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The impact of China's free trade zone policies on the development of new-quality productivity: A study on the mediating role of foreign investment

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ABSTRACT

As the core measure for China to promote institutional opening, the free trade zone (FTZ) policy plays an important role in driving economic growth and fostering new quality productivity (NEWP). This study uses panel data from 285 Chinese cities from 2012 to 2022 and employs a Difference-in-Differences (DID) model to empirically examine the impact of FTZ policies on NEWP. The study found that the FTZ policy has a significant impact on the improvement of NEWP. The empirical results show that FTZ policies significantly promote NEWP, with stronger effects observed in coastal regions, indicating regional heterogeneity. Foreign direct investment plays a key mediating role. After a series of robustness tests, such as the parallel trend test and robustness check, the conclusion still holds. The FTZ policy is an effective way to promote the development of China's NEWP by improving the investment environment to attract foreign investment. The FTZ government strengthens the coordinated cooperation between domestic and foreign capital and builds a modern industrial system through the attraction of foreign investment by institutional opening. This study provides an important theoretical and empirical basis for improving the implementation effect of FTZ policies, promoting the development of NEWP, and fostering high-quality economic growth.

Contribution/ Originality: This study is one of the few that has investigated the relationship between Free Trade Zone (FTZ) policies and new quality productivity (NEWP), employing a Difference-in-Differences (DID) model to assess regional heterogeneous effects innovatively. It further identifies the mediating role of corporate investment in this relationship.

1. INTRODUCTION

In 2023, the Chinese government proposed the concept of "new quality productivity" (NEWP). This concept aims to cultivate strategic, emerging industries and boost economic growth through new quality productivity (Yuan Liu, Duan, & Feng, 2025). NEWP is a form of productivity developed within the emerging industrial structure under the guidance of the concept of high-quality economic development (HQED) (Wang, Wang, & Chen, 2022). This form is driven by innovative development and is an important part of promoting HQED. As China's economy transitions from a period of high-speed growth to a period of high-quality development, the contribution of traditional industrial development models with low labor costs and high resource consumption to economic

growth has gradually declined, and NEWP is becoming the key driving force for achieving HQED (Feng, Yan, & Yan, 2024). NEWP emphasizes the use of technological breakthroughs and traditional industrial modernization to transform production methods. In particular, it is reflected in the comprehensive improvement of labor, work equipment, and work objects through optimized combinations that stimulate the growth of production efficiency and promote HQED.

Under the concept of NEWP, production relations also face higher requirements. A favorable market investment environment and a higher level of opening up to the outside world provide key support for the formation of new production relations (Shao, Dong, & Gao, 2024). China is increasingly aligning its policies with international high-standard trade rules as its opening strategy transitions from traditional factor-based openness to institutional openness. A more relaxed market environment offers institutional guarantees for the development of NEWP. The FTZ policy serves as a crucial platform for China to integrate into the international market and promote institutional innovation. FTZs not only continue the traditional free trade functions (Wang, Wang, & Ma, 2021), but also enhance trade facilitation and investment liberalization through policy incentives such as tax reductions and exemptions, administrative approval optimizations, and more. These measures attract corporate investment and further promote investment in high-tech industries through institutional reforms and innovations, such as negative list systems and tax incentives for R&D expenses, providing endogenous momentum for the development of emerging industries (Zhao, Wang, & Guan, 2022).

Free Trade Zones promote regional trade facilitation by streamlining administrative procedures and reducing investment costs, thereby attracting greater volumes of foreign direct investment. These policies have played a critical role in enhancing the efficiency of resource allocation particularly in terms of capital, labour, and technology (Jiang, Wang, & Liu, 2021), while also advancing China's integration into the international industrial division and cooperation. Unlike traditional special economic zones, FTZ policies attract domestic and foreign investment through the innovation of institutional rules. Studies have shown that FTZ policies have significantly improved the attractiveness of corporate investment (Bao, Dai, Feng, Liu, & Wang, 2023; Zhang & Wang, 2023). The annual growth rate of newly registered foreign-invested enterprises by government authorities has exceeded 90% (Chen, Yuan, & Cui, 2021). Data analysis shows that FTZs have a particularly significant stimulating effect on high-tech industries, especially in coastal areas (Jiang, Lu, & Yang, 2024). Despite the rapid growth in the number of registered enterprises, the average registered capital of a single enterprise is relatively low (Bao et al., 2023). NEWP emphasises the improvement of productivity levels through combination optimisation among workers, labour materials, and labour objects, and these factors together constitute the core of NEWP. FTZ policies should not only focus on increasing the number of investing enterprises but also prioritise attracting higher-quality firms, enhancing capital circulation within the market, and thereby more effectively promoting the development of NEWP.

Existing research mainly focuses on the role of NEWP in specific fields, such as regional economy and digital industry (Song & Zhang, 2024), green economy (Xu, Wang, & Peng, 2024). For example, Chen (2024) analysed the role of free trade zone institutional opening in promoting enterprise innovation through the Difference-in-differences (DID) model according to the classification of state-owned enterprises, domestic enterprises, and coastal enterprises. Although the study recognises that enterprise development should take new productivity as the driving force of enterprise development and recognises the differences between enterprise types and regions, it still does not use NEWP as a dependent variable to directly explore the impact of FTZ policies. Chang and Wang (2024) directly used provincial panel data to verify the role of FTZ policy in promoting NEWP. The results of the study confirmed that the effects of FTZ policy varied across different groups. However, this study still did not overcome the limitations of the high-quality economic development (HQED) concept and did not explore the specific impact pathway of the FTZ policy on NEWP.

Existing literature pays insufficient attention to the specific mechanism of FTZ policy in promoting NEWP, especially the lack of systematic research on the mediating role played by corporate investment. Additionally, there

are significant differences between coastal and inland areas regarding economic development stages and resource endowments (Li, Ye, Liu, & Wu, 2025). The regional heterogeneity of FTZ policies on NEWP still requires more detailed and targeted research. NEWP is the focus of China's current and future economic development. The new economic growth momentum is essential for facilitating China's transition from high-speed economic growth to high-quality economic growth and for achieving high-quality economic development. Under the macro market environment, the FTZ policy is a key means for the government to guide the market. Studying the policy effects of FTZ on NEWP and clarifying the main action channels will have a direct impact on the government's future policy orientation. It is also of significant reference value for other countries in the world to transform their economic development models, promote productivity transformation, and achieve high-quality economic growth.

Based on this goal, this study takes China's FTZ policy as the background, is based on the NEWP evaluation index system at the city level, and uses prefecture-level city panel data and the DID method to explore the heterogeneous impacts of FTZ policies between coastal and inland regions. It also investigates the mediating role of enterprise investment. This study provides a more comprehensive theoretical reference for evaluating the policy effects of FTZs and offers practical and feasible evidence for governments to optimize policy implementation efficiency and promote the development of emerging industries.

The structure of this study is organized as follows: The second part discusses the research design, including the construction method of the NEWP evaluation index system, data sources, and the application of the DID method. The third part presents an empirical analysis using panel data at the city level to examine the role of FTZ policies in promoting NEWP and the differential impact mechanisms between coastal and inland areas. The fourth part concludes the study and offers policy recommendations based on empirical findings, aiming to optimize FTZ policies and enhance NEWP levels.

2. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESES

FTZ policies represent China's strategic attempt to reform trade policies, open domestic markets, and actively participate in international trade under the current global economic landscape (Ye, Wang, Chen, Mao, & Zhang, 2024). FTZs create a more conducive and flexible investment environment for businesses through institutional innovation, which encourages their establishment. Focusing on high-level opening-up, enterprises engage in market competition and drive technological innovation under the guidance of government policies. By supporting the development of emerging industries such as electronic information, this approach contributes to the formation of NEWP (Yi Liu & He, 2024). NEWP is an inherent requirement of HQED; it promotes economic development according to HQED principles. Thus, NEWP follows the concepts of technological innovation, regional coordination, green economy, open markets, and shared development. FTZ construction facilitates the free flow and optimized allocation of resource elements (Lei, Lang, Mei, Fang, & Qiangqiang, 2024). Its development concept not only aligns with the requirements for NEWP but also provides the foundation for its formation and growth. Based on the above analysis of FTZ and NEWP, this study proposes the first hypothesis:

H_1: FTZ policies can improve the level of NEWP.

The theory of free trade posits that it can promote regional economic development. In the process of building FTZs, the negative list system lowers the entry barriers for foreign investment, creating a more relaxed market environment that allows more foreign capital to enter the Chinese market (Jakubczak, 2020). By reducing tariffs, simplifying administrative approval procedures, and providing tax incentives for industries with high technological content, the industrial agglomeration effect can be harnessed to attract more advanced factors, thereby promoting technological progress and transformation. Since coastal areas opened their markets earlier and have more comprehensive infrastructure than inland areas, they experience stronger policy effects under the stimulation of the FTZ system. Due to resource constraints, the policy effects are weaker in inland areas (Chang & Wang, 2024). To verify this view, the second hypothesis is proposed:

H₂: *FTZ policies have a significant impact on NEWP development in both coastal and inland regions of China.*

The FTZ policy provides important support for promoting the transformation of traditional growth momentum into new momentum by optimizing the investment environment (Xie, Jiang, & Kuang, 2025). Specifically, the FTZ policy has improved the convenience of foreign investment through measures such as tariff reductions, administrative decentralization, and financial support for high-tech industries. The inflow of various types of capital has brought new production technologies and further promoted the diffusion of technology. The agglomeration of high-end industries will intensify corporate competition and prompt companies to optimize the allocation of labour, capital, and resources (Liu, Si, & Li, 2023). To verify the critical role of the investment environment, the third hypothesis is proposed as follows:

H_3: FTZ policies can enhance NEWP levels by improving the investment environment.

3. METHODOLOGY AND DATA

3.1. Model Setting

Between 2013 and 2019, China implemented FTZ policies in three phases across 11 regions. The present study provides a solid foundation for applying the DID method to empirical research. This study employs the following two-way fixed effects model to examine the impact relationship between FTZ and NEWP.

$$NEWP_{it} = \beta_0 + \beta_1 FTZ_{it} + \beta_2 Control_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (1)$$

In the model (1), $NEWP_{it}$ represents the NEWP level in region i at time t. FTZ_{it} is the policy dummy variable, indicating whether region i had an FTZ established in year t. $Control_{it}$ represents a set of control variables. β_1 is the coefficient for the policy variable, reflecting the impact of FTZ policies on NEWP. δ_i、μ_t、ε_{it} denote individual fixed effects, time fixed effects, and the random disturbance term, respectively. To test Hypothesis 3, this study employs the stepwise regression method of Baron and Kenny (1986) to examine the mediation effect within the DID model.

$$M_{it} = \alpha_0 + \alpha_1 FTZ_{it} + \alpha_2 Control_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (2)$$

$$NEWP_{it} = \gamma_0 + \gamma_1 FTZ_{it} + \gamma_2 M_{it} + \gamma_3 Control_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (3)$$

The variable M_{it} serves as the mediator variable and is tested in the model (2) as the dependent variable to assess the impact of FTZ policies on the mediator. Subsequently, in model (3), the analysis investigates the mediation role of M_{it} in promoting NEWP through FTZ policies. Control variables remain unchanged across these models.

3.2. Variable Selection

3.2.1. Explained Variable

Han, Zhang, and Zhao (2024) constructed a NEWP index to measure the level of NEWP across 360 Chinese cities. Based on 17 composite indicators, the index is calculated using the entropy weighting method. These 17 fundamental indicators are grouped into three dimensions: new-quality labor, new-quality labor objects, and new-quality labor materials. Missing data for certain regions and years are addressed through interpolation. The NEWP index system is presented in Table 1.

The data primarily originates from the local government's Statistical Yearbook and Statistical Bulletin. The number of invention patents is based on data released by the China National Patent Office. The variable representing the data trading platform is assigned based on the establishment and operational status of data exchanges in each sample city. If a city has a data exchange, the value is set to 1; otherwise, it is set to 0.

3.2.2. Explanatory Variables

The value of the explanatory variable FTZ_{it} is determined based on information published on the official websites of the National Development and Reform Commission and the Ministry of Commerce. This study focuses on three key policy implementation milestones: 2013, 2015, and 2017. If an FTZ_{it} was established in each year, the variable is assigned a value of 1 from that year onward; otherwise, it is set to 0.

Table 1. NEWP level measurement indicator system.

Dimension	Constituent elements	Indicator explanation and source	Weight (%)
New quality labor	Number of employees in emerging industries	Total employees in strategic emerging and future industries (+)	10.08
	Employee individual capability	Average wage per employee (RMB) (+)	0.98
	High-quality employee level	Number of ordinary higher education institutions (+)	5.08
New quality labor objects	Infrastructure	Internet broadband access users (thousands) (+)	3.17
		Total telecom business volume (billion RMB) (+)	4.29
	Future development	Robot installation density (+)	2.47
	Eco-environment	Environmental pollution control investment (billion RMB) (+)	5.01
		Carbon trading, energy rights trading, pollutant trading (billion RMB) (+)	5.10
		Municipal solid waste harmless treatment rate (+) (%)	0.13
New quality labor materials	Technological R&D	Proportion of scientific expenditure in local fiscal expenditure (+)	2.58
	Innovation output	Number of invention applications (+)	8.87
		Number of utility model applications (+)	7.63
	Intelligentization	Number of artificial intelligence companies (+)	12.09
	Greenization	Number of green invention applications (+)	9.64
		Number of green utility model applications (+)	7.98
	Data elements	Level of data element utilization (+)	1.37
		Presence of a data transaction platform (+)	13.53

Note: (+) and (-) indicate the positive and negative impact of each basic indicator on NEWP.

3.2.3. Control Variable

To minimize other factors affecting the experimental results, this study controls for six variables based on existing research: (1) Consumer Capacity (*Con*): Demand stimulation through consumption can drive productivity development. It is measured by the retail sales of consumer goods. (2) Government Intervention (*Gov*): Government policies can guide industrial development at the macro level. The fiscal expenditure of local governments reflects their ability to control the market. (3) Financial Development Level (*Fin*): Financial resources are crucial for the development and innovation of emerging industries. (4) Industrial Structure (*Ind*): Emerging industries and future industries are mainly concentrated in the secondary and tertiary sectors and are measured by the ratio of these sectors. (5) Fiscal Support (*Fis*): The foundation of (NEWP) lies in technological innovation. Government support for scientific and technological development significantly impacts corporate technological innovation. (6) Enterprise Development Level (*Ent*): Industrial enterprises are the source of (NEWP) generation. Local governments measure

this by counting the number of industrial enterprises above a designated size. To ensure comparability across regions and reduce scale-related distortions, the control variables (*Con*, *Gov*, and *Fin*) are expressed as ratios to GDP. Logarithmic transformations are employed to stabilize variance and improve model robustness. The descriptive statistics of these variables are shown in Table 2.

4. RESULTS

4.1. Basic Regression Analysis

H1 is tested using the DID model, and the results are presented in Table 3. The table reports the estimation results both with and without the inclusion of control variables. Adding control variables to the model does not affect the significance of the regression coefficients, and the R-squared level has increased, indicating the appropriateness of the choice of control variables. Based on the empirical results, FTZ policies are found to significantly promote the development of NEWP, thereby confirming Hypothesis 1.

Table 2. Data description list.

Variables	-1	-2	-3	-4	-5
	N	Mean	Std. Dev	Min.	Max.
NEWP	3,705	0.051	0.0743	0.0019	0.618
FTZ	3,705	0.0345	0.183	0	1
Con	3,705	-1.019	0.357	-10.38	0.0125
Gov	3,705	-1.706	0.448	-3.126	0.854
Fin	3,705	0.841	0.425	-0.531	3.059
Ind	3,705	-0.0666	0.481	-2.219	1.732
Fis	3,705	-4.486	0.924	-7.567	-1.576
Ent	3,705	6.610	1.105	2.996	9.722

Table 3. Impact of FTZ on HQED: Basic regression results.

Variables	(1)	(2)
	NEWP	NEWP
FTZ	0.0323***	0.0294***
	(0.0021)	(0.0021)
Con		-0.00192
		(0.0012)
Gov		0.0081***
		(0.0022)
Fin		-0.0140***
		(0.0024)
Ind		-0.0078***
		(0.0017)
Fis		0.0062***
		(0.00064)
Ent		-0.0029**
		(0.0013)
Constant	0.0499***	0.120***
	(0.0003)	(0.0113)
Observations	3,705	3,705
R-squared	0.957	0.960

Note: The p-values are categorized into three significance levels: ** for $p < 0.05$, and *** for $p < 0.01$.

4.2. Parallel Trend Test

To ensure that the NEWP development in FTZ cities is the result of FTZ policies, we conduct a parallel trends test on the above models. As shown in model (4), $FTZ_{i,\ t+K}$ indicates the situation before and after the

implementation year of FTZ policies for city i. If a city established an FTZ in year t, the year before is coded as 0, and the current and subsequent years are coded as 1. β_k reflects the changes in the impact of FTZ establishment on NEWP. Due to the variation in FTZ establishment times across regions, the implementation periods are not fixed but span from the first five periods before the policy implementation to the nine periods after. The first pre-implementation period is selected as the benchmark.

$$NEWP_{it} = \sigma_0 + \sum_{N}^{K} \beta_k FTZ_{i,\ t+K} + \beta_2 Control_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (4)$$

Figure 1 shows the dynamic trend of estimated coefficients of β_k. Before the policy implementation, the estimated coefficients intersect with the zero axis and are statistically insignificant, indicating that there was no substantial difference in the trends between the treatment and control groups. This satisfies the parallel trends assumption. Following the implementation of the policy, the estimated coefficients begin to diverge over time, suggesting a lagged effect of FTZ policies on NEWP. As the construction of FTZs advances, the policy's promoting effect becomes increasingly evident. This finding is also supported by the studies of Liu et al. (2023) and Chen (2024).

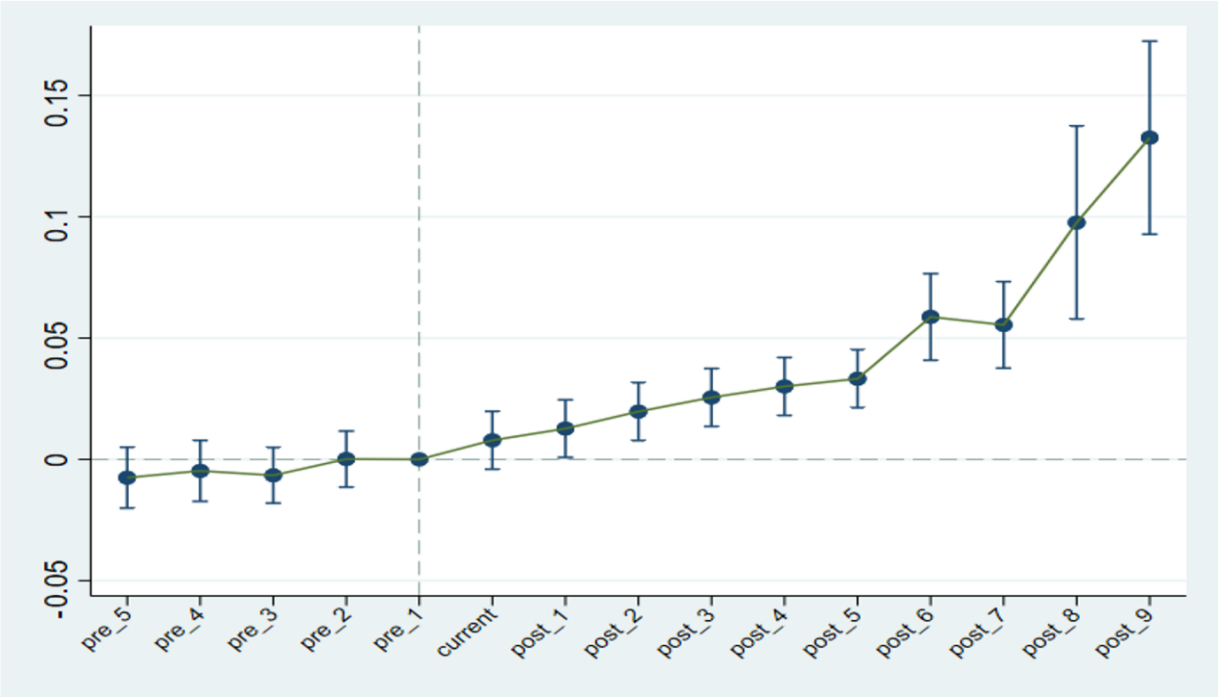

Figure 1. Parallel trend test and dynamic effects.

4.3. Robustness Check

4.3.1. Placebo Test

To eliminate the influence of unobserved factors and improve the robustness of empirical findings, a placebo test is conducted. By randomly sampling new treatment and control groups based on the sampling results, regression analysis is performed. If the estimated coefficients are close to zero and the distribution density curve roughly follows a normal distribution, the test is considered passed.

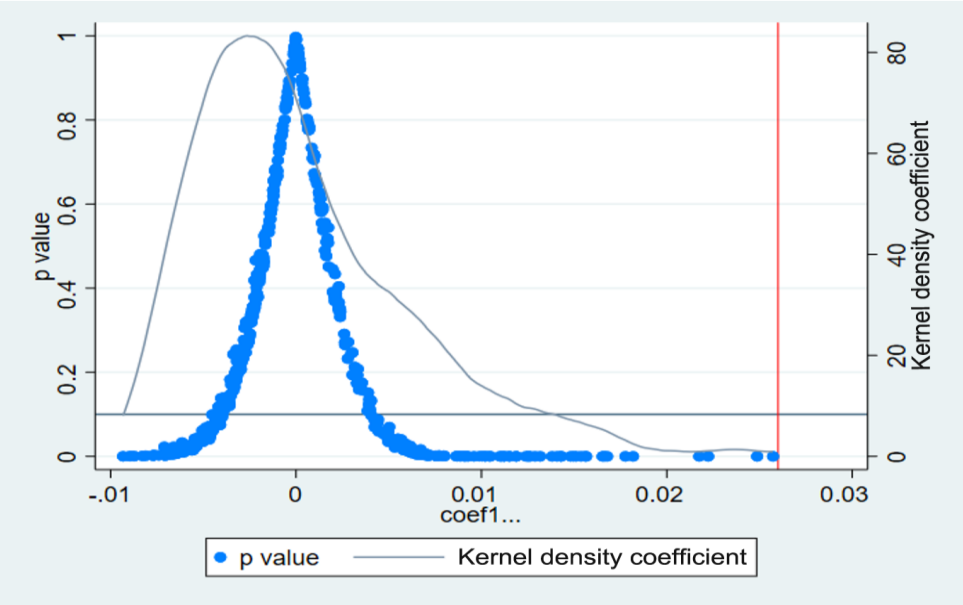

Figure 2. Distribution of coefficient estimates from 1000 random draws.

In each iteration, 21 samples are randomly assigned to the "treatment group," while the remaining samples serve as the "control group." The results of the random assignments are illustrated in Figure 2. This regression is repeated 500 times through random sampling, and it shows a normal distribution, indicating that the FTZ's impact on NEWP is not significant in the placebo data. The comparison with the actual regression coefficients indicates that the observed effects are unlikely to be the result of a single random shock, thereby reinforcing the credibility of the empirical findings.

4.3.2. Adjust the Sample

The directly-controlled municipalities (Beijing, Shanghai, Tianjin, and Chongqing) and Special Economic Zones (SEZs) (Shenzhen, Zhuhai, Xiamen, and Shantou) are among China's earliest regions to implement reform and opening-up policies.

Table 4. Stability test regression results.

VARIABLES	(3)	(4)	(5)	(6)
	NEWP	NEWP	NEWP_P	NEWP_P
FTZ	0.0282***	0.0267***	0.312***	0.294***
	(0.00218)	(0.00213)	(0.0222)	(0.0219)
Con		-0.00114		0.00007
		(0.00105)		(0.0121)
Gov		0.00889***		0.0414*
		(0.00212)		(0.0243)
Fin		-0.0117***		-0.0863***
		(0.00225)		(0.0258)
Ind		-0.00741***		-0.0302*
		(0.00151)		(0.0174)
Fis		0.00520***		0.0584***
		(0.000573)		(0.00660)
Ent		-0.000796		-0.00728
		(0.00129)		(0.0148)
Constant	0.0484***	0.101***	0.867***	1.323***
	(0.000243)	(0.0110)	(0.00280)	(0.127)
Observations	3,047	3,047	3,135	3,135
R-squared	0.967	0.969	0.952	0.954

Note: The p-values are categorized into three significance levels: * for $p < 0.1$, ** for $p < 0.05$, and *** for $p < 0.01$.

They possess distinct advantages in terms of policy support, market resources, and government management authority, which could impact the development of NEWP. This situation complicates the analysis of the relationship between FTZ policies and NEWP, as well as the pathways of their impact. Therefore, municipalities directly under the central government and special economic zones are excluded from the sample. After re-estimating the model using the adjusted sample, the results presented in Table 4 confirm that the main findings remain robust.

4.3.3. Change in NEWP Measurement Method

Using Principal Component Analysis (PCA) to replace the entropy method, this study examines the variability of NEWP indices. The results show that the first four eigenvalues are greater than 1, and the cumulative variance contribution rate reaches 68%. The first, second, third, and fourth principal components are selected as evaluation indicators for NEWP, with a composite score calculated as the NEWP index. Regression with the new NEWP index (NEWP_P) is shown in (5) and (6) of Table 4. These results suggest that the main conclusions are robust to alternative measurements of NEWP, thereby reinforcing the validity of the findings.

4.4. Mediation Test

This section explores the underlying mechanism of how FTZ policies influence NEWP from the perspective of the investment environment. Specifically, FTZ policies can enhance NEWP levels by improving market investment conditions. As discussed in the theoretical analysis, the implementation of FTZ policies fosters a more favourable investment environment, attracting the aggregation of high-end factors and industries. Interactions and clustering among industries provide stronger momentum for the development of NEWP. Based on the foundational DID model, this study applies the stepwise regression method of Baron and Kenny (1986) to test hypothesis 3 and employs the Sobel test and Bootstrap test to enhance the robustness of the conclusions.

$$M_{it} = \alpha_0 + \alpha_1 FTZ_{it} + \alpha_2 \text{Control}_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (5)$$

$$NEWP_{it} = \gamma_0 + \gamma_1 FTZ_{it} + \gamma_2 M_{it} + \gamma_3 \text{Control}_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (6)$$

As shown in models (5) and (6), $M_{it}$is the mediating variable, representing the investment environment (Inv), measured by the actual utilisation of foreign investment. The meanings of other variables remain unchanged. Model (5) is used to evaluate whether FTZ policies impact the investment environment. On this basis, a model is employed to test the mediating effect of the investment environment on the influence of FTZ policies on NEWP.

Table 1. Mediating effect test results.

Variables	(7)	(8)
	Inv	NEWP
FTZ	369,528***	0.0249***
	(90,958)	(0.00218)
Inv		0.00000***
		(0.00000)
Con	24,826	-0.00126
	(50,247)	(0.00120)
Gov	274,641***	0.00637***
	(101,013)	(0.00242)
Fin	-365,672***	-0.00707***
	(107,101)	(0.00257)
Ind	34,482	-0.00944***
	(72,196)	(0.00173)
Fis	118,454***	0.00473***

Variables	(7)	(8)
	Inv	NEWP
	(27,419)	(0.000658)
Ent	174,392***	0.000367
	(61,638)	(0.00148)
Constant	802,568	0.0842***
	(526,218)	(0.0126)
Observations	3,135	3,135
R-squared	0.852	0.968

Note: The p-values are categorized into three significance levels: *** for p < 0.01.

Table 6. Sobel test and bootstrap test results.

		Trade
Sobel	P	0.0024
	Z	13.25***
Bootstrap	[95% conf. interval]	0.0219382 0.0428631

Note: The p-values are categorized into three significance levels: *** for p < 0.01.

As shown in Table 5, the regression coefficients of Inv and FTZ are both positive and significant at the 1% level, confirming the mediating role of Inv in the positive impact of FTZ policies on NEWP. According to the results displayed in Table 6, the p-value of the Sobel test is 0.0024, and the Bootstrap test shows that the 95% confidence interval does not include zero, further reinforcing the above conclusions. It can be inferred that FTZ policies reduce government intervention in the market and enhance market openness. This aligns with previous studies, which emphasize the role of FTZ institutional openness in improving productivity (Chang & Wang, 2024; Guan, Wang, & Zhao, 2024). The implementation of complementary measures, such as streamlining approval processes and building service-oriented governance, enhances government efficiency and promotes fair market competition. These factors contribute to the creation of a better and more relaxed market environment, stimulating the development of NEWP.

4.5. Regional Heterogeneity

FTZ governments have established various core industries in the construction of FTZs based on their unique resource endowments and development conditions (Zhao et al., 2022). The FTZs established in 2013 and 2015 were primarily located in coastal regions, focusing on financial product innovation and opening international markets (Chang & Wang, 2024). In 2017, the establishment of FTZs expanded to central and western regions, with a strategic focus on developing transportation networks while also undertaking the mission of promoting coordinated economic development between eastern and western China (Wang, Fang, & Yu, 2020). This implies that the policy effects of FTZs will exhibit regional heterogeneity.

The data from all sample cities from 2012 to 2022 are divided into the "inland group" and the "coastal group" based on geographical distribution. Regression analysis is performed to examine the locational heterogeneity of the impact of FTZ policies on NEWP. As shown in Table 7, whether control variables are included or not, the impact of FTZs in coastal and inland areas is significantly positive. Compared to inland regions, the policy effects of FTZs in coastal areas are more pronounced. The policy effect of free trade zones in coastal areas is more significant than in inland areas. This finding is consistent with the research of Chang and Wang (2024), which indicates that the first two batches of FTZs promoted the development of NEWP by improving the business environment. However, the effect of the third batch of FTZs is not significant. This may be due to the limited development level of inland FTZs and the weak regional innovation and development capabilities. More targeted policies are needed in inland FTZs to stimulate the development of NEWP.

Table 7. Basic regression results for inland and coastal regions.

Variables	(9)	(10)	(11)	(12)
	NEWP_ Inland		NEWP_ Coastal	
FTZ	0.0287***	0.0286***	0.0303***	0.0308***
	(0.00268)	(0.00268)	(0.00376)	(0.00377)
Con		-0.000790		-0.00484
		(0.00131)		(0.00402)
Gov		-0.00664**		0.00387
		(0.00274)		(0.00694)
Fin		0.000259		-0.00758
		(0.00288)		(0.00626)
Ind		-0.00185		0.0127**
		(0.00189)		(0.00556)
Fis		-0.00004		0.00455**
		(0.000718)		(0.00177)
Ent		0.00774***		0.00633*
		(0.00142)		(0.00363)
Constant	0.0512***	-0.0116	0.0597***	0.0440
	(0.00031)	(0.0119)	(0.00078)	(0.0316)
Observations	2,552	2,552	583	583
R-squared	0.963	0.964	0.971	0.972

Note: The p-values are categorized into three significance levels: * for $p < 0.1$, ** for $p < 0.05$, and *** for $p < 0.01$.

5. CONCLUSIONS AND POLICY IMPLICATIONS

5.1. Conclusions

FTZ policy is a crucial initiative in China's high-level opening to the outside world, serving as a key external driver for NEWP development. Using panel data from 285 cities in China from 2012 to 2020, this study applies the DID method to show that FTZ policy significantly enhances NEWP levels by optimizing the investment environment. Robustness checks further confirm the reliability of the results. Regional heterogeneity analysis indicates that the policy effect is stronger in coastal regions but remains significant in inland areas, highlighting the dynamic nature of differentiated FTZ development. The study reveals that FTZ policy attracts foreign investment, promotes technological innovation, industrial upgrading, and optimizes factor allocation, underscoring the need for more targeted policies in inland areas to tap into their potential.

5.2. Policy Implications

Accelerate the opening of the FTZ system, strengthen domestic and foreign investment cooperation, and enhance technological innovation capabilities. Promote further alignment of FTZ policies with international rules and strengthen institutional innovation. Promote domestic and foreign investment cooperation through special fund support and enterprise collaboration network construction to stimulate innovation and development (Wang et al., 2022). Utilize policy and market advantages to attract high-quality foreign investment and support industrial upgrading of mainland enterprises (Su & Wang, 2024). Using foreign investment as a vehicle, they facilitate the flow of resource elements, empowering NEWP development through technological upgrades and product innovation.

Implementing differentiated FTZ construction to build a modern industrial system and promote the specialized development of leading industries. Leveraging the comparative advantages of different regions within FTZs, using institutional openness to attract more high-end factors, and facilitating industrial agglomeration. Strengthening cooperation among FTZs to promote collaborative technological innovation and drive the development of modern industrial clusters (Lei & Xie, 2023; Liu, Fu, He, Meng, & Liu, 2024). Further improve the transportation network within inland FTZs to accommodate industrial transfers from the eastern regions and gradually achieve industrial upgrading (Zhang, 2017). By shaping an industrial system that aligns with the development of NEWP, driving the transition of regional industries towards strategic emerging industries and future industries.

5.3. Study Limitations

Although this study empirically analyzes the promotion effect of FTZ policies on NEWP, there are still some limitations: The data range of this study covers only 2012-2020, failing to capture recent adjustments in FTZ policies and their dynamic impact on NEWP development. Although the experimental results of the DID model were tested for stability, there may still be unobserved regional characteristics or policy intervention factors affecting the research conclusions. Future research could introduce more complex econometric models, such as PSM-DID and dynamic panel models, to further improve the accuracy of causal inference. The NEWP index system constructed in this study may not fully capture its multidimensional attributes. Although the study compared coastal and inland regions, it did not delve deeply into the specific operational mechanisms and policy differences of FTZs in each region. Based on these limitations, future research can explore the following directions: extending the data time range to dynamically capture the long-term effects of FTZ policy adjustments on NEWP development; combining micro-enterprise data to analyze the effects of FTZ policies on corporate R&D and productivity improvement; adopting more advanced econometric methods to enhance causal inference precision; and exploring the role of FTZ policies in strategic emerging areas (such as digital and green economies) to more comprehensively reveal the multifaceted impacts of FTZ policies on NEWP development.

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