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Impact Of The “Belt And Road” Initiative On The Development Level Of E-commerce In 18 Provinces And Cities Along China ——Based On PSM-DID Method

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Impact Of The "Belt And Road" Initiative On The Development Level Of E-commerce In 18 Provinces And Cities Along China

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Abstract: E-commerce can effectively overcome market obstacles and directly connect consumers with enterprises, and has contributed greatly to the construction of China 's "Belt and Road". At the same time, the construction of the "Belt and Road" has also provided new opportunities for the sustained and healthy growth of e-commerce. In order to explore the specific impact of the "Belt and Road" initiative on the level of e-commerce development in 18 provinces and cities along China's borders, panel data from 31 provinces in China from 2012 to 2017 were used to measure the 31 provinces in 6 years using the vertical and horizontal gap method. The level of e-commerce development, and then using the propensity score matching double difference method (PSM-DID) to explore the impact of the "Belt and Road" initiative on the level of e-commerce development in 18 provinces and cities along China and 13 provinces and cities along non-routes. The results show that the level of e-commerce development in China's provinces or regions is not balanced. Guangdong, Shandong, Jiangsu, and Zhejiang have good e-commerce development levels, and Tibet, Ningxia, Qinghai, and Hainan have poor e-commerce development levels. Eastern regions The level of e-commerce development is higher and the growth rate is faster, while the level of e-commerce development in the western region is lower and the growth rate is slower; the "Belt and Road" initiative can significantly promote the level of e-commerce development in 18 provinces and cities along China, with a promotion effect of 1.71%. And it can promote the vigorous development of e-commerce by increasing regional GDP, increasing mobile phone users and Internet users, and increasing per capita disposable income in cities and towns.

Keywords: " Belt and Road" initiative; E-commerce; vertical and horizontal extension method; PSM-DID

1. INTRODUCTION

The "Belt and Road" initiative is a construction proposed in 2013. It is an abbreviation of "21st Century Maritime Silk Road" and "New Silk Road Economic Belt". It runs through Asia, Europe, and Africa, and integrates the European and Asian economic circles. connect them. The starting point of the Belt and Road Initiative is China, and then westward in the Eurasia, East Pacific and Indian Ocean. As China's economic construction is gradually moving towards high-quality development, the Belt and Road Initiative reflects China's all-round opening-up pattern in the new era, and China's economy is closely linked to the world economy.

As an emerging industry, e-commerce not only effectively overcomes market obstacles, but also changes the traditional consumption model. At the same time, the advent of the 21st century information era and the gradual unfolding of the Belt and Road Initiative in China's 18 provinces and cities have injected new vitality into China's sustained economic growth, making China's e-commerce level stable in the world in terms of scale and speed. One. According to the China E-Commerce Development Report 2018-2019, although from 2016, China's e-commerce has transitioned from a period of ultra-high growth to a period of stable development, but according to relevant data, China's e-commerce transaction volume in 2018 is still as high as 31.63 trillion.

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RMB, an increase of 8.5% year-on-year, of which, the e-commerce transaction volume of goods and services was 30.61 trillion yuan, an increase of 14.5%; in the first half of 2019, online retail sales of physical goods in China increased by 21.6% year-on-year, and e-commerce is still A powerful engine driving China's economic development. At the same time, e-commerce has played an important role in co-construction of the “Belt and Road”, driving innovation and entrepreneurship, strengthening the digital economy, and helping rural areas to revive.

However, the imbalance in regional development in China has led to an imbalance in the development of e-commerce between provinces in China. On this basis, this paper verifies the differences in the level of e-commerce development in China's provinces, and analyzes the specific impact of the “Belt and Road” initiative on the level of e-commerce development in 18 provinces and cities along the Chinese route, and summarizes its influencing factors to form the “Belt and Road” initiative The vigorous development of e-commerce in China provides a theoretical basis.

2. LITERATURE REVIEW

With the development of e-commerce, scholars have begun to enrich their research on the level of e-commerce, mainly focusing on e-commerce development strategies, e-commerce development level measurement, e-commerce spatial differences, and factors affecting e-commerce development level.

In terms of development strategy, with the implementation of the “Belt and Road” strategy, the academic community is also paying close attention to the development of e-commerce and cross-border e-commerce under the “Belt and Road” strategy. Wang Juanjuan and Qin Wei (2015) believe that the development of e-commerce in the Belt and Road strategic zone is very uneven, fails to fully reflect regional characteristics, and lacks sustainable development capabilities. In order to better promote the new normal of e-commerce in the Belt and Road strategic zone, it is necessary to base itself on "market leadership and government participation", encourage self-built e-commerce operation platforms, make clear that e-commerce is a business opportunity to reduce regional disparities, develop specialized cloud logistics, Improve the quality of e-commerce development, give full play to the role of finance in guiding e-commerce, and ensure that the new normality of e-commerce can continue to be promoted by institutional gaps[1]. Du Yonghong (2016) combines cross-border e-commerce with the “Belt and Road” strategy, and believes that cross-border e-commerce has accelerated the pace of foreign trade and injected new vitality into “Made in China”. The “Belt and Road” strategy can eliminate trade barriers, optimize services, and promote the development of cross-border logistics. The development strategy of cross-border e-commerce under the background of the "Belt and Road" strategy is to establish a "Belt and Road" regional e-commerce platform, build a cross-border e-commerce ecosystem, and strengthen international coordination in the cross-border e-commerce field of countries in the "Belt and Road" To improve the cross-border e-commerce credit system under big data, promote the large-scale development of cross-border e-commerce logistics, and change from manufacturing in China to creating in China[2].

In terms of measurement, Tang Yingwen (2015) believes that the development of e-commerce is based on the use of the Internet, selects some indicators that reflect the development level of domestic e-commerce, and constructs an index system with dimensions of the macro level, enterprise level, and micro level. , And cluster measurement by factor analysis[3]. Hao Longfei (2016), Liu Xiaoyang et al. (2018) and Zhao Jianwei et al. (2019) used the e-commerce development index, online shopping index and online merchant index published by Alibaba to measure China's e-commerce development level[4] [5] [6]. Xu Tongsheng (2016) established an e-commerce development level indicator system with transaction level index, infrastructure index, human capital index, development potential index, and industry prosperity index as dimensions, and 13 indicators as three-level indicators. The entropy method was used to measure China. The level of e-commerce development[7].

Yao Huili (2019) constructed an index system using e-commerce transaction index, informatization index, and e-commerce manpower cost as a first-level indicator, as well as eight second-level indicators to measure the level of e-commerce development, and determined the weight of each indicator using the analytic hierarchy process[8].

In terms of spatial differences, Hao Longfei (2016) based on the county data and based on the global Moran index, found that there is a significant spatial concentration of the development level of county e-commerce in the Northeast[4]. Tang Yinghan (2015) found through cluster analysis and factor analysis that the level of e-commerce development in China is extremely uneven, showing a phenomenon of polarization. The level of e-commerce in the eastern coastal areas is higher than that in the western inland areas. There is a certain correlation between the level of e-commerce and the economy, but it is not completely related[3]. Liu Xiaoyang et al. (2018) analyzed spatial differences in e-commerce using spatial interpolation, coefficient of variation, and exploratory spatial data analysis methods. It was concluded that the internal differences between the Yangtze River Delta, the Pearl River Delta and the western region are large, and the internal gaps between central and northeastern provinces are small. . From the provincial scale, the level of e-commerce in China's provinces generally shows a downward trend in the Yangtze River Delta to the west inland. From the perspective of city and county scales, China's level of e-commerce development in the city has a large spatial difference[4].

In terms of influencing factors, Hao Longfei (2016) found that the level of e-commerce development in counties in Northeast China was greatly affected by the level of economic development, the degree of informatization, and the war environment. The population size and education level did not affect the level of e-commerce development. obvious[4]. Research by Liu Xiaoyang et al. (2018) shows that the contribution to the level of e-commerce development is the balance of savings deposits of urban and rural residents> urbanization rate> GDP per capita> proportion of non-agricultural industries> per capita disposable income of urban residents> mobile phone users> Internet users> Landline users [5]. Zhao Jianwei et al. (2019) used spatial data to analyze the factors affecting the development of rural e-commerce in Jiangsu Province, mainly the manufacturing industry foundation, policy elements, transportation and logistics infrastructure, agricultural industry foundation, resource endowment, and Internet infrastructure[6]. Mu Yanhong et al. (2016) found based on literature review and field investigations that the influencing factors of rural e-commerce can be summarized as infrastructure factors, external environmental factors, endogenous factors, e-commerce platform factors, and supply-demand transaction factors[9].

To sum up, in the development strategy, most of the existing researches are based on the strategic level, and there are few empirical studies on the development of e-commerce under the “Belt and Road” initiative. In the measurement of e-commerce development level, existing studies are mostly based on evaluation methods suitable for cross-section data, such as principal component analysis, analytic hierarchy process, and entropy weight method. Although the objectiveness of evaluation is guaranteed, it is not suitable for multi-period panel data indicators. hehe. Based on this, this paper improves the evaluation method, adopts a dynamic evaluation method suitable for multi-period panel data to measure the level of e-commerce development, and uses the propensity score matching double difference method (PSM-DID) to obtain The impact of the “Belt and Road” policy on the level of e-commerce development in the provinces and cities along China ’s roads provides a necessary reference for improving the development of e-commerce in China ’s provinces and cities along the “Belt and Road” initiative.

3. CONSTRUCTION AND MEASUREMENT OF E-COMMERCE DEVELOPMENT LEVEL

3.1 Index system.

This article refers to the e-commerce indicator systems of Yao Huili (2019), Tang Yinghan (2015) and Hao

Feilong (2016) [8] [3] [4], and builds e-commerce with three dimensions of development potential, logistics system, and infrastructure, and 12 indicators as specific measurement standards. Development level indicator system. Among them, the secondary indicators of development potential are: the number of e-commerce application enterprises, e-commerce sales, the proportion of companies with e-commerce transactions, and the level of household consumption. The number of e-commerce application enterprises and e-commerce sales indicate the e-commerce market. The scale, the proportion of companies with e-commerce transactions and the level of household consumption indicate the market potential of e-commerce; the secondary indicators of the logistics system are: the number of employees in the wholesale and retail industry, the area of land for logistics and warehousing, the income of express delivery services, and investment in fixed assets in the transportation industry The number of employees in the wholesale and retail industry and the area of logistics and storage land indicate the size of the logistics market. The revenue from express services and the investment in fixed assets in the transportation industry indicate the development of other markets driven by the logistics market. The secondary indicators of infrastructure are: railway Total mileage, total highway mileage, number of websites, and Internet broadband access ports. The total mileage of railways and roads indicates the infrastructure of land transportation, and the number of websites and Internet broadband access ports represent the network infrastructure. The 12 indicators are all positive, that is, the larger the value, the better the measured level of e-commerce development.

3.2 Evaluation method.

Evaluation of indicators is generally divided into two categories: subjective and objective. The subjective method is based on human judgment, and the objective method is based on the structure of the data itself. The former generally includes analytic hierarchy process, simple arithmetic average method, etc .; the latter includes principal component analysis method, entropy method, TOPSIS, etc. The latter has the advantage over the former that it can perform objective calculations. However, in the face of multi-period dynamic data, the principal component analysis method, entropy method, and TOPSIS applicable to cross-section data are no longer applicable. Therefore, this article attempts to use the horizontal and vertical extension method proposed by Guo Yajun (2002) to evaluate[10]. This method is an evaluation method based on the time-series three-dimensional data table. And the evaluation and ranking are based entirely on the data itself without subjective colors.

First of all, because the dimensions of the data are different and the direct measurement error is large, the data needs to be dimensionlessly processed. The positive index adopts the processing method of formula 1 and the reverse index adopts the processing method of formula 2.

$$\varphi_{ij} = \frac{x_{ij} - \min\{x_{1j},\cdots,x_{nj}\}}{\max\{x_{1j},\cdots,x_{nj}\} - \min\{x_{1j},\cdots,x_{nj}\}} \tag{1}$$

$$\varphi_{ij} = \frac{\max\{x_{1j},\cdots,x_{nj}\} - x_{ij}}{\max\{x_{1j},\cdots,x_{nj}\} - \min\{x_{1j},\cdots,x_{nj}\}} \tag{2}$$

It is assumed that comprehensive evaluation is required for the evaluation objects and evaluation indexes, and the time sequence is T. The running status at is characterized by the evaluation index vector, and a linear comprehensive evaluation function is constructed from:

$$p_i(t_k) = \sum_{j=1}^{m} w_j \varphi_{ij}(t_k), k = 1,2,\cdots,T; i = 1,2,\cdots,n \tag{3}$$

Among them is the comprehensive evaluation value of the first evaluation object in the period, and is the weight of each indicator. The principle of determining the weighting coefficient is that the difference between the evaluated objects is most likely to be reflected on the time-series three-dimensional data table. This difference can be summed by the sum of the squares of the total deviations, as described in Equation 4.

$$e^2 = \sum_{k=1}^{T}\sum_{i=1}^{n}\left(\varphi_i(t_k) - \bar{\varphi}\right)^2 \tag{4}$$

Due to the standardized processing of the original data, $\bar{\phi} = \frac{1}{T}\sum_{k=1}^{T}\left(\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{m} w_j \phi_{ij}(t_k)\right) = 0$. Thus there is a formula 5:

$$e^2 = \sum\sum\left(\varphi_i(t_k)\right)^2 = \sum_{k=1}^{T}\left[W^T H_k W\right] = W^T \sum_{k=1}^{T} H_k W = W^T H W \tag{5}$$

3.3 Descriptive statistics.

The data used in this study are mainly from the National Bureau of Statistics, mainly related to "China Statistical Yearbook", "China Environmental Statistics Yearbook", "China Labor Statistics Yearbook" and so on. It should be noted that the research samples in this article do not include data from Hong Kong, China, Macau, and Taiwan. Missing data for a few provinces in individual years are supplemented using interpolation.

The sample data of 31 provinces between 2012 and 2017 was finally formed, as shown in Table 1.

Table 1. E-commerce development level indicator system

First-level indicators	Secondary indicators	Unit	Indicator Direction	Weight	Mean	Standard Deviation
Development potential （0.0753）	Number of e-commerce application companies	Each	Forward	0.3089	54410.53	24247.96
	E-commerce sales	100 million yuan	Forward	0.2224	53.894	7.67523
	Proportion of companies with e-commerce transactions	%	Forward	0.2343	88079.34	113056.4
	Household consumption level	yuan	Forward	0.2344	20410.07	38743.37
Logistics system （0.4778）	Employees in Wholesale and Retail Trades	Ten thousand people	Forward	0.3587	0.6806	0.5169843
	Land area for logistics storage	Square kilometers	Forward	0.3238	13.15187	3.243826
	Express business income	100 million yuan	Forward	0.1061	274.2027	178.4101
	Investment in fixed assets in the transportation industry	100 million yuan	Forward	0.2114	.3088667	0.1042296
Infrastructure （0.4469）	Total railway mileage	Ten thousand kilometers	Forward	0.1853	10.50653	2.150311
	Total highway mileage	Ten thousand kilometers	Forward	0.3696	664.1955	209.9442
	Websites	Ten thousand	Forward	0.1400	45.42033	12.80024
	Internet broadband access port	Ten thousand	Forward	0.3051	187.0952	153.8755

3.4 E-commerce development level score.

This article uses Matlab 9.1 to write the program of the horizontal and vertical extension method, and calculates the development potential of primary indicators, the weights of logistics systems and infrastructure are 0.0753, 0.4778, and 0.4469. And then get the comprehensive score and average value of the e-commerce development level of 31 provinces in China from 2012 to 2017, as shown in Table 2. As can be seen from the table, the level of e-commerce development in most provinces is increasing year by year. In the 6-year average score of e-commerce development levels in 31 provinces and cities in China, Guangdong, Shandong, Jiangsu, and Zhejiang rank in the top four, and Tibet, Ningxia, Qinghai, and Hainan rank in the bottom four.

Table 2. E-commerce development scores of 31 provinces and cities in China

Province	2012	2013	2014	2015	2016	2017	Mean	Rank
Beijing	0.2580	0.2996	0.3546	0.4055	0.4454	0.4891	0.3754	6
TIanjin	0.1357	0.1452	0.1671	0.1925	0.2046	0.1861	0.1719	25
Hebei	0.2470	0.2712	0.2884	0.3006	0.3467	0.3327	0.2978	10
Shanxi	0.1602	0.1607	0.1754	0.1947	0.2146	0.2034	0.1848	24
Neimenggu	0.1946	0.1982	0.2181	0.2317	0.2680	0.2706	0.2302	16
Liaoning	0.2221	0.2456	0.2606	0.2737	0.2760	0.2643	0.2571	14
Jilin	0.1270	0.1275	0.1400	0.1570	0.1834	0.1871	0.1537	26
Heilongjiang	0.1940	0.2042	0.2196	0.2287	0.2526	0.2489	0.2247	17
Shanghai	0.2844	0.3032	0.3736	0.4150	0.3994	0.4164	0.3653	8
Jiangsu	0.3587	0.4281	0.4896	0.5325	0.5494	0.5652	0.4873	3
Zhejiang	0.2951	0.3690	0.3975	0.4580	0.4987	0.5096	0.4213	4
Anhui	0.1939	0.2114	0.2543	0.3086	0.3361	0.3394	0.2740	12
Fujian	0.2021	0.2177	0.2474	0.2861	0.3277	0.3392	0.2700	13
Jiangxi	0.1565	0.1499	0.1725	0.2168	0.2227	0.2317	0.1917	21
Shangdong	0.3878	0.4260	0.4682	0.5133	0.6017	0.6460	0.5072	2
Henan	0.3021	0.3114	0.3417	0.3871	0.4402	0.4482	0.3718	7
Hubei	0.2673	0.2832	0.3154	0.3515	0.4035	0.4088	0.3383	9
Hunan	0.2467	0.2359	0.2658	0.2854	0.3274	0.3258	0.2812	11
Guangdong	0.4322	0.5469	0.5995	0.6743	0.7593	0.7757	0.6313	1
Guangxi	0.1488	0.1609	0.1878	0.2094	0.2522	0.2502	0.2016	20
Hainan	0.0436	0.0572	0.0816	0.1140	0.1334	0.1205	0.0917	28
Chongqing	0.1452	0.1497	0.1829	0.2142	0.2565	0.2673	0.2026	19
Sichuan	0.2653	0.2953	0.3471	0.3814	0.4672	0.4974	0.3756	5
Guizhou	0.1323	0.1353	0.1639	0.1920	0.2387	0.2484	0.1851	23
Yunnan	0.1864	0.1920	0.2253	0.2514	0.3036	0.3213	0.2467	15
Tibet	0.0332	0.0352	0.0621	0.0860	0.1161	0.0994	0.0720	31
Shanxi_	0.1654	0.1715	0.1974	0.2279	0.2733	0.2816	0.2195	18
Gansu	0.1115	0.1087	0.1379	0.1579	0.1861	0.1727	0.1458	27
Qinghai	0.0660	0.0611	0.0771	0.1023	0.1228	0.1155	0.0908	29
Ningxia	0.0504	0.0485	0.0681	0.0864	0.0997	0.0922	0.0742	30
Xinjiang	0.1444	0.1508	0.1756	0.1977	0.2083	0.2408	0.1863	22

This article refers to Wang Bin (2019) to divide China into five regions to observe the trends and differences in e-commerce development[11]. As shown in Figure 1, it can be seen that the level of e-commerce development in the eastern region is higher and the growth rate is faster. The regional e-commerce development level is second, but its growth rate is not as good as the southwestern region. Northeast China's e-commerce development ranks fourth with the smallest growth rate. The northwestern region has the lowest level of e-commerce development, but its growth rate is greater than that in the northeast. This is quite consistent with the actual situation. At the same time, this shows that the impact of the development level of e-commerce in various provinces and cities in China is multiple, laying a foundation for the analysis of the factors affecting the development level of e-commerce.

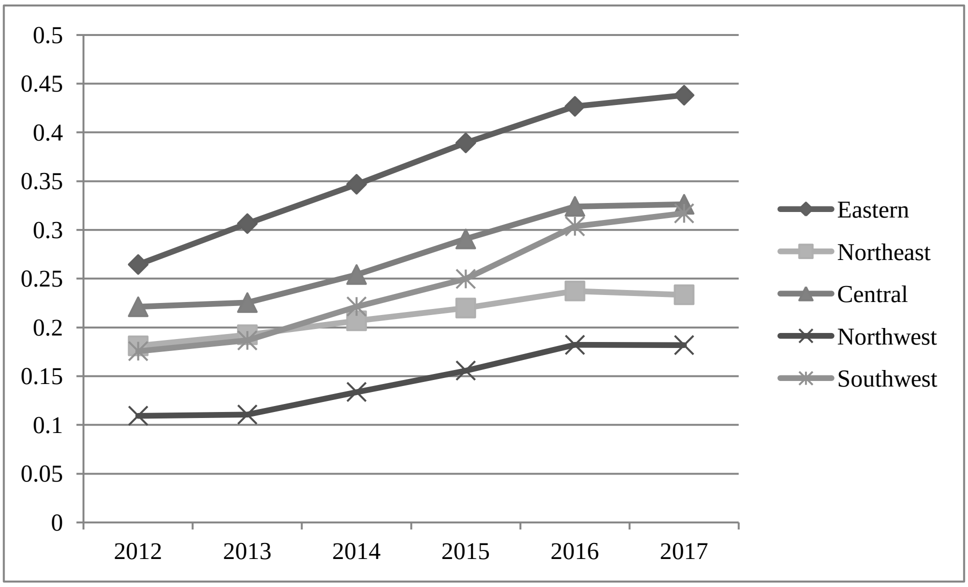

Figure 1. E-commerce development trends and differences in the five regions from 2013 to 2017

4. MODELS AND ESTIMATION METHODS

4.1 Propensity score matching DID model.

The common method for identifying policy effects is the double difference model DID. In order to study the impact of the “Belt and Road” initiative on the level of e-commerce development, the corresponding processing group and reference group were selected and processed using a double difference model. The basic idea is: take the 18 provinces and cities along the “Belt and Road” China as the processing group, and calculate the 13 levels of the e-commerce development level of the processing group before and after the implementation of the policy in order to refer to the 13 provinces and cities along the “Belt and Road” China. The difference is calculated at the same time, the difference of the e-commerce development level of the reference group before and after the implementation of the policy is calculated. Then the two differences are differentiated to eliminate the increment of time change. effect. The specific formula is as follows:

$$Y_{\mathrm{it}} = \beta_0 + \beta_1 treated_{\mathrm{it}} + \beta_2 time_{\mathrm{it}} + \beta_3 treated_{\mathrm{it}}\mathrm{time}_{\mathrm{it}} + \beta_4 \mathrm{X}_{\mathrm{it}} + +\beta_5 \sum year_{it} + \varepsilon_{\mathrm{it}} \quad (6)$$

Among them, the value of i is 0 or 1, when i = 1, it means that the provinces and cities along the “Belt and Road” in China, and i = 0 means that it is not the provinces and cities along the “Belt and Road” in China. The value of t is 0 or 1, t = 1 means after the policy is implemented, and t = 0 means before the policy is implemented. Y indicates the level of e-commerce development of the explained variable, treated indicates the dummy variable of the policy implementation area, and time indicates the dummy time variable of the policy. Because the policy has a delay effect, the time dummy variable is added to the year, and X indicates other control variables affecting the level of e-commerce development. ε represents a random interference term.

However, the use of DID must meet the assumptions of randomness and common trend, that is, the treatment group and the control group before and after the implementation of the policy have a common trend.

The “Belt and Road” initiative was proposed randomly. The specific time cannot be known before the proposal was made, so the randomness assumption is satisfied; however, the 18 provinces and cities along the “Belt and Road” in China are countries based on the Silk Road Economic Belt and 21st Century Maritime Silk. The macro-control of the road is determined and does not meet the randomness assumption. It can be seen from the above that the development of e-commerce in different provinces is quite different. Shanghai, Guangdong, and Zhejiang in the "21st Century Maritime Silk Road" have developed well, and are in line with Tibet, Ningxia, Qinghai, Hainan, Gansu, and Jilin in the northwest. It differs greatly from Xinjiang's development, so the assumption of common trends is not satisfied. The application of DID under the condition of not meeting the common trend will lead to the bias of selectivity, so this article finds a reference group similar to the level of e-commerce development in 18 provinces and cities through the matching of propensity scores, so that the processing group and the control group meet the assumption of the common trend, making the result more precise.

First, the tendency matching scores of the treatment group and the reference group are calculated by the Logit model. After obtaining the tendency scores, a balance test is performed, that is, the test tendency scores no longer have a significant difference between the treatment group and the reference group. Since it is difficult to find two provinces and cities with the same propensity score in reality, this paper uses propensity matching-k-nearest neighbor matching in calipers. The basic idea is that for processing group i, suppose i has N_i^c matching objects. If $j \in C(j)$,its weight is $W_{ij} = 1/N_i^c$, , otherwise its weight is 0. For the treatment group with a total of $N_t$observation variables, the average treatment effect is:

$$ATT=1/N_t \sum_{i\in t} Y_i^t - 1/N_t \sum_{j\in t} w_j Y_i^C \tag{7}$$

Then, using the DID model, we obtain the changes in the level of e-commerce development of the processing group before and after the implementation of the “Belt and Road” initiative policy. $\Delta Y_t = \beta_2+\beta_3$. $\Delta Y_0 = \beta_2$. $\Delta\Delta Y_t=\Delta Y_t - \Delta Y_0 = \beta_3$ is the net effect of the “Belt and Road” initiative policy on the level of e-commerce development in 18 provinces and cities along China's route. If β_3 is positive, it means that the “Belt and Road” initiative has promoted the level of e-commerce development in 18 provinces and cities along China.

4.2 Data source and processing.

Because the “Belt and Road” initiative was proposed in 2013, but the effect of the policy is generally delayed by one or two years, so this article uses 2015 as the first year after the policy is implemented. The treatment group and control group are divided into time and area. Four groups. This article refers to the research by Liu Xiaoyang (2018), Tang Yingwen (2015), Zhao Jianwei, etc. (2019) [5] [3] [6], and selects regional GDP, GDP per capita, end-users of fixed telephones, Internet users, and mobile phones Per capita disposable income of users and cities, GDP of the primary industry, GDP of the secondary industry, GDP of the tertiary industry, and GDP of the transportation industry were used as control variables. The data source is China Statistical Yearbook 2012-2017. Table 3 lists the variable names, data processing methods, and descriptive statistics.

Table 3. Variable descriptive statistics

Variable name	Variable meaning	Calculation	Mean	Standard Deviation
ecommerce	E-commerce development score	-	0.2621	0.1408
treated	Policy dummy	treated=0|1	-	-
time	Time dummy	time=0|1	-	-
did	Interaction term	treated*time	-	-
lngdp	GDP	GDP logarithmic	9.6790	0.9665

Variable name	Variable meaning	Calculation	Mean	Standard Deviation
lnpergdp	GDP per capita	GDP per capita logarithmic	10.7707	0.4114
gphone	Landline users	-	766.6392	599.3119
interuser	Internet user	-	790.2091	657.9114
yphone	Mobile phone users	-	4106.43	2893.454
inconme	Urban disposable income	-	28867.75	8365.897
findustry	GDP of primary industry	Primary industry / GDP ratio	0.0992	0.0503
sindustry	GDP of secondary industry	Secondary industry / GDP ratio	0.4442	0.0825
tindustry	GDP of tertiary industry	Tertiary industry / GDP ratio	0.4566	0.0925
tafindustry	GDP of transportation industry	Transportation industry / GDP ratio	0.0483	0.0146

Note: The score of e-commerce development level has been obtained above, which is dimensionless data. gphone, interuser, yphone, and income are standardized by Z-score. The mean and standard deviation in this table are before normalization, and the mean and standard deviation are all 0 and the standard deviation are 1.

5. ANALYSIS OF EMPIRICAL RESULTS

5.1 Propensity score matching and balance test.

This paper uses propensity score matching-k-nearest neighbor matching in calipers to make the treatment group and reference group comparable, and to overcome the bias of sample selection. First, treat was used as the explanatory variable, lngdp, lnpergdp, gphone, interuser, yphone, inconme, findus, sindustry, tindustry, and tafindustry were used as covariates. Logit model and stepwise regression were used to observe the significance of covariates. Table 4 shows. As can be seen from the table, lngdp, lnpergdp, gphone, interuser, yphone, inconme, findry, industry, and tafindustry have significant effects on treated. Among them, the coefficients of lnpergdp, gphone, interuser, yphone, inconme, findry, and industry are positive, which indicates that per capita GDP, fixed telephone users, Internet users, mobile phone users, disposable income of urban residents, and total production of primary industry Value and the GDP of the secondary industry have a significant positive effect on the "Belt and Road" initiative.

Table 4. Logit model estimation results

Variable name	Coefficient	Standard Deviation	t value	p value
lngdp	-18.7961***	3.1160	-6.03	0.000
lnpergdp	13.4507***	2.2680	5.93	0.000
gphone	4.0701***	0.9703	4.19	0.000
interuser	1.6100**	0.7071	2.28	0.023
yphone	2.2116***	0.8230	2.69	0.007
inconme	4.2112***	0.9358	4.50	0.000
findustry	125.2187***	21.2091	5.90	0.000
sindustry	37.0749***	7.1770	5.17	0.000
tafindustry	-78.7413***	25.9741	-3.03	0.002

Note: *** means significant at 1% level, ** means significant at 5% level, * means significant at 10% level. The tindustry variable is automatically deleted because of collinear regression.

Then check the variable matching effect and balance test, and find that tafindustry fails the balance test, so delete it. The matching effect and balance test of the remaining variables are shown in Table 5. As can be seen from Table 5, only the control variables lnpergdp, income and sindustry satisfy the test of the treatment group and the reference group without significant difference before matching. After matching, except that tafindustry does not satisfy the treatment group and the reference group, there is no significant difference. Therefore, this paper deletes this control variable at this step. The remaining variables lngdp, lnpergdp, gphone, interuser, yphone, inconme, findry, and industry all meet the test of no significant difference between the treatment group and the reference group, and the p values are all greater than 0.1, indicating that the post-matching treatment group and the reference group meet the common trend assumption of double difference. . In addition to lnpergdp, the absolute values of the standard deviation of the remaining variables are all reduced by more than 50%. In addition, according to Rosenbaum and Rubin (1985), the absolute value of the standard deviation after matching needs to be less than 20% to achieve the matching effect [12], it can be known from Table 5 that the absolute values of the standard deviations after the matching are all less than 15%, which indicates that the characteristics of the post-matching processing group and the reference group have been very close and passed the balance test.

Table 5. Variable matching effect and balance test

Variable	Sample	Mean		Standard	Absolute standard	t value	p value
		Treatment group	control group	deviation（%）	deviation reduction		
lngdp	Unmatched	9.3511	10.133	-92.0	89.4	-5.93	0.000
	matched	9.8937	9.7	9.7		0.77	0.446
lnpergdp	Unmatched	10.7560	10.7910	-8.2	11.1	-0.56	0.575
	matched	10.9150	10.9460	-7.3		-0.31	0.760
gphone	Unmatched	-0.1639	0.2270	-40.6	84.2	-2.67	0.008
	matched	-0.1185	-0.1804	6.4		0.32	0.750
interuser	Unmatched	-0.2374	0.3287	-58.6	79.7	-3.96	0.000
	matched	-0.0825	-0.1976	11.9		0.60	0.550
yphone	Unmatched	-0.2309	0.3197	-58.5	87.8	-3.84	0.000
	matched	-0.1082	-0.1753	7.1		0.43	0.671
inconme	Unmatched	-0.0312	0.0432	-7.4	57.8	-0.50	0.618
	matched	0.2608	0.2294	3.1		0.15	0.881
findustry	Unmatched	0.1065	0.0891	35.8	86.2	2.36	0.019
	matched	0.0891	0.0867	5.0		0.20	0.844
sindustry	Unmatched	0.4370	0.4541	-20.7	73.7	-1.40	0.164
	matched	0.4491	0.4446	5.4		0.26	0.793

5.2 DID model.

After matching, double-difference model regression was performed, with ecommerce as the explanatory variable, did, treated, time, control variable set X, and year as the explanatory variables. The mixed panel regression was performed. The results are shown in Table 6. As can be seen from Table 6, the coefficient of did is 0.0171 (p = 0.007), which is significant at the level of 1%, which also shows that the “Belt and Road” initiative has significantly promoted the level of e-commerce development in 18 provinces and cities along China, with a promotion effect of 1.71% . Among other control variables, the GDP per capita, Internet users, mobile phone users, and per capita disposable income of cities and towns can also significantly positively affect the level of e-commerce development. Increasing the per capita disposable income of cities and towns promotes the vigorous development of e-commerce.

Table 6. Regression results of the double difference model after matching

Variable	Coefficient	Standard Deviation	t value	p value
did	0.0171***	0.0063	2.72	0.007
time	-0.0947***	0.0293	-3.23	0.002
lngdp	0.3625**	0.1569	2.31	0.022
lnpergdp	-0.2353	0.1586	-1.48	0.140
gphone	-0.0178	0.0113	-1.58	0.115
interuser	0.0407***	0.0078	5.23	0.000
yphone	0.0933***	0.0186	5.01	0.000
inconme	0.0514***	0.0100	5.15	0.000
findustry	0.2079	0.2450	0.85	0.398
sindustry	-0.0752	0.1181	-0.64	0.525
2013.year	-0.0235***	0.0073	-3.24	0.001
2014.year.	-0.0311**	0.0128	-2.43	0.016
2015.year	0.0487***	0.0119	4.08	0.000
2016.year	0.0422***	0.0074	5.70	0.000
_cons	-0.6627	0.4160	-1.59	0.113
$N = 186, R^2 = 0.7619, F(14,141) = 96.03, p = 0.000$				

Note: *** means significant at 1% level, ** means significant at 5% level, * means significant at 10% level. The treated and 2017.year variables are automatically deleted due to collinear regression.

6. CONCLUSIONS AND RECOMMENDATIONS

In this paper, from the three dimensions of development potential, logistics system and infrastructure, an e-commerce development level indicator system with three first-level indicators and 12 second-level indicators has been established. The city's e-commerce development level is measured. Since then, we have analyzed the impact of the “Belt and Road” initiative on the level of e-commerce development in 18 provinces and cities along China's borders using the propensity score matching double difference method (PSM-DID). Draw the following conclusions and recommendations:

First, China's e-commerce development level is extremely uneven. Among them, the development of the provinces is uneven, and the levels of e-commerce development in Guangdong, Shandong, Jiangsu, and Zhejiang are relatively good. The levels of e-commerce development in Tibet, Ningxia, Qinghai, and Hainan are relatively poor. And the growth rate is relatively fast. The development level of e-commerce in the western region is lower, but the growth rate is slower. Therefore, the development of e-commerce should focus on regional coordination, and adjust such imbalances through policies, so that areas with better development can lead to areas with poor development, and achieve a synergy effect.

Second, per capita GDP, fixed telephone users, Internet users, mobile phone users, urban per capita disposable income, GDP of the primary industry, and GDP of the secondary industry have a significant positive effect on the Belt and Road Initiative. . Therefore, the implementation of the “Belt and Road” policy can be promoted by improving the national economy, Internet development and informatization.

Third, the “Belt and Road” initiative can significantly promote the level of e-commerce development in 18 provinces and cities along the Chinese route, with a promotion effect of 1.71%. Therefore, China should pay attention to the implementation effect and conversion efficiency of the “Belt and Road” policy, evaluate the development of provinces and cities along the route, and improve the contribution of the “Belt and Road” policy to the level of e-commerce development. And the GDP, mobile phone users, Internet users, and urban per capita disposable income can significantly promote the level of e-commerce development. This shows that the national economy, Internet development and informatization are also important factors affecting the development of e-commerce. Therefore, it is possible to promote the vigorous development of e-commerce by increasing regional GDP, increasing mobile phone users and Internet users, and increasing per capita disposable income in cities and towns.

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