



Pilot Free Trade Zone and Productivity of Enterprise

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Abstract. From the creation of the Shanghai Free Trade Zone from September 2013 to September 2020, China has set up six batches of 21 free trade zones in batches. The establishment of free trade zones may often lead to regional economic development and also have a certain impact on the production efficiency of enterprises. This paper studies how and whether the establishment of a free trade zone virtually affects the productivity of enterprises. This paper uses the latest data of 2012–2019 from Shanghai, and Shenzhen A-share listed companies; and adopts multi-period difference in difference method to explore the impact of the establishment of a free trade zone on corporate productivity. Moreover, our research takes the establishment of a free trade zone in the city whether enterprises are located during the simple period as a turning point. Studies have shown that the establishment of a free trade zone can promote the productivity of enterprises obviously, but it has heterogeneity. Besides, the test of impact mechanism shows that the establishment of a free trade zone promotes enterprises to increase R&D investment and obtain more government subsidies, thereby increasing enterprise productivity. This research provides a factual basis for the effectiveness of free trade zone policies and the realization of high-quality and high-efficient development of enterprises.

Keywords: Free trade zone enterprise upgrading · Difference in difference · Opening to the outside world · High-Quality development

1 Introduction

The construction of the free trade zone is a significant strategic move for China to deepen reforms, expand opening up, and pursue high-quality economic development in the new era. Different from previous policy positioning of economic function zones, the free trade zone is no longer a “policy depression” that simply relies on policy incentives to attract investment and agglomeration of enterprises [15]. Instead, it takes institutional innovation as its core task. An institutional innovation system can be replicated and promoted in conjunction with international trade and investment. The decentralization of reform autonomy in the free trade zone has accelerated the pace and depth of institutional innovation. The industrial agglomeration and technology spillover effect in the free trade zone has also become the new engine for high-quality regional economic growth.

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The geographical distribution of the free trade zones has gradually changed from the first eastern coastal provinces and cities to the central and western regions. Provinces and cities promote and coordinate national, regional cooperation and promote the development of land-sea trade [16]. As the first free trade zone established, the Shanghai Free Trade Zone shoulders the mission of “experimental” focusing on trade liberalization, investment liberalization and financial innovation, as well as a radiating and leading role [12, 14]. From the establishment of the Hainan Free Trade Zone in October 2018 to the construction of the Hainan Free Trade Port in June 2020, a series of measures demonstrated the determination to expand opening-up and build a high-level free trade port [11]. In August 2019, it was determined to establish free trade zones in six provinces and regions including Shandong, Jiangsu, Guangxi, Hebei, Yunnan, and Heilongjiang. These six free trade zones are no longer limited to coastal areas, but more consider serving national strategies. At the same time, it has a more accurate functional positioning by giving full play to the advantages of local, regional characteristics. In October 2020, free trade zones were established in Beijing, Anhui and Hunan. While improving their development, they must also integrate and radiate the surrounding areas.

At present, China has only established the free trade zone for seven years, but a reproducible and extendable free trade zone system has been initially formed. As an experimental window for the country to deepen its opening-up and system reform, the enterprises in the free trade zone should have higher production efficiency. It should have higher production efficiency. Also, in research on enterprises, industrial and enterprise data is widely used, but it is trapped by obsolete data and severe lack of data, and the data of listed companies are updated in a timely and very standardized manner. Therefore, this paper uses the latest data of 2012–2019 from Shanghai, and Shenzhen A-share listed companies; and adopts multi-period DID method to study the impact of the establishment of the free trade zone on the upgrading of enterprises. Not only to enrich the current literature research on the construction of the free trade zone but also to evaluate the free trade zone policy effects have a different reference role.

The arrangement of the rest of this article includes five parts. The second part is a literature review. The third part describes the influence mechanism of the free trade zone establishment on enterprise upgrading. The fourth section is the research design, including variables and data sources, model setting. The fifth part is empirical results, including benchmark regression results, robustness test, mechanism test, analysis of heterogeneity. The last part presents conclusions, policy recommendations and research prospects.

2 Literature Review

The literature closely related to the research theme of this article is mainly divided into two categories, one is the evaluation study on the policy effect of the free trade zone; the other is the literature research on the enterprise productivity.

First, the literature research on the free trade zone; since the creation of the Shanghai Pilot Free Trade Zone in 2013, many scholars have conducted extensive qualitative research on the economic growth effects of the establishment of the free trade zone and the design of financial rules based on this natural event. Quantitative policy evaluation.

Specifically, the literature on the earliest creation of the Shanghai Free Trade Zone is the most abundant and profound. By comparing the real growth value of import and export trade before and after the creation of the Shanghai Free Trade Zone and “The counterfactual value” it was found that the establishment of a free trade area not only had a positive impact on local trade results but also had a positive spillover effect on neighboring regions [5, 13]. Based on the PSM-DID process, it has been found that the establishment of a free trade area has a positive effect on capital flows in Shanghai.

Moreover, a large number of scholars have pointed out through empirical research that the creation of the Shanghai Free Trade Area has a positive “system dividend” effect [6], industrial structure upgrading effects [9] and significant economic growth effects [7]. Secondly, the literature research on enterprise productivity; the enterprise is the main body of economic growth, and the research on enterprise upgrading has always been one of the hot topics that scholars at home and abroad have been concerned about for a long time [1]. At present, there are abundant researches on enterprise upgrading at home and abroad. However, the main thing closely related to this article is the research on the impact of the creation of economic function zones on the upgrading of enterprises. For example, Gilbert pointed out that the unique policy advantages of economic functional zones will promote the agglomeration of enterprises, and the agglomeration of enterprises will produce spillover effects such as technology and talents and improve the production efficiency of enterprises [2, 4]. However, Neumark and Simpson [8] pointed out that although the establishment of economic function zones in various countries produces spillover effects caused by industrial agglomeration in the region, it also brings about “beggar-thy-neighbours”, that is to say, it will cause damage to neighbouring regions [3]. The crowding-out effect in the market and talents. However, limited to the availability of micro-data, the current research on the impact of economic function zones on the productivity of micro-enterprises, scholars mainly use the micro-database of Chinese industrial enterprises, and the data stays in 2013, which is not enough to reveal the comprehensive pursuit of China in the new era Production status of enterprises with high-quality development.

Through the analysis of existing literature, this article finds that the current literature research on free trade zone policies mainly focuses on the regional macro-level institutional dividends brought about by the implementation and promotion of free trade zone policies, such as economic growth effects, industrial agglomeration effects, and investment Trade expansion effects, and so on. The changes in the business environment brought about by the in-depth enactment of free trade area policies will inevitably have a significant impact on the development of enterprises. However, scholars have not studied the institutional dividends and policy effects of the establishment of free trade zones on enterprises.

3 The Influence Mechanism of the Free Trade Zone Establishment on Enterprise Upgrading

The establishment of the free trade zone is a typical quasi-natural experiment. What effect does the creation of a free trade zone have on the upgrading of enterprises in the region, promote or inhibit? How stimulus is the policy effect? And through which

transmission mechanism? Next, this part will discuss the specific impact mechanism based on technological innovation and the reduction of government subsidies caused by the agglomeration effect during the establishment of the free trade region [17].

The first is from the perspective of technological innovation. After the establishment of the free trade zone, the free and convenient flow of investment, trade, and cross-border capital have intensified competition among enterprises. In order to maintain a stable market share and compete for market resources, enterprises have to enrich and upgrade product types and quality and enhance product competitiveness [10]. In turn, companies are forced to carry out technological innovation. Besides, the creation of the free trade region has dramatically enhanced the customs clearance of various resource elements such as goods and services and improved the efficiency of the industrial chain of enterprises. Talent is the foundation of technological innovation. The free trade zone uses its excellent platform effect to attract talents of different levels to enter the zone, optimize the talent structure, and form a talent pool effect. The accumulation of talents conducts technological research and development for enterprises in the free-trade region.

The second is from the perspective of government subsidies. It reveals that the goal positioning of the free trade area is to connect with the international high-standard free, open and fair competition rule system. Since the reform and opening up, various central and local government subsidies have indeed played an important supporting role for the revitalization of Chinese national enterprises, the promotion of enterprise exports, and the implementation of the “going global” strategy. So will government subsidies, as a policy of supporting the development of enterprises have a negative influence on the development of enterprises? Domestic and foreign scholars have found in their research that, compared with non-subsidized companies, the productivity of government-subsidized companies has increased significantly.

When studying government subsidies and corporate export behaviour, a large number of scholars found that government subsidies can not only increase the export choices of enterprises but also help enterprises to expand their export scale and promote the improvement of enterprise efficiency. Many scholars based on the empirical test of the data of Chinese industrial enterprises show that continuous and high-intensity government subsidies may stimulate enterprises to seek rent and increase their non-productive expenditures. However, moderate government subsidies are advantageous to the enterprise cost reduction, the stimulation enterprise vigour, the promotion enterprise total factor productivity.

Hypothesis 1: Under the establishment of a free trade zone, the research and development of enterprises caused by the capital agglomeration and industry competition will improve efficiency and promote enterprise upgrade.

Hypothesis 2: Under the establishment of a free trade zone, government subsidies under system dividend and industrial policy are conducive to improving the productivity of enterprises by reducing costs and stimulating vitality.

4 Research Design

4.1 Variables and Their Measurement and Data Sources

From September 2013 to September 2020, China set up free trade zones in 18 province-level division, including four municipalities directly under the Central Government, Shanghai, Tianjin, Chongqing and Beijing. Most provinces have become three free trade zones. For example, cities in the provinces of Guangdong, Fujian, Liaoning, and Hainan are all within the scope of a free trade zone. According to the geographical location of the free trade zone, it can be determined to the city level, which allows a more detailed analysis of the influence of free trade area policies on enterprise productivity.

Explained variable: The research goal of this article is the productivity of each listed company. Using four methods to measure them, namely the ordinary least squares method and the fixed effects model method, Olley and Pakes method and Levinsohn and Petrin method. Olley and Pakes' assumption is that investment and total output always maintain a monotonic relationship, which implies that samples with zero venture cannot be assessed. Because not all businesses have good investment every year, many business samples are discarded in the measurement process. Instead of using investment amount as proxy variables, Levinsohn and Petrin use intermediate product input indicators instead. From a data point of view, intermediate inputs are more readily available.

Core explanatory variable: The core explanatory variable of this article is the impact time of the free trade area policy. If a free trade area is established in year t of the city where the company is located, the value is 1 for the current year and subsequent years, and the other is 0. **Control variables:** (1) Size of the company (Size), expressed as the logarithm of the company's total values; (2) Return on total assets (Roa), expressed as the ratio of the net profit of the current year to the total assets at the end of the period; (3) Ratio of fixed assets (PPE), Expressed as the ratio of the company's fixed assets to total assets; (4) Liquid assets to liabilities ratio, presented as the proportion of current assets to current liabilities; (5) asset-liability ratio Leverage, expressed as the ratio of the company's total liabilities to total assets for the year Expressed; (6) Cash flow (C.F.), expressed by the ratio of the company's monetary funds to total assets; (7) Capital expenditure ratio (Cap), expressed by the ratio of company's capital expenditures to total assets; (8) Company age, expressed by the current year minus the year the company was established.

The sample data of this study is the data of A-share listed companies in Shanghai and Shenzhen from 2007 to 2019. The data of government subsidies are from Wind database, and the financial data used to calculate the company's productivity, other mechanism variables and control variables come from the CSMAR database. We merge security codes and year identification codes. Then we remove the companies whose control variables are missing, the companies whose establishment time is later than the listing time (Table 1).

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
PFTZ	17,324	0.1373	0.3441381	0	1
RD	17,324	4.4618	5.275141	0	169.3844
GOV	14,689	6.6114	1.868752	-3.992583	15.43177
Size	17,324	12.7512	1.309332	8.595788	19.42615
Roa	17,324	0.0494781	0.0716551	-1.859121	1.201571
PPE	17,324	0.2124729	0.1476834	0.000206	0.9203241
Liquid	17,324	3.077408	4.828875	0.0747016	190.8722
Leverage	17,324	0.389425	0.204775	0.007521	2.861043
CF	17,324	0.2038239	0.1530272	0.0008247	0.9598173
Cap	17,324	0.0543197	0.0498647	1.34E-06	0.6417516
Age	17,324	3.017254	0.2439628	1.791759	4.158883
Age2	17,324	9.163336	1.46622	3.210402	17.29631

4.2 Empirical Model

At present, China has established 21 free trade zones in 6 batches, and the time and location of free trade zones are not consistent. Therefore, this article adopts the multi-period DID model. $PFTZ_{it}$ is a dummy factor for the creation of the free-trade region. If enterprise i enters the free-trade region for the first time in period t , then the value of establishment of free trade zone corresponding to enterprise i in period t and after is 1, otherwise it is 0.

$$TFP_{it} = \beta_0 + \beta_1 PFTZ_{it} + \sum_{n=2}^k \beta_n \times Con_{it} + \tau_t + \gamma_i + \varepsilon_{it} \quad (1)$$

TFP_{it} represents the regional GDP of enterprise i during year t . $PFTZ_{it}$ is the DID item of whether the free trade zone is created. It is the product of the control group and the experimental group and the dummy variable of whether to establish the free trade zone. Con_{it} is a series Control variable, τ_t are time dummy variables and γ_i are individual dummy variables.

5 Empirical Results

5.1 Benchmark Regression Analysis

Based on the quasi-natural experiment of setting up a free-trade region, the influence of the establishment of a free trade zone on the production of enterprises is examined by using a multi-period DID model. Table 2 reports the benchmark regression results. The 1st to the 3rd columns are the results without adding control variables, which respectively indicate the results of the enterprise effect of not controlling time and industry province

Table 2. Benchmark regression results

Variables	(1)	(2)	(3)	(4)
PFTZ	0.161***	0.0813***	0.0542***	0.0162**
	(0.01)	(0.011)	(0.008)	(0.008)
Year\Enterprise	No	Yes	No	Yes
Industry\Province	Yes	Yes	Yes	Yes
Observations	17,324	17,324	17,324	17,324
R-squared	0.048	0.090	0.455	0.468

Note: The robustness standard errors are shown in the parenthesis. ***, **, * are significant at the 1%, 5%, and 10% levels respectively. The following tables are the same.

effect, the enterprise effect of controlling time not controlling the industry province effect, and the enterprise affect of controlling time controlling the industry province effect. We found that the creation of free trade zones can significantly foster the growth of enterprise upgrading, except for the enterprise effect of controlling time but not the provincial effect of industry. The fourth to sixth columns are the results of adding control variables that do not control time enterprise effect and industry province effect, control time enterprise effect does not control industry province effect, and control time enterprise effect controls industry province effect. It has been found that the situation is similar to the above except for the control. From here, we see that the creation of a free-trade region can significantly improve the upgrade of enterprises as a whole. It becomes significant after controlling the time when the enterprise effect does not control the industry province effect and the time control enterprise effect controls the industry province effect. This shows that the enterprise does not change with the industry province. Fixed effect factors play an important role in enterprise upgrading.

5.2 Robustness Test

At present, the most commonly used methods of measuring enterprise productivity in the academic circle are the least-squares method (OLS), fixed effects method (F.E.), Olley-Pakes method (O.P.) and Levinsohn-Petrin method (L.P.), each method. Each has its advantages and disadvantages. To ensure the firmness of the company's productivity measurement, we adopt the method of changing the explained variables to test the robustness. Table 3 reports the influence of the establishment of free trade regions on the productivity of enterprises measured by OLS, F.E., O.P. and L.P. methods. After controlling the time-enterprise effect and the industry-province effect, we have found that the creation of a free trade area has a very constructive effect on enterprise productivity measured by the four methods. The test results are robust.

Table 3. Tests under different explained variables

Variables	(1)	(2)	(3)	(4)
PFTZ	0.0449*** (0.009)	0.0438*** (0.009)	0.0607*** (0.009)	0.132*** (0.02)
Constant	-0.153 (0.221)	-0.156 (0.222)	-30.70*** (0.228)	15.99*** (0.55)
Control variable	Yes	Yes	Yes	Yes
Year\Enterprise	Yes	Yes	Yes	Yes
Industry\Province	Yes	Yes	Yes	Yes
Observations	17,324	17,324	17,324	17,324
R-squared	0.172	0.168	0.291	0.387

5.3 Mechanism Verification

Due to factors such as factor market price distortions and low business environment in the development of enterprises, the low technological level of enterprises lacks innovation vitality, which affects the further upgrading and development of enterprises. The foundation of a free trade area can better alleviate the disadvantages as mentioned above. The continuous improvement of trade liberalization, trade facilitation and institutional innovation is not only conducive to building a higher level of the open economy and new system, but also learning advanced foreign technology for enterprises. Furthermore, experience provides the conditions; companies may increase investment in research and development to promote their upgrading. Construct a moderating effect model to test the mechanism, and use enterprise R&D investment as a moderating factor for the foundation of a free trade zone.

$$TFP_{it} = \beta_0 + \beta_1 PFTZ_{it} + \beta_2 * PFTZ_{it} * R\&D_{it} + \sum_{n=3}^k \beta_n \times Con_{it} + \tau_i + \gamma_t + \varepsilon_{it} \quad (2)$$

Table 4 reports the results of the mechanism test based on the enterprise R&D perspective. Columns (1) and (2) are the results of the company's total factor productivity estimated using the O.P. method as the explained variable. The first column (1) does not include the interaction term. Adding the interaction item in column (2), it can be seen that after the interaction item is added, the result of the free-trade zone policy dummy variable changes from significant to insignificant. This is due to the impact of the interaction term after the inclusion of the interaction term. The effect of the policy dummy variables in the trade zone will not change. The estimate of the interaction term is notably positive at the 5% level, which shows that when the free-trade zone policy dummy variables remain stable, the increase in R&D investment will help companies increase productivity. To guarantee the authenticity of the results, columns (3) and (4) are the results of the total factor productivity measured using the OLS method as the explained variable. The results are similar to the L.P. method, indicating that the results are stable and reliable. This better validates the hypothesis 1 of this article.

Table 4. Mechanism inspection based on enterprise R&D

Variables	(1)	(2)	(3)	(4)
RD_PFTZ		0.003**		0.004***
		(0.001)		(0.001)
PFTZ	0.029***	0.011	0.036***	0.009
	(0.01)	(0.013)	(0.011)	(0.014)
Constant	-32.36***	-32.35***	-0.306	-0.299
	(0.236)	(0.236)	(0.253)	(0.253)
Control variable	Yes	Yes	Yes	Yes
Year\Enterprise	Yes	Yes	Yes	Yes
Industry\Province	Yes	Yes	Yes	Yes
Observations	12,043	12,043	12,043	12,043
R-squared	0.405	0.406	0.218	0.219

Regarding whether government subsidies can promote enterprises to increase productivity, there are many controversies in academic circles. Some scholars believe that government grants can trigger enterprises to enhance R&D investment and increase productivity, while some scholars argue that government grants may stimulate rent-seeking enterprises and be detrimental to productivity. Is there a positive effect or a negative effect? This paper conducts a mechanism test by constructing an adjustment effect model, taking government subsidies as an adjustment factor for the foundation of a free trade area, and first examines the adjustment effect of government subsidies on the policy effect of the free trade zone.

$$TFP_{it} = \beta_0 + \beta_1 PFTZ_{it} + \beta_2 * PFTZ_{it} * GOV_{it} + \sum_{n=3}^k \beta_n \times Con_{it} + \tau_i + \gamma_t + \varepsilon_{it} \quad (3)$$

Table 5 reports the results of the mechanism test based on the perspective of government grants. To guarantee the reliability of the test outcomes, the organization's total factor productivity estimated by four unique techniques is as yet utilized as the explained variable. After controlling a series of control variables and fixed effects, the results are still similar. Columns (1) to (4) are the empirical results of using O.P., L.P., OLS and F.E. methods to estimate total factor productivity as the explained variable. The main focus is on the estimate of the interaction term GOV_PFTZ. The coefficient of the interaction term variable passes 1% Significance level test, and the result is positive, which reveals that when the free trade zone policy is stable, increasing government subsidies can increase corporate productivity, and reducing government subsidies will reduce corporate productivity. This better verifies Hypothesis 2 of this article.

Table 5. Mechanism test based on government subsidies

Variables	(1)	(2)	(3)	(4)
GOV_PFTZ	0.0522*** (0.004)	0.218*** (0.01)	0.0192*** (0.004)	0.0171*** (0.004)
PFTZ	-0.240*** (0.03)	-1.107*** (0.08)	-0.085*** (0.027)	-0.075*** (0.027)
Year\Enterprise	Yes	Yes	Yes	Yes
Industry\Province	Yes	Yes	Yes	Yes
Observations	14,689	14,689	14,689	14,689
R-squared	0.102	0.108	0.080	0.077

6 Conclusions and Policy Recommendations

The establishment of a free trade zone can bring a series of policy dividends, such as improvement of the business environment, trade liberalization and trade facilitation, institutional innovation can reduce the cost of enterprises and financing constraints; which can effectively increase the productivity of enterprises. This research utilizes the data of listed companies from 2007 to 2019 and uses the Double Difference (DID) model to estimate the influence of the creation of a free trade zone may have on corporate productivity. Research shows that the establishment of a free trade area can significantly boost corporate productivity, but it has heterogeneity.

The nature of corporate equity does not significantly increase corporate productivity for state-owned enterprises to establish free trade zones, and it significantly increases corporate productivity for privately-owned corporations. Whether the establishment of free trade regions for high-tech enterprises is essential: for high-tech, the productivity of technology enterprises has a significant part in promoting and has no significant impact on non-high-tech enterprises. The establishment of a free trade area in the region in which the company is located plays a vital part in promoting the eastern region, but not in the central and western regions. The regulatory effect mechanism test reveals that the creation of a free-trade region increases productivity by promoting enterprises to increase R&D investment and obtain government subsidies.

Previous studies have verified that the free trade region policy can effectively enhance regional economic growth. The research in this article confirms that the free trade region policy is also conducive to enhancing the productivity of regional enterprises. The existing relatively complete innovation results should be used in the newly established free trade zone.

Improving the performance of private companies is better than the performance of state-owned enterprises, and the development capacity of state-owned enterprises must be improved. Various non-governmental business funding policies should be pursued to promote the joint development of state-owned enterprises and private enterprises. Enterprises in the free-trade region in the eastern region have performed even better in the upgrading of enterprises. They should continue to maintain the demonstration effect in

the development of the national free-trade region, and copy and promote good experience based on the development of each region. The high-tech business revitalization is better than non-high-tech businesses, and continue to play the role of the market to eliminate backward enterprises, cultivate more high-tech enterprises. The high-tech business also can improve the international competitiveness of all industries.

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