

Article

Deciphering the Relationship between Regional Production Factors, Governance, and the Economic Performance of Metropolitan Areas in China

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Abstract: The metropolitan area serves as a vital catalyst for advancing the new urbanization strategy and remains a focal point of current academic research in China. This paper endeavors to explore the developmental mechanisms of China's metropolitan areas, centering on the circulation of regional production factors within these urban conglomerations. Additionally, it introduces the hypothesis of various spatial governance models for these metropolitan areas. Drawing upon theoretical research, the paper substantiates the hypothesis regarding the development mechanisms and spatial governance model of metropolitan areas through several case studies. Finally, we present the principal research findings concerning the development mechanisms and spatial governance models of China's metropolitan areas, along with issues in need of further examination.

Keywords: metropolitan area; spatial governance; mechanism; model



Citation: Yan, J.; Li, Z.; Chen, Y.; Zhang, J.; Nian, S. Deciphering the Relationship between Regional Production Factors, Governance, and the Economic Performance of Metropolitan Areas in China. *Land* **2023**, *12*, 2185. <https://doi.org/10.3390/land12122185>

Academic Editors: Eddie C.M. Hui, Tingting Chen, Xun Li and Wei Lang

Received: 2 November 2023

Revised: 14 December 2023

Accepted: 16 December 2023

Published: 18 December 2023



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1. Introduction

Though China's metropolitan areas have been a subject of interest for both academic communities and governments for several years, they continue to be a prominent research field. This enduring interest can be attributed to China's transition from a pro-growth urbanization stage to the "new-type urbanization" stage. As outlined in the National New Urbanization Plan (2014–2020), urban agglomerations (chengshiqun) and metropolitan areas (dushiquan) are slated to be the primary drivers of China's urbanization. This vision emphasizes that the development of metropolitan areas must go beyond the resource allocation and spatial governance capabilities of individual administrative units [1]. Achieving this necessitates the establishment of innovative regional cooperation mechanisms [2]. Therefore, the development of metropolitan areas demands efficient resource allocation to break down administrative and institutional barriers. In essence, the integration of cross-boundary markets serves as a prerequisite for the coordinated development of metropolitan areas [3], with the flow of economic, cultural, and social factors across administrative boundaries being the key to their growth.

However, China's metropolitan spatial governance is grappling with several new challenges. First, the path dependence established during the era of urban growth supremacism, particularly prior to 2012, has emerged as a hindrance to the progress of metropolitan areas. Many cities continue to prioritize economic growth through spatial expansion, often at the expense of ecological environments, the quality of daily life, and the well-being of residents—the elements essential for high-quality developments. The governance of metropolitan areas needs to struggle to restrain the relentless drive for economic growth by local governments [4]. Second, metropolitan areas exhibit a wide array of economic, social, and developmental disparities, resulting in distinct models of spatial governance for each.

To address the challenges faced by diverse metropolitan areas, it is imperative to scrutinize their development mechanisms, explore the governance models, and propose a range of new spatial strategies.

To fill the gap, this study will explore different governance models for different types of metropolitan areas in China. The study will be organized as follows. First, linking to the literature on the development mechanism of metropolitan area, we will examine the patterns of the development of metropolitan area from the perspectives of multi-scale spatial analysis and spatial evolution, and disclose the internal mechanisms of these developments. Second, based on the research on the development mechanism of metropolitan area, we will propose a research framework for China's metropolitan areas. Third, through a case study of the development of China's metropolitan area, it will further examine the links between the metropolitan areas' development mechanism and spatial governance model. Finally, according to the theoretical and empirical research, findings and further discussions will be presented.

2. Literature Review

2.1. *Deciphering the Mechanism of Metropolitan Area Developments*

The flow of regional production factors, including people, goods, and information, constitutes a critical driver for the development of metropolitan areas. The production, utilization, circulation, and distribution of these factors are intricately connected to the efficiency of metropolitan area development. The examination of the development mechanism of metropolitan areas can be approached from two complementary perspectives: spatial scale and the evolutionary process.

2.1.1. Metropolitan Area Developments from a Scalar Perspective

In accordance with the definitions of metropolitan areas found in the literature, it is affirmed that the metropolitan area transcends being merely a conceptual regional structure; it also represents a functional social entity [5]. This implies that the metropolitan area is not confined to being solely a physical space; it encompasses a social dimension, as well. Even some scholars believe that scale has never been a fixed and given concept, but is constructed by specific social, political, economic, and cultural processes and their relationships [6]. Or rather, from a scalar perspective, there are different levels of analysis in economics, society, and politics [7]. Therefore, the spatial analysis of metropolitan areas should encompass not only physical space, but also extend to social space, economic space, and other relevant dimensions.

On this basis, some scholars have established a scale division into three levels: "global national local" [8]. Some scholars have also established scale levels for the body, home, community, city, region, country, and world [9]. In a sense, this stratification naturally hierarchizes spatial scales [10]. Such hierarchical divisions reflect an orderly order that may be vertical, nested, or relative, such as local, regional, and international.

From the perspective of local spatial scale, the literature emphasizes two primary focal points within metropolitan areas: the spatial configuration of the metropolitan area as a whole and the role of the core city within the metropolitan area. Research on metropolitan morphology predominantly examines the spatial structure within metropolitan areas, encompassing concepts such as Megalopolis, Urban Field, Metropolitan, Metropolitan Region, and Metropolitan Area. Nevertheless, these terms, including Metropolitan, Metropolis, and Megalopolis, often lack precise definitions, creating challenges for scholars researching Metropolitan Regionalization, Metropolis, and Metropolitan Area [11].

Most researches center on the central cities or mega cities within metropolitan areas. As urbanization and metropolitan area development progress, issues such as urban sprawl, ecological concerns, and social governance challenges in metropolitan areas have gained prominence. Although British scholar Geddes and his proponent Mumford agree with the varying degrees of expansion in major European cities, they strongly oppose the emergence of mega cities [12]. Consequently, it has become a consensus in metropolitan area research

to approach the study from a regional perspective. This perspective has given rise to the concepts of Regionalism and New Regionalism, both aimed at addressing the issues faced by metropolitan areas. However, Regionalism leans toward establishing a singular metropolitan government, while New Regionalism favors governing the metropolitan area through the establishment of consultative mechanisms. It places significant emphasis on government cooperation and collaboration between governmental and non-governmental organizations. New Regionalism prioritizes cooperative and coordinated mechanisms over the pursuit of a unified metropolitan government and management organization [4]. This theoretical perspective has evolved into a crucial cornerstone in the governance of regional spatial scales within metropolitan areas.

From the perspective of regional spatial scale, the metropolitan area transcends being solely an urban form; it encompasses a broader relationship encompassing cities, towns, rural areas, and the environment. This approach avoids the limitations associated with isolated studies of individual metropolitan areas by investigating cities and towns within the metropolitan area from a regional scale. This method has progressively extended its focus to encompass the social, economic, ecological, and environmental dimensions of metropolitan areas. Later, New Regionalism emerged in the 1990s, which advocates for enhanced cooperation and management across a wide spectrum of metropolitan areas, exhibiting a more inclusive approach than traditional Regionalism [13]. It places emphasis on regional characteristics and various social issues, advocating for development goals that integrate social equity, environmental protection, and economic growth. New Regionalism prioritizes material planning and close coordination between different levels of material planning and social and economic development planning [14]. It underscores the importance of respecting the reasonable demands of various cities and local governments during the governance process, which encourage various stakeholders to voice their demands and engage in negotiations to gradually reach consensus [15].

In China, research on metropolitan areas has been significantly influenced by Regionalism. Scholars such as Jiatai Song, who introduced the term “Urban Agglomeration” to China, Hongjun Yu and Gonghao Cui who focused on the study of Megalopolis, and Shimou Yao, who localized the concept of Urban Agglomeration in China, among others, based their research on the principles of Regionalism. They laid the foundational research basis for Chinese urban agglomeration, and this approach has been widely adopted by subsequent Chinese scholars [16–19]. In 1966, Peter G. Hall has introduced the concept of world cities [20], and later proposed Mega-City Region theory in 2006 [21], which has established a vital foundation for the quantitative examination of urban spatial networks [22]. Against the backdrop of economic globalization, John Friedmann extended the study of urban spatial networks by incorporating the global strategic behaviors of multinational corporations. He contends that the developmental imbalances have driven the concentration of wealth and resources in world cities [23]. This observation underscores the fact that the distribution, flow, and reorganization of elements on a global spatial scale significantly influence the development of metropolitan areas.

2.1.2. Metropolitan Area Developments from an Evolutionary Perspective

These various forms of metropolitan areas at different spatial scales also mirror the distinct developmental stages through which metropolitan areas upgrade. The metropolitan area is not a static, multi-scale urban spatial structure; rather, it represents a dynamic spatial development process. This dynamic spatial development process, in turn, illustrates the evolutionary mechanism of metropolitan areas. First, we can approach the study of metropolitan area space at a particular stage from a static standpoint. In this context, the spatial changes in the distribution of metropolitan area elements can be comprehended as a form of spatial interaction. Edward Louis Ullman is widely recognized as one of the foundational contributors to the theory of spatial interaction. Ullman systematically outlined three fundamental principles underpinning spatial interaction: complementarity,

transferability, and intervening opportunity [24]. These three characteristics reveal the pivotal role of various factor circulations in the development of metropolitan areas.

In accordance with the theory of “flow space”, globalization and informatization have transformed the way humans perceive the world. Flow can transmit and interact between cities in the form of people, goods, capital, technology, and information (Figure 1), thus giving rise to an extensive spatial network with cities serving as nodes [25]. Therefore, it becomes evident that in the process of economic globalization and regional integration, metropolitan areas anchored by major cities emerge as new economic development centers [26].

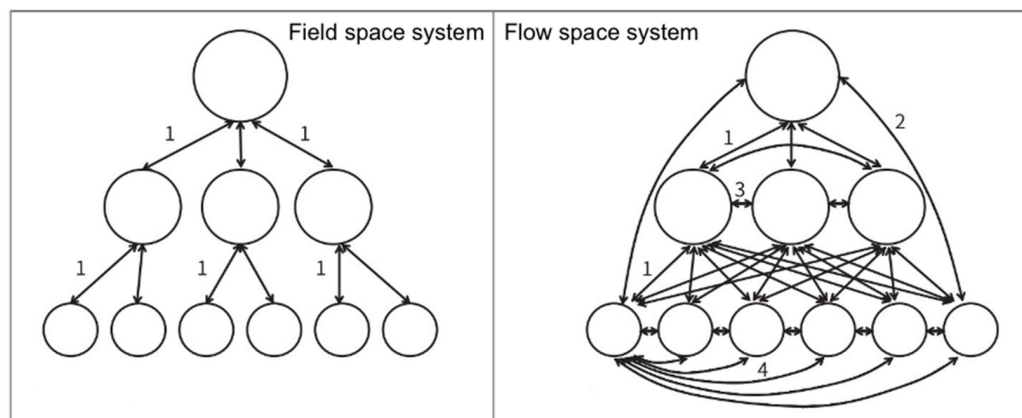


Figure 1. Analysis of field space system and flow space system. Source: Qin Jing 2022 [27].

Second, we should shed light upon the dynamic aspect of the spatial development process of metropolitan areas. The previously mentioned multi-scale nature of metropolitan areas signifies disparities in their developmental stages, spatial compositions, and even the evolutionary mechanisms and trajectories. If we view the metropolitan area as the process of interaction involving the polarization, expansion, and reconstruction of various production factors within a specific space, then this interaction process forms the trajectory of metropolitan area development.

In the late 1990s, economic geographers began to introduce the basic theory of evolutionary economics into their research, explore the historical evolution law of regional economic activities, and gradually build the basic theoretical framework of evolutionary economic geography. This historical perspective of evolutionary economic geography helps to link time and space elements, thus revealing the gradual evolution mechanism of the spatial distribution of economic activities [28]. In the context of evolutionary economic geography, two fundamental concepts, path dependence and path creation, play a pivotal role. Path dependence refers to the spatial agglomeration of economic activities, which does not result from rational location decisions made by enterprises and consumers, but rather emerges from the historical accumulation of localized knowledge and economic activities. In other words, past events and developments influence the current distribution of economic activities in a region. Path creation, on the other hand, is driven by influential entrepreneurs and actors who actively shape and create new economic paths, often by introducing innovative practices, technologies, or industries into a region. These path-creating actors play a key role in steering economic development in new directions. In sum, evolutionary economic geography helps us understand how economic activities are both shaped by historical legacies (path dependence) and can be influenced and directed by forward-thinking individuals and organizations (path creation) within specific spatial and temporal contexts.

Ultimately, the mobility of regional production factors within metropolitan areas stands as a pivotal factor whether we are analyzing the development mechanism of these areas from a static or dynamic perspective (Figure 2). The flow of regional production factors in different scales of metropolitan area is also a reflection of field space and flow

space. The field space formed by regional production factors reflects the urban system structure of metropolitan areas, including the spatial aggregation of regional production factors in different levels of cities and towns. At the same time, flow space reflects the spatial connection of urban network, including the flow process and flow state of regional production factors between different cities. The ability of various elements in the metropolitan area to move, connect, and complement each other is not only the objective of spatial governance, but also the central focus of such governance efforts [27]. This perspective has also been substantiated by related research conducted in European contexts [29]. The mobility of regional production factors, combined with openness and innovation, represents the primary driving mechanisms that propel the development of metropolitan areas. These factors, working in tandem, facilitate the exchange, interaction, and dynamic evolution of various elements within these complex urban regions.

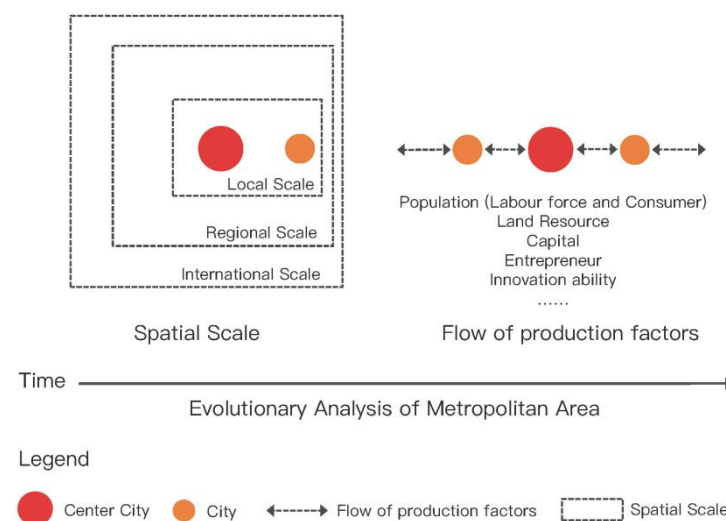


Figure 2. Metropolitan area development mechanism analysis. Source: own elaboration.

Observing regional factors of production and their economic performance in metropolitan areas necessarily requires a systematic perspective. On the one hand, the flow of factors in the metropolitan area will have different degrees of impact on the economic performance of the metropolitan area, and the agglomeration and diffusion of factors in different cities and towns will also affect the form of the urban system in the metropolitan area. On the other hand, the urban system in the metropolitan area, including the urban hierarchy and spatial layout, will also exert centripetal and centrifugal forces on the flow of factors in the metropolitan area. Governance plays an intervening role in the process of mutual promotion of factors, towns, and economic performance. Governance approaches at local, regional, and international scales will have an impact on the flow of elements within the metropolitan area between towns and between urban and rural areas, and this impact will further affect the economic performance of the metropolitan area.

3. Method

This research aims to explore the mechanism between regional production factors, governance, and the economic performance of metropolitan areas. It aims to contribute to the understanding of the complex interactions between economic development and the production factors, and to provide policymakers with insights for better regional economic development. First, the research should answer the key question of how the regional production factors and governance influence the economic performance of metropolitan areas, especially in China.

The research uses the qualitative method to explore the relationships between regional production factors, governance, and economic performance. The interview method is used to gather detailed information from stakeholders in the metropolitan area, while

the observation method is used to collect quantitative data and analyze its relationship with economic performance. Part of the interviews and observation materials is based on some planning and research projects which authors previously attended in Guangzhou, Zhengzhou, and Hefei.

Interviews (Table 1) are conducted with different stakeholders, mainly including government officials, scholars, and experts in the field. The interviews are semi-structured, allowing participants to provide their opinions on the development of metropolitan area, especially on factors and policy making. Observation data are collected through secondary sources such as statistical reports, government documents, and academic studies. The data are analyzed using descriptive statistics and econometric methods to examine the relationships between production factors, governance, and economic performance at the macro level. The observation data provide contextual information to supplement the interview data. The planning and research projects in three cities provide a strong support in the research process.

Table 1. Interviews.

No.	Institution	Position	Date	Questions
GZ 01	Municipal Development and Reform Commission	Officer	8 March 2012	The city's current economic and industrial development status, existing problems, and future ideas and plans. What are the requirements of regional development for the future development of the city, what is the status of the city, and the relationship with surrounding cities.
GZ 02	Municipal Bureau of industry and information technology	Officer	8 March 2012	The city's current economic and industrial development status, existing problems, and future development ideas (the scale, economic benefits, regional distribution, and existing problems of leading industries, characteristic industries, and emerging industries). Influence of industrial structure adjustment of surrounding cities on the city.
GZ 03	Bureau of Commerce	Officer	8 March 2012	Basic information of export and import trade (trade volume, number of import and export trade enterprises, etc.), existing problems and development ideas. Types of export exchange earning products and distribution of export exchange earning bases.
GZ 04	Development zones (national, provincial, and municipal)	Officer	8 March 2012	The main development direction, current situation, main problems, and future development ideas of the Development Zone. Major projects planned to be constructed or introduced in the park.
GZ 05	Municipal Planning Bureau/Municipal Construction Bureau	Officer	8 March 2012	Summary of the implementation of the previous version of the plan. The current situation, existing problems, and countermeasures of urban real estate construction in the city. Urban housing construction planning.
GZ 06	Municipal Bureau of land and resources	Officer	8 March 2012	Basic information and implementation of land use planning in this city.

Table 1. Cont.

No.	Institution	Position	Date	Questions
GZ 07	Municipal Transportation Bureau and Highway Bureau	Officer	8 March 2012	The layout of major transportation facilities such as existing expressways, passenger stations and freight stations, and the layout of future planning. Statistical data of passenger and freight volume of expressways and main passenger stations in the past decade, and the traffic volume predicted in the future.
GZ 08	Guangzhou Institute of planning and design	Director	12 October 2022	Compare Guangzhou with other cities in the Pearl River Delta, as well as Hong Kong, Shanghai, Shenzhen, and Tianjin. Interpretation of the evolution of Guangzhou's spatial structure.
GZ 09	Guangzhou Institute of planning and design	Director	12 October 2022	Industrial approach—measures and countermeasures: finance, commerce and trade, culture, ecology. The Integration of Guangzhou to Dongguan and Foshan. The connection of Guangzhou with Hong Kong and Macao.
GZ 10	Urban Planning Compilation Research Center	Director	13 October 2022	The development of Pearl River Delta financial backstage service area. The development of equipment manufacturing industry, etc.
GZ 11	School of Geography and Planning, Sun Yat-sen University	Professor	13 October 2022	Compare Guangzhou with relevant foreign coastal cities in terms of culture, ecology, industry, and space.
ZZ 01	Provincial Development and Reform Commission	Officer	8 August 2016	The current situation, existing problems, and future plans of economic and industrial development in Henan Province. What are the advantages and disadvantages of the economic and industrial development conditions in Henan Province. What is the general situation of industrial cooperation and competition among development zones, development zones in the province, and surrounding urban development zones.
ZZ 02	Provincial Commission of Industry and Information Technology	Officer	8 August 2016	The current economic and industrial development status, existing problems, and future development ideas of the province (the scale, economic benefits, regional distribution, and existing problems of leading industries, characteristic industries, and emerging industries). The impact of industrial structure adjustment of surrounding cities on the province. The development status of strategic emerging industries in the province, their proportion in the output value of the secondary industry, existing problems, and prospects.

Table 1. Cont.

No.	Institution	Position	Date	Questions
ZZ 03	Provincial Department of Commerce	Officer	8 August 2016	Basic information of export and import trade (trade volume, number of import and export trade enterprises, etc.), existing problems, and development ideas. Development level of circulation modernization (including e-commerce transactions, business public information platform service coverage, etc.).
ZZ 04	Provincial Housing and Urban Rural Development	Officer	8 August 2016	Urbanization development process and urbanization rate. Provincial urban development strategy.
ZZ 05	Provincial Department of Land and Resources	Officer	8 August 2016	The strategy of reserve land resources and the strategy of overall planning of land resources.
ZZ 06	Provincial Department of Transportation	Officer	8 August 2016	The current layout and future planning of major transportation facilities such as highways, passenger stations, and freight stations. Layout of current railway hub and future planning. Current airport layout and future planning layout.
ZZ 07	Provincial Department of Environmental Protection	Officer	8 August 2016	Distribution and scope of key environmental protection areas (nature reserves, scenic spots, important water sources, environmentally sensitive areas), and areas of public protection with adjacent cities.
ZZ 08	Provincial Department of Culture	Officer	8 August 2016	Vision and intention of cultural industry.
ZZ 09	Provincial Department of Human Resources and Social Security	Officer	8 August 2016	Introduction of foreign intelligence, number of overseas trainees and overseas students, industry, etc. Training and incentive policies for highly skilled talents and rural practical talents.
ZZ 10	Henan University of Economics and Law	Vice-chancellor	22 June 2022	Opinions on the economic development of the Central Plains urban agglomeration. The impact of industrial structure adjustment in surrounding cities on the Zhengzhou.
ZZ 11	Henan Urban Planning and Design Institute	Chief planner	24 June 2022	Opinions on the economic development of the Central Plains urban agglomeration. Main development directions, current situation, existing problems, and future development strategies of national and provincial development zones.
HF 01	School of Business, Anhui University	Professor	11 July 2023	How can Anhui tourism integrate into the integrated development of the Yangtze River Delta, especially what specific role Hefei plays.
HF 02	Hefei Urban Planning and Design Institute	Senior Engineer	19 July 2023	What is the interactive relationship between urban development and local economy in Hefei.

Table 1. *Cont.*

No.	Institution	Position	Date	Questions
HF 03	Anhui Urban and Rural Planning and Design Institute	Director	1 September 2023	How can the integrated development of the Wanjiang River economic belt and Yangtze River Delta urban agglomeration enable the high-quality development of Hefei's economy and urban construction.
HF 04	Ance Think Tank Consulting Company	Director	14 September 2023	How to effectively enhance people's sense of happiness and achievement through high-quality urban development in Hefei.

The research hypothesizes that regional production factors and governance have significant impacts on the economic performance of metropolitan areas. Specifically, it is expected that a well-developed infrastructure, large amount of skilled labor force, access to technology innovation, and efficient government administration will enhance the economic performance of metropolitan areas. The research selected Guangzhou, Zhengzhou, and Hefei metropolitan areas as cases. The sample includes a wide range of stakeholders representing different sectors. Primary data are collected through interviews, while secondary data are obtained from published reports and databases providing information on economic indicators, resource endowments, governance systems, and other relevant variables.

4. Research Hypotheses

The research focuses on the theme of regional production factor flow, from the perspectives of spatial scale and spatial evolution, a large amount of literature research has been conducted to sort out the potential role of regional production factors in the development of metropolitan areas, and further analyze the possible development mechanisms. On the basis of research on development mechanisms, the article proposes three spatial governance models in the metropolitan area.

4.1. Assumption of Metropolitan Area Spatial Governance Models

The interplay at global, regional, and local scales concerning the production, utilization, and distribution of factors constitutes the process of spatial governance (Figure 3). The spatial dynamics of competition and cooperation surrounding these factors have a profound impact on regional development and governance [30]. This process is primarily manifested through the flow of factor polarization, expansion, and reconstruction.

In the context of metropolitan areas, a lack of effective governance over competition and cooperation can result in disorder development and inefficient factor utilization. Excessive homogenization within the region can breed vicious competition, leading to inadequate cooperation among governments. This, in turn, often results in local government efforts at regional cooperation becoming a mere formality [31]. However, it is important to acknowledge that adjustments and reforms in the spatial governance of metropolitan areas should be tailored to the specific developmental stages of each locality. The underlying idea of these reforms is to maintain a balance among different principles, such as economic efficiency, competition, and equality in the provision of goods and services [32]. Consequently, we can classify the spatial governance of metropolitan areas into the following types.

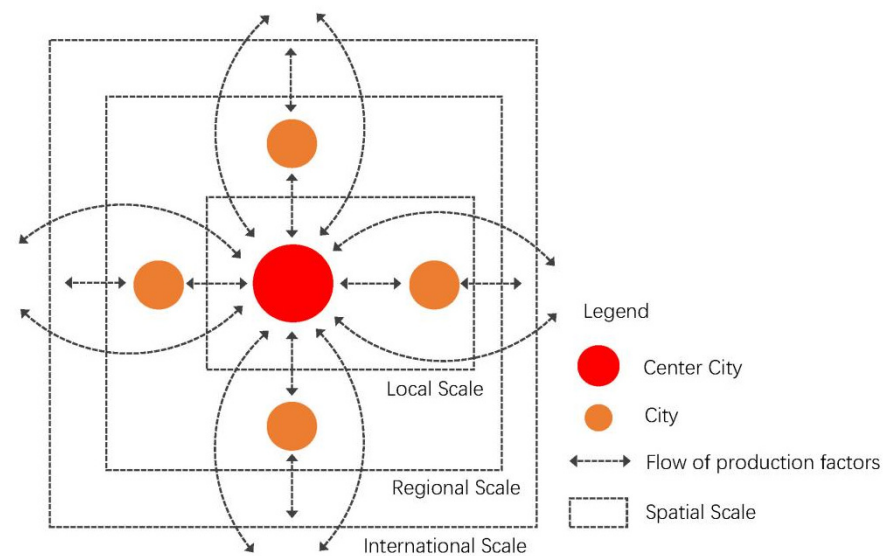


Figure 3. The mechanism of spatial governance in metropolitan area. Source: own elaboration.

4.1.1. Model 1: Local Scale Spatial Governance of Metropolitan Area

Local spatial governance primarily relies on administrative divisions, which constitutes a more traditional approach to spatial governance (Figure 4). In many metropolitan areas that are in the polarization stage, the conventional method of influencing the spatial arrangement and flow of elements is through administrative division management. This is a strategy that has been employed in numerous cases during the development of China's current metropolitan areas.

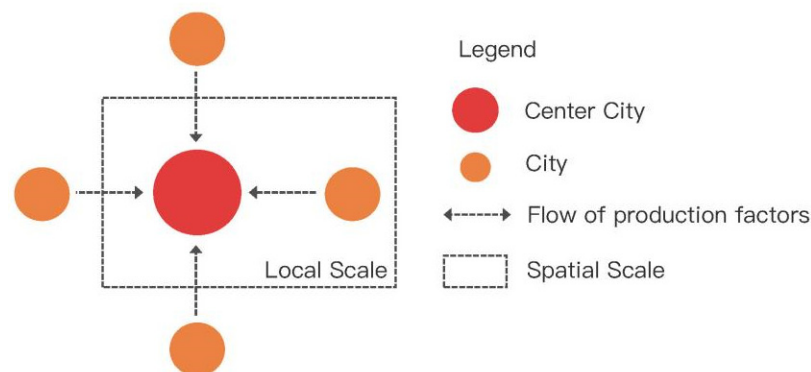


Figure 4. Local scale spatial governance in metropolitan area. Source: own elaboration.

China's existing administrative hierarchy system exhibits a noticeable and persistent bias towards administrative centers, which also tends to favor larger cities. These two biases have been mutually reinforcing [33]. Considering the administrative divisions, it becomes imperative to consider appropriate adjustments to establish a two-tier metropolitan government system, which would enhance the management and control of external effects [34].

Through these adjustments to administrative divisions, the capacity of metropolitan areas to attract and gather elements at the local level can be substantially improved. Research based on panel data from China's prefecture-level cities spanning from 2009 to 2016 indicates that the administrative level has a positive and direct impact on enhancing urban innovation capacity. Each elevation of the administrative level by one tier results in an approximate 35% improvement in urban innovation capacity [35].

From the perspective of local spatial scale, a metropolitan area in the polarization stage advances the integration of elements within the area by utilizing administrative divisions to

elevate the overall development level of the metropolitan area. Conversely, a metropolitan area in the expansion stage is more focused on dismantling administrative barriers. The incentive for eliminating divisions through administrative division adjustments stems from common interests and shared needs. In this stage, fragmentation can effectively be eradicated through local-scale spatial amalgamation [36].

In the context of local spatial scale governance for metropolitan areas, breaking administrative subordination through adjustments in administrative divisions enables independent economic units in the region to shift from operating primarily within the external economy to functioning within an internal economy. This transition results in reduced transaction costs. Through the optimization of industrial structures and the integration of similar industries within the region, excessive competition can be transformed into integrated operation, ultimately lowering competition costs. Furthermore, barriers between economic units in the region can be dismantled, fostering the free flow of goods and factors while reducing protection costs [36].

4.1.2. Model 2: Regional Scale Spatial Governance of Metropolitan Area

Spatial governance at the regional spatial scale within metropolitan areas relies on intergovernmental cooperation among local governments and typically does not entail adjustments to administrative divisions (Figure 5). This governance model proves to be more practical for the industrial development of metropolitan areas, as it directly addresses the issue of market failure in metropolitan area governance. The foundation of the modern mainstream theory of industrial policy rests on the concept of market failure [37]. In a certain sense, regional spatial scale governance in metropolitan areas positions government cooperation as an ideal strategic approach, capable of mitigating internal frictions and harmful competition within certain metropolitan areas [38].

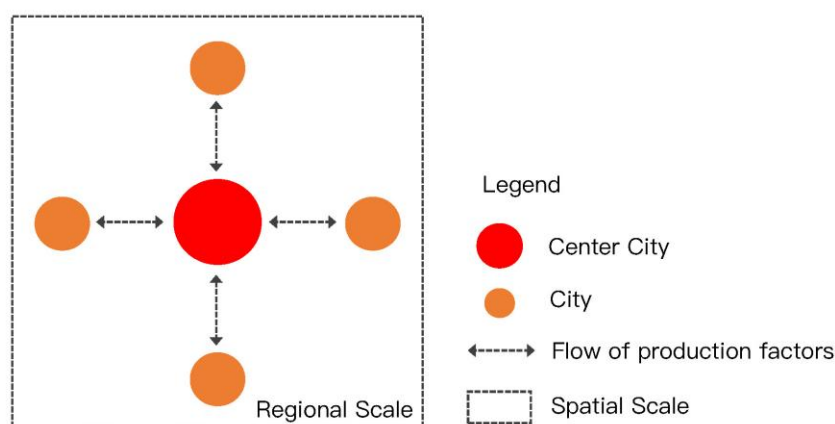


Figure 5. Regional scale spatial governance in metropolitan area. Source: own elaboration.

From both the regional spatial scale and the perspective of development stages, intergovernmental relations play a pivotal role in influencing and developing metropolitan areas. Intergovernmental relations encompass the effective promotion of development across various domains. The study of intergovernmental relations in metropolitan areas has gradually evolved into two research directions: holistic government and collaborative government. Dommel argued that the vertical intergovernmental relationship in metropolitan areas is a complex interplay governed by laws and regulations. Consequently, the establishment of holistic government should be advanced through the formulation and enforcement of laws and regulations that govern these relationships [39]. On the other hand, Christensen et al. emphasize the horizontal relationships between local governments within metropolitan areas. They stress the importance of holistic government, which involves fostering comprehensive horizontal government development through intersectoral government cooperation and system building. This approach aims to harmonize both the

horizontal and vertical relationships among different levels of government [40]. In the context of collaborative government, Wright underscored the significance of consultation and mediation. They advocate for the rational resolution of conflicting policies among cities, with the goal of effectively allocating resources within the metropolitan area and delivering high-quality services to the public [41]. These various perspectives highlight the multifaceted nature of intergovernmental relations in metropolitan areas and the diverse approaches to addressing the associated challenges.

Scholars have proposed that the spatial governance of metropolitan areas could entail the development of a governance system for the metropolitan area. The theoretical underpinnings and governance models in Western research have broadly evolved from traditional regionalism, which emphasizes the establishment of a metropolitan government, to a model that highlights collaborative cooperation among urban governments [42]. This governance model is also rooted in the principles of consultation and cooperation.

4.1.3. Model 3: Global Scale Spatial Governance of Metropolitan Area

While there is a growing trend towards de-globalization in recent years, it is undeniable that cities worldwide remain interconnected through global supply chains, innovation chains, and value chains. The movement of factors on an international spatial scale has become an irreversible trend. Spatial governance of metropolitan areas at the international spatial scale involves a competitive game in which these areas partake in the production, utilization, and distribution of factors on a global scale (Figure 6). This global interconnectedness underscores the importance of understanding and participating in the global economic landscape for metropolitan areas.

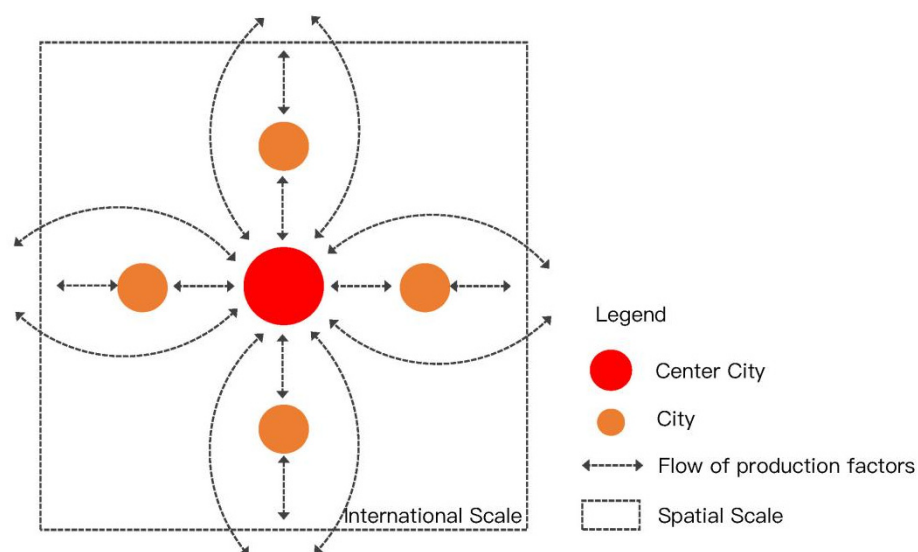


Figure 6. Global scale spatial governance in metropolitan area. Source: own elaboration.

In comparison to the local and regional scales, the governance of metropolitan areas at the international scale is notably more open and innovative. Each institutional order represents a governance system that provides a framework guiding actors' decision-making processes [43]. It is this very openness and innovation that generates a significant degree of uncertainty in the spatial governance of metropolitan areas at the international scale. The driving forces behind regional coordinated development can be broadly classified into four categories: originating driving forces, internal driving forces, external driving forces, and other uncertain driving forces. Innovation factors, economic development, and social support represent the originating and internal forces that foster the coordinated development of regions. Conversely, resource conditions, ecological environments, and government regulations and controls serve as uncertain forces influencing the coordinated

development of regions, owing to variations in regional comparative advantages, carrying capacity, and policy measures [44].

In summary, whether at the local, regional, or international scale, the spatial governance of metropolitan areas revolves around establishing a framework for the order of factor flows. In practice, it remains crucial to conduct a comprehensive analysis of the formation process, constraints, and long-term trends of metropolitan areas. This includes examining the mechanisms behind the development of various production factors and their evolving environments [45]. Understanding these elements is vital for effective spatial governance and the sustainable development of metropolitan areas.

5. Case Study

This study selected three typical urban agglomerations in China as empirical evidence and used interview and observation research methods to verify the interaction of urban factors, economy, and governance at different scales (including local, regional, and international scales) (Figure 7).

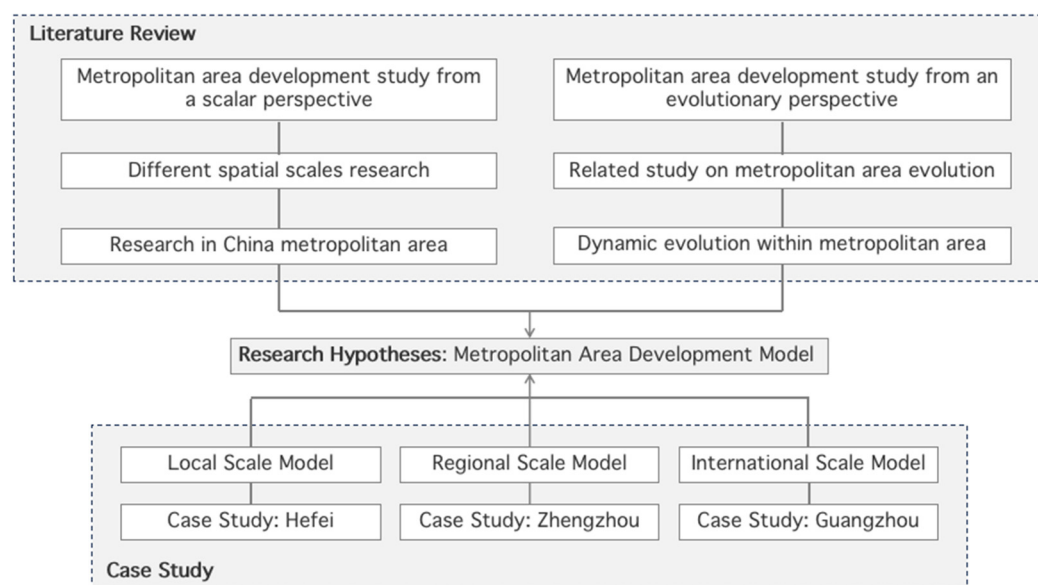


Figure 7. Analytical framework.

5.1. A Case Study of China's Metropolitan Area Governance

5.1.1. Metropolitan Area Development Mechanism and Governance Evolution

When discussing China's metropolitan areas and urban agglomerations, cities like Beijing, Shanghai, and Guangzhou, as well as their associated urban agglomerations (such as the Beijing-Tianjin-Hebei Urban Agglomeration, the Yangtze River Delta, and the Pearl River Delta), come to mind. Beijing, Shanghai, and Guangzhou were traditionally considered first-tier cities in China and served as the core cities within some of the few metropolitan areas in the country during the early stages of China's market reform and open door. These three metropolitan areas played a critical role in attracting international resources and leading regional growth domestically. The transformation evolved from bottom-up urbanization dominated by small towns in the 1980s to urbanization characterized by development zones in the 1990s. Later, it shifted to urbanization centered on new towns and new districts in the 2000s. The current phase of urbanization is characterized by the development of metropolitan areas and urban agglomerations. This rapid growth process mirrors the changes in the spatial growth patterns and the evolution of metropolitan areas in China.

The 1980s and 1990s marked the early stages of China's reform. The relaxation of macroeconomic policies provided a solid foundation for the flow of factors across the

country. Reforms such as the transformation of urban state-owned land use rights, the establishment of labor employment markets, the restructuring of private enterprises, and financial system reforms ensured the entry of land, labor, entrepreneurs, and capital into the market. Alongside the policy directives aimed at attracting external investment, governance at the international and regional spatial scales within metropolitan areas played a significant role during this period. Particularly, metropolitan areas centered around Beijing, Shanghai, and Guangzhou experienced rapid development. Emerging within the Beijing-Tianjin-Hebei (BTH), Yangtze River Delta (YRD), and Pearl River Delta (PRD) Urban Agglomerations, their progress gradually extended to the regional spatial scale and then further expanded to the international scale.

Following the implementation of the reform and opening policy, China underwent more than three decades of rapid urbanization development. Some researchers have characterized this period as the “growth supremacism stage”, and the driving force behind this phase is often attributed to the Urban Growth Theory. During this time, Chinese cities experienced unprecedented transformation and expansion in size. The implementation of the Urban Growth Theory indeed contributed to China’s rapid development, and it brought to the forefront a host of urban challenges.

As some scholars have pointed out, China has continued to rely heavily on government intervention rather than the involvement of civil society to drive high economic growth [46]. This approach has not only yielded substantial economic growth, but has also led to notable urban issues and concerns, underscoring the need for a more balanced and sustainable urban development strategy.

The reform of the central government and local government tax distribution system in 1994 had a significant impact on urbanization in China. In the reform, the central government transferred a portion of the tax revenue that was originally highly concentrated in the hands of the central government to local governments, which motivated local governments to pursue financial success and set the stage for the emergence of what is often referred to as the “urban growth machine”. After the year 2000, guided by the pursuit of growth, local governments took control of and managed factors related to urban development, often referred to as “city management” [47]. During this period, local spatial scale governance played a pivotal role in the development of metropolitan areas. Through a series of policies and measures, local governments rapidly attracted the available production factors to their regions. This led to a period of rapid urban expansion and the systematic promotion of metropolitan area development across the country.

In the era of urban growth supremacism, the development of metropolitan areas was primarily linear, focused on a single goal: local economic growth. Against the backdrop of globalization, local-scale spatial governance, represented by local governments, regional-scale spatial governance, represented by provincial governments, and international-scale spatial governance, represented by countries, achieved an unprecedented level of consistency. The premise for this expansionary development was the presence of sufficient development factors and a conducive factor circulation environment. During this period, China’s urbanization was characterized by a high degree of export oriented economic strategy, low factor utilization costs, and minimal barriers to factor flows. In addition to the policy guidance from local, provincial, and central governments, numerous opportunities existed for local development and participation in international competition at local and regional spatial scales through factor exchange. The era of growth supremacism was clearly manifested during this period, with the growth machine propelling the rapid development of China’s metropolitan areas and urban agglomerations.

During this period, governance of metropolitan areas at various spatial scales became a critical process involving a spatial competition between the supply side (represented by local governments with a focus on public interests) and the demand side (represented by enterprises with a focus on market interests). While the policies related to land use, human resources, and price liberalization laid the foundation for the free flow of factors during the early stages of market reform, the tax system, land system, population system, and

other reforms in this period significantly encouraged the flow of various production factors within the market system.

Urban and regional planning, serving as a principal tool of spatial governance, played a crucial role in regional and local spatial governance. Wu summarized the development of China's urban and rural planning and urban and rural governance over the past three decades, emphasizing the importance of planning for growth [48]. Growth was not only a technical objective of China's urban and rural planning, but also a fundamental value guiding the implementation and management of urban and rural planning. Urban and rural planning served as a vital instrument of urban governance, and the value of growth was integral to urban and rural governance and spatial governance.

Consequently, during this stage, we witnessed the rapid rise and internationalization of metropolitan areas like Beijing, Shanghai, and Guangzhou. Metropolitan areas centered around powerful provincial capitals, such as Nanjing and Hangzhou, also experienced significant growth and became crucial drivers of regional economic development. The period from the 1980s to the early 2010s is often labeled as the "Growth Supremacism" stage in the field of urban studies. However, since the early 2010s, this stage of development has evolved into a new phase known as "new urbanization". As the era of urban growth supremacism draws to a close, China's urbanization has entered a transformative stage.

Several significant changes have shaped this new phase. International investment structures have shifted, and the improvement in domestic development levels has increased the cost of utilizing various factors. In recent years, the uncertainty caused by the trend of de-globalization, as well as changes in the political and economic landscape, has presented China's urbanization with fresh and significant challenges. In response to this evolving environment, China has introduced a range of strategies, including new urbanization and structural transformation. The implementation of these strategies has ushered in a new era for the development of China's metropolitan areas. The concept of the new urbanization strategy revolves around reforming the development model of urbanization. During the growth supremacism stage, it was a common practice for local governments, including those in tier 3 or tier 4 cities, to use urban land resources to attract private sector investment. This approach often resulted in the wastage of land resources, environmental quality, and finances.

In response to these challenges, governments have started to establish urban growth boundaries to control the size of cities. Recent planning reforms have led to the serious implementation of strategies like urban growth boundaries, ecological protection boundaries, and basic farming area boundaries. These measures aim to manage urban growth more efficiently, protect the environment, and safeguard agricultural land. During the period of new urbanization, the primary driving force behind urbanization is urban agglomerations and metropolitan areas, reflecting the strategic goal of structural reform. By optimizing the internal structure of urban agglomerations or metropolitan areas, spatial entities capable of participating in regional, national, or international competition can be cultivated. Beyond Beijing, Shanghai, and Guangzhou, which have evolved into world-class metropolitan areas, their urban agglomerations have also become highly competitive on the international stage. Additionally, these urban agglomerations host various international and regional metropolitan areas, such as the Nanjing metropolitan area.

Recently, China has established or is planning 19 urban agglomerations, including the Beibu Gulf urban agglomeration, Chengdu-Chongqing urban agglomeration, Central Plains urban agglomeration, and more. Over 26 metropolitan areas have been formed or are in development, such as the capital metropolitan area, Shanghai metropolitan area, Nanjing metropolitan area, Hefei metropolitan area, Zhengzhou metropolitan area, and others. These urban agglomerations and metropolitan areas span major provinces in China and have become critical spatial forms of urbanization at this stage. The development of metropolitan areas has become a vital component of China's new urbanization strategy.

However, it is important to note that there are significant disparities in the development stages of these metropolitan areas, and the spatial governance methods they require

are correspondingly diverse. Moreover, the current development environment contains numerous uncertainties, and the spatial governance of metropolitan areas on international, regional, and local scales must contend with multiple challenges, paths, scenarios, and possibilities.

5.1.2. The Metropolitan Area Governance Models

From the study of development pattern and evolution of China's metropolitan areas, arguably, the construction of metropolitan areas under different development stages has distinct characteristics in terms of international, regional, and local spatial scale governance. Even in the same era of development, due to the differences of regional development stages, we can still find typical models of different ways of spatial governance. Three representative metropolitan areas are selected to further elaborate the development and governance of metropolitan areas under different spatial scales.

Model 1: Local scale spatial governance as the dominant model, Hefei as a case.

The development of the Hefei metropolitan area (Figure 8), which includes the capital city of Anhui Province, Hefei, represents an intriguing case study of metropolitan development in China. This region's transformation from a small county to a thriving metropolitan area illustrates the role of spatial governance at various scales in shaping urban development.

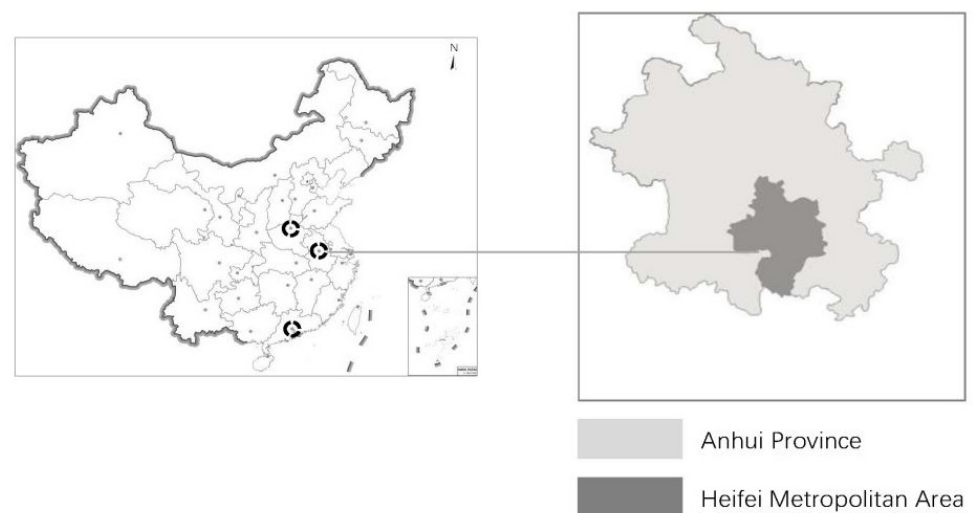


Figure 8. Hefei metropolitan area. Source: own elaboration.

At the local spatial scale, the Hefei government recognized the importance of scaling up to enhance the city's prominence and strengthen its position as the provincial capital. In 2006, a series of strategic transformations were initiated to expand the Hefei Economic Circle, establish the Hefei metropolitan area, and eventually position Hefei as the core of the Wanjiang River economic belt. Administrative adjustments, such as the incorporation of parts of Chaohu city into Hefei, were implemented to expand the urban space, integrate transportation resources, and enhance the city's role as a growth pole in the region (Table 2).

The province of Anhui provided policy support to integrate into the Yangtze River Delta urban agglomeration, thereby enhancing the Hefei metropolitan area's participation in international competition and regional division of labor. However, an interesting phenomenon emerged when examining development data after the administrative division adjustment in 2011. While Chaohu experienced accelerated growth, Hefei (excluding Chaohu) showed slower GDP growth (Table 3). The study also found that the expansion intensity of Hefei metropolitan area lagged other national metropolitan areas. This raised questions about whether regional economic development could continue to be driven solely by spatial governance mechanisms like administrative division adjustments. The case of Hefei's metropolitan area highlights the complexity of spatial governance and

the need for a multifaceted approach to urban development, where local, regional, and international factors intersect and interact. This case also emphasizes the importance of long-term strategic planning and the challenges associated with realizing the potential of a rapidly expanding metropolitan area.

Model 2: Regional scale spatial governance as the dominant model, Zhengzhou as a case

The case of the Zhengzhou metropolitan area (Figure 9) in Henan Province exemplifies how spatial governance strategies at different scales have played a crucial role in urban development. Similar to Anhui's focus on strengthening the provincial capital in Hefei, Henan aimed to develop the Zhengzhou metropolitan area while establishing the Central Plains urban agglomeration with Zhengzhou at its core. The interconnectedness of the metropolitan area and the urban agglomeration through spatial governance reflects innovation at both local and regional scales.

Table 2. Hefei metropolitan area development process.

Year	Development Stage	Cities in the Region in the Stage
2006	Provincial Capital Economic Circle	Hefei, Chaohu, Lu'an
2009	Hefei Economic Circle (re-position)	Hefei, Lu'an, Chaohu, Tongcheng, Huainan
2012	Expansion of Hefei Economic Circle (Dingyuan County merged into Hefei) and Administrative Division Adjustment of Hefei and Chaohu	Hefei, Huainan, Tongcheng, Lu'an, Dingyuan (Chaohu administrative division adjustment)
2013	Expansion of Hefei Economic Circle (Chuzhou County merged into Hefei)	Hefei, Tongcheng, Lu'an, Chuzhou, Huainan
2016	Hefei Economic Circle Upgrade to Hefei Metropolitan Area, Hefei was Positioned as Sub-center City in YRD Urban Agglomeration	Hefei, Tongcheng, Chuzhou, Huainan, Lu'an
2017	Hefei Metropolitan Area Expansion (Wuhu and Ma'anshan merged into Hefei)	Hefei, Tongcheng, Lu'an, Chuzhou, Wuhu, Ma'anshan, Huainan
2019	Hefei Metropolitan Area Expansion (Bengbu merged into Hefei)	Hefei, Tongcheng, Lu'an, Chuzhou, Wuhu, Ma'anshan, Huainan, Bengbu

Source: Tiantian Liang, 2022 [49].

Table 3. GDP and population after combination of Hefei and Chaohu.

GDP (Billion Yuan)/Growth Rate	YEAR 2010	YEAR 2011	YEAR 2020
Hefei (excluding Chaohu part)	2701.61/NA	3324.61/23%	9065.86/173%
Chaohu (administrative division adjustment)	258.83/NA	312.01/21%	979.86/214%

Source: Anhui Statistical Yearbook. NA: Data is not available before combination.

In terms of local-scale spatial governance, in contrast to Hefei's administrative division adjustments, Zhengzhou adopted the strategy of urbanization to integrate resources between cities, particularly with Kaifeng. These two cities share geographical proximity, cultural traditions, and historical ties. While Kaifeng once held the position of provincial capital, Zhengzhou's transformation into a transportation hub city led to the reversal of their regional rankings. This transition increased urban polarization in favor of Zhengzhou.

The shift in development strategy became evident when the Zhengzhou-Kaifeng urban integration strategy was introduced in 2003. This strategy aimed to improve the connectivity between the two cities, shorten transportation distances, and lay the founda-

tion for Kaifeng to develop urban industries based on a regional model. It also facilitated the elimination of policy barriers in various areas such as public services, urban taxation, financial settlement, and industrial development alignment between the two cities.

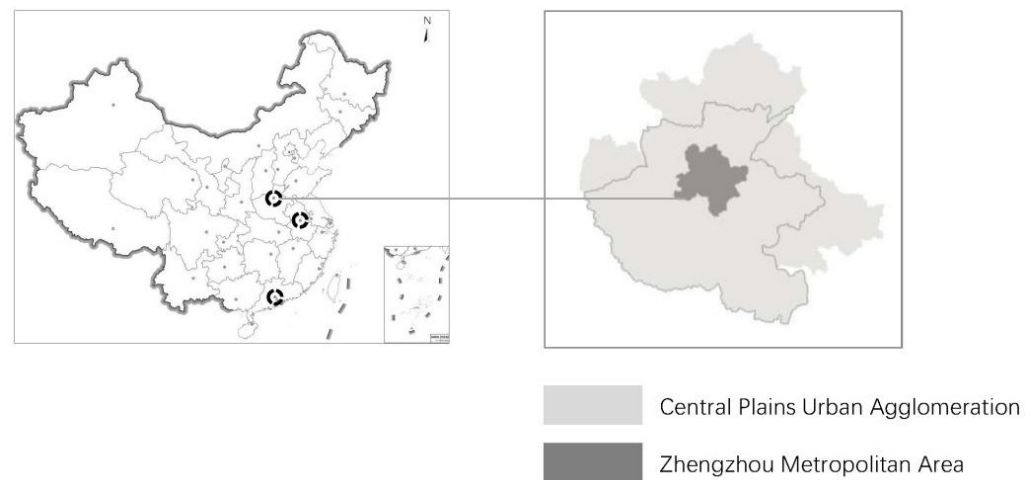


Figure 9. Zhengzhou metropolitan area. Source: own elaboration.

At the regional scale, the Central Plains Urban Agglomeration Development Plan (CPUADP) issued by the central government in 2016 further strengthened Zhengzhou's role as the core of the Central Plains urban agglomeration, which encompasses 30 cities across several provinces. This strategic plan elevated Zhengzhou to a regional central city in the era of high-speed rail, enhancing its international influence.

Despite the continuous support for the Zhengzhou metropolitan area's development through the New Urbanization Strategy, the region faces challenges in participating in international competition. The limited international scale of spatial governance is a potential concern, given that many coastal metropolitan areas enjoy greater opportunities for international engagement. The case of the Zhengzhou metropolitan area underscores the dynamic interplay between local and regional spatial governance strategies, emphasizing the importance of comprehensive planning and coordinated development to realize a region's full potential.

Model 3: International scale spatial governance as the dominant model, Guangzhou as a case

The Guangzhou metropolitan area (Figure 10), situated in the Pearl River Delta urban agglomeration, stands as one of China's traditional metropolitan areas with a long history of international trade and strategic relationships with Hong Kong and Macao. Its development, when viewed in terms of spatial governance, has been notably mature across local, regional, and international scales.

At the local scale, the integration of the Guangzhou-Foshan metropolitan area, which has been actively pursued for many years, has yielded impressive results, transforming it into a significant growth pole in the Pearl River Delta. Guangzhou and Foshan, two neighboring cities in Guangdong Province, share common geographical proximity, historical roots, and cultural heritage, forming a unique cultural region known as Guangfo. Historically, Guangzhou and Foshan were major centers for trade and craftsmanship, with Guangzhou being an important foreign trade port and Foshan excelling in its distinct handicraft industry.

The collaborative development of the two cities in the past has laid the foundation for their contemporary integrated development. This partnership has naturally evolved into a model of collaborative and mutually beneficial spatial governance. Urban infrastructure development and policy adjustments in transportation, spatial integration, talent attraction, and institutional integration have played crucial roles in ensuring Foshan's access to Guangzhou's resources and boosting its industrial development. Key policies, such as the

Cooperation Agreement on Urban Integration Construction in Foshan and Guangzhou, have driven urban regional planning, transportation infrastructure, industrial cooperation, environmental protection, and other aspects of integration between the two cities.

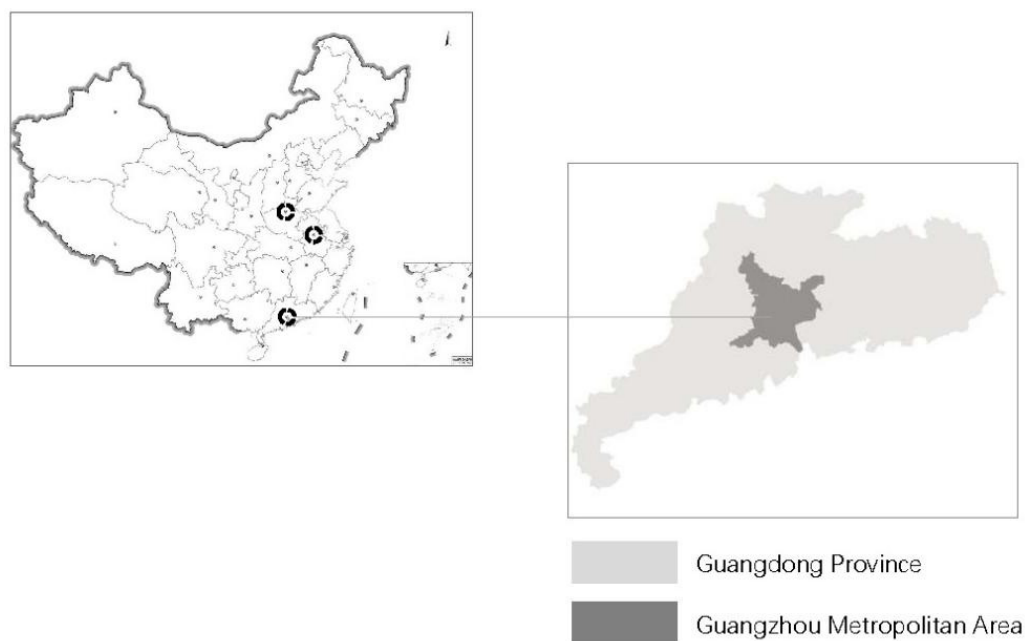


Figure 10. Guangzhou metropolitan area. Source: own elaboration.

Moreover, the economic development of the Guangzhou-Foshan metropolitan area benefits from the effective integration of the two cities. The industries in Guangzhou and Foshan do not exhibit homogenization tendencies. They have interconnected and complementary industrial developments, which span from heavy industry to light industry, and from productive service industries to advanced manufacturing industries. The region has collaborated to establish numerous industrial clusters and collaborative development zones, such as the automobile manufacturing industry.

On a regional and international scale, Guangzhou and the Pearl River Delta possess inherent advantages. The shift from the traditional Pearl River Delta region (PRD) to the Pan Pearl River Delta region (PPRD) and, eventually, the formation of the Guangdong Hong Kong Macao Greater Bay Area (GBA) reflects a gradual upgrading and evolution. The spatial structure has evolved from the triangular structure of Guangzhou, Shenzhen (Hong Kong), and Zhuhai (Macao) to the urban agglomeration structure of Guangzhou (Foshan)-Hong Kong (Shenzhen) and Guangzhou (Foshan)-Macao (Zhuhai). The Guangzhou-Foshan metropolitan area model represents a collaborative, win-win, and international development pattern, with the GBA encompassing its core engines. The collaboration and development model seen in the Guangzhou-Foshan area is akin to that of the Shanghai metropolitan areas in the Yangtze River Delta (YRD) urban agglomeration.

6. Findings and Discussions

The development of metropolitan areas is significantly influenced by the flow of production factors, and it is a key determinant of their growth and evolution. The study on 30 provinces and cities in China revealed that promoting the flow of production factors and improving the level of regional coordination and integration can promote regional economic growth [50]. The way production factors move and interact within the space of a metropolitan area affects its growth and expansion. The quality and quantity of this flow matter; it is not just about numerical growth, but about high-quality spatial flows that promote the positive development of the metropolitan area.

From the perspective of evolutionary economic geography, this continuous high-quality flow of production factors represents a process of path locking, path dependence, and potential path breakthroughs for regional production factors. The mechanism behind this process is pivotal for the spatial governance of metropolitan areas.

Metropolitan areas employ spatial governance models to intervene in the production, utilization, and reconstruction of spatial factors within their territories. These models operate at different scales, such as the local scale, regional scale, and international scale. The choice of spatial governance model depends on the development stage and regional context of the metropolitan area. Metropolitan areas can have different spatial governance models based on their regional differences and development stages. The most suitable governance model is one that aligns with the specific circumstances and needs of the metropolitan area.

Metropolitan areas that have the international scale governance model often go through the development stages of local and regional scales, which is also closely related to the development stage and development environment of the metropolitan area. With the scale and quality of production factor agglomeration and the efficiency of factor flow changing, a few metropolitan areas have the possibility to participate in international competition. Adopting the international scale spatial governance model will better release the driving force of the metropolitan area. However, not every metropolitan area with local or regional scale spatial governance is suitable for a higher level of governance. The development stage and development environment often restrict the ability of such cities to gather and use production factors.

Under the framework of metropolitan area spatial governance model, there are various means to intervene the flow of production factors. For example, the construction of municipal facilities, including transportation, communication, and municipal facilities, can affect the speed, direction, and quality of circulation; barriers to the circulation of factors can be established through public policies, which can affect the aggregation, circulation, and diffusion of factors in space; it is even possible to influence the circulation of elements in a larger region through legislation.

From the above cases, it can be seen that planning, as a public policy and governance tool, has a very comprehensive impact on the production factors in the metropolitan area. Joint regional planning and spatial planning have been widely explored in European and American metropolitan areas, and achieved good results. It is not only an effective way to overcome the contradiction between administrative boundary barriers and regional integration in metropolitan areas, but also the self-regulation mode of regional development and the most important governance mechanism for the coordinated development of metropolitan areas [51].

Metropolitan areas with the capacity for international spatial governance have experienced rapid development in the context of globalization. The world city region and Mega-City metropolitan area are gradually replacing countries and cities as the core players in global industrial organizations and regional competition [52]. However, with the rise of de-globalization and disruptions in international economic circulation, there is a need to reevaluate how metropolitan areas, including Chinese ones like Guangzhou, Shanghai, or Beijing, can adapt to the challenges and changes in international-scale spatial governance.

A question arises regarding the growth limits in regional and local-scale metropolitan area governance. Cases like Hefei and Zhengzhou suggest that, despite administrative divisions being adjusted to increase the number of core cities in metropolitan areas, it does not always result in exponential growth or synergistic effects. This leads to the question of whether metropolitan areas with low levels of internationalization will face growth limitations in the current development environment. In essence, they may have reached a point of path dependency, where factors governing growth have become locked. If a growth supremacism model, reliant on linear spatial factor polarization, is followed, can it generate the desired growth? These questions may require several years to provide

definitive answers and are influenced by various factors, including the evolving economic and political environment.

In this study, we only discussed the economic performance of production factors under different governance models. However, we cannot clearly analyze which type of production factors will play a more important role in the process of metropolitan governance. In other words, do different production factors play different roles in different stages of development? Which is very important in the practice of metropolitan spatial governance.

7. Conclusions

The main purpose of this paper is to reveal the interaction between the flow of production factors, governance, and economic performance in urban agglomeration areas. In the theoretical research section, a large amount of literature was reviewed and analyzed from the perspectives of spatial scale and spatial evolution, proposing potential mechanisms for the development of urban agglomerations, and making spatial model assumptions about the elements, governance, and economic performance of urban agglomerations. Through empirical research, this spatial model and its model classification at three different scales have been further validated.

The main innovation of this study is to propose the important value of regional production factor circulation in the development mechanism of urban agglomerations, as well as the possible important role of urban agglomeration governance around factor circulation. On the one hand, this study further enriches the theoretical system of urban agglomeration development; on the other hand, this study can also provide a preliminary explanation of some laws that exist in the development process of urban agglomerations, and can provide reference for public policy formulation.

Author Contributions: Conceptualization, J.Y.; Methodology, J.Y. and Y.C.; Resources, J.Z. and S.N.; Data curation, S.N.; Writing—original draft, J.Y. and Y.C.; Writing—review & editing, Z.L.; Supervision, Z.L.; Project administration, J.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

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