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Impact of Pilot Free Trade Zones on Foreign Direct Investment: Evidence from China

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SUMMARY: *The Pilot Free Trade Zone in China is one of the main elements of the country's advanced opening up policy that influences international economic cooperation, the allocation of resources, and industrial growth, including construction. This research analyzes the panel data for 285 cities in China between 2000 and 2021, using the DID method to assess the impact of PFTZs on the flow of FDI to regions. The study demonstrates that PFTZs contribute significantly to the increase in FDI. This result is confirmed through PSM-DID robustness tests. Moreover, PFTZs contribute to infrastructure modernization and increasing demand for high-quality construction projects, which contributes to the attraction of foreign investments in the construction industry, including architecture, engineering, and urban planning. Furthermore, this research explores the heterogeneity of the policy impacts caused by the implementation of PFTZs and provides opportunities for foreign construction companies operating in China.*

KEYWORDS: *China, Pilot Free Trade Zone, Foreign Direct Investment, Multi-Period Difference-In-Differences, Construction Industry, Infrastructure Development*

1 Introduction

The outbreak of the novel coronavirus disease (COVID-19) at the beginning of 2020 shocked the entire global economy, bringing about major disruption in international trade and investments [1]. UNCTAD statistics revealed a reduction of the global FDI to $859 billion in 2020, marking a 42% fall compared to $1.5 trillion seen the previous year. The number was 30% lower than even the lowest level witnessed in the global financial crisis of 2009 [2]. In contrast to the decline in foreign investments in many countries, China managed to see growth in the amount of foreign capital attracted in the same year [3]. Notably, China succeeded in increasing its use of foreign investments amid such negative external factors due to two main reasons. First, the world showed confidence in China's ability to control the pandemic. Second, there were general stability and positive expectations concerning the economic situation in China. At the same time, it proves the attractiveness of the open approach used in China and including the development of pilot free trade zones and free trade ports to foreign investments [4-7]. Taking into account the downward pressure on the global economy, as well as such macroeconomic challenges as US-China trade tensions, the role of pilot free trade zones as platforms for the openness of the country towards the outside world became particularly important [8].

The designation of the pilot free trade zones refers to the name of China's free trade zones that operate very similarly to those known as the free trade port zone in the sense that both of

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these zones belong to the group of the zones that operate on the basis of the customs-free regime within the territory of the country [9]. However, despite the evident similarities in functions, the concepts remain different to each other. First of all, pilot free trade zones can be regarded as the example of the novel concept of the free trade parks where innovative institutional reforms concerning the internationalized management regime are tested and developed. The major emphasis made by the pilot free trade zones is on such aspects as foreign investments, import/export goods transactions, and foreign services trade, as well as development of offshore business [10-13]. These zones have traditionally been set up with the help of upgrading some existing areas such as bonded zones and export processing zones in order to deepen China's new round of opening-up efforts in its inland areas. The essential characteristic feature of the pilot free trade zones lies in their focus on achieving openness via institutional innovations, rather than through such advantages as tax and tariff preferences [14, 15]. Simultaneously, the pilot free trade zones become the most important testing grounds used to promote China's Free Trade Area (FTA) strategic vision. As regards Shanghai Pilot Free Trade Zone, the original example of testing grounds, one should note that this particular zone is characterized by gradual replication reform approach moving from experimental to full-scale implementation of changes [16].

In essence, what sets apart these zones is the "experimental" nature of their establishment, which allows for institutional innovation and reforms through pilot projects, with successes being institutionalized later and scaled up. Zhang, H. and Zhou, C. found that China's pilot FTZs enhanced the Green Total Factor Energy Efficiency (GTFEE), due to industrial upgrade and innovation efforts made in green technologies, with the effects particularly visible for coastal cities and cities not having resource bases, contributing to high-quality economic development and sustainable environment development [17]. Yao, D. and Whalley, J. provide a thorough review of China's (Shanghai) Pilot Free Trade Zone experiment, as a place where China tried out new measures of reform and opening-up, discussing the background and development path of the Zone, as well as some initial economic outcomes of liberalizing the capital account and financial liberalization [18]. Meng, G. and Zeng, D. found out that by 2018, the Shanghai Pilot Free Trade Zone was home to more than 50,000 foreign-invested companies, indicating a considerable growth of its economy. The zone served as a testing site for implementing new national policies aimed at expanding openness in foreign trade and easing regulations for domestic as well as international companies [19]. Chen, H. et al. noted that the policy regarding the establishment of pilot free trade zones attracted foreign investors, resulting in the annual increase in newly registered businesses by more than 90%. This effect was particularly visible in those cities where special economic zones were introduced earlier, while recently created pilot free trade zones demonstrated relatively small results due to time delays and changes in policies [20].

Creating pilot free trade zones has improved China's management in investment and yielded positive impacts both on trade development and on the movement of capital flows. Guan, C et al., in their study of pilot free trade zones of Guangdong province, have shown that through imitation, independent innovation, industrial agglomeration, and optimization of financial resources, such zones can significantly help in the process of structural adjustment of China's service industry and positively spill over the neighboring cities [21]. Wei, L's study on pilot free trade zone of Fujian province showed that the introduction of policies aimed at transforming functions of the government and promoting economic cooperation, especially with Taiwan, helps in utilizing the advantages of the region, creating improved business environment, and launching scalable innovation projects [22]. Li, Z et al.'s study focused on the impact of China's pilot free trade zones on urban entrepreneurship. The results obtained in their study demonstrated that such zones promote entrepreneurship, with this impact being

particularly pronounced in western and northern cities as well as in the service industry sector. Also significant are the spatial spillover effects which, as is known, are very important for economic growth in developing countries [23]. Bao, T et al.'s study of impacts of pilot free trade zones on capital flows, import, and export showed that such zones promote FDI as well as OFDI [24]. In the study performed by Xue, F et al., the impacts of pilot free trade zone policy on carbon emission reductions were assessed and shown to produce significant effect that increases over time, driven by the mechanism of spatial spillovers associated with technological progress [25].

Regarding the issue of empirical methodology, Difference in Differences (DID) has been extensively used in recent studies attempting to estimate the effects of China's pilot free trade zones on foreign investments. According to Meng, L. and Jiang, Z., the pilot free trade zones contribute to reducing inefficient investments made by companies by limiting underinvestment and overinvestment. These results were confirmed using two approaches: dual machine learning analysis and staged DID model [26]. Huang, Q. applied non-parametric synthetic control method to evaluate the policy impacts of Shanghai Pilot Free Trade Zone on FDI. Results of the study showed that the implementation of the policy led to the growth of FDI stock by RMB 205.26 billion from 2013 to 2015. An average annual spillover effect from the policy amounted to RMB 68.42 billion at a spillover rate of 14.2%, whereas cumulative FDI flows grew by CNY 133.06 billion in the same period with an average annual spillover of CNY 44.35 billion at a spillover rate of 116.2% [27]. In addition, Zhao, T. and He, F. used DID analysis to show that pilot free trade zones contribute to enhancing the quality of economic development in China by stimulating reforms towards markets and institutional innovations. It is worth mentioning that such effects occur more intensively among coastal free trade zones and areas located in the Guangdong-Hong Kong-Macao Greater Bay Area [28]. Moreover, Shahid, R. et al. utilized DID estimation to study how the Shanghai Pilot Free Trade Zone influences the process of industrial upgrading within GVCs. As it turned out, Shanghai contributed to this upgrading through attraction of foreign direct investment and innovative activities. Structural changes in the industry have been facilitated by trade and investment liberalization, innovation mechanisms, and integrated services platform [29].

The literature that has already been conducted regarding the pilot free trade zones in China provides extensive insights into the development and institutional features of the zones and even evaluates their economic impact on a national and regional level. When it comes to the topic of attracting foreign investments, most researchers have mainly focused on the issue of the overall amount of FDI but neglected more detailed analyses. It is vital to know the evolution of foreign mergers and acquisitions as well as greenfield investments with regards to the number, sectors, and regions of investment in the process of developing pilot free trade zones in order to facilitate rational decision-making on the part of investors.

In this context, key questions arise: Is PFTZ construction conducive to attracting FDI specifically for building and infrastructure projects? Do variations in economic size, geography, and policy timing across PFTZs create heterogeneities in construction-focused investment? This study analyzes FDI impacts across China’s 21 PFTZs using multi-period DID modeling (2000–2021 city-level data). Results confirm PFTZs significantly boost FDI, with pronounced effects in construction-intensive sectors. Robustness tests validate these findings, while heterogeneity analysis reveals coastal zones excel in high-tech port construction, whereas inland zones drive FDI into affordable housing and transport networks.

2 Background of the Establishment of the PFTZ and Research Hypotheses

Following the launch of the Shanghai Pilot Free Trade Zone in September 2013, China has created 21 PFTZs in total, constantly improving the related policies and institutions to facilitate the development of these zones. Geographically speaking, the process has been characterized by gradual progress from the coastline towards the inland areas. During the past decade, the 21 PFTZs created have covered a total of 51 cities in 21 provinces, including the whole territory of Hainan Island, starting from the eastern coast via the inland regions all the way to the border areas. As a consequence, a framework for reform, openness, and innovation covering both western-eastern and northern-southern directions was formed. Institutionally, a policy framework integrating targeted construction programs and preferential policies has initially taken shape.

The creation of pilot free trade zones is undoubtedly an important strategy in China's comprehensive plan for opening up. As a frontline in matching domestic practices with international standards, the PFTZs are tasked with exploring institutional arrangements consistent with the high level of international trade regulations and promoting liberalization of foreign trade and investment. In recent years, the dividends from the WTO entry have become increasingly limited. Hence, China needs new venues for openness, new growth drivers, and regional development strategies, which were addressed directly by the PFTZ strategy [30].

Apart from serving the country's opening strategy, PFTZs are also testbeds for domestic reforms. The results achieved through the reform tests in PFTZs can be applied elsewhere throughout the country. From administration to the financial system, from trade facilitation to investment liberalization, the PFTZs have been actively exploring, breaking through institutional barriers, and fully mobilizing market vitality and social creativity. This series of reform experiments has not only contributed to the PFTZs themselves but also served as a good model within China [31]. The Pilot Free Trade Zones of China need to take full advantage of the opportunities that their testing ground provides, finding new approaches, gaining new experience, and coming up with new ideas to promote further reforms and openness.

On the other hand, regional cooperation has always been one of the main objectives of the Pilot Free Trade Zone project. With the creation of 21 such areas in China, there have emerged powerful incentives for coordinated development of regions and their complementary capabilities can work to their mutual benefit. Each region supports each other, thus contributing to regional economic development on the whole. This approach is beneficial both because it boosts the economy as a whole and provides experience in solving the problem of regional inequalities.

China's Pilot Free Trade Zones have influenced regional FDI along three main lines. First, investment management has been reformed. The Shanghai PFTZ was the first to introduce negative list management, changing the foreign access process to a filing system, greatly simplifying the steps and reducing costs and risks for enterprises. Simultaneously, the investment field is continually aligning with international standards, and as the number of negative list restrictions declines, opening up to the outside world expands, providing clear guidance for foreign investment and reducing uncertainty [32]. Furthermore, the PFTZ's commercial registration system innovation has relaxed the access environment, optimized the market and business environment, and enhanced its attractiveness to foreign investment.

The second pathway is finance liberalization and innovation. In the framework of the PFTZs, various financial openings measures have been adopted and implemented, including but not limited to the relaxation of market access, foreign exchange management reform,

administrative approval reform, financial regulatory innovation, which altogether have promoted capital liquidity [33]. Relaxing the requirements for financial market access has helped reduce investment threshold, while reforming foreign exchange management has favored multinational companies and thus attracted a considerable amount of foreign investment. Additionally, PFTZs have made some significant contributions to the internationalization process of RMB. In summary, the aforementioned reforms have enhanced the standard and efficiency of financial services and investment platforms in terms of openness.

The third pathway is government simplification and decentralization. The governance pattern reform in the framework of the PFTZs has weakened the involvement of governments directly in business affairs, which in essence is favorable to international direct investment. On the one hand, as the administrative simplification reform goes further, the threshold and cost of investment are reduced. On the other hand, as post-event supervision is being put into practice, the transition of governmental functions and efficiency of resource allocation has been promoted significantly [34]. All these factors are favorable to the business environment and help stimulate market vitality and innovation, thereby contributing to open and dynamic development of the PFTZs and the economies they belong to.

Combined with the above analysis, the research hypothesis to be tested in this paper is proposed: the establishment of PFTZs is conducive to the growth of foreign direct investment.

3 Model setup and data selection

3.1 Methodology

To test the hypothesis, this study employs a difference-in-differences (DID) approach. Under the assumption of homogenous treatment effects, the baseline DID regression model is specified as follows:

$$y_{it} = \rho + \rho_1 D_{it} + \rho_2 X_{it} + A_i + B_t + \varepsilon_{it} \tag{1}$$

$$D_{it} = Treat_i * Post_t \tag{2}$$

where i and t denote city and year, respectively. y_{it} is a measure of foreign direct investment from city i in year t. $Treat_i$ is a dummy variable indicating whether the city has established a PFTZ, taking the value of 1 if a PFTZ has been established and 0 otherwise. $Post_t$ is a dummy variable coded 1 once a PFTZ in the city has been established, and 0 prior to establishment. The interaction term D_{it} captures per-city years with a PFTZ. X_{it} is a set of time-varying, city-level control variables. A_i and B_t are city and time fixed effects, respectively. These fixed effects account not only for time-invariant factors but also for common shocks such as the COVID-19 pandemic. Time fixed effects additionally absorb inflation and exchange rate fluctuations. ε_{it} is the remainder error term. The coefficient ρ_1 captures the policy effect of PFTZ establishment on FDI.

3.2 Variable description and Data Sources

(1) Dependent variables: Total actual use of foreign capital (FDI) per annum in every prefecture-level city measured at the end of each year serves as an indicator of FDI inflows for our analysis [35].

(2) Independent core variable: The independent core variable is a multiplicative product of two dummy variables, which takes the value of 1 whenever city ii

i is a hosting city of PFTZ, and year tt

t is not before the period of establishment of PFTZ, while taking a value of 0 in all other cases.

(3) Control variables: Using previous literature, we have considered the following variables as control variables:

Industrial development level ($indus_{it}$), measured by the city's gross industrial product, is included to reflect the region's well-established industrial base, which provides a strong foundation for attracting foreign direct investment and thus confers a location advantage. Consumer market size ($sale_{it}$), expressed as total retail sales of consumer goods, captures the market potential of the region. The level of scientific and technological capacity ($tech_{it}$), measured by scientific and technological expenditures, strengthens the competitive advantages of local enterprises and thereby draws in foreign direct investment. Financial development ($finance_{it}$), measured by the year-end loan balance of financial institutions in each city, contributes to lowering enterprise costs and improving capital liquidity. Infrastructure development ($road_{it}$), measured by urban road area per capita, is also included as a control variable. To ensure comparability across units, all variables are logarithmically transformed. Detailed descriptive statistics are presented in Table 1.

Table 1: Descriptive statistics

Variable	Obs	Mean	Standard deviation	Median	Min
$\ln FDI_{it}$	5577	9.36	1.89	1.00	15.00
D_{it}	5577	0.03	0.16	0.00	1.00
$\ln indus_{it}$	5577	16.17	1.62	10.00	21.00
$\ln sale_{it}$	5577	14.12	1.43	10.00	19.00
$\ln tech_{it}$	5577	8.18	2.25	1.00	16.00
$\ln finance_{it}$	5577	15.72	1.45	6.00	21.00
$\ln road_{it}$	5577	2.16	0.80	-4.00	6.00

The present research utilizes panel data collected on an annual basis for 285 prefecture-level cities in China except for Taiwan Province and the two special administrative regions during the years 2000-2021. Regarding the time period of creation of PFTZs and the availability of data, 50 cities that created PFTZs within the years 2000-2021 are treated as the treatment cities. Two considerations have been taken into account for ensuring the reliability of the dataset. The first consideration involves the exclusion of Honghe Prefecture and Dehong Prefecture since they have created PFTZs in 2019. In addition, with regard to the Hainan Free Trade Zone, Haikou and Sanya are the two cities that are included as the treatment cities.

4 Do PFTZs spur FDI? Empirical Results

4.1 Benchmark regression results

Regression coefficients of equation (1) are provided in Table 2 below. The columns from (1)

to (6) show regression results based on different specification models, ranging from the one with no control variables to the one containing all control variables. With each addition of control variables, there is an increase in the R^2 value, culminating in stabilization at 0.782.

Table 2: Model estimation result

Variable	(1)	(2)	(3)	(4)	(5)	(6)
D_{it}	0.27*** (0.08)	0.33** (0.16)	0.33** (0.16)	0.32** (0.16)	0.33** (0.15)	0.37** (0.15)
$\ln indus_{it}$		0.24*** (0.06)	0.24*** (0.06)	0.23*** (0.06)	0.23*** (0.06)	0.21*** (0.05)
$\ln sale_{it}$			0.17*** (0.05)	0.16*** (0.05)	0.15*** (0.05)	0.16*** (0.05)
$\ln tech_{it}$				0.03 (0.03)	0.03 (0.03)	0.03 (0.03)
$\ln finance_{it}$					0.06*** (0.02)	0.06*** (0.02)
$\ln road_{it}$						0.17*** (0.05)
Constant	9.35*** (0.01)	5.47*** (0.89)	3.14*** (1.06)	3.08*** (1.06)	2.23** (1.10)	2.14* (1.09)
Observations	5,576	5,576	5,576	5,576	5,576	5,576
R-squared	0.775	0.777	0.778	0.779	0.780	0.782
Yearfix	YES	YES	YES	YES	YES	YES
Cityfix	YES	YES	YES	YES	YES	YES

Note: ***, **, * denotes 1%, 5%, and 10% significance levels, respectively. Cluster standard errors are reported in parentheses.

As presented in Table 2, all the regression coefficients related to the core explanatory variable are positive and significantly different from zero at the 1% level of significance, irrespective of whether control variables have been included or not. This finding offers robust evidence in favor of the positive influence of PFTZ establishment on foreign investment. From a substantive perspective, after including all control variables in the regression model, the value of the core variable coefficient becomes 0.37 and is still significant at the 5% level. This suggests that the introduction of a PFTZ is associated with an approximate 44% rise in regional foreign direct investment 100(exp(0.37)-1). Thus, there exists a significant promoting impact of the policy on FDI in cities establishing a PFTZ, and the research hypothesis is empirically proven.

The values of the estimated effects' magnitude reveal that the core variable coefficient is 0.27 and is statistically significant at the 1% level in the equation where no control variables are considered. After introducing all the control variables in the model, this coefficient becomes 0.37 and is significant at the 5% level, implying that considering city-specific features enhances the impact of the policy under examination. All control variable coefficients exhibit positive signs, which suggest that the regional industry development, financial development, scientific and technological advancement, consumer market scale, and regional infrastructure investment are positively correlated with regional foreign direct investments.

4.2 Robustness test

(1) PSM-DID estimation

The influence of PFTZs on FDI may also depend on the regions, leading to the possibility of sample selection bias in the estimation process. In order to eliminate this problem and confirm the robustness of the estimation results obtained in the benchmark regressions, propensity score matching (PSM) is utilized in this paper in order to minimize selection bias and confounding bias caused by the non-random allocation of PFTZs. Using the Logit model to calculate the probability score of each observation in the dataset, a set of control units can be found from those cities without PFTZs but with similar characteristics as the treated cities. Regression analyses are then performed using this set of matched sample. As can be seen in columns (1)-(6) of Table 3, the coefficients of the core variable are still significant and positive.

Table 3: PSM-DID estimation result

Variable	(1)	(2)	(3)	(4)	(5)	(6)
D_{it}	0.35***	0.39**	0.39**	0.35**	0.37**	0.39**
	(0.08)	(0.16)	(0.16)	(0.16)	(0.15)	(0.15)
$\ln indus_{it}$		0.20***	0.19***	0.19***	0.19***	0.18***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
$\ln sale_{it}$			0.16***	0.14***	0.13***	0.14***
			(0.05)	(0.05)	(0.05)	(0.05)
$\ln tech_{it}$				0.09**	0.09**	0.09**
				(0.04)	(0.04)	(0.04)
$\ln finance_{it}$					0.08***	0.08***
					(0.02)	(0.02)
$\ln road_{it}$						0.13***
						(0.05)
Constant	9.68***	6.41***	4.15***	3.74***	2.61**	2.38*
	(0.01)	(0.90)	(1.16)	(1.19)	(1.22)	(1.21)
Observations	4,658	4,658	4,658	4,658	4,658	4,658
R-squared	0.767	0.768	0.769	0.770	0.773	0.774
Yearfix	YES	YES	YES	YES	YES	YES
Cityfix	YES	YES	YES	YES	YES	YES

Note: ***, **, * denotes 1%, 5%, and 10% significance levels, respectively. Cluster standard errors are reported in parentheses.

(2) Parallel trend test

In this research, a DID design involving multiple periods is adopted to explore the impact of the formation of PFTZs on foreign direct investments in host cities. An important condition for the effective use of the DID technique is the parallel trends assumption, which assumes that without the presence of any policy shock, the trends of both the treatment group and the control group would remain the same. In order to confirm whether the pre-intervention trends of the two groups remain parallel, a separate test model is created based on the method of Bao et al. [36]:

$$\ln FDI_{it} = \delta_0 + \sum_{t=1}^{5} \eta_{t-n} D_{i,t-n} + \sum_{t=0}^{8} \eta_{t+n} D_{i,t+n} + \delta_t \ln X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (3)$$

where D_{it} equals one for pilot cities in the t^{th} year before the establishment of a PFTZ, D_{i0} equals one for pilot cities in the year in which the PFTZ was established, and D_{it} equals

one for pilot cities in the t^{th} year after the establishment of the PFTZ. η are the coefficients in which we are interested. This paper choose 5 lags and the year of establishment of the policy is used as the benchmark group in the selected time interval. η_{t-n} which are statistically insignificant support the presence of PT. Figure 1 shows the results, which are consistent with PT as the confidence intervals of the η_{t-n} include 0.

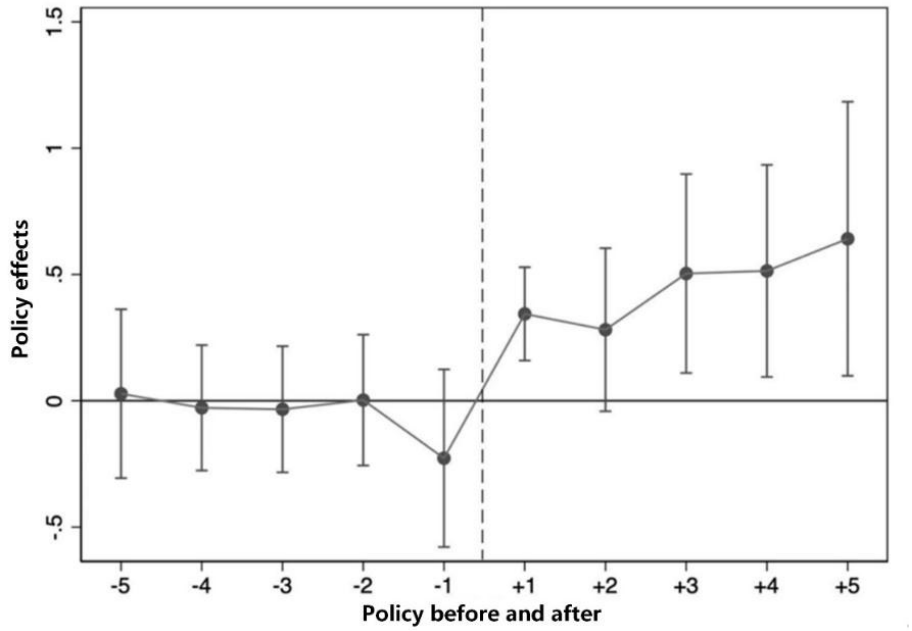

Figure 1: Parallel trend test

(3) Placebo test

The placebo test is then employed to further confirm the stability of the baseline regression analysis findings and avoid any unobserved impacts due to the characteristics of the treatment group [37, 38]. The placebo test involves the following steps. In the baseline regression model, the treatment group consists of 50 cities. These cities within the treatment group are then transferred to the control group. Before the implementation year of the FTZs, a random selection from non-FTZ cities is used to form a new treatment group of 50 cities. New estimated coefficients can be obtained by regression analysis of the newly generated samples. By repeating the above steps 500 times, the estimated coefficients of 500 virtual experiments can be obtained, which are then plotted as kernel density curves and compared with the normal distribution curves. The outputs of this paper are shown in Figure 2.

Equation (1) is then estimated on the placebo sample, and the estimate of ρ_1 along with its p-value is recorded. This procedure is repeated 500 times, yielding a distribution of estimates for ρ_1 and their corresponding p-values (see Figure 2). The average estimate of ρ_1 is close to 0, and thus substantially smaller than the benchmark regression coefficient of 0.37 (see Table 2). Figure 2 further shows that the majority of associated p-values exceed 0.1. On the basis of these results, the in-space placebo analysis supports the conclusion that ρ_1 = 0, which adds credibility to the finding of a positive impact of PFTZ establishment on FDI.

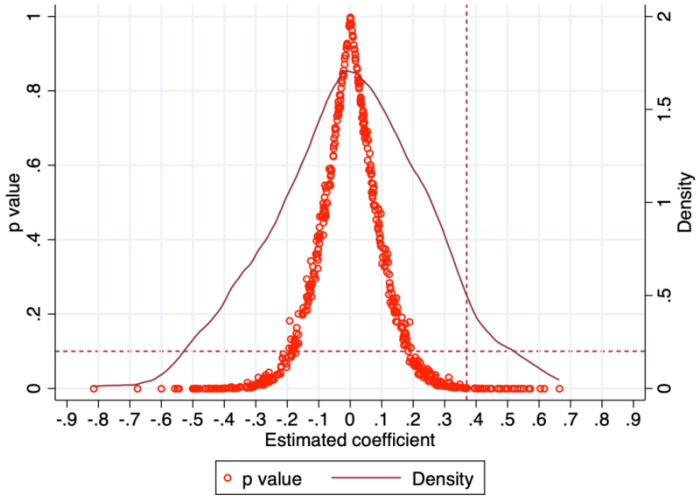

Figure 2: Placebo test

(4) Excluding the impact of major public events

In light of the significant disruptions caused by the coronavirus pandemic on the world's economic environment, it is imperative to exclude all sample data collected after the year 2020 to avoid the distortion of results caused by major event shocks. As such, using a robustness test sample period of 2000-2019 will ensure that the results derived in the regression analysis are valid and reliable. As indicated in Table 4 below, it is evident that the primary results obtained are consistent even without considering the impacts of major public events. In summary, the robustness tests conducted above provide a firm empirical basis for investigating the impact of PFTZ on foreign direct investments and are highly instrumental in future research and policy considerations.

Table 4: Results excluding data from 2020 and 2021

Variable	(1)	(2)	(3)	(4)	(5)	(6)
D_{it}	0.28**	0.31	0.32	0.29	0.33*	0.35*
	(0.12)	(0.21)	(0.21)	(0.20)	(0.19)	(0.19)
$\ln indus_{it}$		0.18***	0.18***	0.18***	0.18***	0.17***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
$\ln sale_{it}$			0.08*	0.07	0.07	0.08*
			(0.05)	(0.05)	(0.05)	(0.05)
$\ln tech_{it}$				0.08**	0.08**	0.08**
				(0.04)	(0.04)	(0.04)
$\ln finance_{it}$					0.08***	0.08***
					(0.02)	(0.02)
$\ln road_{it}$						0.12**
						(0.05)
Constant	9.67***	6.68***	5.48***	4.99***	3.78***	3.58***
	(0.01)	(0.83)	(1.09)	(1.15)	(1.17)	(1.17)
Observations	4,170	4,170	4,170	4,170	4,170	4,170
R-squared	0.780	0.781	0.782	0.783	0.785	0.786
Yearfix	YES	YES	YES	YES	YES	YES
Cityfix	YES	YES	YES	YES	YES	YES

Note: ***, **, * denotes 1%, 5%, and 10% significance levels, respectively. Cluster standard errors are reported in parentheses.

4.3 Heterogeneity analysis

(1) Heterogeneity Analysis of Effects of Coastal and Inland PFTZs on Policy Effectiveness

So far China has established a total of 21 PFTZs, of which there are 11 coastal PFTZs and 10 inland PFTZs, covering all the coastal provinces in the country. Table 5 demonstrates the effects of coastal and inland PFTZs on foreign direct investments based on geography.

Table 5: Policy effects of FTZs in different regions

Variable	(1)	(2)	(3)	(4)
	coastal	inland	coastal	inland
D_{it}	0.41**	0.64***	0.38**	0.60***
	(0.18)	(0.20)	(0.17)	(0.19)
$\ln indus_{it}$			0.05	0.13**
			(0.06)	(0.06)
$\ln sale_{it}$			0.05	0.18***
			(0.06)	(0.06)
$\ln tech_{it}$			0.13***	0.07*
			(0.05)	(0.04)
$\ln finance_{it}$			0.01	0.11***
			(0.02)	(0.03)
$\ln road_{it}$			0.09	0.05
			(0.07)	(0.06)
Constant	10.39***	9.23***	7.31***	2.27
	(0.01)	(0.00)	(1.54)	(1.49)
Observations	1,834	2,824	1,834	2,824
R-squared	0.777	0.754	0.782	0.762
Yearfix	YES	YES	YES	YES
Cityfix	YES	YES	YES	YES

Note: ***, **, * denotes 1%, 5%, and 10% significance levels, respectively. Cluster standard errors are reported in parentheses.

From Table 5 we find that columns (1) and (3) indicate the estimation effects of coastal PFTZs. We can see that the estimation coefficient of the core variables is significantly positive at the 5% level, which means that PFTZs can provide a good push to FDI growth. Columns (2) and (4) indicate the estimation effects of inland PFTZs. From that we find that the estimation coefficient of core variables is significantly positive at the 1% level, proving that inland PFTZs can effectively boost FDI growth.

In addition to the directional effects, inland PFTZs also exhibit a more pronounced positive influence intensity. There are several reasons why such characteristics exist. Firstly, the policies of inland PFTZs are directly aimed at the expansion of inland openness and participation in the Belt and Road strategy. For example, the construction of the PFTZ in Sichuan Province mainly revolves around creating an inland highland for opening up to the outside world. Secondly, the labor cost and land cost in the inland area are relatively lower, which attracts a number of labor-intensive and land-intensive foreign enterprises. Thirdly, although inland regions lag behind coastal regions in terms of economic development, there remains a lot of undeveloped market potential and huge consumption space, making it possible for foreign enterprises to have advantages when entering the inland market.

(2) Policy Effects Analysis of Different Batch of PFTZs

Since 2013 and until the end of 2020, there are 21 batches of PFTZs, including the whole

Hainan Province and 51 prefecture-level cities in China. In this paper, the samples are all six batches of PFTZ cities from 2013 to 2020. Table 6 shows the estimation results of each batch of PFTZs.

Table 6: The impact of different batches of free trade zones on regional foreign direct investment

Variable	Batch1	Batch2	Batch3	Batch4	Batch5	Batch6
D_{it}	0.49***	-0.03	0.76***	0.91***	0.12	0.26
	(0.19)	(0.11)	(0.13)	(0.23)	(0.16)	(0.28)
$\ln indus_{it}$	0.14***	0.14***	0.14***	0.15***	0.14***	0.15***
	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)
$\ln sale_{it}$	0.15***	0.14***	0.18***	0.15***	0.12***	0.15***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
$\ln tech_{it}$	0.08***	0.08***	0.10***	0.08***	0.06**	0.09***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\ln finance_{it}$	0.09***	0.09***	0.09***	0.09***	0.08***	0.09***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\ln road_{it}$	0.16***	0.15***	0.15***	0.16***	0.14***	0.16***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	2.41***	2.58***	1.90**	2.30**	3.30***	2.25**
	(0.94)	(0.92)	(0.90)	(0.93)	(0.90)	(0.91)
Observations	3,781	3,874	4,015	3,799	4,060	3,939
R-squared	0.707	0.723	0.722	0.695	0.726	0.724
Yearfix	YES	YES	YES	YES	YES	YES
Cityfix	YES	YES	YES	YES	YES	YES

Note: ***, **, * denotes 1%, 5%, and 10% significance levels, respectively. Cluster standard errors are reported in parentheses.

As can be observed from the estimates reported in Table 6, the estimated coefficients of core independent variables for the first, third, and fourth batch of PFTZs have all been estimated positively and significantly. Of all these, the third batch stands out since it records the highest estimated coefficient that is also statistically significant at the 1% level implying that the policies formulated in this batch have been very successful in promoting FDI within these zones. The estimated coefficients for the fifth and sixth batches of PFTZs have also recorded positive signs but not statistically significant implying that even though their policies have positively affected FDI within host cities, it has not yet been clearly demonstrated. The second batch of PFTZs which was established in 2017 appears to present a different case since there is likelihood that FDI within these zones might have fallen. This can be explained by the fact that there were stringent qualification audits conducted in China to evaluate foreign investments in the same year while global FDI flow had fallen as well.

There are two primary reasons why the impacts of policies of the third and fourth batches were more significant than those of the first batch. For instance, the core policies of the third batch put much attention on external openness and synergies between industries, which are suitable methods for producing locational advantages and encouraging foreign investments. Also, the fourth batch was set up in Hainan province, which had a unique strategic position. Since Hainan province is an island province, it had geographic advantages, which enabled it to utilize all the advantages of the island. Moreover, the Hainan PFTZ benefited from being a latecomer. It was different from other PFTZs due to the geographic advantages of the region and open policies, which encouraged foreign direct investments.

There were two reasons behind the relatively weaker impact of policies of the second, fifth, and sixth batches. For example, once the PFTZs were founded, there would be a time lag before the related regulations, laws, and open-door policies were gradually implemented and improved [39]. Also, the fifth and sixth batches were created quite recently. In addition, the period used to examine the impact of the sixth batch was relatively short.

5 Conclusion

In the current study, the authors utilize multi-period DID methodology to analyze the effect of China's 21 Pilot Free Trade Zones on foreign direct investment using a dataset of 285 prefectural-level cities from 2000 to 2021. The results show that the pilot free trade zones effectively boost FDI inflows to regions, a claim which is validated by PSM-DID, parallel trend test, and placebo test. Among the industries benefitting most from the policy, the construction industry deserves special attention due to its progress in infrastructure construction, sustainable building methods, and international engineering cooperation. In addition to overall findings, it is worth mentioning that there exists heterogeneity among batches and geographical areas of PFTZs in promoting FDI attraction. The literature review reveals that numerous theories and empirical studies have been proposed regarding FDI location choice and the optimization of conditions for FDI attraction via policy making, and PFTZ policies can optimize conditions for attracting foreign investment and improve FDI location choices. Overall speaking, the effectiveness of PFTZs in attracting FDI inflow is positive, although not very high at an initial stage but increases gradually as policy implementation progresses and opening-up strategies improve. There is heterogeneity in the effect of PFTZ policies on FDI attraction among different batches of PFTZs, and the inland PFTZs have achieved relatively significant results due to their unique advantages.

From the above discussion, the following specific policy suggestions can be drawn. First, there should be deeper efforts toward financial reforms and innovations. The financial services should be liberalized and reorganized to create diverse financing avenues and products for businesses, as well as attracting foreign financial institutions and capital. In addition to encouraging innovative service models to lower business costs, financial measures need to be enhanced to guarantee the liquidity of business capital. Second, the PFTZs should strive to promote broad opening of the service sector, enhance the competitiveness and internationalization of the local service industry, increase attractiveness to foreign investors, and provide a quality environment for local enterprises. Furthermore, PFTZs should attract matching foreign investment and promote the growth of local enterprises based on their own strengths and distinctive policies. Their differentiated exploration can promote comprehensive opening and high-quality development. Finally, it is necessary to improve the system, balance "liberalization" and "control," guide the development of healthy and sustainable outward investment through effective market supervision, improve the negative list system, ensure the orderly operation of the market and the stable flow of capital, and manage outward investment projects by classification to promote their sustainable development. The above suggestions are significant in the ongoing development of PFTZs and the proper regulation of FDI.

PFTZ policy may be regarded as a brand new area for China's foreign economic expansion. The study of the influence that PFTZ policies have on foreign direct investment in their respective regions is of great significance for the development of an open economy in China. It would be interesting to conduct further investigations into differences between industries or regions within the PFTZs regarding foreign direct investments attraction or to determine if foreign investments brought about by the establishment of the PFTZs bring

spillover effects to other industries in the countries hosting PFTZs. As the literature on pilot free trade zones matures, it is likely to take a more quantitative and systemic approach.

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