improve the digital trade environment. To promote the development of digital trade, the government should increase investment in infrastructure, accelerate the upgrading of urban networks, popularize rural broadband, and lower the market access threshold for infrastructure. The development of digital trade is inseparable from relevent talents. The government should also increase the reserve of digital trade talents, and increase the quantity and quality of talents through channels such as the introduction of digital technical talents and the cultivation of digital talents. I

Information collection and data collection are the foundation of big data. All regions should strengthen information cooperation and establish information platforms and databases in various fields of digital trade, so that data analysis has broad-based data information. The government and enterprises should also attach importance to the establishment of a big data ecosystem, so that each decentralized and database becomes a data analysis system that is closely related and linked in an orderly manner. In addition, attention should also be paid to the integrated application of big data and other Internet technologies. Finally, the government should pay attention to the security of data and information, and formulate strict laws and regulations to protect data security.

REFERENCES

[1] Zheng Xiaoyu, [D], Statistical measurement of China's digital trade development and analysis of its influencing factors, Zhejiang Institute of Technology, 13-16 (2021).

[2] Wang Xue, [D], Research on the Influencing Factors of China's Digital Trade, 17-24 (2021).

[3] Yang Huiying, Yang hongju, [J], How does digital trade affect the rise of global value chains? * – based on empirical evidence from countries within the RCEP framework, International Economic Cooperation, 76-87 (2022).

[4] Yang Huiying, Yang hongju, [J], Research on the Influence of Digital Trade on Industrial Structure Upgrade——Experience Data from China's Interprovincial Panel, Price: Theory & Practice, 56-63 (2022).
[5] horsten Beck, Ross Levine, Alexey Levkov.,[J],Big Bad Banks, The Winners and Losers from Bank Deregulation in the UnitedStates. The Journal of Finance,2010,65(5):1637-1667.
[6] Chen gang, [J], Communication between judges in different places and judicial efficiency: empirical evidence from the president of the high court, Economics,2012, (2):1171-1192