Administrative boundary effects of cross-border migration of manufacturing enterprises: a case study from the Pearl River Delta in China

Xu Wenbo
Affiliation: School of Architecture, Southeast University, Nanjing, China
Email: seuarchxwb@126.com
Zhao Shengbo
Affiliation: School of Architecture, Southeast University, Nanjing, China
Email: shengbo2016@seu.edu.cn

Abstract
This study examines the migration trajectories of 468 representative leading manufacturing enterprises in the Pearl River Delta (PRD) region, aiming to analyze the impact of various administrative boundaries on the relocation and site selection decisions of these enterprises. The analysis focuses on the cross-boundary migration behavior of enterprises at both the inter-prefecture-level city and intra-prefecture-level city levels. The key findings are: (1) Despite the highly contiguous urban development in the PRD region, few enterprises choose to migrate across prefecture-level cities. (2) Driven by cost considerations and the local industrial network, urban boundary areas have become a significant target for enterprise relocation. (3) County/district and street boundaries within cities do not impose constraints on enterprise migration. Instead, intra-prefecture-level city migration is relatively frequent.

Keywords
Administrative boundary, Manufacturing enterprises, Cross-boundary migration, Dynamic mechanism, Pearl River Delta

1 Introduction

Manufacturing industry is a crucial driving force for urban development, and the aggregation and diffusion of manufacturing spaces often play a pivotal role in the evolution of urban and regional spatial patterns. The headquarters of manufacturing enterprises are particularly significant as they exercise critical control and influence over regional industrial chains. Observing the location selection and relocation activities of manufacturing enterprises provides an important perspective for studying the evolution of regional industrial spatial structures. As early as the 1940s, the cross-regional relocation of enterprises in the United States driven by labor costs and competition among enterprises attracted the attention of academics (McLaughlin and Robock, 1949). Evolutionary economic geography pays more attention to the study of industrial clusters and enterprise dynamics (Cooke and Morgan, 1998), focusing on analyzing the historical evolution of the spatial distribution of economic activities, especially emphasizing the "dynamic", "historical inheritance", and "synergy" of this process (He et al., 2014). Neoclassical economic theory argues that enterprises seek to locate in areas that maximize expected profits, which is the primary driver of relocation (Nakosteen and Zimmer, 1987). It is often observed in research that the advantages of headquarters agglomeration drive enterprises to relocate their headquarters to a few central cities (Holloway and Wheeler, 1991), which further strengthens the agglomeration advantages of enterprise headquarters (Klier, 2006; Wu and Ning, 2010).

For different types of enterprises, academics have explored various perspectives on their relocation patterns. For cross-border manufacturing enterprises, clustering factors, innovation factors, and enterprise heterogeneity characteristics are key factors influencing their location choices (Ye et al., 2019). For Chinese state-owned enterprises, institutional factors still play a dominant role (Wang et al., 2021), and tend to be strengthened. Institutional embeddedness can significantly promote enterprise relocation (Long et al., 2020). High-tech enterprises tend to relocate nearby and prefer to move into existing technology parks or headquarters agglomeration areas (Zhang and Zhang, 2022). Case studies of Japanese and Taiwanese enterprises in China show that cultural factors are also important in influencing enterprise location choices (Chang et al., 2010). Additionally, regional ecological benefits and government regulations on environmental protection are also among the important factors affecting enterprise relocation (Chen et al., 2019). It is evident that for different types of enterprises in different regions, the factors influencing their relocation are often complex and diverse.

On one hand, with the rapid development of information technology, the theory of regional network spatial structure represented by "space of flows" (Castells M, 1989) (Sassen, 1998; Hall, 1999) is increasingly being applied to analyze the emerging phenomenon of "Mega-City Regions." It is generally believed that within mega-city regions, as infrastructure continues to iterate and cross-border infrastructure (highways, subways, high-speed railways) is continuously constructed, the hindrance effect of administrative boundaries begins to dissipate. This allows for effective flows of population, industry, and capital between regions, leading to the formation of various functional agglomeration spaces during the process of these flows (Yuan et al., 2023). Existing research has observed a high frequency of flows of various factors within the Guangdong-Hong Kong-Macao Greater Bay Area. It is believed that boundary effects will significantly decrease, promoting rapid growth in cross-city border areas and forming a high-density industrial functional network (Li et al., 2018). In the "highly integrated and mobile" functional network of the Greater Bay Area (Fang et al., 2022), enterprise relocation is undoubtedly an important way for the agglomeration and diffusion of industrial functional elements. On one hand, the functional connections of spatial organizations between subsidiaries and headquarters within enterprises significantly promote the network density of the PRD, enhancing the overall functional polycentricity of the metropolitan area and simultaneously greatly increasing the agglomeration function intensity of cross-city enterprises. On the other hand, the distribution of enterprise headquarters exhibits a certain degree of heterogeneity, not entirely concentrated in the main urban areas of Guangzhou and Shenzhen. The agglomeration function intensity of headquarters in the Guangzhou-Shenzhen corridor, especially in areas near Shenzhen such as Longgang and Bao'an, has significantly increased (Zhao et al., 2021).

On the other hand, the significant impact of administrative divisions and administrative boundaries on regional economic development, enterprise location selection, and relocation has been verified in numerous studies. Although administrative boundaries are non-physical, they can cause discontinuities between regions through boundary effects, leading to regional inequality (Zheng, 2023). In Chinese geographical and planning research, "administrative region economy" is believed to have originated from the central government delegating economic development authority to local governments since the reform and opening up, greatly enhancing the enthusiasm of local governments to develop local economies (Sun et al., 2020), and forming a distinctive "local corporatism" (Jiang et al., 1996). The "institutional distance" between administrative regions is believed to deeply affect regional economic integration, indicating that local governments compete more for capital elements than for labor, establishing obvious institutional spatial boundaries and administrative barriers (Wang et al., 2023). The special environment of China's economic transformation has created substantial differences in political resources possessed by governments at different regions and levels. Private enterprises have to consider the location decision of their headquarters under the guidance of strategic thinking in pursuing political resources (Wan, 2009). For resource-based enterprises, among the four factors that influence enterprise relocation - policy, economy, strategy, and sentiment - government policy factors have the most significant impact on the relocation of resource-based enterprises (Li, 2015).

Based on this, the following hypotheses are proposed in this study: Under the conditions of highly contiguous development of physical space and high-frequency flow of industrial factors in the Guangdong-Hong Kong-Macao Greater Bay Area, the administrative boundaries, in general, would not have a significant impact on the migration of enterprises' partial functions, such as the cross-prefecture-level city layout of subsidiaries and branches. However, does it still have a certain effect on the relocation of corporate headquarters? If the administrative boundary has no impact on the relocation of corporate headquarters, what kind of spatial pattern should the relocation of corporate headquarters in the Greater Bay Area exhibit? If there is a certain impact, what is the mechanism of this administrative boundary's effect, and how does it occur?

2 Data and Methodology

2.1 Study area and data

The research area of this study comprises nine cities at or above the prefecture-level in the PRD region, specifically including Shenzhen, Dongguan, Huizhou, Guangzhou, Foshan, Zhaoqing, Zhuhai, Zhongshan, and Jiangmen. The spatial identification precision of corporate headquarters locations is at the level of subdistrict/township, with a total of 604 spatial units. The research focuses on the 468 enterprises listed in the "Top 500 Guangdong Manufacturing Enterprises 2022" jointly released by Guangdong Enterprise Confederation and Guangdong Entrepreneurs Association, which are located within the aforementioned research scope. Through the use of business registration change information data from websites such as *Tianyancha* and *Qichacha*, the author retrieved the address change information of the enterprises since their establishment, excluded duplicate change data in terms of actual geographical location, and recorded the spatial migration of these enterprises. Additionally, information such as the city of operation, establishment time, and industry type of these enterprises was also collected.

Due to the significant time span of the sample enterprises' establishment, ranging from the

1980s to 2016 (131 enterprises were established before 2000, 249 between 2000 and 2010, and 88 after 2010), it is difficult to conduct standardized analysis of each enterprise based on a unified time frame. To reflect the overall trend characteristics, the study focuses on the migration trajectories of enterprises since 2000 (for enterprises established after 2000, the sub-district address where they were located at the time of establishment is selected). This time span of over 20 years can stably reflect the development status and spatial migration demands of the enterprises, considering that the average lifespan of manufacturing enterprises is only about 10 years, and the probability of demise significantly decreases for enterprises that have survived for more than 20 years (Xie, 2018).

2.2 Methodology

Social network analysis is a crucial research method in new economic sociology, focusing on studying social phenomena and structures from the perspective of "relationships." In recent years, it has also been widely used to measure economic and industrial relationships between spatial locations (Hou et al., 2009; Huang et al., 2023). This paper primarily employs social network analysis methodology and the network analysis functions of UCINET to measure and analyze the migration network of manufacturing corporate headquarters in the PRD region.

In the study, the addresses of the enterprises are standardized to the centroid of the respective sub-districts to facilitate a better analysis of the spatial connections between sub-district units. Based on the frequency of enterprise migrations between sub-district spatial units, a corporate migration network is established for the 604 sub-district spatial units in the PRD to study the degree of connection and network structural characteristics between different spatial regions. In the social network, enterprise migrations between spatial units are considered as a type of connection, and Gephi is used to visualize the network map and identify the strength of connections between various subgroups.

3 Multiscale characteristics of cross-border migration of enterprises

3.1The distribution of enterprise migration samples

Based on the statistical analysis of the migration trajectories of the 468 sample enterprises in this study since 2000, the data reveals the following patterns: (1) Only one enterprise underwent cross-provincial migration, specifically from Zhejiang Province to Guangdong Province. (2) There were only three enterprises that migrated across different prefecture-level cities. (3) Eighty-four enterprises migrated across different urban districts within the same city. (4) Eighty-six enterprises migrated across different sub-districts within the same urban district. (5) One hundred and twenty-one enterprises migrated within the same sub-district. (6) One hundred and seventy-three enterprises never underwent any migration.

The data suggests that most migrations occur within the same city or urban district, indicating a relatively localized pattern of corporate relocation in the PRD region. Cross-provincial and cross-city migrations are relatively rare, reflecting the concentration of economic activities and the attractiveness of the local environment for manufacturing enterprises.

Tab.1 Types and quantities of enterprise migration

Types	Number of enterprises	Proportion (%)
Inter provincial migration	1	0.2
Migration across prefecture level cities	3	0.6
Inter district migration within the city	84	17.9
Same district relocation within the city (excluding sub-district relocation)	86	18.4
Internal relocation within sub-district	121	25.9
No migration	173	37.0
Total	468	100

In this study, non-relocated enterprises and enterprises that only migrated in a sub-district are regarded as spatially stable manufacturing factors, and then we can observe which areas are more conducive to the long-term stability of manufacturing enterprises. By sorting out the distribution of 293 qualified enterprises, it can be seen that the stable manufacturing area in the PRD region mainly includes 7 sectors: Shenzhen Nanshan-Guangming sector, Zhuhai Jinwan-Doumen sector, Zhuhai-Zhongshan boundary sector, Dongguan east sector, West of Dongguan City-Guangzhou Nansha sector, Foshan Shunde sector, Foshan Nanhai-Sanshui sector.

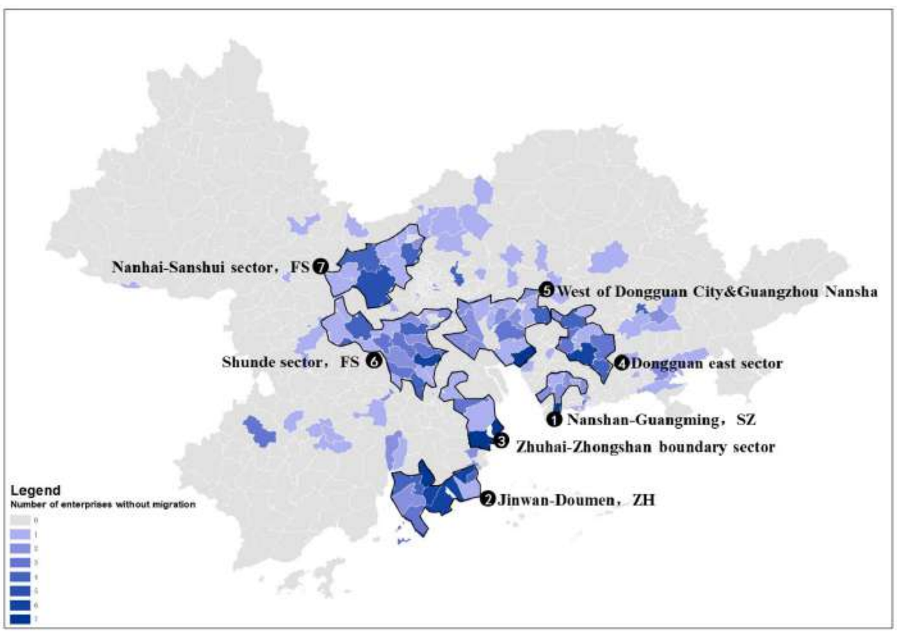

Fig.1 Distribution map of enterprises without migration and migrated over short distances

As above, by analyzing the places where 174 cross-sub-district migration enterprises have moved in and out, it is possible to analyze which regions are losing manufacturing and which are strengthening. The analysis shows that most of the headquarters of manufacturing enterprises moved out of the central areas of cities, such as Futian District, Shenzhen, Xiangzhou District, Zhuhai City, and Chancheng District, Foshan City. The places where enterprises move in are relatively scattered. On the one hand, the suburbs of cities are an important direction for the proliferation of manufacturing headquarters. The concentrated areas include Doumen District of Zhuhai City, Guangming District of Shenzhen City, and Sanshui District of Foshan City. On the other hand, in Shenzhen, there is also a tendency for the headquarters of manufacturing enterprises to further gather in the central area of the city, such as Yuehai sub-district in Nanshan District and Xin'an sub-district in Baoan District.

Overall, the migration frequency of leading enterprises in the PRD region is relatively low, failing to form a dense and complex migration network within the region. Instead, they have maintained overall stability. The scope of enterprise migration is primarily confined to within the administrative jurisdictions of prefecture-level cities, rarely breaching administrative boundaries. Among these, Shenzhen, Zhuhai, and Foshan are key cities with relatively active enterprise migration. While the networks between these cities exhibit geographical proximity, they lack correlation.

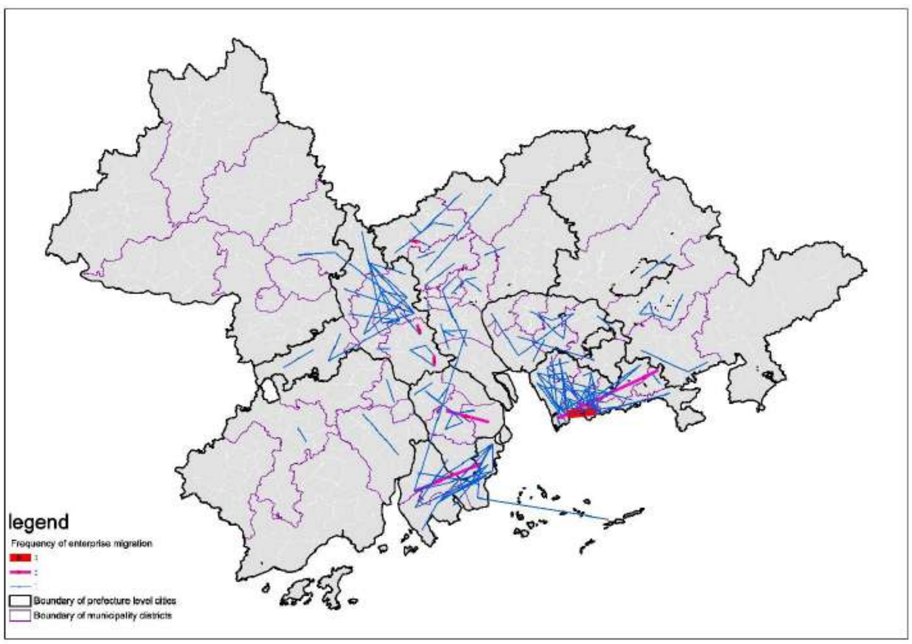

Fig.2 The migration trajectory of enterprises and the administrative boundaries of prefecture level cities and municipal districts

3.1Migration network of enterprises across prefecture level cities

As mentioned above, the spatial migration network of corporate headquarters in the PRD region exhibits a high degree of "unitization." Specifically, enterprises tend to exhibit high-frequency migration within the administrative jurisdictions of prefecture-level cities, while cross-city networks have not formed, demonstrating a significant administrative boundary effect. Applying social network analysis to observe the spatial migration networks of enterprises in each city, it can be found that the enterprise migration networks in the PRD region can be broadly classified into the following types:

(1) High-frequency - Networked: This category includes Shenzhen and Zhuhai. It is characterized by frequent migrations of enterprises within the city, exhibiting relatively complex spatial network features. Notably, some sub-districts have formed significant clusters of enterprises, and these sub-districts serve as the core of the city's enterprise migration network. For example, Yuehai Sub-district, Nanshan Sub-district, and Xixiang Sub-district in Shenzhen, and Nanping Sub-district, Hongqi Sub-district, and Tangjiawan Sub-district in Zhuhai.

(2) High-frequency - Discrete: This group comprises Guangzhou, Foshan, Dongguan, and Zhongshan. These cities exhibit a certain level of activity in enterprise migrations within their respective domains, but they have not formed spatial networks. From the perspective of spatial connections, there are numerous subgroups of spatial units that form migration relationships, but they are disconnected from each other, failing to form highly concentrated enterprise clusters within sub-districts as seen in Shenzhen.

(3) Low-frequency - Discrete: This category includes Huizhou, Jiangmen, and Zhaoqing. These cities have a low level of activity in enterprise migrations within their administrative boundaries, with only a small number of migrations, let alone the formation of dense spatial networks. One of the objective reasons for this is that their economic development base is relatively weak, resulting in a lower number of enterprises within their domains.

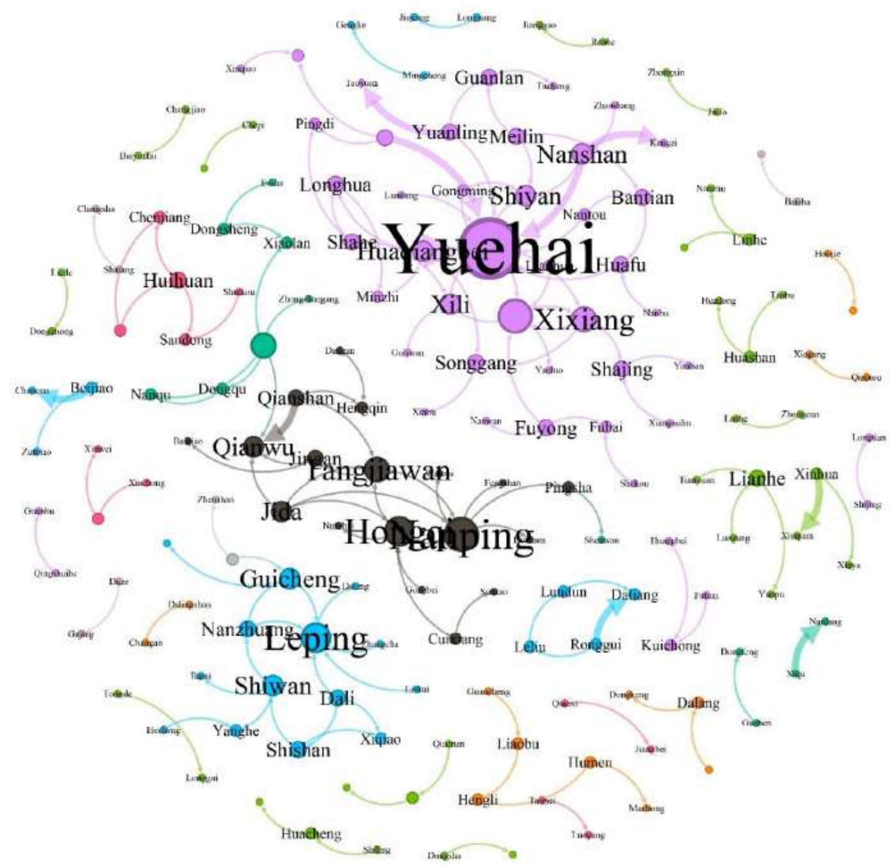

Fig.3 Spatial Network of Enterprise Migration in 9 Cities of the PRD

3.2 Internal enterprise migration network within prefecture level cities

Due to the high degree of typicality of Shenzhen's enterprise migration network within the PRD region, Shenzhen serves as an exemplary case to analyze whether the administrative boundaries of municipalities and sub-districts can play a role in enterprise migration. To investigate this issue, this study utilizes social network analysis to cluster the spatial migration relationships of enterprises within Shenzhen. It is found that sub-district boundaries and municipal district boundaries have a significant limiting effect on enterprise migration in Shenzhen. From the perspective of overall spatial relationships, enterprises in various municipal districts have high-frequency migration relationships, making it difficult to form distinct spatial subgroups based on municipal districts in the network structure. This phenomenon is significantly different from the network relationships across prefecture-level cities. Among sub-districts, enterprise migration seems to be more of a norm, with a high frequency of migrations between enterprises located in Nanshan, Yuehai, Xili, Huaqiangbei, Shatou, and other districts belonging to different municipal districts.

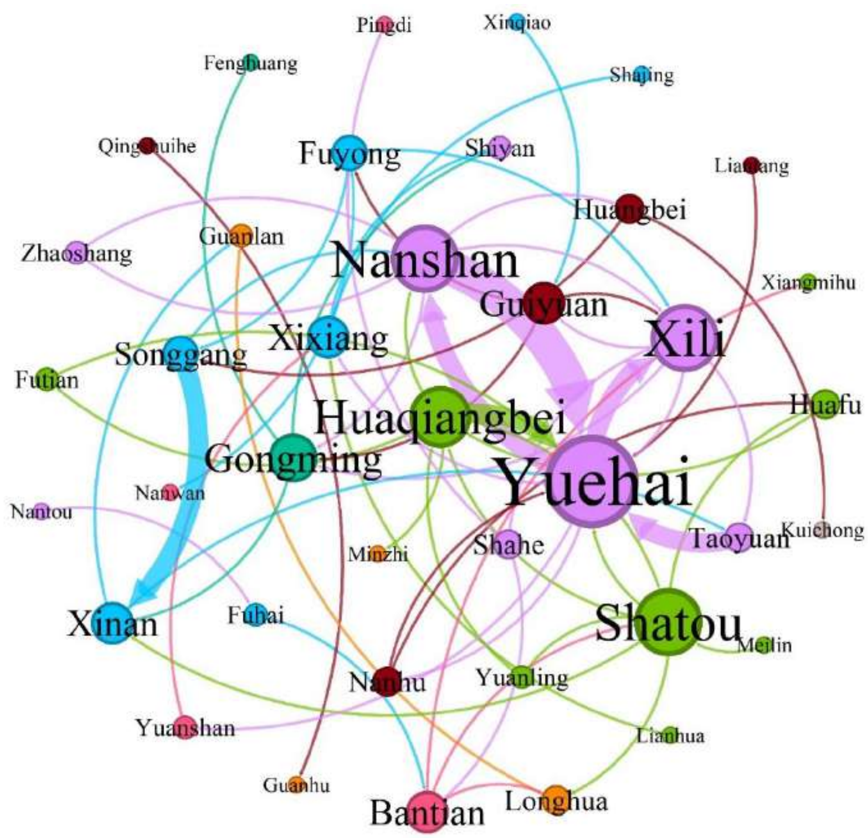

Fig. 4 Spatial Network of Enterprise Migration in Shenzhen City

4 The spatial agglomeration of enterprises in typical border areas

4.1 Characteristics of Enterprise Headquarters Agglomeration in Border Areas

In general, there is a clear trend of manufacturing enterprise headquarters relocating from central urban areas to outer suburban areas. Except for a few areas such as Yuehai Sub-district in Shenzhen, manufacturing enterprise headquarters in the central urban areas of Shenzhen, Guangzhou, Zhuhai, and other cities have experienced significant losses. Correspondingly, the outer suburbs, or urban fringe areas, have become the primary destination for manufacturing enterprise relocations.

This study also employed the standard deviational ellipse (SDE) tool to analyze whether there is a clear directionality in the overall migration patterns of manufacturing enterprise headquarters in various cities. The analysis results reveal significant differences in the distribution of manufacturing enterprise headquarters across cities.

(1) In the Shenzhen-Dongguan-Huizhou region, Shenzhen's manufacturing enterprises exhibit a clear trend of spatial diffusion and northward movement. The dispersion of enterprises in Dongguan remains stable but there is an overall southward movement. Meanwhile, enterprises in Huizhou tend to move closer to Dongguan and Shenzhen. Overall, there is a clear trend of manufacturing enterprise headquarters relocating from the central areas of their respective cities to cluster in the boundary regions of Shenzhen, Dongguan, and Huizhou.

(2) In the Guangzhou-Foshan-Zhaoqing region, the distribution of enterprises in Guangzhou remains generally stable. In Foshan, enterprises have relocated from towns and sub-districts near the Guangzhou-Foshan boundary to more distant areas, resulting in increased dispersion. While the sample size of enterprises in Zhaoqing is small, there is also a tendency for them to migrate to more peripheral areas.

(3) In the Zhuhai-Zhongshan-Jiangmen region, enterprises in Zhuhai tend to migrate from central districts such as Gongbei and Xiangzhou to peripheral areas near ports like Doumen and Jinwan, with an increased concentration of enterprises. In Zhongshan, there is a clear trend of diffusion in the enterprise distribution, with a noticeable concentration towards areas adjacent to Zhuhai. The sample size of enterprises in Jiangmen is small, and the overall change in distribution characteristics is not significant.

(4) Overall, there is a significant clustering of enterprise headquarters along the Shenzhen-Dongguan, Shenzhen-Huizhou, and Zhuhai-Zhongshan boundaries. Although enterprises are relocating from central urban areas to outer suburban areas, they are not crossing administrative boundaries, completing address changes within their respective administrative jurisdictions.

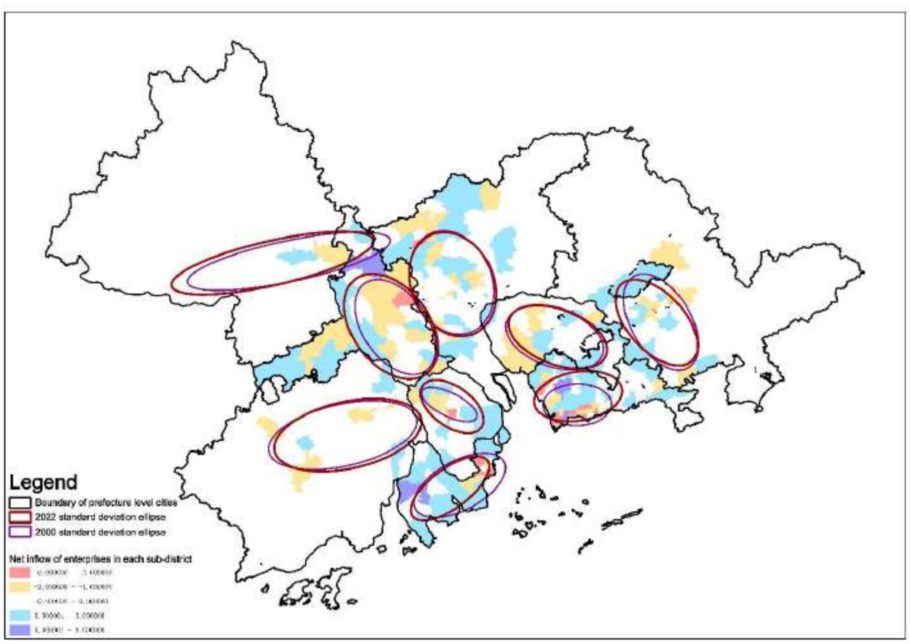

Fig.5 Elliptical Analysis of the Distribution Standard Deviation of Manufacturing Enterprises in Various Cities of the PRD

Tab.2 Standard deviation ellipse analysis of the distribution pattern evolution of manufacturing enterprises in various cities

region	Distribution of enterprise start-up			Distribution of mature enterprises		
	XStdDist	YStdDist	Rotation	XStdDist	YStdDist	Rotation
Shenzhen	0.170	0.104	88.784	0.221	0.121	80.314
Dongguan	0.252	0.143	109.204	0.257	0.137	110.83
Huizhou	0.148	0.264	149.107	0.142	0.258	137.466
Guangzhou	0.200	0.265	158.766	0.205	0.267	156.156
Foshan	0.161	0.265	144.918	0.190	0.294	143.150
Zhaoqing	0.514	0.102	78.125	0.513	0.110	77.252
Zhuhai	0.249	0.122	61.613	0.231	0.098	53.066
Zhongshan	0.151	0.059	116.348	0.179	0.099	125.589
Jiangmen	0.377	0.154	77.311	0.372	0.166	77.580

4.2 Case analysis of typical border areas

4.2.1 Shenzhen-Huizhou Border: Unilateral Agglomeration Driven by Shenzhen Enterprise Spillovers

Shenzhen, with its robust industrial innovation foundation, boasts the largest number and highest quality of manufacturing enterprise headquarters in the PRD region. In recent years, due to the continuously rising costs of land and other factors in the central urban area, relocating to lower-cost suburbs has become an important choice for manufacturing enterprises to maintain their competitiveness. Among these destinations, the border areas of Shenzhen, Dongguan, and Huizhou are significant migration hubs. However, it is noteworthy that most of the manufacturing enterprises relocating to this border area originate from the central urban area of Shenzhen, while there is a limited influx of enterprises from Huizhou and Dongguan.

To promote coordinated development among the three cities, around 2010, the idea of constructing an industrial cooperation demonstration zone in the border area was proposed. This initiative aimed to leverage the respective advantages of the three cities and jointly develop competitive industrial park platforms. However, since the concept remained at the level of overall planning without establishing a cross-regional development mechanism for benefit sharing and balancing, the progress of the cross-administrative cooperation platform was sluggish.

Huizhou hopes to rely on the growth poles of Shenzhen and Dongguan to drive its manufacturing development and maximize its land resource advantages. However, it also worries about losing control over land use. Similarly, Dongguan has concerns about its dominant role in developing this area and the associated land interests, leading to a lack of proactive cooperation. Ultimately, the "Pingxinqing" cooperation zone was shelved due to difficulties in balancing the interests of the three parties, difficulties in coordination, and the inability to break through institutional barriers. Shenzhen had to build an industrial park called "Shenzhen International Low-Carbon City" within its own jurisdiction. This kind of cross-boundary conflict over interest coordination undoubtedly plays a significant role in Shenzhen's unilateral transfer of industries to border areas.

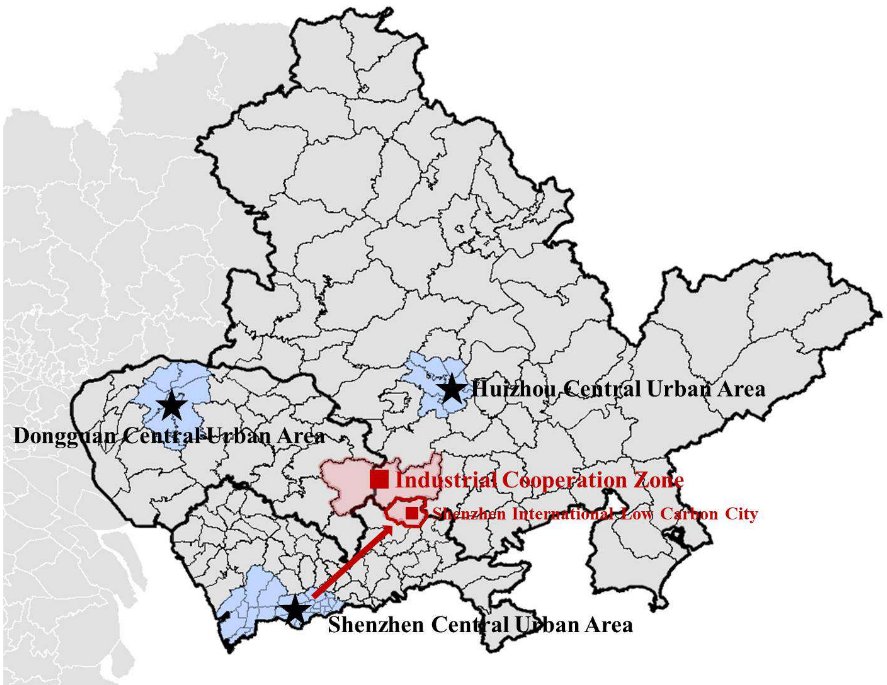

Fig.6 Distribution of industrial platforms in the cross-border areas of Shenzhen, Dongguan, and Huizhou

4.2.2 Zhuhai Zhongshan Border: Enterprise Agglomeration Driven by High Level Platforms

Compared to the difficulties encountered by Shenzhen, Dongguan, and Huizhou in coordinating development in their border areas, the border region between Zhuhai and Zhongshan has developed a significantly different spatial pattern. In Zhuhai, some enterprises have spontaneously relocated from the land-saturated central urban area to the Zhuhai High-tech Industrial Development Zone. Similarly, in Zhongshan, numerous enterprises have shifted from the central urban area and other towns to the coastal Cuiheng New Area in the east. Under the joint promotion of these two forces, a contiguous emerging industrial cluster has taken shape in the border area between Zhuhai and Zhongshan. While the two cities have not formulated significant planning schemes or joint agreements for the border region, this emerging industrial hub is still accelerating its formation.

The key factors behind this difference lie in the geographical conditions and economic development levels of the region compared to the Shenzhen-Dongguan-Huizhou border. Firstly, Zhuhai and Zhongshan have smaller municipal areas, and their border areas are closer to the central urban districts, making it more convenient for enterprises to change their business locations. Secondly, although the governments of the two cities have not jointly formulated plans or issued relevant policies, they have reached a consensus on the key direction of regional development under the guidance of higher-level planning. Both cities have identified the Pearl River Estuary region as a potential area for future development and have established high-level industrial development support platforms, which has facilitated the concentration of enterprises in this region.

This example also demonstrates that the industrial park platforms established by local governments are significant driving factors for promoting industrial transfer and the relocation of enterprises. These platforms offer enterprises numerous preferential conditions in terms of land, tax policies, infrastructure, public services, and talent attraction, making them attractive destinations for relocation.

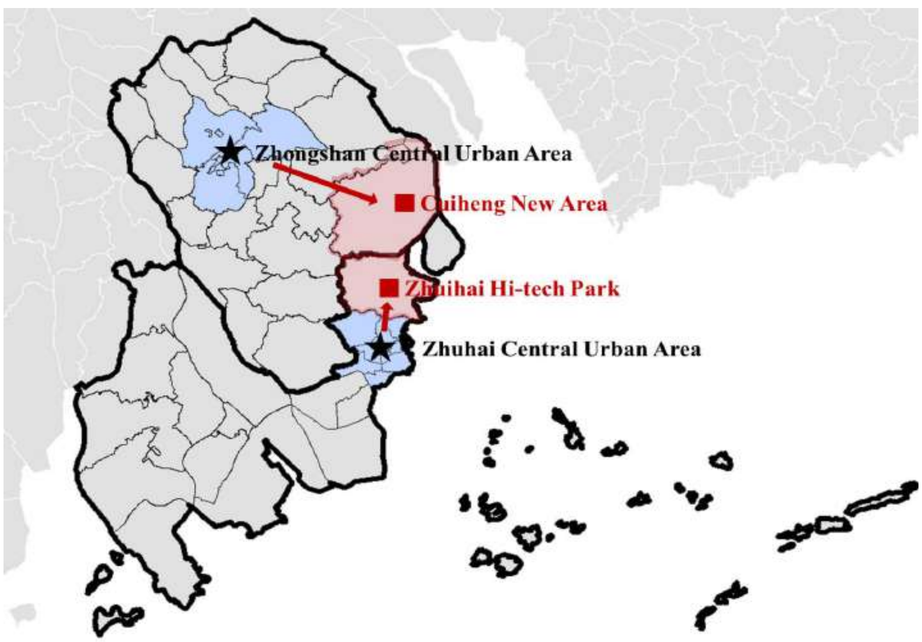

Fig.7 Distribution of Industrial Platforms in Zhuhai Zhongshan Cross border Area

5 Mechanism of Administrative Boundary Effect

This study aims to apply the "Thrust-Traction" model from the field of urbanization research to explain the typical phenomenon of enterprises relocating from central urban areas to outer suburbs without crossing prefecture-level city administrative boundaries, from the perspective of comprehensive cost-benefit analysis.

(1) Under the model of local government corporatism, retaining tax-generating enterprises is crucial for promoting local economic growth. Local governments often adopt various measures to retain enterprises. Governments can offer incentives such as land supply, tax concessions, and infrastructure support to encourage enterprises to develop locally in the long term.

(2) As enterprises develop locally, they form close social network ties with the local production network. These ties include not only explicit connections in the industrial and supply chains, but also localized demands for education, healthcare, and other services for the company's employees. This stable embedded relationship is a significant reason for deterring enterprises from migrating across prefecture-level cities.

(3) Cross-city migration of enterprises may involve significant uncertainty, especially when there are significant differences in the business environment between different cities, which can lead to significant adaptation costs for enterprises in new cities.

For enterprises located in regional central cities, staying local requires paying higher land costs and higher operating costs in terms of energy, labor, and logistics. However, the benefits are also evident: staying in regional central cities ensures continued government support, avoiding the need to re-establish relationships with neighboring city governments, and minimizing disruption to existing business networks. Additionally, there is a risk of losing skilled employees who may not be willing to relocate.

For enterprises in peripheral cities, relocating to regional central cities during the upgrading process to access higher-level business resources and research and development capabilities is a viable option. However, the high operating costs in regional central cities may adversely affect business operations. Furthermore, complete relocation often requires re-establishing government-enterprise relations, and there is significant uncertainty about whether they will receive the same level of support as in their original location. Therefore, relocating to border areas adjacent to regional central cities offers the advantage of more convenient access to information, services, and research and development, while maintaining local cost advantages and "government-enterprise relations" advantages.

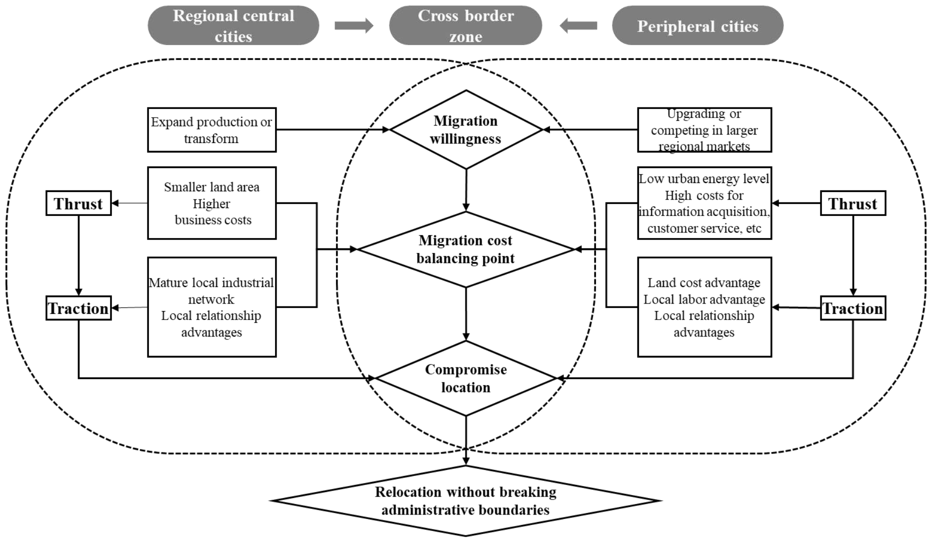

Fig.8 Analysis framework for enterprise migration decisions based on the " Thrust-Traction " model

6 Conclusions and Discussion

The research has shown that while the PRD region has achieved a high level of concentrated development in terms of physical space and the complexity of human, logistics, and information flow networks among cities, there still exists a certain degree of "administrative division barriers" in the relocation of manufacturing enterprise headquarters at the prefecture-level city level. Within prefecture-level cities, however, enterprises exhibit frequent cross-regional migration and mobility without being affected by administrative divisions at the municipal district or sub-district level. This indicates that the phenomenon of "administrative district economy" is primarily manifested at the level of prefecture-level city governments in China, which is consistent with existing research on local corporatism.

From the perspective of the mechanisms of enterprise relocation and site selection, two primary "push-pull" forces determine the migration decisions of enterprises: optimization of operating costs and maintenance of localized networks. From the cost perspective, as the population and functions of central urban areas continue to grow, land prices, energy, transportation, and other operating costs for enterprises inevitably increase, making it difficult to meet the new spatial demands of enterprise transformation and expansion. Therefore, relocation to urban suburban areas with relatively lower costs is a common phenomenon in the development of manufacturing enterprises. Under the sole influence of cost factors, it is a reasonable assumption for enterprises to cross administrative boundaries and relocate to adjacent cities with lower comprehensive costs.

However, enterprise operations are extremely complex systems, and the ability to integrate into the local industrial ecological network is a crucial factor. In China, the government often plays an important supporting role in local industrial development, including but not limited to the supply of industrial land, the formulation of industrial assistance policies, preferential policies for talent recruitment, support for scientific and technological research and development activities, the provision of public service facilities, and urban infrastructure construction. Once an enterprise leaves its original city and relocates to a new location, it will lose its stable government-business relationship that has been cultivated for many years and incur significant costs in adapting to the new environment. Correspondingly, local governments are also reluctant to let local enterprises leave their jurisdictions due to considerations such as tax revenue and employment.

It is important to note that the enterprise relocations discussed in this study are based solely on the registered location of enterprises obtained from the business administration departments. Although this address can generally be considered as the location of the enterprise headquarters, it does not fully reflect the spatial and temporal characteristics of the economic activities of the enterprise. Modern enterprises often have complex organizational structures and operate in multiple locations, often establishing different types of branches or subsidiaries in multiple cities or flexibly leasing office space to meet production needs. A comprehensive review of the spatial distribution and migration characteristics of various functions within enterprises and a re-examination of the comprehensive effects of administrative boundaries will be an important direction for future improvements in this research.

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