A Study on Urban Development under the Policy of Inland Free Trade Zones

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Abstract. The Free Trade Zone (FTZ) serves as an important experimental farm for China's deepened reform and opening up, significantly promoting country's economic growth. This research analyzes panel data gathered from China's inland cities between 2015 and 2020 to examine the effects of inland FTZs on regional growth. By measuring per capita GDP and employing the difference-in-differences (DID) method, the study examines policy effects in establishing inland FTZs on these cities. The findings reveal that the creation of inland FTZs significantly boosts the growth rate of urban per capita GDP. Additionally, this paper presents policy recommendations for the development of inland-type FTZs: optimizing the internal spatial structure of FTZ cities, playing a radiation-driven role of FTZ cities, and implementing institutional innovation and promotion within FTZ cities. The aim is to learn from the successful experiences in the development of inland-type FTZs, which provides a reference for the construction of FTZs in other inland regions.

Keywords: Inland FTZ, Difference-in-Differences Method, Economic Development.

1. Introduction

The Free Trade Pilot Zone (hereafter referred to as "FTZ") is an essential platform for China's reform and opening up, since it promotes regional economic growth and implements a high degree of openness. The practices of the first two batches of FTZs in 2013 and 2015 have shown that these regions effectively enhanced regional economic competitiveness and openness through the implementation of trade and investment liberalization and facilitation, as well as measures to expand openness. Based on these successful experiences, China established the third batch of FTZs in 2017 (Liaoning, Zhejiang, Henan, Hubei, Sichuan, Shanxi, and Chongqing), further expanding FTZ strategy. Compared to the first two batches, the third batch of FTZs spans both coastal and inland areas, mostly focuses on the central and western areas. This type of shift of FTZs from coastal to interior locations marks implementation of China's efforts to deepen reform and open up and explore an open economy at the regional level [1]. Interior free trade zones are critical to the economic growth of China's interior areas. Its purpose is to advance the Belt and Road Initiative, reinforce developing strategy in the western part of the country, and facilitate the connectivity of the Yangtze River Economic Belt. The inland FTZ offers a range of development opportunities for the central and western areas of China, supporting the opening up of interior places to the outside world and regional economic growth. Furthermore, it helps to close the growth gap between coastal and interior communities and promotes coordinated regional economic development.

Although a substantial amount of literature has conducted in-depth analysis and evaluation of the economic effects of FTZs, such as Li Fan and Ye Xiuqun using the Difference-in-Differences (DID) approach to explore the policy implications of FTZs [2,3]. Zhang Jun examines the correlation between FTZs and economic growth [4]. Cai et al. employed dynamic panel data models (DPD) and synthetic control methods (HCW) to assess the impact of the Shanghai FTZ on a local GDP [5]. Lin Xiaoqian analyzed the effects of inland FTZs on industrial organization upgrading based on the mediation effect [6]. Zhao Ying demonstrated that FTZs can promote regional economic growth [7]. Wang et al. used the DID approach and Bayesian Information Criterion (BIC) to find the impact of FTZs development on regional economic growth in China, finding that the establishment of FTZs

positively affects local per capita GDP growth rate [8]. However, there is limited research on the policy effects of inland FTZs. Ye Penghao pointed out that inland FTZs are not only areas for expanded openness but also regions whose economic driving effects are worthy of examination and analysis [1]. Moreover, due to geographical location and factor endowment heterogeneity, the development model of inland FTZs differs from that of coastal FTZs [9].

Therefore, studying the impact and spillover effects of inland FTZs on regional economic development is of significant importance. Theoretically, it will further provide theoretical support and experience for promoting high-level openness and development in inland areas. Practically, it demonstrates how to enhance the level of openness in inland areas, reduce the economic gap between the East and West, and improve the business environment in inland regions.

As a result, this paper employs the DID model to conduct an empirical analysis of FTZs city-level panel data. Specifically, it uses economic data from 2015-2020 as the analysis basis, considering inland FTZs cities as the control group consisted of nearby cities without FTZs and the treatment group. The research objectives are to assess the driving impact of the policy of the inland FTZs by using per capita GDP as a measurement indicator, and analyze the effect of the inland FTZs policy before and after implementation and explores the regional heterogeneity. Finally, the research summarizes the policy effect of the inland FTZs, and puts forward relevant suggestions to provide reference for regional spatial planning and economic development.

2. Policy Background and Research Hypotheses

2.1. Policy Background

The establishment of a free trade zone (FTZ) in China represents a significant strategic initiative with the objective of expanding change and being more transparent in light of the new age. This initiative plays a pivotal role in China's growth of the economy and opening up to outside influences. In the context of the fast growth of global commerce, China’s traditional development model and scale have put substantial pressure on coastal FTZs and free trade ports. As a result, establishing inland FTZs is a natural progression for the country’s foreign trade development.

In 2017, five more inland FTZs in Henan, Hubei, Sichuan, Shaanxi, and Chongqing were authorized by the State Council. From an international perspective, the establishment of these inland FTZs aims to align with higher international trade and economic rules, adapting to new trends in global economic development. Domestically, the expansion of FTZs from coastal to inland regions reflects China’s broader efforts to open up and deepen reforms [10]. The commonalities in the general plans of the five inland FTZs are as follows:

The first is to accelerate government function transformation, which emphasizes the deepening of administrative management system reforms, optimizing the legal environment, and strengthening post-event supervision mechanisms. Furthermore, it establishes a unified and centralized comprehensive administrative law enforcement system to enhance enforcement efficiency through multi-channel market supervision. The rapid transformation of government functions improves administrative efficiency and provides protective strategies for certain industries, reducing corporate burdens.

The second is to promote trade transformation and financial sector innovation. It encourages multinational companies to set up regional centers in FTZs, facilitating the integration of advanced manufacturing with modern services. It also supports the development of “Internet Plus” and fosters deep integration of the Internet with modern manufacturing industries. The establishment of a compatible local and foreign currency account management system in FTZs should be explored to facilitate cross-border trade and investment settlement.

The third is to advance the “Belt and Road Initiative” and Yangtze River Economic Belt Development. It mainly focuses on the China-Europe international railway transport corridor to improve customs cooperation mechanisms along the "Belt and Road" countries. Industrial chains should be used as links, and funds should be established within FTZs to optimize coordination at

various stages. High-end industries should be gathered and economic cooperation models innovated to achieve industrial transformation and upgrading. This approach aims for holistic development from specific points, ensuring balanced growth.

2.2. Research Hypotheses

Since the establishment of FTZs, their impact on regional development has been in a benign state. Under the advantage of institutional guidance, based on the study above, the following theories are put forth in this paper:

Hypothesis 1: The construction of inland FTZs can promote regional economic growth and have strong creative benefits.

Policy incentives can attract continuous industrial investment, forming industrial clusters and economies of scale. Furthermore, in addition to the direct benefits brought by policies, the agglomeration economy will also promote regional economic development. These reasons are as follows: the regional sharing of intermediate inputs can greatly save costs. The concentration of the work force can raise the level of the labor force by enhancing the matching of professional talents. The sharing of information and ideas between enterprises can also promote the improvement of production and research and development technology. Therefore, the creative benefits of landlocked FTZs are remarkable.

Hypothesis 2: The establishment of inland FTZs has a significant regional heterogeneity effect on development levels.

Due to differences in administrative levels and locational advantages, the policy effects of FTZs vary. Regions with higher administrative levels have more advantages in terms of economic autonomy, policy inclination, and factor endowment [11]. This may lead to faster implementation of FTZ policies [12]. Furthermore, the mobilization of social resources is more efficient, and the promulgation of related policies, laws, and regulations has priority over other regions. For instance, Henan and Hubei focus on technological breakthroughs and innovation, while Sichuan and Chongqing leverage transportation advantages to build transport hubs, and the government of Shaanxi places considerable emphasis on the Belt and Road Initiative as a means of stimulating economic growth in the western regions of the country. Thus, due to regional differences, the creation of landlocked FTZs will also have vital regional heterogeneity for regional development level.

3. Research Design

3.1. Model Construction

This study employs the Difference-in-Differences (DID) approach to assess the policy benefits of establishing inland FTZs on the improvement of urban development levels. According to the basic principles of this method, cities involved in the establishment of inland FTZs in 2017 (such as Zhengzhou, Luoyang, Kaifeng, Yichang, Chongqing, Wuhan, Chengdu, Xiangyang, Luzhou, Xian, and Xianyang) are taken as the experimental group. Neighboring cities with similar development conditions but without FTZs established before 2020 are used as the control group. The model is constructed as follows:

$$\ln GDP_{it} = \alpha_0 + \alpha_1 FTA_i * post_t + \beta X_{it} + \gamma_i + \mu_t + \varepsilon_{it} \quad (1)$$

Where i and t represent the sample province and year respectively; X is the set of control variables; γ represents time-fixed effects; μrepresents spatial fixed effect; ε is the random disturbance term.

3.2. Variable Selection and Descriptive Statistics

Dependent Variable: The level of urban development ($\ln$ GDP) is calculated as logarithmic per capita GDP.

Independent Variables: FTA is used to represent the regional dummy variable. If the city is an inland city with there is a free trade area, this variable's value is 1, otherwise it is 0. The time dummy

variable is represented using "post," where the year of the establishment of the inland FTZ (2017) and subsequent years are coded as 1, and the remaining years are coded as 0.

Control Variables: Based on existing research, the control variables are as follows: ln Gov(logarithm of fiscal revenue/GDP) representing government development level; FIN (total loans and deposits of financial institutions at year-end/GDP) representing financial development level; EDU (number of college students per household registration population) representing education level; and ln Fra(logarithm of total urban road area per urban population) representing infrastructure construction.

These variables can be shown in Table 1 as follows.

Table 1. Variable Selection and Calculation Methods

Variable Type	Variable Name	Variable Meaning	Calculation Method	
Independent	FTA*post	Inland FTZ Strategy	Sample City	FTA=1 Inland city with free trade zone FTA=0 Inland cities without free trade zones
			Year	post=1 Year of establishment of the inland Free Trade Zone (2017) and subsequent years post=0 for the remaining years
Dependent	ln GDP	Urban Development Level	Logarithm of per capita GDP	
Control	ln Gov	Government Development	Logarithm of fiscal revenue/GDP	
	FIN	Financial Development	total loans and deposits of financial institutions at year-end/GDP	
	EDU	Education Level	Number of college students per household registration population	
	ln Fra	Infrastructure	Logarithm of per capita road area	

3.3. Research Subjects and Data Description

This paper uses 2015-2020 municipal panel data for empirical testing. The experimental group includes 11 cities in China's first FTZs: Zhengzhou, Luoyang, Kaifeng, Yichang, Chongqing, Wuhan, Chengdu, Xiangyang, Luzhou, Xian, and Xianyang (table 2). The control group includes inland cities that do not have FTZs. The provincial and local statistical yearbooks as well as the China Statistical Yearbook are the sources of the data.

Table 2. Descriptive Statistics of Variables

Variable Name	Obs	Mean	Std. Dev.	Min	Median	Max
LNGDP	2264	10.8526	0.526	9.23	10.83	12.29
did	2264	0.0177	0.132	0.00	0.00	1.00
LNGOV	2264	0.2121	0.116	0.04	0.18	2.06
FIN	2264	2.7302	1.341	0.72	2.38	21.30
EDU	2264	0.0209	0.027	0.00	0.01	0.19
LNFRA	2264	2.8654	0.415	0.81	2.87	4.10

4. Empirical Analysis

4.1. Benchmark Regression Results

The regression results on the impact of the inland FTZ strategy on urban development levels are presented in Table 3. In Column 1, the regression is conducted without controlling for fixed effects. In column 2, fixed time and fixed effects of the city are added to column 1 for regression. The regression results show that the core explanatory variable did has a strong positive association with the degree of urban development level at the 1% confidence level, indicating that the urban

development level increases by 0.24 points on average for each additional unit of the inland FTZ strategy. This shows that the inland FTZ strategy will enhance the level of urban development and have a significant promoting effect. This conclusion has been verified both statistically and economically. From the perspective of economics, the strategy of the inland FTZ may directly or indirectly promote the development of the city by improving the convenience of trade, promoting investment and innovation, and attracting talent.

Table 3. Benchmark Regression Results

Variable	LNGDP	LNGDP
	(1)	(2)
did	0.176***	0.241***
	(0.037)	(0.024)
LNGOV	-2.433***	-0.788**
	(0.313)	(0.367)
LNFIN	0.058***	0.011
	(0.014)	(0.012)
EDU	5.477***	3.087**
	(0.625)	(1.330)
LNFRA	0.278***	0.357***
	(0.029)	(0.033)
_cons	10.297***	9.897***
	(0.143)	(0.110)
N	2264	2264
r2	0.527	0.275

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.2. Parallel Trend Test

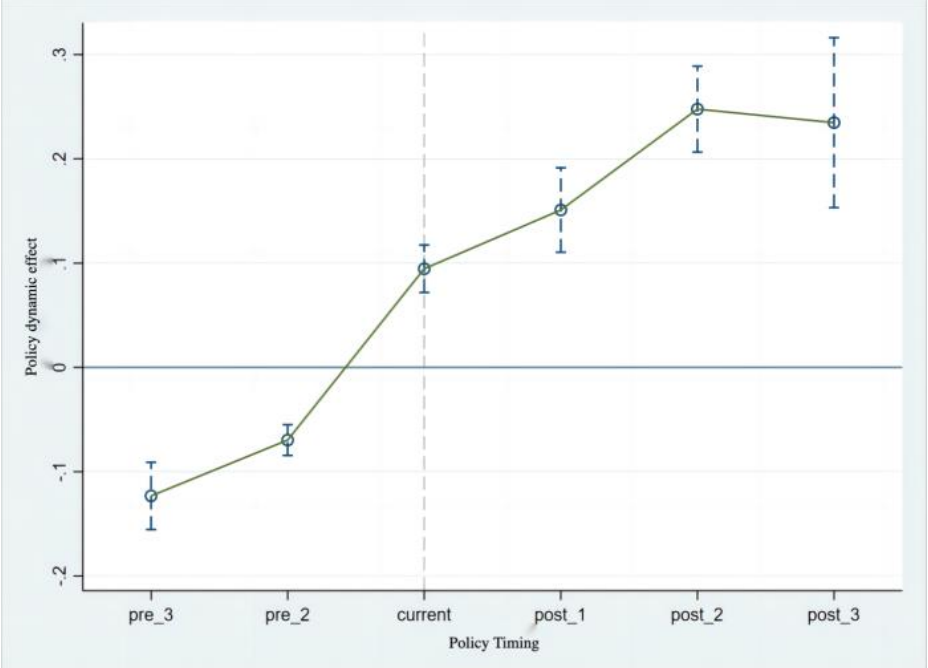

Figure 1. Parallel Trend Test

The parallel trend test result is displayed in Figure 1. Before inland FTZs are established, the estimated coefficients fluctuated around zero, indicating no significant trend differences amid the treatment and control groups. However, the estimated coefficients are significantly positive and there exists a pronounced disparity amid the treatment and control groups after the inland FTZs are established. This finding provides preliminary support for the parallel trend hypothesis. The DID approach is proved applicable under the selected sample and problem background. Before the policy was implemented, the treatment group and the control group were sufficiently comparable. This also makes this paper more effective in assessing the actual impact of inland FTZ policies on urban economic development, which enhances the credibility of the research results.

4.3. Robustness Tests

Multiple robustness tests are conducted to guarantee the robustness of the empirical findings, including lag period tests, placebo tests, and propensity score matching DID (PSM-DID). Table 4 reports the results of these tests.

Table 4. Robustness Test Regression Results

Variable	Lag Period Test	Placebo Test	Propensity Score Matching
	(1)	(2)	(3)
L.did	0.321**		
	(0.490)		
did		0.046	
		(0.061)	
did			0.044**
			(0.076)
Control Variables	YES	YES	YES
N	2264	2264	2264
R2	0.002	0.015	0.035

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.3.1. Lag period test

To address potential endogeneity issues with control variables, the model includes a one-period lag of the treatment effect variable to detect the long-term impact of the policy on urban economic development, as shown in Table 4(1). The findings demonstrated that the coefficient of one-stage lag was 0.321, which was significant at the significance level of 5%. This demonstrates that the inland FTZ policy continues to exert a substantial positive influence on urban economic growth during the lag period, which confirms the validity of the baseline regression findings and represents the policy's long-term mechanism.

4.3.2. Placebo test

To rule out the randomness of the results further, a placebo test was performed. The specific method is to construct a false policy time point and conduct a counterfactual test to verify whether there is a significant effect before the policy is implemented. The findings indicate that the coefficient of the interaction term is 0.046 and is not statistically important, as depicted in Table 4 (2). This suggests that the trends in the treatment and control groups prior to the implementation of the policy are consistent, meaning the policy effect is due to the actual impact of the policy implementation rather than random factors, Thus, the credibility of the aforementioned regression results is further confirmed.

4.3.3. Propensity score matching DID (PSM-DID)

The propensity score matching method is applied to address the endogeneity issues arising from sample selection bias. Specifically, the 1:3 nearest neighbor matching method without replacement is employed, using all control variables as matching variables and estimating propensity scores with a Probit model. The coefficient of 0.044 is significant at the 5% significance level following matching, as shown in column 4 (3) of Table 3. This shows that even after controlling for selection bias, the positive impact of FTZ policies on urban economic development is still significant. This result further verifies the robustness and credibility of the study conclusion, indicating that the policy effect still exists after controlling for potential endogenous problems.

Therefore, it is concluded that the impact of the inland FTZ strategy on promotion on urban economic development is both significant and stable, supported by various testing methods.

4.4. Heterogeneity Analysis

According to Table 5, as is evident, the policy cities of the inland FTZ have higher levels and types, and the inland cities closer to the eastern region play a more significant role. The effect of the policy on the lower level and remote geographical location is diminishing. This indicates that hypothesis 2: the creation of landlocked FTZs has significant regional heterogeneity on the regional development level, which can be verified.

In the first second-tier cities, the FTA policy has a significant positive impact on the dependent variable. This is because policy implementation and resource allocation in first-and second-tier cities are more adequate. But in third- and fourth-tier cities, this effect is not significant, which suggests that it may be relatively weak in these areas. In the eastern cities, the influence of policies on the dependent variables is significant and large, while in the western cities, the influence is relatively small. This reflects the advantages of the eastern region in terms of economy, resources, and policy implementation.

Table 5. Heterogeneity Analysis Regression Results

Variable	City Level Type			Geographic Location	
	First-tier	Second-tier	Third/Fourth-tier	East	West
	(1)	(2)	(3)	(4)	(5)
did	0.076***	0.091**	0.002	0.921***	0.431**
	(0.265)	(0.082)	(0.009)	(0.870)	(0.042)
Control Variables	YES	YES	YES	YES	YES
N	632	756	876	1050	1214
R2	0.003	0.012	0.018	0.024	0.071

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

The results show that the first batch of inland FTZs established in 2017 had a notably favorable effect on the levels of local urban development, with significant regional heterogeneity for different regional development levels.

Firstly, the FTZ city should optimize the functional layout in its internal construction and build a smart city, ensuring a coordinated layout of residential and commercial areas for citizen convenience. It is essential to properly plan new industrial areas to reduce urban pollution and enhance goods distribution. Government administrative agencies and cultural education institutions should be centralized to form administrative and cultural centers, improving city management efficiency and cultural atmosphere. Additionally, functional composite area construction should be promoted to renovate old urban areas, increase land use efficiency, and boost regional vitality. Various spatial elements should be coordinated, and the application of smart technology for intelligent space management should be promoted. Smart transportation and governance systems using big data should

be developed to optimize traffic management, monitor and dispatch traffic flows in real-time, reduce congestion, and improve traffic efficiency. Urban management should be digitalized to enhance government management and service capabilities, achieving refined urban management.

Secondly, Inland FTZs should maximize their spillover effects and reduce siphon effects on surrounding cities by clarifying the core functional positioning of FTZ cities, developing distinctive industries, and enhancing their regional influence. The transportation network between FTZ cities and surrounding areas should be strengthened. High-speed rail and highway connectivity should be promoted to reduce commuting time and facilitate quick goods distribution, thereby strengthening intra-regional collaboration. FTZ cities should emphasize the industrial division of labor and cooperation by transferring parts of the industrial chain to surrounding areas, forming a reasonable industrial division and optimizing resource allocation. Regional industrial alliances and collaborative innovation platforms should be established to enhance technology exchange and industrial cooperation, thereby improving regional innovation capacity. Furthermore, balanced regional development should be achieved by considering significant differences in geographical location and resource endowment, which can drive the development of surrounding cities.

Thirdly, inland FTZs should increase institutional innovation replication and promotion. The net effect of FTZ policies is influenced by multiple factors. Therefore, FTZ cities should tailor their development strategies and construct differentiated FTZs. Specifically, FTZ cities should promote institutional innovation and deepen original, integrated, and differentiated reforms to explore new development paths suitable for their conditions. The existing achievements in well-developed FTZ cities should be consolidated, and institutional innovation should be strengthened. In economically weaker areas, successful FTZ experiences should be replicated. Local advantages should be leveraged, and the comprehensive industrial system, robust industrial base, inland port system, and market hinterland of inland FTZs should be relied upon to facilitate rapid development and construct a new open economy system.

The results of this study enhance the research results on inland FTZ policy and give a scientific basis for the promotion of inland FTZ and urban development. At the same time, it also points out the problem of regional differences puts forward effective suggestions for the construction of FTZ cities, and makes reference and guidance for the development of other inland cities. Although this study has achieved some satisfactory results, there are still some limitations. Future studies can consider expanding the samples of inland cities to further explore their internal differences and obtain a deeper and more comprehensive understanding. In addition, more indicators can be selected as explained variables to more comprehensively discuss the impact of inland FTZ policies on urban development.

Authors Contribution

Every author contributed equally and their names were listed in alphabetical order.

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