Paradigm Academic Press
Law and Economy
ISSN 2788-7049
JUL. 2024 VOL.3, NO.7

The Policy of Cross Border E-Commerce Comprehensive Pilot Zone and the Growth of Urban Total Factor Productivity — Empirical Testing Based on Double Difference Method

Hanning Huang[1]

[1] Business School, Nanjing University, Nanjing 210000, China

Correspondence: Hanning Huang, Business School, Nanjing University, Nanjing 210000, China.

doi:10.56397/LE.2024.07.05

Abstract

Since the establishment of the first pilot zone in 2015, China's cross border e-commerce has rapidly developed, becoming a new engine driving international trade. This paper delves into the impact of China's cross border e-commerce comprehensive pilot zones on urban total factor productivity.

The paper first provides an overview of the development trajectory and current status of cross border e-commerce comprehensive pilot zones and analyzes the potential mechanisms through which these pilot zones might affect urban TFP. Utilizing data from 70 major cities between 2011 and 2019, the study employs a Difference-in-Differences approach to evaluate the impact of the pilot zone policies on urban TFP growth. The results indicate that the establishment of pilot zones significantly enhances urban TFP growth rates, with more pronounced effects in the eastern regions. The regional heterogeneity test reveals that the pilot zones positively influence TFP growth in the eastern and central regions, while the impact on the western and northeastern regions is not significant. Robustness checks further confirm the significance of the policy effects. Based on the findings, the paper proposes policy recommendations, including strengthening policy support, enhancing infrastructure development, reinforcing technological innovation capabilities, and promoting regional coordinated development to fully leverage the role of cross border e-commerce comprehensive pilot zones in boosting urban TFP and driving high-quality economic development.

Overall, this paper provides empirical evidence for understanding how cross border e-commerce comprehensive pilot zones enhance urban TFP through technological innovation and policy support, offering important insights for optimizing relevant policies and promoting regional economic development.

Keywords: cross border e-commerce comprehensive pilot zones, total factor productivity, multiple-period difference-in-differences method

1. Introduction

Currently, the rapid development speed, wide coverage, and profound impact of the digital economy are unprecedented. China attaches great importance to the development of the digital economy and elevates it as a national strategy to promote its rapid development and sustained growth in scale. China's digital economy has ranked second in the world for several consecutive years. In 2022, the scale of China's digital economy reached 50.2 trillion yuan, a year-on-year increase of 10.3%, accounting for 41.5% of the gross domestic product. In recent years, China's e-commerce, especially cross border e-commerce, has developed rapidly and become a highlight of foreign trade development. The Central Economic Work Conference held in 2023 proposed to accelerate the cultivation of new momentum in foreign trade, consolidate the foundation of foreign trade and foreign investment, and expand intermediate goods trade, service trade, digital trade, and cross border e-commerce exports.

In 2015, China established its first cross border e-commerce comprehensive pilot zone in Hangzhou. On November 14, 2022, the State Council agreed to establish comprehensive cross border e-commerce pilot zones in 33 cities and regions including Langfang. After this expansion, the number of comprehensive pilot zones for cross border e-commerce in China has reached 165, covering most provinces of China.

The establishment of a comprehensive cross border e-commerce pilot zone is an important strategic measure for China to respond to new global trade trends, promote domestic consumption upgrading, and promote high-quality economic development. The implementation of this policy not only brings unprecedented development opportunities to China's cross border e-commerce industry, but also has a profound impact on the prosperity and innovation of global e-commerce.

Firstly, the establishment of a comprehensive pilot zone for cross border e-commerce will help promote the transformation and upgrading of China's foreign trade. Under the traditional foreign trade model, small and medium-sized enterprises often face high market entry barriers and trade barriers. Cross border e-commerce, with its low cost and high efficiency, has opened the door to the international market for small and medium-sized enterprises, enabling them to participate more conveniently in global trade. Through policy support and innovative services in the pilot zone, small and medium-sized enterprises can adapt more quickly to changes in international market demand and enhance their competitiveness.

Secondly, the construction of cross border e-commerce comprehensive pilot zones has promoted the diversified and personalized development of China's consumer market. With the improvement of residents' income levels and the updating of consumption concepts, consumers have increasingly diversified demands for goods and services. The cross border e-commerce comprehensive pilot zone has met consumers' pursuit of high-quality life by introducing high-quality foreign goods and services, while also stimulating the vitality and innovation ability of the domestic market.

In addition, the construction of cross border e-commerce comprehensive pilot zones has injected new momentum into the development of China's digital economy. In the pilot zone, the government, enterprises, and industry organizations can jointly study and formulate regulatory policies and service standards that adapt to the characteristics of cross border e-commerce, providing experience and reference for the healthy development of global e-commerce. Cross border e-commerce, as an important component of the digital economy, its development level directly affects China's position in the global digital economy competition. The pilot zone has accelerated the integration of digital technology in the field of trade through policy innovation and technological application, promoted the development of new forms of digital trade, and enhanced China's competitiveness in the global digital economy.

Based on the above analysis, in-depth exploration of the development of cross border e-commerce and the driving force of new technologies has profound strategic value for improving the operational system of various economic sectors in China.

2. Literature Review

2.1 Research on the Development of Cross Border E-Commerce Comprehensive Pilot Zones

From the analysis of policy evaluation, Ding Huiping (2019) classified 13 cross border e-commerce comprehensive pilot zones and divided them into three different levels based on their development status. He believed that it was necessary to concentrate resources and focus on building cross border e-commerce comprehensive pilot zones and proposed the construction of four major systems: information sharing system, financial support system, logistics guarantee system, and credit management system. Zhang Xiaheng et al. (2019) used the Delphi method and Analytic Hierarchy Process to determine weights and constructed an evaluation model based on three aspects: basic performance, service performance, and growth performance to evaluate the operation of 35 cross border e-commerce comprehensive pilot zones in China. They pointed out that there are significant differences in the performance of these pilot zones, which are closely related to the level of economic development and are significantly correlated with the approved batches. The pilot zones that are prioritized for approval perform better. The development of cross border e-commerce comprehensive pilot zones needs to go through four stages: innovation cultivation, innovation breakthrough, innovation deepening, and innovation diffusion.

From the perspective of their policy impact effects, Ma Shuzhong and Guo Jiwen (2022) used the establishment of the third batch of cross border e-commerce comprehensive pilot zones as empirical objects and found that the establishment of these pilot zones increased the average cross border e-commerce exports of various industries in the city by about 21%. This promotion effect is closely related to a series of institutional innovations introduced by the pilot zones, which have alleviated financing restrictions and reduced export trade costs, especially after the introduction of the "no ticket tax exemption" policy, this promotion effect has been further enhanced. According to Wang Rui et al. (2020), the construction of cross border e-commerce pilot zones has promoted the construction of cross border e-commerce infrastructure and the vigorous development of the entire industry, facilitated trade,

and significantly promoted the positive development of urban cross border e-commerce trade. Wang Lirong and Rui Lili (2022) used the synthetic control method and panel data policy evaluation method from a counterfactual perspective to evaluate the impact of the first and second batches of cross border e-commerce comprehensive pilot zones established in China on the economy. They compared and analyzed the differences in regional economic effects of each pilot zone based on their industrial foundation and institutional reform priorities. The research results show that the first batch of comprehensive pilot zones significantly promoted regional economic growth, improved foreign trade level, and upgraded industrial structure; The second batch of comprehensive pilot zones mainly promotes the level of foreign trade, but their impact on regional economic growth and industrial structure is not significant. In addition, the study also found that the promotion effect of foreign trade in inland comprehensive pilot zones is significantly higher than that in coastal comprehensive pilot zones.

2.2 Technological Progress and Total Factor Productivity

Considering the factors that affect urban total factor productivity, Wu Jia and He Shuquan (2020) found that an increase in the scale of production factor flow will optimize the factor structure within the region, thereby promoting the improvement of regional total factor productivity. The increase in labor, capital, and technological factors have a significant spatial effect on the improvement of productivity. Zhang Ziran (2021) analyzed spatial panel data from 264 prefecture level and above cities and found that the increase in economic development quality, fiscal expenditure to income ratio, fixed capital stock, and input-output rate can promote the growth of total factor productivity in the region.

The cross border e-commerce comprehensive pilot zone has a positive impact on technological efficiency by improving the allocation and utilization capacity of production factors. On the one hand, the comprehensive pilot zone enjoys policy support and complete supporting facilities, providing a good innovation environment for industries in the area. On the other hand, the establishment of comprehensive pilot zones helps to improve the quality of government public services and management efficiency, making customs, taxation and other departments in the city more coordinated, enhancing the city's demand for resource coordination, and promoting effective resource transformation at both internal and external levels (Li Qihang et al., 2021). Therefore, the comprehensive pilot zone has a positive effect on the technological efficiency of the city. Zhang Jianqing et al. (2021) believe that import trade can help enterprises purchase intermediate inputs at a lower cost, while export trade can enhance the competitiveness between enterprises. Through the mechanism of survival of the fittest and stimulating technological innovation, the level of opening up to the outside world can be improved, indirectly enhancing the total factor productivity of Chinese cities.

Overall, research on cross border e-commerce pilot zones mostly focuses on analyzing their performance, and research on their policy effects is also more concentrated in the trade field. There is not much research on their impact on urban total factor productivity. This article will discuss on this further.

3. Analysis of the Comprehensive Pilot Zone for Cross Border E-Commerce and the Mechanisms Influencing Total Factor Productivity

3.1 The Development History of Cross Border E-Commerce

The cross border e-commerce comprehensive pilot zone is a pilot urban area established in China since 2015, with a comprehensive nature of cross border e-commerce. It aims to take the lead in technical standards, business processes, regulatory models, and information construction in cross border e-commerce transactions, payments, logistics, customs clearance, tax refunds, and foreign exchange settlement. Through institutional innovation, management innovation, service innovation, and collaborative development, it aims to solve deep-seated contradictions and systemic problems in the development of cross border e-commerce, create a complete industrial chain and ecological chain of cross border e-commerce, and gradually establish a set of management systems and rules framework that not only adapt to the current global trend of cross border e-commerce development, but also guide future development directions. Through the practice of these pilot zones, China aims to accumulate experience and form a series of replicable and promotable models to promote the healthy growth of cross border e-commerce nationwide.

The Ministry of Commerce, the General Administration of Customs, the State Administration of Taxation and other departments have introduced a series of policy measures to support the development of cross border e-commerce comprehensive pilot zones, mainly in the following four aspects:

Firstly, the "no invoice tax exemption" policy refers to the trial implementation of value-added tax and consumption tax exemption policies for export enterprises in the cross border e-commerce comprehensive pilot zone who export goods without obtaining valid purchase certificates and meet certain conditions.

Secondly, "income tax preferential treatment" refers to the trial implementation of the "Approved Collection of Enterprise Income Tax" method for export enterprises that meet certain conditions in the cross border e-commerce comprehensive pilot zone, and the taxable income rate is uniformly calculated at 4%. Those who meet the

conditions for preferential policies for small and micro profit enterprises can enjoy the preferential income tax policies for small and micro profit enterprises. If the income obtained belongs to the tax-exempt income regulations, it can enjoy tax exempt income preferential policies.

Thirdly, the "simplified customs clearance" policy refers to the use of convenient measures such as "list approval and summary declaration" by customs to supervise or inspect the export of cross border e-commerce retail goods that meet the conditions within the region, in order to improve the efficiency of enterprise customs clearance and reduce clearance costs.

Fourth, relax import supervision, that is, relax import supervision conditions, and do not implement the requirements of initial import licensing, registration, or filing for cross border e-commerce retail imported goods, and regulate them as personal use imported goods.

The development process of the comprehensive pilot zone can be divided into the following stages:

1) Preliminary exploration stage (2015)

In March 2015, the Chinese government decided to establish the first cross border e-commerce comprehensive pilot zone, selecting Hangzhou as the pilot. This move aims to explore new models and mechanisms for cross border e-commerce, in order to promote the development of foreign trade and economic transformation and upgrading. As a pilot, the Hangzhou Comprehensive Pilot Zone has explored the operation mode and management mechanism of cross border e-commerce through innovative policies and systems, providing valuable experience for the development of cross border e-commerce nationwide.

2) Expansion stage (2016-2018)

Based on the successful experience of the Hangzhou Pilot Zone, in 2016 and 2018, the State Council successively approved the establishment of the second and third batches of cross border e-commerce comprehensive pilot zones, including multiple cities such as Tianjin, Shanghai, Guangzhou, and Shenzhen. These pilot zones have further promoted the scale and standardized development of cross border e-commerce. Promote Hangzhou's successful experience to more cities, which have formulated cross border e-commerce policies suitable for local development based on their own characteristics. At the same time, cooperation is carried out among various pilot zones to form regional synergies and promote the improvement and optimization of the cross border e-commerce industry chain. A large number of cross border e-commerce enterprises have settled in the newly established comprehensive pilot zone, driving local economic development and employment growth.

3) Accelerated development stage (2019-2020)

In 2019 and 2020, the State Council approved the establishment of the fourth and fifth batches of cross border e-commerce comprehensive pilot zones, further expanding their coverage to the central and western regions and more second and third tier cities. At this stage, the cross border e-commerce comprehensive pilot zone has expanded from developed coastal areas to inland areas, promoting coordinated development of regional economy. The government has issued a series of policy documents to further improve the regulatory and service system of cross border e-commerce, and enhance policy support. Each comprehensive pilot zone has increased investment in infrastructure such as logistics, warehousing, and informatization, actively applied new technologies such as big data, artificial intelligence, and blockchain, promoted innovation in cross border e-commerce models, and improved the operational efficiency of cross border e-commerce.

4) Comprehensive deepening stage (2021 present)

In recent years, the cross border e-commerce comprehensive pilot zone has entered a stage of comprehensive deepening development. Enterprises in the pilot zone have accelerated their pace of expanding into the international market and built a complete cross border e-commerce ecosystem, including supply chain management, logistics distribution, financial services, platform operation, and other links. The government has continuously introduced new policies to support the development of cross border e-commerce, and various comprehensive pilot zones have made significant progress in digital technology application, platform construction, service optimization, and other aspects.

3.2 Development Status of Cross Border E-Commerce Comprehensive Pilot Zones

With the deepening development of globalization and the innovation of Internet technology, cross border e-commerce has become a new engine to promote international trade. From the perspective of development scale, according to statistics from China Customs, in 2023, China's cross border e-commerce imports and exports amounted to RMB 2.37 trillion, an increase of 15.3% compared to 2022 (the same below), accounting for 5.7% of China's total import and export value of goods trade during the same period, with a proportion increase of 0.8 percentage points. Among them, exports amounted to approximately 1.84 trillion yuan, an increase of 20.2%, accounting for 7.7% of China's total export value during the same period; Imports amounted to approximately 533.52 billion yuan, an increase of 1.1%, accounting for 3% of China's total import value during the same period.

The number of consumers participating in cross border e-commerce imports has been increasing year by year, reaching 163 million in 2023. The rapid development of cross border e-commerce not only meets the diverse and personalized needs of domestic consumers, but also helps our products reach the world, becoming an important driving force for the development of foreign trade. At the same time, the pivotal role of cross border e-commerce platforms in the development of business formats continues to strengthen, using cross border e-commerce as a link to achieve overseas layout of the entire industry chain, and promoting the coordinated upgrading of manufacturing, logistics, and other matching modern service industry systems.

Table 1. Cross border E-commerce Import and Export Situation from 2019 to 2023

	Amount (100 million yuan)			YoY (%)		
Year	Imports and Exports	Exports	Imports	Imports and Exports	Exports	Imports
2019	12903	7981	4922	22.2	30.5	10.8
2020	16220	10850	5370	25.7	39.2	9.1
2021	19237	13918	5319	18.6	28.3	-0.9
2022	20599	15321	5278	7.1	10.1	-0.8
2023	23744	18409	5335	15.3	20.2	1.1

3.3 Mechanism Analysis of the Impact of Cross Border E-Commerce Comprehensive Pilot Zones on Urban Total Factor Productivity

3.3.1 Trade Growth Effect

Essentially, all policies implemented in China's cross border e-commerce are aimed at reducing transaction costs, reducing transaction barriers, and promoting trade facilitation. By implementing a "single window" system and integrating data from regulatory departments such as customs, taxation, and foreign exchange, electronic and one-stop services for customs declaration and inspection procedures can be achieved, significantly improving customs clearance efficiency. At the same time, provide tax incentives for cross border e-commerce enterprises, such as reducing tariffs, value-added tax, and consumption tax, reducing enterprise costs, and promoting the growth of cross border transactions.

Since the establishment of cross border e-commerce comprehensive pilot zones in various cities, a series of measures have been introduced. For example, the Guangzhou Comprehensive Pilot Zone has strengthened the "3+N" policy matrix for cross border e-commerce, taken the lead in exploring the launch of six innovative measures, including the cross border e-commerce import and export information system, the nested use of the "micro police certification" system, the cross border e-commerce public distribution center, and the "true knowledge code" for tracing imported goods, optimizing regulatory models and facilitating overseas links. The Hangzhou Comprehensive Pilot Zone relies on multiple cross border payment institutions within the area to expand cross border payment scenarios, enhance cross border payment scale, extend service chains, innovate and construct diversified payment formats, and build a highland for cross border payment; Building a cross border e-commerce talent ecosystem through the linkage between government, enterprises, schools, and communities, and pioneering a new model of government enterprise linkage to promote the transformation of traditional industries through joint industry university research, promoting traditional foreign trade and manufacturing enterprises to achieve "brand going global" through cross border e-commerce.

By reducing production costs and improving operational efficiency, enterprises can achieve an optimized cycle of cost-effectiveness in cross border import and export trade. This cycle enables enterprises to more effectively manage resource inputs and outputs in the production process, optimizing the synergy of various transaction links. This optimization lays a solid foundation for the improvement of technological efficiency. By enhancing technological efficiency, enterprises can promote the growth of total factor productivity, thereby gaining a competitive advantage in international trade.

3.3.2 Optimize Industrial Structure

Firstly, the theory of industrial structure points out that institutional innovation and technological innovation are the key driving forces for promoting the optimization and upgrading of industrial structure to higher levels and achieving economic growth. In the construction of cross border e-commerce comprehensive pilot zones, institutional innovation plays a core role, aiming to create a more convenient, efficient, and cost-effective business environment for enterprises by improving management and service processes. Drawing inspiration from Hangzhou's exploration, comprehensive pilot zones for cross border e-commerce in various regions have gradually

established a basic framework of "two platforms and six systems". Two platforms, namely online comprehensive service platform and offline industrial park platform; The six systems include information sharing system, financial service system, intelligent logistics system, e-commerce integrity system, statistical monitoring system, and risk prevention and control system. Many enterprises have integrated cross border e-commerce B2B direct exports and overseas warehouses through the national customs clearance integration model, integrating online import and export customs clearance, tax refund and other government services, linking financial, logistics and other market services, greatly expanding business development space and promoting industrial transformation and upgrading. The comprehensive pilot zone has created a high-quality environment conducive to industrial development through institutional innovation and innovation in management and services. With the continuous improvement of the business environment, it helps to promote the growth and prosperity of the industrial ecosystem.

Secondly, the establishment of the pilot zone optimizes supply chain management, improves supply chain efficiency, reduces operational costs for enterprises, and enhances the stability of the industrial chain. At the same time, through policy guidance and resource integration, promote the agglomeration of cross border e-commerce industry, form industrial clusters, strengthen the coordinated development of upstream and downstream of the industrial chain, and enhance the overall competitiveness of the industrial chain. By providing a superior commercial environment, the pilot zone enables enterprises in the area to achieve efficient utilization of resources, reduce costs in resource allocation, and improve the efficiency of resource allocation. When capital is effectively managed and controlled, it will have a positive effect on the improvement of total factor productivity.

In addition, by implementing incentive measures such as tax incentives and financial support, the comprehensive pilot zone has attracted a large number of enterprises to settle in, forming a good industrial ecology. These policies not only reduce the operating costs of enterprises, but also stimulate their innovation vitality and promote the development of new technologies and formats. By actively participating in international cooperation and exchange, introducing advanced international management experience and technology, timely understanding the latest developments and technological trends in the international market, and promoting the international spillover of technology.

4. Research Design

4.1 Data Source

At present, China has established a total of 165 cross border e-commerce comprehensive pilot zones in seven batches. Due to the short establishment time of the fourth batch and later, the policy effect is not yet obvious. Therefore, this article selects cities that have established pilot zones in the first, second, and third batches as the scope of investigation. Among them, except for Yiwu City, which established the pilot zone in 2018 as a county-level city, all other pilot cities are prefecture level cities or municipalities directly under the central government. Considering the uniformity and comparability of the sample data, Yiwu City is not currently considered. Considering the impact of the epidemic since 2020, this article selects data from 70 large and medium-sized cities in China from 2011 to 2019 for research, including 34 experimental groups and 36 control groups.

The data mainly comes from the China Urban Statistical Yearbook, China Economic Database (CEIC), statistical yearbooks of various cities over the years, and the National Economic and Social Development Statistical Bulletin. Some missing data are supplemented with the mean of adjacent years. The data analysis software is Stata18.

4.2 Variable Selection

4.2.1 The Dependent Variable

This article selects the growth rate of urban total factor productivity as the dependent variable. Total Factor Productivity (TFP) is a key analytical tool for evaluating the root causes of economic growth, used to measure the contribution of production factor inputs to economic growth, and is also an important indicator reflecting an economic growth model and its sustainable development capacity.

Referring to the approach of Liu Bingsickle, Li Qingbin (2009), Lu Xiaodong, and Lian Yujun (2012), this paper adopts the Malmquist index method based on the DEA model to measure the TFP growth rate of 70 large and medium-sized cities from 2011 to 2019.

1) Output data

The measure of economic output is based on regional GDP, taking into account factors such as inflation, and the GDP deflator is calculated using 2011 as the base period to obtain the actual GDP of the region. Among them, due to the difficulty in obtaining the GDP deflator index of prefecture level cities, data from the province where the city is located will be used as a substitute.

2) Capital investment

The calculation of capital investment refers to Zhang Jun et al. (2004) who proposed using the perpetual inventory

method to estimate stock and made some supplements. The specific method is as follows:

$$K_{it} = I_{it}/P_{it} + (1-\delta)K_{i(t-1)}$$

Where K_{it}, P_{it}, I_{it}, δ_{it} represents the capital stock, investment deflator, fixed assets investment and economic depreciation rate of the city in the period respectively. P_{it} is measured by the GDP deflator of the province where the city is located, while the initial capital stock is calculated using the following method:

$$K_{i0} = I_{i0}/(g+\delta)$$

Where, g is the geometric average growth rate of fixed assets investment from 2011 to 2014, and δ is the depreciation rate. With reference to Wang (2013), δ is set at a fixed value of 6%.

3) Labor input

There are multiple ways to measure labor input. This article refers to the method proposed by Zhan Xinyu et al. (2020) and measures it by the proportion of the number of regular undergraduate and vocational students in a city to the total population at the end of the year.

In summary, this article uses Deap2.1 software to estimate the urban TFP growth rate of 70 large and medium-sized cities from 2011 to 2019.

4.2.2 Core Explanatory Variables

The core explanatory variable of this article is the 0-1 variable sydid, which represents the interaction term between the comprehensive experimental zone policy and the time variable. The three batches of cross border e-commerce comprehensive pilot zones were established in 2015, 2016, and 2018, respectively. If a city was established as a pilot zone in, the explanatory variable for that city in and after is set to 1, otherwise it is set to 0. Specifically, for the first batch of cities established in cross border pilot zones, namely Hangzhou, the explanatory variable is set to 1 in 2015 and later, and 0 before 2015; For the cities established in the second batch of cross border e-commerce comprehensive pilot zones, including Shanghai and 12 other cities, the explanatory variable is set to 1 in 2016 and later, and 0 before 2016; For the cities established in the third batch of cross border e-commerce comprehensive pilot zones, including 22 cities such as Nanjing, the explanatory variable is set to 1 in 2018 and later, and 0 before 2018.

4.2.3 Control Variables

In order to control and mitigate the impact of other factors on urban total factor productivity, referring to previous literature, this article adds a series of economic indicators as control variables in the benchmark regression model, including: (1) Economic development level, logarithm of regional GDP; (2) Industrial structure, the ratio of the output value of the tertiary industry to the output value of the secondary industry; (3) Infrastructure construction level, logarithm of fixed assets investment; (4) The degree of education emphasis, the ratio of education expenditure to local general public budget expenditure (5) The logarithm of urban size and population density; (6) The level of foreign trade, the ratio of total import and export trade to regional GDP; (7) The level of social consumption is the logarithm of the total retail sales of consumer goods.

Table 2. Descriptive statistical results of variables

Variable type	Variable	Meaning	N	Mean value	Variance	Min	Max
Explained Variable	tfpch	TFP growth rate	630	1.023	0.260	0.273	5.546
Core explanatory variables	sydid	Policy effects	630	0.148	0.355	0	1
Instrumental variable	eco	Level of economic development	630	3.557	0.329	2.733	4.467
	ind	Industrial structure	630	1.158	0.742	0.371	5.169
	inf	Infrastructure construction level	630	7.481	0.311	6.607	8.661
	sca	City size	630	2.705	0.299	1.244	3.362
	tra	Foreign trade level	630	0.365	0.443	0.004	2.374
	con	Social consumption level	630	7.254	1.582	5.893	8.200

4.3 Model Settings

This article uses the double difference method to analyze the impact of the setting of cross border e-commerce comprehensive pilot zones on the urban TFP growth rate, and constructs a benchmark model as follows:

$$tfpch_{it} = \beta_0 + \beta_1 sydid_{it} + \gamma Z_{it} + \lambda_i + \mu_t + \varepsilon_{it}$$

Among them, i represents the city, t represents the year, $tfpch_{it}$ represents the TFP growth rate of city t in year t, $sydid$ is the core explanatory variable, and Z is the control variable. β_1 captured the difference in TFP growth between the experimental group and the control group before and after policy implementation and characterized the annual effect of establishing a comprehensive cross border e-commerce pilot zone policy. To control for regional factors that do not change over time and macroeconomic factors that have the same impact on all cities, urban fixed effects λ_i and annual fixed effects μ_t are added to the regression, where ε_{it} is a random disturbance term.

5. Empirical Analysis

5.1 Parallel Trend Test

The use of the double difference method requires satisfying the parallel trend hypothesis. Researchers usually evaluate the trend before the policy or event occurs to support the rationality of the parallel trend hypothesis, that is, by testing whether the coefficients in each period before the policy implementation or event occur are significant, to determine whether the parallel trend hypothesis is satisfied.

The parallel trend test results are shown in Figure 1. The dashed line represents the current period of policy implementation, and the left side of the horizontal axis represents before policy implementation. Before the current policy time point, the time points were all around the horizontal axis, indicating that there was no significant difference between the experimental group and the control group before the policy, indicating that the parallel trend test passed. After the current policy, the point of departure from the horizontal axis indicates that the implementation of the policy may have a positive impact on the dependent variable.

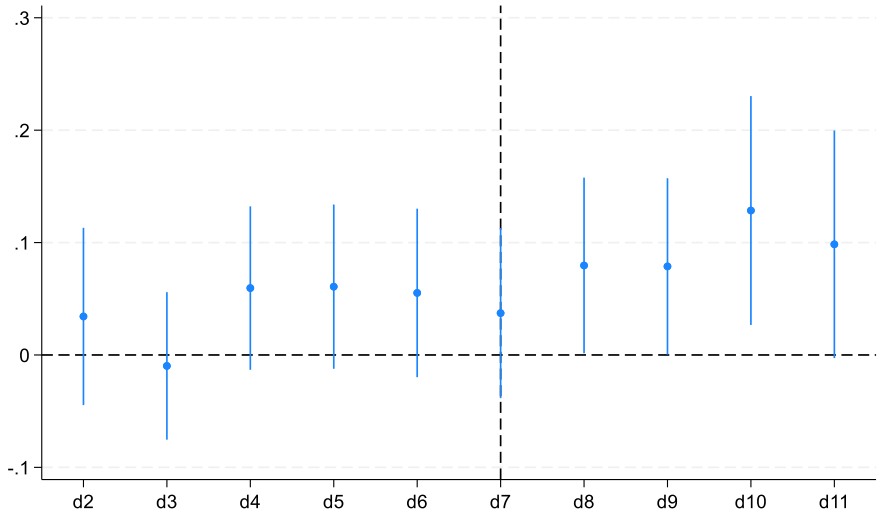

Figure 1. Parallel Trend Test Results

5.2 Benchmark Regression Results

This article examines the impact of the establishment of cross border e-commerce comprehensive pilot zones on the growth rate of urban TFP. The first column only controlled for urban fixed effects and year fixed effects, and the results showed that the establishment of the experimental zone increased the urban TFP growth rate. In column (2), control variables were added, and when both time and region were fixed, it was positive at a significance level of 5%, indicating that policy implementation increased the TFP growth rate by 1.7%.

Table 3. Benchmark Regression Results

	(1)	(2)

Policy effects	0.024*	0.017**
	(0.029)	(0.018)
Level of economic development		0.068**
		(0.157)
Industrial structure		-0.003
		(0.009)
Infrastructure construction level		-0.058***
		(0.040)
City size		-0.064**
		(0.124)
Foreign trade level		-0.005***
		(0.030)
Social consumption level		0.002***
		(0.007)
Constant	1.021***	1.264***
	(0.012)	(0.787)
Urban fixed effects	YES	YES
Year fixed effect	YES	YES
N	630	630
R^2	0.243	0.252

Explanation: * p<0.1, * * p<0.05, * * p<0.01, values in parentheses are standard errors.

5.3 Regional Heterogeneity Testing

The economic zone division of the Bureau of Statistics divides China into eastern, central, western, and northeastern regions, and regression analysis is conducted separately. The results of regional heterogeneity testing are shown in Table 4.

Table 4. Heterogeneity test results

	Eastern	Central	Western	Northeastern
Policy effects	0.027**	0.012**	-0.003***	-0.093*
	(0.053)	(0.071)	(0.037)	(0.192)
Control variable	YES	YES	YES	YES
Urban fixed effects	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
N	630	630	630	630
R^2	0.2486	0.2557	0.2711	0.2362

The results indicate that the establishment of the experimental zone has the most significant promoting effect on TFP growth rate in the eastern region, and also has a certain positive effect in the central region, while there is no such effect in the western and northeastern regions. Economically developed cities usually have more complete infrastructure such as transportation, logistics, and information, with a large number of high-quality talents covering multiple fields such as e-commerce operations, international trade, and marketing. At the same time, economically developed cities often respond and implement national policies more quickly. The establishment of cross border e-commerce comprehensive pilot zones enables them to take the lead, explore new models and rules, and through cross border e-commerce policy support and service optimization, reduce enterprise operating costs, improve production efficiency and management efficiency, and thus accelerate the improvement of total factor productivity. The pilot zone encourages technological innovation and application, and improves production and

supply chain efficiency by introducing advanced information and logistics technologies. Enterprises in economically developed cities are more mature in supply chain management, have stronger innovation capabilities and a more active innovation environment, and can continuously introduce new business models and services. Therefore, the effect on improving total factor productivity is more obvious.

5.4 Robustness Testing

Considering the potential lag of policy shocks, this article treated the dependent variable with lag of one and two periods and conducted regression analysis. The regression results are shown in Table 5, with columns (1) and (2) representing lag of one and two periods, respectively. It was found that the regression coefficient is still significantly positive, and as the number of lag periods increases, the policy effect becomes more pronounced, indicating that the improvement and transmission of technology require some time to manifest. In addition, the samples from municipalities directly under the central government were further excluded for placebo testing, and the regression results were reported in column (3), indicating that the policy effect is still significant.

Table 5. Robustness test regression results

	(1)	(2)	(3)
Policy effects	0.043**	0.055**	0.019**
	(0.059)	(0.053)	(0.048)
Control variable	YES	YES	YES
Urban fixed effects	YES	YES	YES
Year fixed effect	YES	YES	YES
N	630	630	630
R^2	0.2181	0.3911	0.3491

6. Policy Recommendations

6.1 Strengthen Policy Support

Increase policy support for the comprehensive pilot zone, ensure policy implementation is in place, and enhance the sense of achievement of enterprises. The government should further improve policies related to cross border e-commerce, provide more favorable tax, customs clearance, foreign exchange and other policy support, and promote the development of cross border e-commerce enterprises. Establish and improve policy supervision and evaluation mechanisms to ensure transparency and fairness in policy implementation. The government should regularly evaluate the implementation of policies in the comprehensive pilot zone, timely identify and solve problems in policy implementation, and improve policy effectiveness.

6.2 Improve the Level of Infrastructure Construction

Increase investment in logistics, information and other infrastructure in the comprehensive pilot zone, and improve the level of infrastructure construction. The government should strengthen cooperation with enterprises, build modern logistics parks, cross border e-commerce public service platforms and other infrastructure, and provide efficient and convenient services for enterprises. Promote the development of smart logistics and intelligent warehousing, improve logistics efficiency and service quality. The government should support enterprises to apply new technologies such as big data and artificial intelligence, improve the intelligence level of logistics and warehousing, reduce logistics costs, and improve logistics efficiency.

6.3 Strengthen Technological Innovation Capabilities

Support enterprises in the comprehensive pilot zone to increase investment in technology research and development, and enhance their technological innovation capabilities. The government should establish a special fund to support enterprises in conducting technological research and innovation, and promote the progress and application of cross border e-commerce technology. Establish a cross border e-commerce technology innovation platform to promote technological exchange and cooperation among enterprises. The government should support enterprises, research institutions, and universities to jointly establish technology innovation platforms, promote the research and application of cross border e-commerce technology, and enhance technological innovation capabilities.

6.4 Promote Regional Coordinated Development

Increase support for the comprehensive pilot zones in the central and western inland regions, and promote coordinated regional development. The government should provide more policy support and financial investment

to improve the construction level of comprehensive pilot zones in the central and western inland areas, and narrow the regional development gap. Promote cooperation and exchange between comprehensive pilot zones, and form a regional coordinated development pattern. The government should support cooperation and exchange between comprehensive pilot zones, promote resource sharing and complementary advantages, and enhance the overall development level of the zones.

Reference

Jia Junxue, Luo Liheng, Gu Jia, (2023). Local government environmental regulation and high-quality economic development. *China Industrial Economics*, (05), 99-117. DOI:10.19581/j.cnki.ciejournal.2023.05.006.

Lu Xiaodong, Lian Yujun, (2012). Estimation of total factor productivity of Chinese industrial enterprises: 1999-2007. *China Economic Quarterly*, *11*(02), 541-558. DOI:10.13821/j.cnki.ceq.2012.02.013.

Wang J, (2013). The economic zones: Evidence from Chinese municipalities. *Journal of Development Economics*, 101, 133-147.

Wang Lirong, Rui Lili, (2022). Impact of comprehensive cross border e-commerce pilot zones on regional economy and analysis of differences — Based on the perspective of "counterfactual". *South China Journal of Economics*, (03), 53-73. DOI:10.19592/j.cnki.scje.391409.

Wu Jia, He Shuquan, (2020). The spatial impact of factor mobility on total factor productivity in China. *Statistics & Decision*, *36*(23), 93-97. DOI:10.13546/j.cnki.tjyjc.2020.23.021.

Zhan Xinyu, Liu Wenbin, (2020). Chinese-style fiscal decentralization and local economic growth target management-Empirical evidence from provincial and municipal government work reports. *Management World*, *36*(03), 23-39+77. DOI:10.19744/j.cnki.11-1235/f.2020.0032.

Zhang Jianqing, Gong Enze, (2021). A study on the impact of China-Europe shuttle trains on total factor productivity in Chinese cities. *World Economy Studies*, (11), 106-119+137. DOI:10.13516/j.cnki.wes.2021.11.008.

Zhang Jun, Wu Guiying, Zhang Jipeng, (2004). Estimation of interprovincial physical capital stock in China: 1952-2000. *Economic Research Journal*, (10), 35-44.

Zhang Ziran, (2021). Research on the influencing factors of urban TFP growth under the condition of spatial aggregation. *Journal of Hunan University (Social Sciences)*, *35*(03), 39-48. DOI:10.16339/j.cnki.hdxbskb.2021.03.006.

Zhou Chuang, Zheng Xugang, Xu Wenli, (2024). New urbanization construction in counties and employment quality of agricultural transfer population. *The Journal of World Economy*, (04), 212-240. https://doi.org/10.19985/j.cnki.cassjwe.2024.04.007.