Paired Assistance with Chinese Characteristics: Evidence from the "Enclave Economy" in the PRD Region

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Abstract: *Paired assistance is an important means for developed regions to help less-developed regions achieve common prosperity. Despite its advantages, government-mandated paired assistance tends to be less effective due to the lack of economic incentives for assisting localities. Therefore, local governments in China have explored an incentive-compatible paired assistance model. Based on the paired assistance between cities in the Pearl River Delta (PRD) region and the eastern, western and northern parts of Guangdong Province, this study designed a natural experiment for the network relationship of paired assistance. Empirical results based on industrial and commercial registration data and land transfer data indicate that paired assistance has enhanced bilateral investment linkages, and that the inter-regional benefit sharing mechanism has incentivized assisting localities to provide paired assistance. Our heterogeneity analysis reveals that a shorter distance between assisting and beneficiary localities may lead to better results of paired assistance. This study contributes to the understanding of incentive mechanisms for local government cooperation and offers insights for balancing regional development and achieving common prosperity.*

Keywords: *Paired assistance, enclave economy, inter-regional benefit sharing*
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1. Introduction

Inter-regional paired assistance is becoming an important policy tool for balancing regional economic development and achieving common prosperity. Initially, paired assistance programs were defined as "unilateral poverty alleviation" motivated by political mobilization, with a lack of intrinsic incentives limiting their effectiveness. In recent years, the enclave economy model[1] has found widespread application in paired assistance, especially in prosperous regions such as the Pearl River Delta (PRD) and the Yangtze River Delta (YRD) regions. Both sides of assistance have benefited economically and fiscally from the enclave economy by working together to build industrial parks and other initiatives. This approach enables the optimization of cross-regional distribution of land, capital, labor, and local government investment promotion capacity. The enclave economy has

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[1] According to the Planning Department of the National Development and Reform Commission (NDRC), the enclave economy is a regional economic development model based on mutual benefit and win-win results. In this model, two or more independent localities collaborate to construct and develop various industrial parks. The goal is to achieve complementarity and efficient utilization of production factors through coordinated mechanisms of planning, construction, management, and benefit sharing.

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positive policy implications for China as it seeks new paths for coordinated regional development and common prosperity[2].

This paper examines the establishment, operational mechanisms, and effects of inter-regional paired assistance using a case study of Guangdong, a province with considerable regional development gaps. The stark disparity between the prosperous PRD region and the province's less developed eastern, northern, and western regions demands a paired assistance program. Guangdong has a long history of paired assistance; as early as 2002, prefectural-level cities in the PRD region established paired assistance relations with cities in Guangdong's eastern, northern and western regions, with joint development of industrial parks serving as an avenue of assistance. Tax revenue, GDP, and other economic indicators from these joint industrial parks were shared by local governments on both sides, making the assistance mutually advantageous rather than solely for poverty alleviation. Tax revenue incentives and government performance ratings prompted assisting localities to provide more assistance and resources to the beneficiary localities, encouraging businesses to invest, relocate, or establish subsidiaries in the beneficiary areas. In the first half of 2017, the paired assistance industrial parks in the PRD and Guangdong's eastern, northern and western regions started construction on 103 industrial projects worth more than 100 million yuan. These industrial parks, which serve as the major vehicle for cooperative industrial development, recorded 90.1 billion yuan in value-added from large enterprises, a 15.2% increase year on year, and 19.17 billion yuan in total tax income, a 12.9% increase year on year[3]. According to our survey, the Shenzhen-Shantou Special Cooperation Zone had implemented 104 industrial projects by 2023, with 96 of them originating from Shenzhen. These sporadic bits of evidence indicate that the paired assistance mechanism with Chinese characteristics, driven by both political mobilization and benefit sharing, has yielded positive results and represents a combination of a capable government and an effective market. However, thorough empirical evidence is still required to accurately assess the effects of paired assistance.

In a case study of Guangdong Province's paired assistance policy, we paired prefectural-level cities in the PRD with those in the province's eastern, northern, and western regions. Those pairs having joint industrial parks are classified as the treatment group, while those without are classified as the control group. Using data from the commercial and industrial registration database, we used the staggered difference-in-differences (DID) method to assess the paired assistance policy's effect on industrial investment. Our findings show a considerable rise in the number of investment transactions between prefectural-level cities with paired assistance relationships, indicating closer cooperation and economic ties between assisting and beneficiary localities. Based on the industrial land transfer data from the Land Market Network (https://www.landchina.com/), we used the DID approach to examine the importance of benefit sharing between assisting and beneficiary localities in light of changes in the benefit sharing mechanism during the paired assistance process. We discovered that without the benefit sharing mechanism, there was a considerable decline in the area of industrial land transfers within joint industrial parks, indicating a decrease in the motivation and intensity of assistance from assisting localities. Following the recovery of the benefit sharing mechanism, the area of land transfers within joint industrial parks rapidly increased, indicating the favorable benefits of the benefit sharing mechanism on the outcomes of paired assistance. Furthermore, we conducted a heterogeneity analysis

[2] For instance, the NDRC and seven other ministerial agencies enacted the *Guiding Opinions on Supporting the Development of the Enclave Economy* in June 2017, which calls for "support to cooperation of the 'enclave economy' in various paired assistance and collaboration programs". In the Implementation Scheme for Paired Assistance from Cities in the Shanghai-Jiangsu-Zhejiang Region to Cities in Northern Anhui (Fa Gai Di Qu [2021] No.1744), it is envisioned that cities in the paired assistance program develop innovative enclaves, campuses for paired assistance within industrial parks, and mechanisms for cost-sharing and benefit sharing. State-owned enterprises (SOEs) at the central and local levels are encouraged to take the lead in advancing and serving as destinations for industrial relocation.

[3] Sohu Focus Shenzhen Station: *Driving up Northeastern Guangdong! Shenzhen Launches the "Shenzhen Headquarters Plus Shenzhen-Shantou Base" Model*, Sohu.com, August 24, 2017.

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based on the geographical distances between assisting and beneficiary localities and found that distance has a considerable inhibiting effect on the outcomes of paired assistance.

This study makes three major contributions. First, it advances our understanding of the inter-regional paired assistance system with Chinese characteristics, viewing it as an exemplary combination of a capable government and an effective market. Existing research focuses on the political incentives for inter-regional paired assistance in China, recognizing it as a manifestation of the socialist system's strength (Zhu and Qin, 2012) and China's national governance capabilities to "concentrate resources to accomplish great endeavors" (Wang and Su, 2020). The paired assistance system is seen as a key policy tool for the unitary state to balance regional economic development by coordinating resource distribution via the central government authority (Wang, 2022). It is a unique type of horizontal transfer payment (Shi and Fan, 2020), distinguished by government decrees and high resource mobilization capabilities. These studies have reinforced the critical importance of a "capable government" and political mobilization in the regional assistance network with Chinese characteristics. What is absent from the picture is the long-term sustainability of paired assistance, as well as potential Pareto improvements. This paper emphasizes local government incentives for providing paired assistance. We found that the mechanistic design has incentivized both sides to collaborate in the development of industrial parks and share the benefits of economic growth and fiscal income. As a result, assisting localities play a larger role in strengthening local industrial structure, encouraging effective land use, and improving industrial spatial layout in beneficiary localities. Such collaboration promotes local development capacity for balanced regional development.

Second, this study addresses the enclave economy's paired assistance model, which has gained traction in recent years. Existing research on the enclave economy has primarily relied on qualitative case studies. According to case studies on the the Shenzhen-Shanwei Special Cooperation Zone (Wang and Hui, 2021; Zhang et al., 2020) and the Suzhou-Suqian Industrial Park (Yang, 2014), the enclave economy is driven by the diverse demands of the home and host localities for land, capital, and other production factors. By breaking down jurisdictional barriers, the enclave economy provides a significant option for poverty alleviation in poor regions through inter-regional collaboration (Zhang, 2019). A predictable benefit sharing mechanism is critical to the success of the enclave economy, and unjust benefit sharing is a primary cause of lack of sustainability and failure to achieve desired goals (Hua, 2020). These qualitative case studies give us enough background information to conduct an empirical analysis of the outcomes of paired assistance through the enclave economy. To our knowledge, this is the first empirical study in China to identify the causal effects of the paired assistance and the impact of the benefit sharing mechanism.

Finally, our empirical findings give essential theoretical inspiration for eliminating local protectionism and regional segmentation while promoting economic development and establishing a single national market. According to the market-preserving federalism theory advanced by Weingast (1995), Qian and Weingast (1997), and Qian and Roland (1998), intergovernmental competition under the fiscal decentralization system encourages local governments with fiscal self-interest to protect markets and private property, thereby promoting local market-based economic development. Nonetheless, fiscal decentralization-induced local government competition may result in a fragmented regional economy, local protectionism, and regional segmentation (Qian and Weingast, 1996; Young, 2000; Yin and Cai, 2001; Lu et al., 2004; Bai et al., 2004; Wang et al., 2007), impeding the free flow of capital and the formation of a unified national market (Lyu and He, 2022; Liu, 2022). Furthermore, performance appraisals for civil servants can also bring about such situations (Zhou, 2004; 2007). In our study, the benefit sharing mechanism (including the distribution of fiscal revenue, GDP, and other economic development indicators) for paired assistance weakened the fiscal and political incentives for assisting parties to resort to local protectionism and regional segmentation, while increasing capital flow and efficiency in the spatial allocation of production factors, allowing both parties to benefit from

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coordinated regional development. This paper outlines a political economics explanatory framework for inter-regional paired assistance and regional cooperation, adding knowledge to the exploration of a market-based approach to common prosperity.

The remainder of this paper is structured as follows: Section 2 focuses on the policy context. Section 3 outlines the identification strategy and model design. Section 4 looks at the investment effects of paired assistance. Section 5 analyzes how the benefit sharing mechanism affects land transfers inside the joint industrial parks. Finally, Section 6 discusses the conclusions.

2. Policy Background

2.1 Joint Industrial Parks: A Key Vehicle of Paired Assistance

The Guangdong provincial government has issued a series of policy documents establishing paired assistance between the PRD region and the province's eastern, northern, and western regions. This project intends to foster all-round regional development and coordination through complementary strengths and long-term collaboration. Since 2005, the Guangdong provincial government has been looking into ways to encourage industrial relocation from the PRD region to the province's mountainous areas, as well as its eastern and western parts, through industrial parks. The Guangdong provincial people's government issued the Opinions on Advancing Industrial Relocation through Partnering the Mountainous Areas and Eastern and Western Parts of the Province with the PRD Region (For Trial Implementation) (Yue Fu [2005] No.22) ("Opinions"). According to this document, local governments in the mountainous areas or the eastern and western parts of Guangdong Province may designate specific areas of land from their local development zones, industrial parks, and high-tech industries development zones approved by the State Council and provincial government, as well as construction land plots designated in the master plan, for the establishment of industrial relocation parks. According to the cooperative development agreement between the parties involved in industrial relocation, local governments in the PRD region are in charge of organization, planning, investment, development, construction, and investment promotion. During the agreement term, both parties adhere to an agreed-upon ratio for benefit sharing.

Guangdong Province has both prefectural-city-level and county-level industrial relocation parks, with the latter predicated upon the former[4]. For example, the Guangzhou (Meizhou) Industrial Relocation Park was formed as a joint industrial park at the prefectural-city level by the Guangzhou and Meizhou municipal governments. It is above county-level industrial parks such as Guangzhou Nansha (Pingyuan), Guangzhou Panyu (Wuhua), and Guangzhou Haizhu (Fengshun) industrial relocation parks, which are influenced by the paired assistance relationships. For example, Guangzhou City's Nansha, Panyu, and Haizhu districts assist Pingyuan, Wuhua, and Fengshun counties, respectively. Many official documents have established the strong connection between joint industrial parks and paired assistance, underlining the significance of industrial relocation parks to paired assistance. They also advocate for enhancing collaborative development initiatives for industrial parks as the vehicle of cooperation.

Clearly, the joint industrial parks represent a crucial form and primary vehicle for industrial assistance between the PRD region and Guangdong's eastern, northern and western regions. Therefore, we designate the establishment of joint industrial parks as the starting point for the actual implementation of industrial paired assistance[5]. Using the establishment of these joint industrial parks as a policy shock,

[4] *The Work Scheme for the Promotion of Capacity Expansion and Efficiency Improvement of Industrial Parks in the Eastern, Northern and Western Regions of Guangdong Province* (Yue Ban Fa [2013] No.22) classifies industrial parks into demonstration industrial parks for cooperation between prefectural-level cities and other industrial parks for county-level jurisdictions. Provincial industrial relocation policies are applicable to both types of industrial parks.

[5] We determined the time points for the establishment of joint industrial parks according to the Promotional Brochure for Industrial Parks in Guangdong Province, official websites of various industrial parks, as well as local yearbooks.

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we explore the impact of paired assistance on the economic ties between both regions.

2.2 Benefit Sharing Mechanism

The *Opinions* laid out for the first time the principle of benefit sharing for industrial parks. It stipulated that both parties should agree on the ratio for the distribution of the locally retained part of tax revenues and fees generated from an industrial park. This aims to ensure win-win results between the mountainous areas and eastern and western parts of Guangdong Province and the PRD region, while strictly enforcing relevant national fiscal policies and accommodating the interests of both parties. This principle has been upheld in subsequent official documents[6].

In 2013, the benefit sharing mechanism underwent a significant change: the sharing of tax revenues for host regions was removed, and since then, all tax revenues were retained by the beneficiary localities. Additionally, regional GDP and other economic indicators were also retained by these localities. In 2013, the Communist Party of China (CPC) Guangdong Provincial Committee and Guangdong Provincial People's Government enacted the *Decisions on Further Promoting the Revitalization and Development of the Eastern, Northern and Western Regions of Guangdong Province* (Yue Fa [2013] No.9), which stipulated that for any project invested in the eastern, northern and western regions of Guangdong Province, the project company should, in principle, serve as an independent legal entity, with the tax revenues subject to local retention to be retained by the locality. In the same year, the CPC Guangdong Provincial Committee and Guangdong Provincial Government clarified in the *Notice on the Adjustment of the Paired Assistance Relationship between the Pearl River Delta Region and the Eastern, Northern and Western Regions of Guangdong Province* (Yue Ban Fa [2013] No.27) that profits of government investment from industrial parks in the beneficiary cities of paired assistance (excluding tax revenues and fees) should be fully retained to support the further development of the industrial parks. The beneficiary cities should be responsible for the GDP accounting of the demonstration industrial parks, calculation of energy consumption per unit of GDP, and control of primary pollutants.

In 2016, however, the benefit sharing mechanism became reinitiated. As stipulated in a succession of policy documents[7], for new joint industrial projects in which assisting cities were directly involved in their organization and implementation, the assisting and beneficiary localities may agree on a certain ratio for the sharing of GDP, industrial value-added, tax revenues, energy consumption per unit of GDP, emissions of primary pollutants, and energy consumption limits. This shift in the benefit sharing mechanism provided an opportunity for our exploration of the benefit sharing mechanism's effects on paired assistance.

3. Identification Strategy and Empirical Design

In this section, we utilized the establishment of joint industrial parks as a policy shock to conduct a natural experiment to verify the investment effect of paired assistance[8]. Specifically, we matched the prefectural-level cities in the PRD region with those in the Guangdong's eastern, northern and

[6] The *Guiding Opinions of Guangdong Provincial People's Government on Further Advancing Cooperation on the Joint Development of Industrial Relocation Parks*: All parties are encouraged to agree upon terms of benefit sharing for industrial parks. During the agreement period, both sides may share a certain ratio of the locally retained part of new tax revenues, as well as regional GDP and other primary economic indicators, according to their input of capital and other resources, equity ratio, and cooperation agreement on the basis of observing relevant national and provincial laws and regulations.

[7] *The Opinions on Deepening Comprehensive Work on Paired Assistance in the Pearl River Delta Region and the Eastern, Northern and Western Regions of Guangdong Province* (Yue Wei Ban 2016 No.81), the Notice of Guangdong Provincial People's Government on Several Policy Initiatives for Promoting the Quality and Efficiency of Industrial Parks in the Eastern, Northern and Western Regions of Guangdong Province (Yue Fu [2016] No.126), and the Notice of the Department of Finance of Guangdong Province on the Fiscal Support Policies for Assisting Joint Industrial Development between the Pearl River Delta Region and the Eastern, Northern and Western Regions of Guangdong Province (Yue Cai Gong [2016] No.384).

[8] Since the joint industrial parks are the main vehicle for paired assistance as we explained in the policy background, it is more reasonable to use the time points of their establishment to reflect the effects of industrial paired assistance between the Pearl River Delta and the eastern, western and northern parts of Guangdong Province.

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western regions into pairs. Pairs with joint industrial parks are designated as the treatment group, while those without are designated as the control group. We investigated the impact of the paired assistance relationship on manufacturing investment in assisted regions using a staggered DID model. As a natural experiment design, the standard DID model can exclude the impact of "pre-experiment differences" between the treatment and control groups by satisfying the parallel trend hypothesis, while also avoiding endogeneity from unobservable factors to obtain relatively reliable estimates. For this reason, the DID model is extensively applied in current policy evaluations. Given the inconsistent time points for the establishment of joint industrial parks, we cannot use the standard DID model. Therefore, we employ the staggered DID model as an extended version to evaluate the policy effects. The staggered DID model captures policy shocks to individuals at various time points with the following model specification:

$$y_{ijt}=\alpha+\beta_1 Treat_{ijt}+\sum_k \gamma_k X_{jt}^k \eta_t+\lambda_{ij}+\eta_t+\varepsilon_{ijt} \quad (1)$$

In equation (1), y_{ijt} is the explained variable that denotes the number of manufacturing investment made by a prefectural-level city from the PRD region to a prefectural-level city in the eastern, northern or western region of Guangdong Province. Subscript i denotes a prefectural-level city in the PRD region, subscript j denotes a prefectural-level city in the eastern, western or northern region of Guangdong Province, and subscript t denotes year. α is the intercept term, and $Treat_{ijt}$ is the dummy variable for distinguishing between the treatment group and control group in various years. If a prefectural-level city i of the PRD region and a prefectural-level city j of the eastern, northern or western region of Guangdong Province have established a joint industrial park, and year t follows the establishment of the joint industrial park, $Treat_{ijt}$=1; otherwise, it is 0. $Treat_{ijt}$ is the core explanatory variable, whose coefficient β_1 denotes the impact of the establishment of the joint industrial park on the investment links between both localities[9]. $\sum_k \gamma_k X_{jt}^k$ are control variables, which primarily include the freight transportation volume of each prefectural-level city of the eastern, western or northern region of Guangdong Province, per capita general budgetary income, per capita general budgetary spending, regional infrastructure (number of telephone subscribers/registered population), and regional welfare level (number of hospital beds/10,000 inhabitants). In order to exclude the interference of policy shock to the control variables, we use an interaction term between the control variables before the policy shock and the dummy variable of year[10], i.e., $\sum_k \gamma_k X_{jt}^k \eta_t$. In terms of fixed effects, we have controlled for the fixed effect of combination λ_{ij}[11] between cities or county-level jurisdictions in the PRD region and the eastern, western or northern regions of Guangdong Province and the time fixed effect η_t. ε_{ijt} is stochastic error term, and the combination-level robust standard error is adopted.

In order to test the impact of the benefit sharing mechanism on land transfers, we utilize the abolition of the benefit sharing mechanism between 2014 and 2016 and the resumption of the mechanism after 2016 as policy shocks to design our natural experiment and explore the impact of changes in the share of tax revenues and economic indicators on the area of land transfers within the joint industrial parks. We choose the area of land transfers as a proxy of the effectiveness of paired assistance for the following reasons: first, there is a positive correlation between the area of land transfers and project implementation; second, the identification of whether a transferred land plot is located within an industrial park based on the "project location" variable[12] helps us determine the effectiveness of assistance in a more precise manner. To ensure comparability between the treatment group and the

[9] For instance, City A and City B collaboratively constructed Industrial Park A in 2005, and City A and City C collaboratively constructed Industrial Park B in 2008. Then, = 0 before 2005, and equals 1 in 2005 and afterwards; = 0 before 2008, and equals 1 in 2008 and afterwards.

[10] Here, we adopt an interaction term between control variables and the dummy variable of time for the first phase, i.e., 2000.

[11] Here, the fixed effect of combination equals the individual fixed effect in the two-way fixed effect model.

[12] In our data, the "project location" variable is the location of a project. If it is located in an industrial park, we consider that the land plot is located in the industrial park.

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control group, we firstly identify county-level jurisdictions with joint industrial parks, and then designate land plots for sale in those joint industrial parks as the treatment group and those outside as the control group. The DID model is employed to control for the fixed effect of interaction between industrial parks and county-level jurisdictions and the fixed effect of interaction between county-level jurisdictions and time. Given the policy changes on two occasions (abolition and resumption of the benefit sharing mechanism), we conducted an evaluation using the event study approach.

Our model is specified as follows:

$$y_{pct}=\alpha+\sum_{s=-3}^{6}\beta_s Park_c \cdot L_t^s+\lambda_{pc}+\eta_{ct}+\varepsilon_{pct} \quad (2)$$

In equation (2), y_{pct} is the explained variable, which is expressed as the logarithm of the area of transferred industrial, mining and warehousing land plots within or outside the industrial parks in county-level jurisdiction c in year t. α is the intercept term, and $Park_c$ is the dummy variable of industrial park to distinguish between the treatment group and control group in various years. If y_{pct} is the logarithm of the area of transferred industrial, mining and warehousing land plots in county-level jurisdiction c and in year t, $Park_c$=1; otherwise, it is 0. L_t^s is the dummy variable of period s after the policy shock, s=(-3, -2, -1, 0, 1, 2, 3, 4, 5, 6). When observations are in period s, the value of L_t^s is 1; otherwise, it is 0. In the specific regression analysis, we adopt -1 period (2013) as the base period. Also, we have controlled for the fixed effect of interaction λ_{pc} between the industrial park and the county-level jurisdiction to control for potential differences within and beyond industrial parks of the county-level jurisdiction. The fixed effect of interaction η_{ct} between county-level jurisdictions and time is also controlled for. ε_{pct} is the stochastic error term. We adopt the cluster-robust standard error at the county-level jurisdiction.

4. Testing the Effectiveness of Paired Assistance: An Investment Perspective

In this section, we evaluated the effectiveness of paired assistance from an investment perspective. We began by explaining our sample and data sources, followed by an analysis of the impact of paired assistance on manufacturing investment. Next, we conducted parallel trend test, robustness test, and the heterogeneity analyses in distance of paired assistance. We then examined the effects of paired assistance on investments across all sectors and the establishment of subsidiaries. Finally, we analyzed regional economic integration using the social network method.

4.1 Sample and Data Sources

In this section, our data were collected from the industrial and commercial registration data provided by the Dizhi Research Institute and the *China City Statistical Yearbook*. For the industrial and commercial registration data in our baseline regression, we utilized the basic information of enterprises from the above database, the list of company shareholders, and the industry glossary table. We specifically identified the shareholder data of Guangdong-based enterprises. Our sample spans from January 1, 2000 to December 31, 2018. Firstly, we identified enterprises based in Guangdong Province. Secondly, we matched these enterprises with the IDs of invested companies from the list of company shareholders[13]. Lastly, we obtained the industry codes of invested enterprises from the industry glossary table using the matched samples. In this manner, we acquired data on Guangdong-based enterprises and their shareholders. Additionally, we sourced the control variables required for our estimation model from the *China City Statistical Yearbook*.

Next, our data processing was carried out in the following steps:

Firstly, we conducted data cleansing and filling. For enterprises whose location cannot be determined based on their location variable, we extracted their addresses from company names. For

[13] We have excluded the data of natural person shareholders as we aim to measure the connection between enterprises from two localities.

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instance, if an enterprise named "Guangzhou ABC Co., Ltd". has a missing location or is identified as located in "Guangdong Province", we extracted the fields related to the names of prefectural-level cities to confirm that the enterprise is located in Guangzhou City. Enterprises whose location cannot be determined according to their names are simply deleted. Second, we identified observations of invested enterprises located in the prefectural-level cities of the eastern, western and northern regions of Guangdong Province with shareholders located in prefectural-level cities in the PRD region[14]. We have combined each of the nine prefectural-level cities in the PRD region with the 12 prefectural-level cities from the eastern, western and northern regions of Guangdong Province. Thirdly, we have only retained manufacturing data. Fourthly, we have aggregated enterprise-level data at the level of prefectural cities to convert enterprise-level data into data at the level of the combination of prefectural-level cities. In this manner, we have obtained the balanced panel data of 88 combinations[15] of prefectural-level cities for a period of 19 years (from 2000 to 2018) [16]. The descriptive statistics are presented as follows:

Table 1: Descriptive Statistics

	Control group			Treatment group		
	Observations	Mean	SD	Observations	Mean	SD
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Number of investment transactions	1,425	0.55	1.16	247	2.5	4.12
Number of investment transactions (logarithm)	1,425	0.28	0.50	247	0.81	0.87
Per capita general budgetary income (yuan/person)	1,425	985.8	741.84	247	976.3	757.71
Per capita general budgetary spending (yuan/person)	1,425	2,721.16	2,290.03	247	2,867.2	2,417
Number of telephone subscribers/registered population	1,190	0.63	0.28	206	0.58	0.24
Number of hospital beds/10,000 persons	1,419	20.83	8.12	245	20.7	7.86
Freight transportation volume (10,000 tons)	1,296	5,971.86	4,390.54	225	5,948.88	4,368.38

Notes: In the table above, the number of investment transactions refers to the number of manufacturing equity connections for each combination. The number of investment transactions (logarithm) is computed by adding 1 to the number of investment transactions and then taking the logarithm of the result. The remaining variables represent the economic characteristics of prefectural-level cities in the eastern, western, and northern regions of Guangdong Province, which serve as control variables. Notably, the large number of samples in the control group is determined by the data structure. According to Pamela Jakiela (2021), as long as the number of untreated individuals is sufficiently large and the data in the pretreatment period are ample, it can be ensured that the treated individuals will not receive negative weights. Therefore, this design can enhance the precision of the estimator in the two-way fixed effect for the staggered DID method.

4.2 Impact of Paired Assistance on Manufacturing Investment

Regression results obtained from the estimation model (1) using manufacturing investment data are presented in Table 2:

[14] According to the *Notice of the Guangdong Provincial Economic and Trade Commission on the Recognition of Industrial Relocation Parks in Guangdong Province* (Yue Jing Mao Gong Ye [2005] No. 582), the PRD region includes: Guangzhou (excluding Conghua), Shenzhen, Zhuhai, Foshan, Dongguan, Zhongshan and Jiangmen cities, Huizhou's urban districts, Huidong County, Boluo County, Zhaoqing's urban districts, and Gaoyao and Sihui cities. The eastern and western regions include: Shantou, Shanwei, Chaozhou, Jieyang, Zhanjiang, Maoming and Yangjiang cities. The mountainous areas refer to other cities and counties (districts) in the province outside the aforementioned areas. According to the Administrative Measures for Industrial Relocation Parks in Guangdong Province (Yue Jing Xin Yuan Qu [2010] No. 649), the industrial areas of the PRD region include Guangzhou (excluding Conghua City), Shenzhen, Zhuhai, Dongguan, Foshan and Zhongshan cities, Jiangmen's urban districts, Taishan and Heshan cities, Huizhou's urban districts, Boluo County, Zhaoqing's urban districts, and Sihui City. Beneficiary regions of industrial relocation include other prefectural-level cities and districts/counties in the province outside the above-mentioned areas. Therefore, the prefectural-level cities in the PRD in this paper include Guangzhou, Shenzhen, Zhuhai, Foshan, Dongguan, Zhongshan, Jiangmen, Huizhou and Zhaoqing cities.

[15] We obtained 88 rather than 108 combinations because 20 combinations had no investment correlation in each of those years and were thus deleted.

[16] Since not every combination had investment relations between 2000 and 2018, we set the number of investment transactions to be zero for the combinations without investment relations in specific years. We also conducted regression analysis using unbalanced panel data without filling in missing values with zeros, and the results are generally consistent and available upon request.

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Table 2: Impact of Paired Assistance on Manufacturing Investment

	Number of investment transactions		Number of investment transactions (logarithm)	
Variable	(1)	(2)	(3)	(4)
$Treat_{ijt}$	1.459***	1.420***	0.295***	0.288***
	(0.544)	(0.528)	(0.090)	(0.087)
Observations	1,672	1,672	1,672	1,672
R-squared	0.534	0.572	0.552	0.584
Combination FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control variable	NO	YES	NO	YES

Notes: Table 2 presents the regression results of Model (1). The dependent variables in columns (1) and (2) are the numbers of manufacturing investment transactions in each prefectural-level city in the eastern, western, and northern parts of Guangdong Province made by prefectural-level cities in the PRD region, while columns (3) and (4) present the logarithms of these numbers. Columns (1) and (3) show regression results without introducing the control variables. Columns (2) and (4) show regression results after introducing the control variables. All regressions control for the combination fixed effect (Combination FE) and the fixed effect of year (Year FE). Numbers in parentheses are standard errors clustered at the combination level. *P<0.1, ** P<0.05, *** P<0.01.

As shown in Table 2, the establishment of joint industrial parks significantly boosted manufacturing investments in prefectural-level cities in the eastern, western, and northern parts of Guangdong Province by prefectural-level cities from the PRD region. The results remain largely unchanged after introducing the control variables, demonstrating the robustness of the findings. It is important to note that the coefficients may understate the impact of the joint industrial parks, as investment is not the only way manufacturing enterprises are established in these parks. In many cases, enterprises relocate or are deregistered and re-registered elsewhere. Additionally, the PRD region attracts overseas investment to the eastern, western, and northern parts of Guangdong Province. Due to data constraints, we are unable to accurately identify these avenues.

4.3 Parallel Trend Test

One important prerequisite for the DID method to obtain reliable results is that the treatment group and the control group must satisfy the parallel trend hypothesis. To verify this hypothesis and explore the temporal heterogeneity of the policy effects, we specified the following model, referring to the event study approach:

$$y_{ijt} = \alpha + \sum_{s=-5}^{10} \beta_s Treat_{ijt}^{s} + \sum_{k} \gamma_k X_{ji}^{k} \eta_t + \lambda_{ij} + \eta_t + \varepsilon_{ijt} \quad (3)$$

In equation (3), $Treat_{ijt}^{s}$ is the dummy variable of period s after the policy shock, and s=(-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10). When an observation is in period s and city i in the PRD region is in a paired assistance relationship with city j in the eastern, western, or northern part of Guangdong Province, the value of $Treat_{ijt}^{s}$ is 1; otherwise, it is 0. In our regression analysis, we designate the -1 period, i.e., the year before policy initiation, as the base period. We test the temporal change in the policy effect of joint industrial parks by comparing the economic and statistical significance of parameter β_s in the above equation and assess whether Model (1) satisfies the parallel trend hypothesis. If the coefficients of β_{-5}, β_{-4}, β_{-3}, β_{-2} are insignificant, the parallel trend hypothesis is satisfied. Definitions of other variables are consistent with Model (1).

Figure 1 presents our parallel trend chart plotted according to Model (3). We may use Figure 1 to conduct a parallel trend test and dynamic effect analysis of Model (1). In Figure 1, the horizontal axis represents time, the vertical axis is the trend of dependent variables, and the dotted line indicates the 95% confidence interval. If the confidence interval crosses the solid line at 0 on the vertical axis, it indicates no statistically significant difference of the dependent variable between the treatment

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group and the control group for that year. If there is no statistically significant difference between the treatment and control groups during the policy implementation period (i.e., the period where the horizontal axis is 0), we can consider that the parallel trend hypothesis in Model (1) is satisfied. Figure 1 suggests that the parallel trend hypothesis in Model (1) is basically satisfied, and that the baseline conclusions are relatively reliable.

In this paragraph, we analyzed change in the policy effect over time. Figure 1 reveals that compared with the control group, the treatment group shows a significant upward trend of investment transactions in a few years after the establishment of the joint industrial parks, which is significantly positive in certain years. The results in Figure 1 verified the conclusions of Table 2, and demonstrated that there is a certain lag in the effects of the joint industrial park. This lag can be attributed to the following reasons: the time of policy shock is defined as the time of the approval or establishment of an industrial park, which was followed by a certain period of construction and investment promotion before companies moved in and received investment. This process is manifested as a lag of policy effect in the chart.

Bias is likely to arise from the estimation of the estimator of the two-way fixed effect (TWFE) within the staggered DID model. For this reason, we utilized the doubly robust DID estimator with multiple time periods developed by Callaway and Sant'Anna (2021) (Callaway and Sant Difference-in-Differences, CSDID) method, which is based on the double robustness approach to avoid DID estimation error. The core approach is to divide the samples into groups to estimate the treatment effect of different groups and compute the average effect of treatment on the treated (ATT). The principle of this aggregation strategy is to reduce the weight of groups for which bias might exist. The results are shown in Table 3. We discovered that the ATT of the four different types all suggests that the establishment of industrial parks significantly increased manufacturing investments to the prefectural-level cities in the eastern, western and northern parts of Guangdong Province from their paired prefectural-level cities in the PRD region. This finding is consistent with the baseline result, demonstrating the robustness of our conclusions.

To demonstrate the robustness of our results, we conducted a placebo test on the baseline regression results. The basic approach involved randomly setting the treatment group and the timing of the policy shock to check whether the estimated coefficient remains significant. After performing random sampling

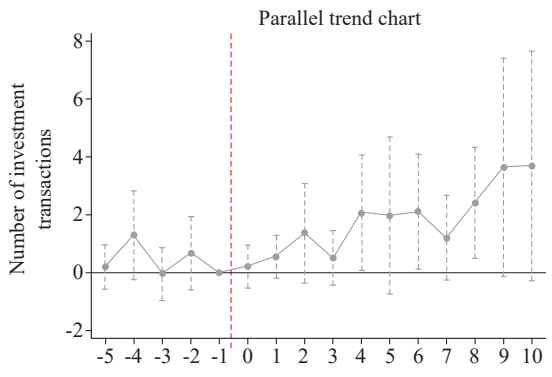

Figure 1: Impact of Paired Assistance on Manufacturing Investment

Notes: Figure 1 plots the dynamic effect of joint industrial parks on the manufacturing investments from the assisting localities to beneficiary localities, and the dependent variable is the number of investment transactions made by the assisting localities to beneficiary localities. Coefficients for various periods in this chart are obtained with estimation model (3). We have controlled for the fixed effects of combination and time with a 95% confidence interval and standard errors clustered at the combination level.

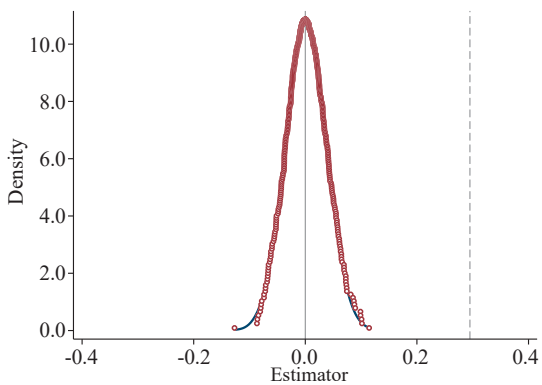

Figure 2: Placebo Test

Note: This figure shows the kernel density distribution of the coefficients obtained from 500 random samples of the treatment group and the timing of the policy shock. The horizontal axis represents the estimated coefficient, and the vertical axis represents the kernel density of the coefficient. The thick line composed of circles represents the kernel density of the coefficients obtained from the 500 random samples. We can see that the simulated estimated coefficient is distributed around zero and follow a normal distribution. The black dashed line is the actual estimated coefficient of 29.5%, which does not intersect with the thick line. This aligns with the expectations of the placebo test.

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Table 3: Impact of Paired Assistance on Manufacturing Investment

	Simple weighted ATT	Dynamic ATT	Calendar time ATT	Group ATT
	(1)	(2)	(3)	(4)
Simple ATT	1.906** (0.777)			
Pre_avg		0.180 (0.109)		
Post_avg		2.879** (1.224)		
CAverage			1.541** (0.656)	
GAverage				1.903*** (0.662)

Notes: Callaway and Sant'Anna (2021) suggest that by selecting different weights, four different types of average treatment effects (ATT) can be calculated. These are: (1) simple weighted ATT: a simple weighted sum with equal weights. (2) Dynamic ATT: the average treatment effect of the weighted sum grouped by the time from the first treatment by distance. (3) Calendar time ATT: the average treatment effect of the weighted sum grouped by normal years. (4) Group ATT: the average treatment effect of the weighted sum grouped by the time of first treatment.

500 times, we found the estimated coefficient to be around zero. Therefore, we consider the baseline regression results to be robust. To illustrate this more clearly, we have plotted the kernel density chart of the estimated coefficient computed over 500 iterations, which is presented in the following chart:

4.4 Heterogeneity Analysis: Impact of the Geographical Distance on the Effectiveness of Paired Assistance

Geographical distance is a major factor in economic exchanges across regions. Longer distances typically involve higher transaction costs, which can compromise the effectiveness of paired assistance. In this section, we use the following heterogeneous DID model to investigate the impact of geographical distance on paired assistance:

$$y_{ijt} = \alpha + \beta_1 Treat_{ijt} + \beta_2 Treat_{ijt} \cdot Distance_{ij} + \sum_k \gamma_k X_{jt}^k \eta_t + \lambda_{ij} + \eta_t + \varepsilon_{ijt} \quad (4)$$

Conventional DID model generally assumes that the treatment effect is homogeneous, i.e., the treatment effect must be the same for all individuals. In heterogeneous DID, we may allow the treatment effect to vary across pairs with different distances. We make this adjustment by introducing variable $Distance_{ij}$, which denotes the geographical distance between city i in the PRD region and city j in the eastern, western or northern part of Guangdong Province, and the rest variables are defined consistently with Model (1). As can be learned from the above equation, for pairs with $Distance_{ij}$=0, their treatment effect is β_1, and for pairs with $Distance_{ij}$>0, their treatment effect is $\beta_1+\beta_2$, where β_2 denotes the impact of distance on the policy effect, and if β_2 is greater than zero, it means that the policy effect is stronger when distance is greater, and vice versa. In order to obtain the best results, we have adopted the following four definitions of the distance variable $Distance_{ij}$, which include: first, distance between the boundaries of two localities, which refers to the shortest straight-line distance between the boundaries of assisting and beneficiary localities. Second, the centroid distance between two localities refers to the straight-long distance between the centroids of the assisting and beneficiary localities. Third, the centroid distance between the beneficiary localities and the PRD region refers to the shortest straight-line distance between the boundary of a beneficiary locality and the centroid of the PRD region. Fourth, the boundary distance between a supported locality and the boundary of the PRD region refers to the shortest straight-line distance between the boundaries of a supported locality the PRD region. In all cases, distance is measured by kilometers. Model (4) is estimated using manufacturing investment data with regression results in Table 4.

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Table 4: Impact of Geographical Distance on Manufacturing Investment

	Number of investment transactions							
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treat_{ijt}$	2.691***	2.522***	3.984***	3.646***	3.026***	2.776**	1.970***	1.836***
	(0.778)	(0.789)	(1.192)	(1.217)	(1.145)	(1.201)	(0.612)	(0.615)
$Treat_{ijt}$*Distance between the boundaries of two localities	-0.011***	-0.009**						
	(0.003)	(0.004)						
$Treat_{ijt}$*Centroid distance between two localities			-0.010***	-0.009**				
			(0.003)	(0.004)				
$Treat_{ijt}$*Centroid distance between beneficiary locality and the PRD region					-0.010**	-0.009		
					(0.005)	(0.005)		
$Treat_{ijt}$*Boundary distance between beneficiary locality and the PRD region							-0.019***	-0.015***
							(0.005)	(0.005)
Observations	1,672	1,672	1,672	1,672	1,672	1,672	1,672	1,672
R-squared	0.544	0.580	0.542	0.579	0.539	0.576	0.540	0.576
	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variable	NO	YES	NO	YES	NO	YES	NO	YES

Notes: Table 4 presents the regression results of Model (4). Among the variables in rows (1) through (4), the boundary distance between two localities refers to the shortest straight-line distance between the boundaries of assisting and beneficiary localities. The centroid distance between two localities refers to the straight-line distance between the centroids of the assisting and beneficiary localities. The boundary distance between the supported locality and the PRD region is the shortest straight-line distance between the boundaries of the supported locality and the PRD region. All distances are measured in kilometers. Odd-numbered columns present regression results without control variables, and even-numbered columns present regression results with control variables. All regressions have controlled for the combination fixed effect (Combination FE) and the time fixed effect (Year FE). Numbers in parentheses are standard errors clustered at the combination level. *P<0.1, **P<0.05, ***P<0.01.

The regression results in Table 4 suggest that distance significantly inhibits the policy effect, and the conclusion is highly robust. For instance, the coefficients in Column (1) indicate that an increase in the distance between two localities by 1 km is associated with a reduction in the policy effect by 0.41%. This means that when the distance between two localities is approximately 200 km, the policy effect is reduced to an extremely low level, and when the distance is about 244 km, the policy effect is almost zero. In summary, geographical distance has a significantly negative impact on the effect of paired assistance. When pairing assisting localities with beneficiary localities, upper-level government needs to consider the distance between them[17].

4.5 Impact of Paired Assistance on Investment and Establishment of Subsidiaries in All Sectors

Most projects established in joint industrial parks have been driven by investments from manufacturing enterprises. However, given the interdependence between manufacturing and other sectors, it is likely that the collaboration has strengthened ties across a broader range of industries.

[17] Geographical distance may not be the only important factor; "administrative distance" and the associated coordination costs can also play a significant role. For instance, in the paired assistance between the PRD region and the eastern, western, and northern parts of Guangdong Province, the Guangdong Provincial Department of Finance acts as a coordination platform for the benefit sharing mechanism. It reviews tax refund quotas, processes tax submissions from various prefectural-level cities in the eastern, western, and northern regions, and refunds those tax revenues to paired cities in the PRD region. The Statistics Bureau of Guangdong Province collects GDP and other economic statistics for the joint industrial parks and distributes them to the supporting and beneficiary localities according to an agreed-upon ratio. The complex coordination required for inter-provincial benefit sharing, due to the relatively long "administrative distance" and high transaction costs, has limited the number and effectiveness of enclave economies. To address this, it is recommended to promote cross-regional administrative cooperation, such as through joint administrative conferences involving the three provinces and one municipality of the PRD region. This would encourage cross-provincial enclave economies and reduce coordination costs.

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This need for enhanced cooperation in various sectors has been reiterated in several policy documents. For example, the Decisions on Accelerating the Development of Mountainous Areas (Yue Fa [2022] No.13) encourages agriculture-related enterprises in the PRD region to partner with leading agricultural enterprises in mountainous areas for agricultural processing and distribution. Similarly, the Fiscal Support Policies of Guangdong Provincial Department of Finance for Supporting Joint Industrial Development between the PRD Region and the Eastern, Western, and Northern Regions of Guangdong Province (Yue Cai Gong [2016] No.384) offers bonuses and allowances to producer services enterprises specializing in R&D, testing and measurement, industrial design, information services, modern finance, and modern logistics. Therefore, in addition to the manufacturing sector, paired assistance is likely to stimulate investment across a broader spectrum of industries.

Using the industrial and commercial registration database, we have screened the investment data for all sectors in Guangdong Province, as well as the data of subsidiaries established in the eastern, western, and northern parts of Guangdong Province by enterprises from the PRD region. In this section, our data treatment method aligns with that used for assessing the impact of paired assistance on manufacturing investment. The key difference is that, instead of focusing solely on manufacturing enterprises, we have included enterprises from all sectors.

Regression results of Model (1) are presented as follows:

Table 5: Impact of Paired Assistance on Investment and Establishment of Subsidiaries in All Sectors

	Number of investment transactions		Number of investment transactions (log)		Number of subsidiaries		Number of subsidiaries (log)	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treat_{it}$	12.728**	12.612**	0.364**	0.353**	10.980*	11.109*	0.509**	0.507**
	(5.203)	(5.184)	(0.143)	(0.137)	(5.792)	(5.802)	(0.214)	(0.208)
Observations	2,033	2,033	2,033	2,033	2,033	2,033	2,033	2,033
R-squared	0.557	0.567	0.792	0.805	0.543	0.550	0.751	0.761
Combination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Control variable	NO	YES	NO	YES	NO	YES	NO	YES

Notes: Table 5 presents the regression results of Model (1). Columns (1) through (4) show the estimated coefficient based on shareholder data across all sectors from 2000 to 2018. Columns (5) through (8) provide the estimated coefficient for the establishment of subsidiaries across all sectors during the same period. The dependent variables in columns (1) and (2) are the number of investment transactions in prefectural-level cities in the eastern, western, and northern parts of Guangdong Province made by various localities in the Pearl River Delta region, with columns (3) and (4) representing their logarithms. In columns (5) and (6), the dependent variables are the numbers of subsidiaries established in prefectural-level cities in the eastern, western, and northern parts of Guangdong Province by companies from various prefectural-level cities in the PRD region, with columns (7) and (8) showing their logarithms. The odd-numbered rows present regression results without control variables, while the even-numbered rows include results with control variables. Our regressions control for the combinations fixed effect (Combination FE) and the year fixed effect (Year FE). Numbers in parentheses are standard errors clustered at the combination level. *P < 0.1, **P < 0.05, ***P < 0.01.

As can be discovered from Table 5, the establishment of the joint industrial parks has a significantly increased investments made and subsidiaries established in the beneficiary localities by the assisting localities across a wide range of sectors. This explains that paired assistance has not only promoted investment in manufacturing enterprises, but played a significantly positive role in promoting business development across all sectors as well. This conclusion is relatively robust with or without the control variables.

4.6 Analysis of Regional Economic Integration Using the Social Network Analysis Method

In this section, we further utilized the social network analysis (SNA) method to examine the issue of regional economic integration. The SNA analysis gained traction since the 1990s as a major

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analytical method for sociological research. Today, its influence has spread to sectors such as politics, management, geology, and economics. Here, the SNA method is employed to measure the level of regional economic integration. Specifically, assisting and beneficiary localities are considered as nodes, and investment relations between two localities are considered as the edge connecting the nodes. The concept of whole network density in the SNA is utilized to assess the level of economic integration in Guangdong Province.

In the directed graph, the following equation is employed to compute the overall network density:

$$\text{Overall network density} = \frac{m}{n(n-1)}$$

In this equation, m is the number of edges, and n is the number of nodes. This equation means the following: the overall network density equals "actual number of relationships" divided by "theoretically maximum number of relationships". Hence, the greater the overall network density, the closer the links are between members of a network. We use manufacturing investment data between prefectural-level cities in Guangdong Province to compute this index. It needs to be noted that based on the equation for the above index, two localities will be considered as having an economic relationship as long as the number of investment transactions between them is greater than zero (the two nodes are considered as connected by an edge). In order to measure investment intensity, we compute the network density under different thresholds of connection. For instance, when the threshold of connection is 1, the two localities will be considered as having an economic relationship if the number of investment transactions between them is greater than zero. If the connection threshold is 5, the two localities will be considered as having an economic relationship only when the number of investment transactions exceeds 5. We have plotted the overall network density charts between 2000 and 2018 under different thresholds.

Figure 3 indicates a significant upward trend in the overall network density over time. Even if the connection threshold increases and the overall network density decreases, the upward trend remains significant. This suggests that the level of economic integration in Guangdong Province has increased, facilitating the integration of supported localities into the development process of the PRD region.

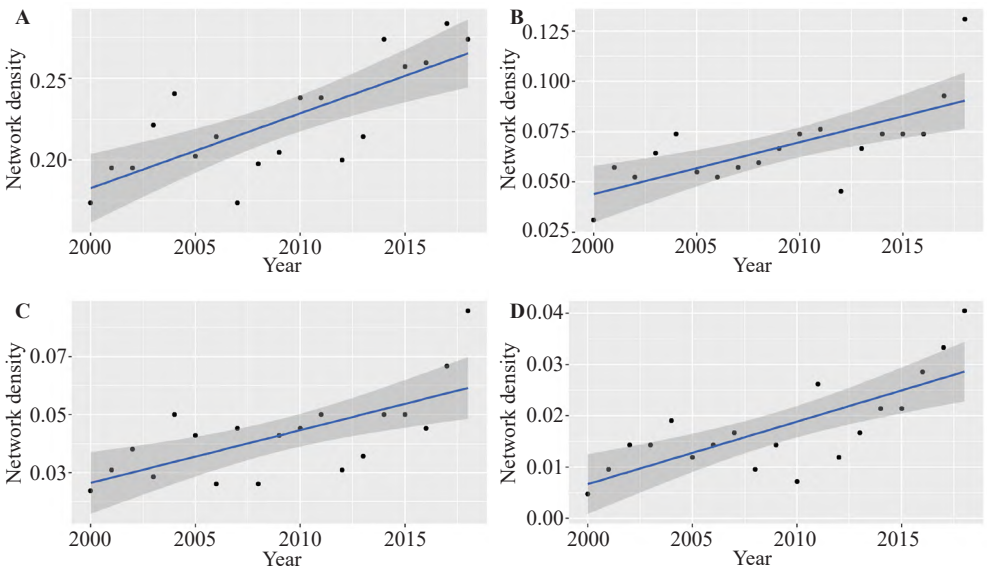

Figure 3: Overall Network Densities under Different Thresholds

Note: Connection thresholds corresponding to A, B, C and D are 1, 3, 5 and 10.

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5. Impact of the Benefit Sharing Mechanism on the Effectiveness of Paired Assistance

This section investigates the effects of the benefit sharing mechanism on paired assistance. We firstly present an explanation of the data sources and treatment, and then verify the effect of the benefit sharing mechanism on land transfers within the joint industrial parks based on the mean chart and the parallel trend chart.

5.1 Data Sources and Processing

Data required for regression in this section include the land transfer data from the China Land Market Network[18] with a sample period between 2011 and 2020, and the samples include prefectural-level cities in the eastern, western and northern parts of Guangdong Province[19].

We made the following data processing: first, we selected the samples of prefectural-level cities in the eastern, western and northern parts of Guangdong Province over the decade between 2011 and 2020. Second, we deleted abnormal data indicating land transfer areas smaller than 0.01 ha. Third, we have divided our samples into 12 categories based on the "land purpose" variable in accordance with the Classification of the Current Status of Land Utilization released by the National Standardization Management Committee, and deleted land transfer data other than industrial, mining and warehousing land use, which is conducive to the identification of effects of paired assistance considering that most of the projects carried out in the joint industrial parks were industrial projects. Fourth, we deleted observations with administrative appropriation as their mode of land supply based on the following considerations: most land allocations by administrative appropriation between 2011 and 2020 cannot represent the establishment of industrial enterprises because they were acquired from reserved land plots and land plots approved upon the construction of industrial parks and owned by village committees and cooperatives.. Fifth, given the absence of county codes, we extracted the first six digits of the "electronic regulatory codes" variable for observations with missing county codes to supplement such county codes[20]. Sixth, we introduced a dummy variable *park* of whether a land plot is in a joint industrial park. If the "project location" variable includes the "industrial relocation park" field, we assign a value of 1 to this dummy variable; otherwise, it is 0. Seventh, we have deleted counties and districts without any joint industrial parks during the period between 2011 and 2020. Eighth, we have aggregated the areas of land transactions for various years and county-level jurisdictions and based on their location within joint industrial parks. In this manner, we have obtained the panel data within and outside the joint industrial parks between 2011 and 2020.

5.2 Mean Chart and Dynamic Effects

Firstly, we used the mean chart to analyze changes in the absolute land transfer areas of the treatment and control groups. As shown in Figure 4, there was a significant decrease in the land transfer areas for industrial, mining, and warehousing land use between 2014 and 2016, followed by a sharp increase in 2017.

Next, we conducted a regression analysis of Model (2) based on the land transfer data to create a parallel trend chart for observing the dynamic policy effect. According to Figure 5, it can be seen that

[18] China Land Market Network, hosted by the Real Estate Registration Center of the Ministry of Natural Resources, collects land supply and transaction information released by natural resources authorities at all levels. It is a commonly used authoritative data source for research on land transfer issues in China.

[19] Cross-regional investment by enterprises is not used as the primary explained variable for the following reasons: first, such data may lead to a certain degree of underestimation as they do not include cross-regional relocation (deregistration and re-registration elsewhere) and the attraction of overseas investment to beneficiary localities with assistance from supporting localities. Second, land transfer areas reflect the size of projects while there are too many missing values for the investment volume variable of cross-regional corporate investment.

[20] The first six digits of an electronic supervision code are the county code of the area where a land plot is located.

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between 2014 and 2016, the treatment group witnessed a significant reduction in the area of industrial, mining and warehousing land transfers, followed by a sharp increase after 2016 to reach the pre-2014 level. Based on its revocation during 2014 and 2016 and resumption after 2016, we consider that the benefit sharing mechanism has exerted a significantly positive impact on the results of paired assistance. In other words, the distribution of tax revenue and economic indicators may facilitate the attraction of investment transactions to the industrial parks. The abolition of the benefit sharing mechanism discouraged assisting localities from providing assistance to beneficiary localities and weakened the effects of assistance.

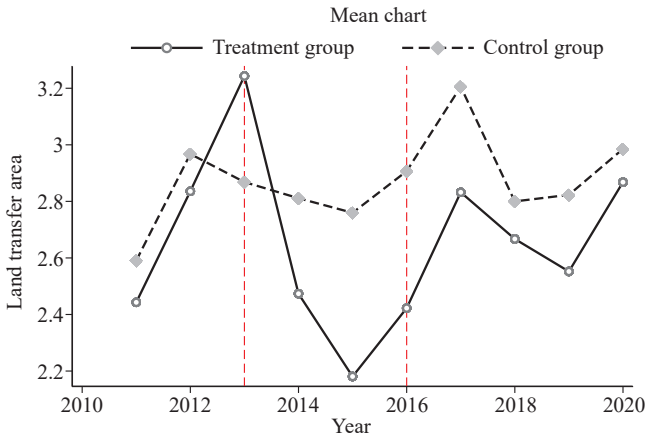

Figure 4: Impact of the Benefit Sharing Mechanism on Land Transfers within Joint Industrial Parks

Note: The samples are land transfer data of the eastern, western and northern parts of Guangdong Province between 2011 and 2020. The dependent variable is the logarithm of land transfer area. The treatment group is the mean values of total land transfer area (logarithm) in the county-level industrial parks in various years, and the control group is the mean value of the total land transfer area (logarithm) and the county-level industrial parks for various years.

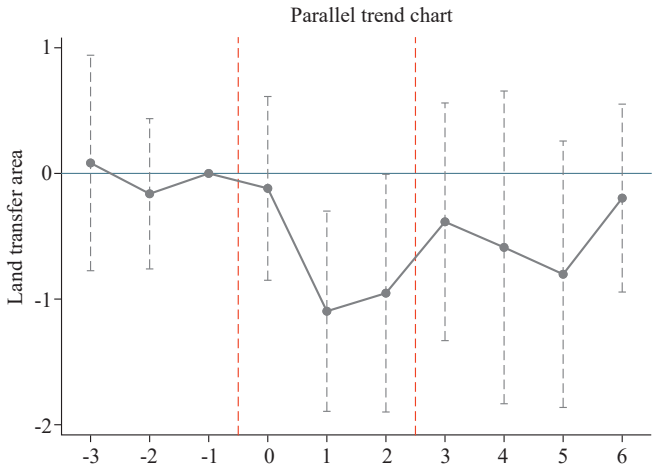

Figure 5: Impact of the Benefit Sharing Mechanism on Land Transfers within Joint Industrial Parks

Notes: Figure 5 presents the estimated results from Model (2), using land transaction data from the eastern, western, and northern regions of Guangdong Province between 2011 and 2020. The dependent variable is the land transfer area logarithm. The base period (-1 period) is 2013. The period between the two dotted lines represents the years when the benefit sharing mechanism was not in place. We controlled for fixed effects of interaction between district/county and year, as well as between industrial parks and district/counties. Standard errors are clustered at the district/county level.

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6. Concluding Remarks

This study examines the mechanisms and effects of the paired assistance policy between China's PRD region and the eastern, western, and northern parts of Guangdong Province, focusing on the impact of the benefit sharing mechanism. Our findings are as follows:

First, the paired assistance policy, implemented through joint industrial parks, fostered cooperation between local governments. This policy greatly boosted manufacturing investments in beneficiary areas from assisting localities and further increased investments across all sectors. It created efficient and sustainable assistance relationships, contributing to economic integration of Guangdong Province and facilitating integration of supported localities into the PRD region.

Second, the benefit sharing mechanism for tax revenue and economic development indicators has been crucial in promoting paired assistance and regional cooperation. We recommend that the government actively explore incentive-compatible paths for coordinated regional development to achieve common prosperity through high-quality development.

Thirdly, heterogeneity analysis indicates that geographical distance has a significant impact on the effects of paired assistance. The shorter the distance between assisting and beneficiary localities, the better the effects of paired assistance. One possible reason is that longer distances make it harder for enterprises from assisting localities to gain information about beneficiary localities, raising uncertainties over investment and the costs of production and coordination after investment. For both governments, longer distances mean higher trade costs.

Fourthly, provincial government coordination has been instrumental in the effective paired assistance within Guangdong Province. Cross-provincial paired assistance, however, is less effective due to higher trade costs and barriers to benefit sharing. When implementing this incentive-compatible paired assistance mechanism nationwide, it is necessary to consider trade costs for inter-regional cooperation. For instance, cross-regional administrative joint meetings and other mechanisms may reduce the costs of cross-regional cooperation, enhance the expected returns of cooperation, and create potential opportunities for balanced regional development.

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