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Analyzing the Impact of Urban Scale Expansion on Regional Economic Development: A Case Study of the Chang-zhu-tan Urban Agglomeration in Hunan Province

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Abstract

This study examines the dynamics between urban scale expansion and regional economic growth, with a focus on the Chang-Zhu-Tan urban agglomeration inHunan Province. Through an in-depth analysis of economic data over several years, weidentify variations in the regional economic structure and urban construction. Employing linear and regression analyses, the research investigates the correlation between land use planning and economic growth, incorporating spatial-temporal characteristics and multidimensional space analysis to identify factors influencing urban expansion stages. Findings indicate that urban scale expansion correlates positively with coordinated socio-economic development, population growth, andurban transformation rates, displaying a pattern of intensification followed by a moderation phase, extending from central to peripheral areas. The study underscores the impact of regional economic conditions on urban expansion, advocating for enhanced regional industrial development and industrial optimization to bolster economic benefits.

Keywords: *Urban Scale Expansion; Chang Zhu Tan; Temporal And Spatial Characteristics; Spatial Analysis; Regional Economies.*

1. Introduction

The continuous expansion of urban construction land serves as a principal mechanism for societal construction and economic advancement. Viewed through the lens of regional economic development, under the constraint of finite resources, the enlargement of urban scale invariably impacts the utilization efficiency of other land resources [1]. Absence of a scientific land allocation strategy in the urban expansion process inevitably hampers the cyclical and sustainable development of the regional economy [2]. As a vanguard area for economic development in Hunan Province, Chang-Zhu-Tan has embraced the mandate for high-level, high-frequency constructioninitiatives since 2007. Aimed at catalyzing economic growth from specific points to broader areas, efforts have been channeled into comprehensive development across infrastructure transformation, support for urban industrial chains, and ecological and environmental safeguarding. By 2020, the gross regional product of Hunan Province ascended to 4178.149 billion yuan, marking a 3.8% increase from the preceding period [3]. Notably, the

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Chang-Zhu-Tan economic zone accounted for over half of this achievement in 2020, with a contribution rate of 56% [4]. This development not only spurred economic growth across the province but also augmented local fiscal revenue and the average consumption level. Such progress has positioned the tri-city area of Changsha, Zhuzhou, and Xiangtan as regions with the most closely aligned industrial structures and urban construction within Hunan Province.

While the urban population of Chang-Zhu-Tan surpasses 10 million, a discernible disparity remains when juxtaposed with developed areas such as Beijing, Shanghai, and Guangzhou [5]. The per capita GDP still trails behind that of more developed cities, indicating a phase of incremental growth in overall strength, which has provided a buffer for the expansion of urban scale and regional economic development. From the vantage point of urban industrial chain structure, the three regions have begun to carve out their advantageous industries [6]. In comparison to traditional industry scales, the emergence of a substantial number of medium and heavy enterprises has outpaced the foundational machinery, steel, and other heavy industries. Despite noticeable advancements in Chang-Zhu-Tan's urban development, challenges such as uneven resource distribution, inadequate integration capabilities, and the nascent state of industrial chains persist [7]. The growing population base has further accentuated the trend of rural-to-urban migration. Consequently, there is a pressing need for enhancements and optimizations in public infrastructure, medical services, social security, and educational systems. The economic and industrial structure of urban conglomerates remains irrational, with the industrial layout typified by a "two, three, and one" scenario. The limited number of regional pillar enterprises fails to harness local resources effectively, thus contributing minimally to regional economic growth [8]. Given that the Xiangtan area hosts a concentration of industries, including electricity, chemical, coal manufacturing, food, and textiles, it poses certain risks to urban environmental protection and ecological balance. The intensive resource consumption by these sectors underscores the critical challenge of balancing development with resource conservation in the Chang-Zhu-Tan area [9]. In light of these findings, this study aims to elucidate the dynamic interplay between urban scale expansion and regional economic development, further delving into the regional economic disparities, influential factors, and the temporal and spatial dynamics of urban land expansion in Changsha, Zhuzhou, and Xiangtan.

2. Research Status of Urban Scale Expansion and Construction at Home and Abroad

Land resources stand as the fundamental bedrock and conduit for human existence,everyday activities, and social production. In the realm of urban scale expansion, these resources constitute not merely the foundational material but also a pivotal economic asset. Currently, as China navigates through a phase of industrial transformation, the pace of urban construction has been noticeably accelerating [10]. Factors of productionare migrating from the agricultural sector, leading to an incremental swell in urban landscale [11]. This burgeoning tension between land utility and economic growth has become starkly evident, casting a profound impact on the economic vitality of provincesand cities [12]. Internationally, scholars have conducted extensive analyses and research on the trends of urban scale expansion. In the context of the United States, significant scholarly attention has been devoted to understanding the repercussions of urban growth on regional economic dynamics [13]. Studies initially delve into the traitsand policy frameworks of suburban expansion, constructing data models that simulateurban construction

trajectories, and undertaking comparative analyses of expansion intensities across three contiguous cities. Findings indicate that two of these cities are at nascent stages of expansion, whereas the third, a central city, has progressed into suburbanization [14]. Conclusively, these studies dissect the nuances of urban scale growth by integrating geographic data across different timelines, underscoring that theallocation of land resources is paramount in dictating regional economic shifts. Datingback to the late twentieth century, the UK has embarked on numerous dynamic simulation studies pertaining to urban construction and expansion, leveraging satellite sensing data for image processing [15]. These studies initiate by categorizing the resource inventory and land classifications of suburban fringes, subsequently formulating a planning paradigm with advanced deep learning neural network algorithms aimed at minimizing the socioeconomic impacts of urban expansion [16].

The study of urban expansion, land resource utilization, and regional economic change is a subject of frequent scholarly interest in China. Researchers incorporate evaluations of land use suitability and comprehensive benefit analyses, taking into account the current scale of land utilization, topography, and other salient factors [17].Such evaluations holistically assess the ecological environment and industrial evolutionwithin the expansion zones. Viewed through the prism of ecological conservation and the sustainable progression of regional economies, these analyses provide precise directives and recommendations for urban construction and growth. Notably, spatial analysis emerges as a particularly efficacious technology, demonstrating pronounced efficacy in dissecting complex urban spatial structures [18]. This technique allows for the examination of a designated area as a cross-sectional data entity, facilitatingdiscourse and inquiry in tandem with chronological data, thanks to the extensive reachof remote sensing [19]. Chinese academics have discerned that demographic shifts and economic index growth exert the most profound influence on urban sprawl and the development of construction land. The findings from such quantitative analyses yield considerable accuracy, enabling a lucid discernment of the interrelations among diversefactors [20]. As China's industrialization and urban construction forge ahead, the tension between urban growth and economic objectives increasingly impedes thesustainable development of regional economies. Against this backdrop, this paper selects Chang-Zhu-Tan, the fulcrum of regional development in Hunan Province, as a case study. Chang-Zhu-Tan, being at the forefront of local economic progression in Hunan, grapples with analogous dichotomies. It is imperative to ascertain the land requisites for urban expansion and construction in this area to augment land resource utilization rates. This would mitigate the clash between resource consumption and regional economic growth, refining the urban development paradigm. The paper endeavors to further unravel the intricate nexus between urban scale expansion and regional economic development from a spatial perspective.

3. Study on the Relationship between Urban Scale Expansion and Regional Economic Development in Chang Zhu Tan

3.1 Study on Urban Scale Expansion and Structural Change of Chang Zhu Tan Based on Spatial Analysis

Urban expansion and the allocation of construction land have ascended to the forefront of national development agendas. Post-economic reform, China has channeled considerable investments and efforts into urban scale augmentation. Such expansion invariably leads to the diminishment of ecological resources, posing an inescapable socio-ecological dilemma that demands urgent resolution. As the nation progresses into the advanced stages of industrial and

urban transformation, its developmental trajectory exerts an increasingly profound influence on the regional economic fabric, exacerbating land-use conflicts. Absent scientific planning of land resources, the specter of impediments to sustainable regional economic advancement looms large. In the context of Chang Zhu Tan City, this paper seeks to dissect the evolutionary patterns of spatial expansion and scrutinize the underlying connections between urban scale expansion and regional economic growth.

The tri-city conglomerate of Changsha, Zhuzhou, and Xiangtan epitomizes an urban group where commutation is finely tuned to approximately 1.5 hours, reflecting a well-integrated transportation network. Throughout their developmental trajectory, these cities have metamorphosed from isolated points into a cohesive linear urban continuum, cementing their collective identity. This evolution from discrete entities to a unified urban line is starkly discernible in spatial analyses, underscoring the symbiotic relationship fostered among them. The extensive spread of industrial chains across these cities has culminated in the emergence of a distinctive industrial tapestry, accentuating spatial heterogeneity. With the ongoing magnification of the Chang-Zhu- Tan urban scale, there has been a consequential internal reconfiguration of urban space. In recent years, the region of Zhuzhou Changtan has become a theater for three emergent modes of spatial interaction, which are graphically illustrated in Figure 1.

These modes are likely representative of the dynamic exchange of resources, services, and information, sculpting the region's spatial and economic landscape.

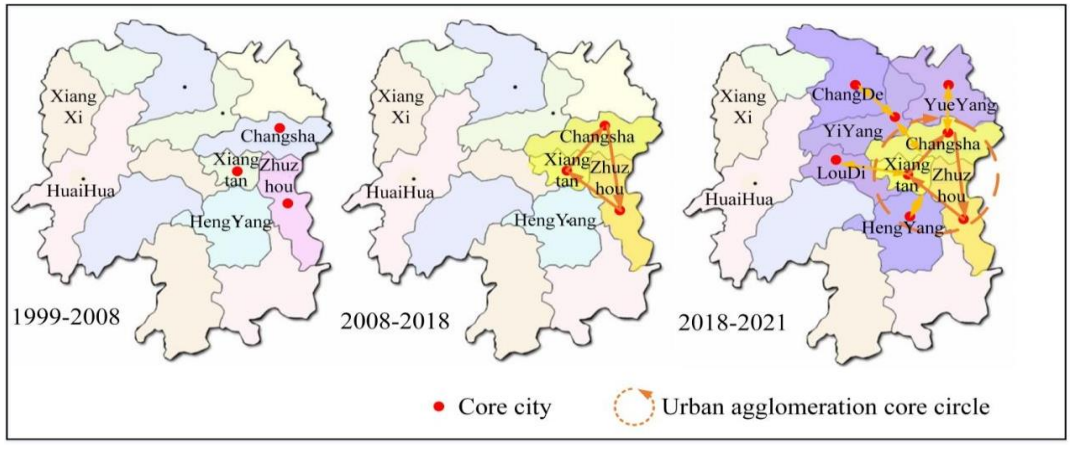

Fig 1: Spatial Evolution of the Three Regions of Chang Zhu Tan.

This paper delves into the dynamics of urban scale expansion, its structural nuances, and the trends that govern its progression. Within this framework, the frequency of urban planning for land use and the vigor of expansion are posited as indicators reflective of structural shifts within urban conglomerates. A spatial regression analysis model has been utilized to develop a weighting function and to compile panel data, thereby rendering the impact of the Chang-Zhu-Tan region's expansion in more concrete and discernible terms. The initial phase involves measuringand quantifying the nexus binding the tripartite cities, followed by an analysis of urbanscale's spatial structure through the lenses of regional economic linkage, traffic coefficient connectivity, and demographic interdependence. The methodology and sequence of the spatial structure analysis for the Changsha-Zhuzhou-Xiangtan Urban Agglomeration expansion are encapsulated in Figure 2.

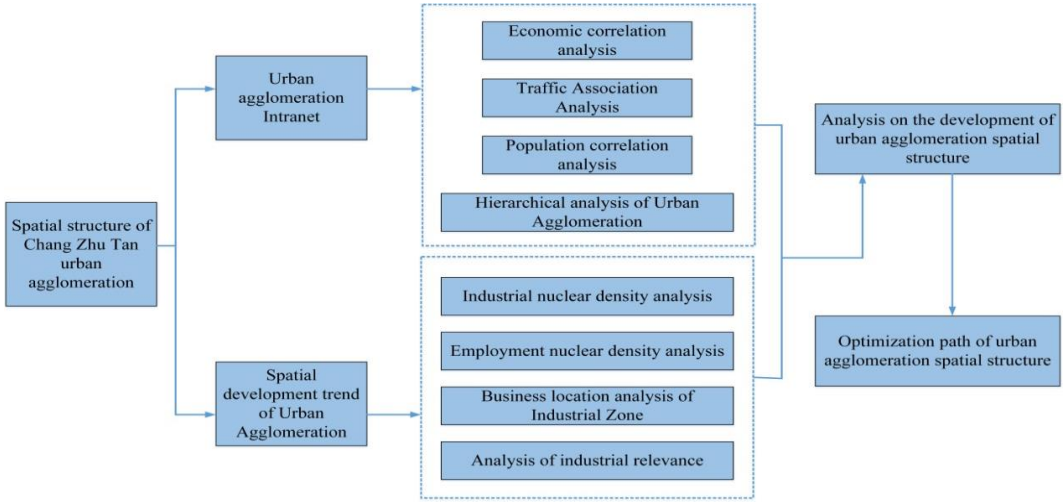

Fig 2: Analysis Flow Chart of Spatial Structure of Urban Agglomeration Expansion in Chang Zhu Tan.

As delineated in Figure 2, an in-depth correlation analysis—anchored in economic, transportation, and population metrics within the urban network—allows for an enriched understanding of urban expansion's repercussions on industry and employment. This approach culminates in the distillation of urban scale expansion principles, pivotal for refining the spatial structure. Our research contemplates the urban scale expansion's spillover effects from three critical vantages: the local economy, geographic positioning, and practical implementability. Economic variables include per capita GDP and population density, which propel land use expansion through the realms of industrial, residential, and infrastructural development. Geographical environmental factors integrate the calculated metrics of slope and fluvial dynamics. Notably, the Xiangjiang River bifurcates the tri-city area, contributing to a unique topographical landscape abundant in natural and botanical resources—a landscape intrinsically tied to land utility. Topography and ecological assets are instrumental in shaping urban sprawl, with terrain gradient serving as a cardinal directional constraint. The factor of realizability encompasses the proximity of towns and rural settlements, assessed through the prisms of transport planning and material conveyance.

The expansion of land along axes defined by high-speed railway lines and national highways, and other transport nodes, is identified as a prevalent strategy. Through meticulous examination of these influencing elements, we've synthesized the urban group scale expansion intensity coefficient for the Chang-Zhu-Tan area, as detailed in Table 1.

Table 1: Average Annual Expansion of Urban Land (%).

Changsha City	**1999~2005**	**2005~2010**	**2010~2015**	**2015~2020**
Changsha County	0.083	0.493	0.988	0.794
Xiangtan City	0.023	0.205	0.188	0.455
Xiangtan County	0.193	0.438	0.248	0.589
Zhuzhou City	0.016	0.062	0.320	0.399
Zhuzhou County	0.067	0.072	0.015	0.075
Urban Agglomeration	0.062	0.230	0.144	0.863

We calculated the annual average expansion coefficient of cities in the three regions of Chang Zhu Tan. Spatial regression calculation is used to analyze the proportion of various construction land in the annual average growth in different periods. The basic formula is:

$$AUEI = (U_{end} - U_{start}) / (U_{urban}) / N \times 100\% \quad (1)$$

In the formula,

U_{end}, U_{start} represents the area values of various construction land in the initial study and the final study respectively.

U_{urban} represents the administrative division within each region. According to the type of spatial scale expansion, urban construction land is divided into three states: filling, edge and surface.The filling state is to use the current lack of urban construction and use the open space gap for functional reorganization. The marginal state is a growth mode extending fromthe central area to the countryside. Surface type refers to the independent formation ofa separate area for industrial land division, which does not overlap with other modules.The division of the above types requires the calculation of the front and rear boundariesof the urban plate:

$$E = \frac{L_{com}}{P_{new}} \quad (2)$$

In the research center, we discussed specific cases of economic, geographical environment, applicability and other factors affecting urban scale expansion. There is acausal relationship between these spatial element data. We build a spatial analysis model to further verify the accuracy of the results:

$$Y = \beta_0 + \beta_i x_i + \varepsilon \quad (3)$$

In the formula, β_0 represents the transverse distance, β_i represents the influence coefficient, and x_i represents the error coefficient with the actual calculation.

Conditionally restrict the above formula:

$$p(y = 1 \mid x) + p(y = 0 \mid x) \quad (4)$$

$$p(y = 1 \mid x) = p(\beta(p) = x) \quad (5)$$

Reconstruct the spatial lag module in urban scale expansion according to theconstrained formula:

$$y_i = \beta_0 + \rho W y + \beta_i x_i + \varepsilon \quad (6)$$

$$\varepsilon \sim N(0, \sigma^2) \quad (7)$$

In the formula, y represents the expansion land area, β_0 represents the transverse intercept, and ρ represents the correlation coefficient in the space.

When the values are 1 and 0, the probability is:

$$p(y = 1 \mid x) = p(y = 0 \mid x) \quad (8)$$

$$p(y = 1 \mid x) = p(\Phi(p) = G(X, \Phi, P) \quad (9)$$

The aforementioned formula enables the development of a spatial model toanalyze urban scale expansion through the application of a normal distribution framework. For empirical analysis, a dataset comprising 4,000 samples was randomly selected from a larger big data pool, facilitating a unified computational approach. Theresults of this analysis reveal that economic factors exert the most significant influenceon the urban expansion coefficient. Subsequently, panel data analysis was employed to investigate the correlation between urban scale development in the Chang-Zhu-Tan region and its regional economic growth over recent years.

3.2 Study on Regional Economic Change of Chang Zhu Tan City Based on the Evolution of Spatial Differences

Differences in regional economies and the distribution of energy resources contribute to uneven economic development. Viewing from a spatial perspective, the interplay among various factors influencing regional economic growth can eitherfacilitate or impede progress, yielding disparate impacts. With urban scale expansion as a backdrop, regional economic disparities become more pronounced. Investigating the intricate relationship between these phenomena necessitates an analysis of the regional economy's structure and its evolution, particularly through the lens of spatial differentiation. The Changsha-Zhuzhou-Xiangtan Urban Agglomeration, positioned incentral Hunan Province and comprising the core cities of Changsha, Xiangtan, and Zhuzhou, along with several other prefecture-level cities, represents a focal point of modern economic development within the province. As of the end of 2020, thisagglomeration not only surpassed other cities in the region in terms of land area and population but also accounted for 63% of the province's per capita GDP. Despite the rapid development and steady increase in comprehensive strength of the Changsha- Zhuzhou-Xiangtan region, the implications of urban expansion on the regional economy are significant. This study employs panel data and statistical methodologies to examine the evolution of regional economic patterns amidst spatial disparities, aiming to elucidate the underlying connection between regional economic dynamics and urban scale expansion.

Panel data analysis facilitates the simultaneous acquisition of spatial and temporal data outcomes, thereby enhancing the efficacy of economic analyses. This methodological approach not only enables the comprehensive evaluation of economic phenomena over time and across different regions but also significantly mitigates various types of errors, thereby augmenting the precision and reliability of the analyticalresults. As an illustrative example, the investigation focuses on the per capita GDP coefficients across the Chang-Zhu-Tan regions over several years, as delineated in Figure 3.

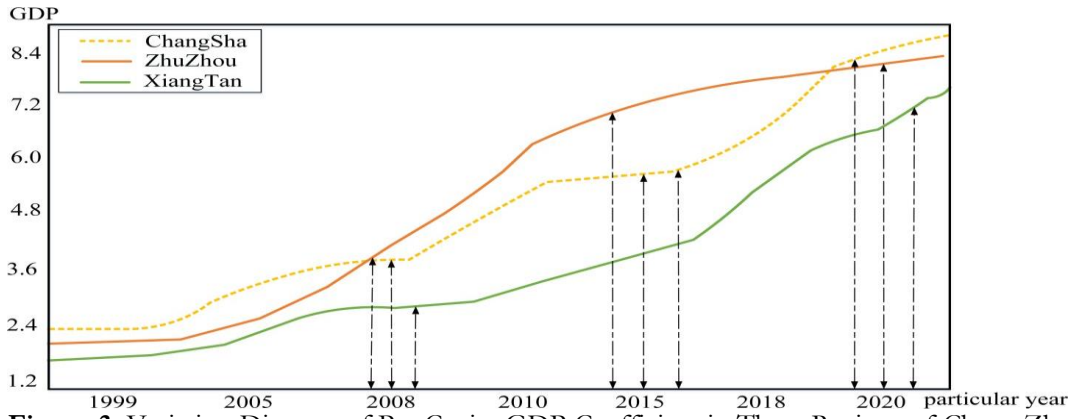

Figure 3: Variation Diagram of Per Capita GDP Coefficient in Three Regions of Chang Zhu Tan in Different Years.

Observations from Figure 3 reveal a notable upward trend in the per capita GDP across the three regions within the Chang-Zhu-Tan area over the analyzed period. Notably, Changsha and Xiangtan exhibit more pronounced growth curves, indicating significant economic development within these regions. This trend necessitates a comprehensive investigation from spatial and geographical perspectives to elucidate the underlying factors contributing to these regional disparities. Such an analysis shouldconsider the spatial distribution of economic activities, infrastructural development, and regional policies that may have influenced the economic trajectories of Changsha and Xiangtan differently from other regions. By integrating spatial and geographical analyses, we can gain deeper insights into the mechanisms driving regional economic growth and identify strategies to foster balanced economic development across the Chang-Zhu-Tan agglomeration.

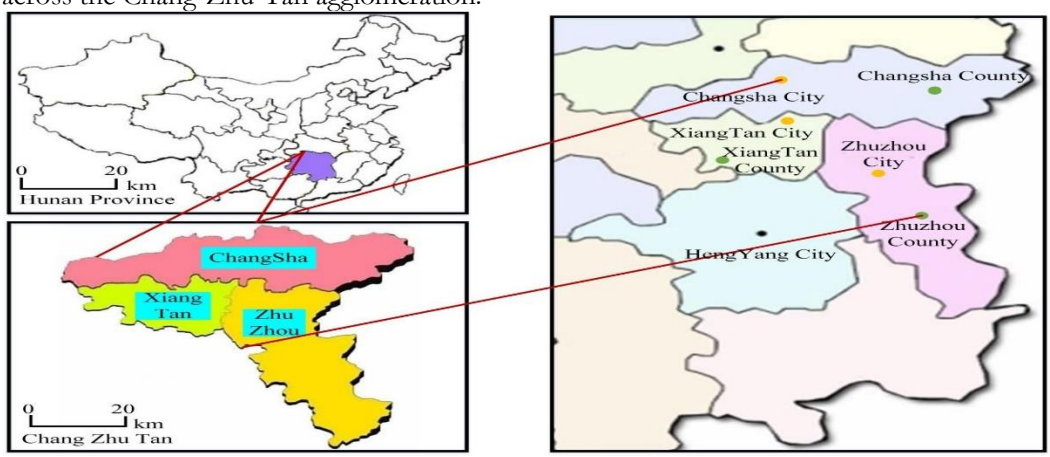

Figure 4: Geographical and Spatial Structure of Chang Zhu Tan.

Figure 4 illustrates the advantageous geographical position of Hunan Province within China, a key factor underpinning its urban development trajectory. The strategic proximity of the Changsha, Zhuzhou, and Xiangtan regions not only fosters regional economic integration but also acts as a catalyst for collective economic growth. In lightof this, urban scale expansion considerations must integrate geographical and regional economic transformations comprehensively. To enhance the analytical rigor of our study, economic sample data were

randomly selected to broaden the degrees of freedom in our panel data analysis, thereby improving the statistical validity of our results. We employed a spatial fixed effects model for our empirical investigation, designed to accommodate the unique characteristics and temporal shifts of each region, ensuring that our model is responsive to regional variations. The specification of the model is asfollows:

$$y_i = \sum_{j=1}^{u} w_i y_i + x\beta_i + \varepsilon_t \quad (10)$$

$$\varepsilon_{it} = p\sum_{j=1}^{n} W_{ij}\varepsilon_{it} + \delta_{it} \quad (11)$$

In the formula, y_i represents the unit change within the spatial distance at this time, and β_i represents the spatial coefficient vector and the distance influence coefficient with the adjacent area. We calculate the error value between the independentdistribution coefficient and the actual result. When the average value is 1, it means thatthe influence of time factor is greater, and when the average value is 0, it means that the influence of space factor is greater. Among the three regions of Chang Zhu Tan, Zhuzhou is located in the micro center, and other cities are surrounded nearby. Withoutconsidering spatial correlation, only the calculation model without spatial connection is constructed:

$$\ln AND_{it} = a + b_i \ln POP_{it} + \beta_2 \ln GDP + \varepsilon_{it} \quad (12)$$

The above formula shows the relationship between the scope of urban constructionexpansion and population, urban development level and local economic changes. The balance index is carried in by the ratio of regional population to total population. The economic development of peripheral areas is relatively slow and the level is low. Therefore, the expansion of urban scale also needs to be combined with regional economic changes and give limited construction resources to the fringe. Considering the correlation between them from the perspective of spatial location is a basic measure.We also use Morgan coefficient to calculate the economic structure, and define a spatialweight matrix as follows:

$$W = \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1N} \\ W_{21} & W_{22} & \cdots & W_{2N} \\ W_{m1} & W_{m2} & \cdots & W_{mn} \end{bmatrix} \quad (13)$$

The value of the element in the spatial matrix is 1 or 0, which represents the adjacent or non adjacent cities. The spatial correlation between regional economy andscale expansion is analyzed as follows:

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(F_i - F)(F_j - F)}{}$$

n n n
(□ □ W_{ij})□ (f_i
□ f)²
i□ 1
j□ 1
i□ 1
（14）

When the value is close to 1, it means they are positively correlated, and when thevalue is close to 0, it means they are not correlated. The structure of the whole space presents a random distribution pattern. In order to ensure the validity of the data, it is also necessary to test the error of the results:

Z □ (Z □ 1.96) $\frac{I - E(I)}{\sqrt{VAR(I)}}$
（15）

The analysis derived from the formula testing indicates a minimal error coefficient,underscoring the model's efficacy in conducting correlation analyses. This investigation reveals a discernible linear relationship between changes in urban regional economics and urban scale expansion within the spatial analysis framework.

4. Analysis on the Relationship between Changsha Zhuzhou Xiangtan Urban Expansion and Regional Economic Development and the Research Results of Rationality Evaluation

Regional economic growth and development are influenced by a constellation of factors including geographical location, ecological conditions, natural resources, demographic dynamics, technological advancements, and political frameworks. In terms of resource allocation, the Chang-Zhu-Tan area benefits from its strategic position along the open Yangtze River corridor, proximate to the surrounding economic zones. This advantageous geographical setting has established it as a focal point for attracting investment and fostering international economic partnerships. Moreover, industrial structure variations play a critical role during phases of regional economic evolution. The demand for labor-intensive industries, which escalates in the intermediate stage of economic development, is directly correlated with population size.

Such industries necessitate substantial human resources, a requirement that urbanization and the expansion of urban infrastructure can mitigate and support. The expansion of urban areas serves to enhance the mobility and integration of the population, thereby accelerating the regional labor production rate and exerting a positive influence on economic dynamics. Our findings, including the construction expansion growth coefficients for the Chang-Zhu-Tan regions, are depicted in Figure 5.

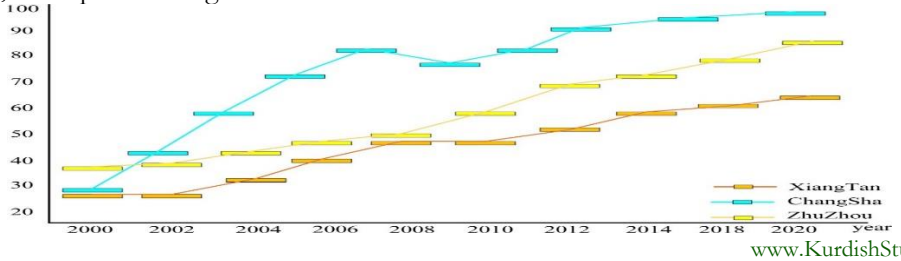

Figure 5: Comparison Chart of Construction Expansion Growth Coefficient in Three Regions of Chang Zhu Tan.

Analysis of Figure 5 reveals that, between 2000 and 2008, Changsha experienceda rapid expansion in urban scale, while the land expansion in Zhuzhou was comparatively moderate. Over the years, the growth trajectories of all three regions within the Chang-Zhu-Tan area have exhibited an exponential increase. Further examination of the urban scale expansion coefficient alongside the regional economic development, as depicted in Figure 6, demonstrates a positive correlation between the expansion of urban scale and the advancement of regional economic development.

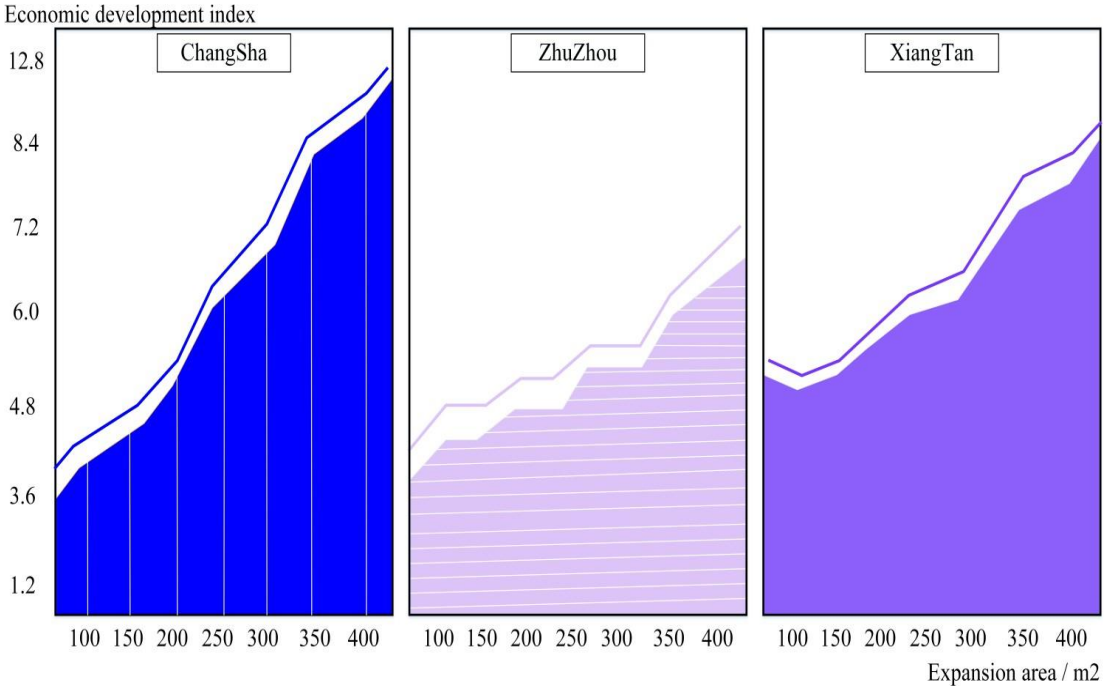

Figure 6: Relationship between Urban Scale Expansion and Regional Economic Development.

The correlation observed between urban scale expansion and regional economic development exhibits variation across different regional divisions. To ascertain the veracity of this relationship, the stability of the overarching model was rigorously assessed through panel data analysis. Furthermore, a comprehensive evaluation involving multiple models was conducted to identify the model that most accurately reflects real-world outcomes. During the initial phases of urban expansion within the Chang-Zhu-Tan region, the average residential land allocation within urban construction zones was recorded at 60.43 square meters, juxtaposed with an average allocation of 34.58 square meters for public infrastructure land. By 2019, paralleling improvements in the economic environment, these figures ascended to 153.4 square meters for residential land and 102.3 square meters for public infrastructure land, respectively. This trend underscores the direct impact of economic environmental shiftson the magnitude and intensity of urban expansion, highlighting their role in enhancingthe quality of living environments and propelling urban development under specific conditions.

In the context of urban construction expansion, the open policy framework presents a

complex array of influencing factors. Beyond elucidating the internaldynamics with regional economic growth, it is imperative to evaluate the scalability ofexpansion efforts. Optimal allocation of land resources, guided by well-defined principles, is crucial for maximizing regional economic development. To this end, thisstudy proposes a rationality evaluation framework encompassing three pivotal dimensions: the economic development coefficient, represented by per capita GDP; thesocial development coefficient, indicated by shifts in industrial productivity; and the ecological environment index. This comprehensive approach allows for a nuanced analysis of the factors influencing urban scale expansion. The comparative impact of economic and social factors on the urban expansion coefficient is systematically depicted in Figure 7.

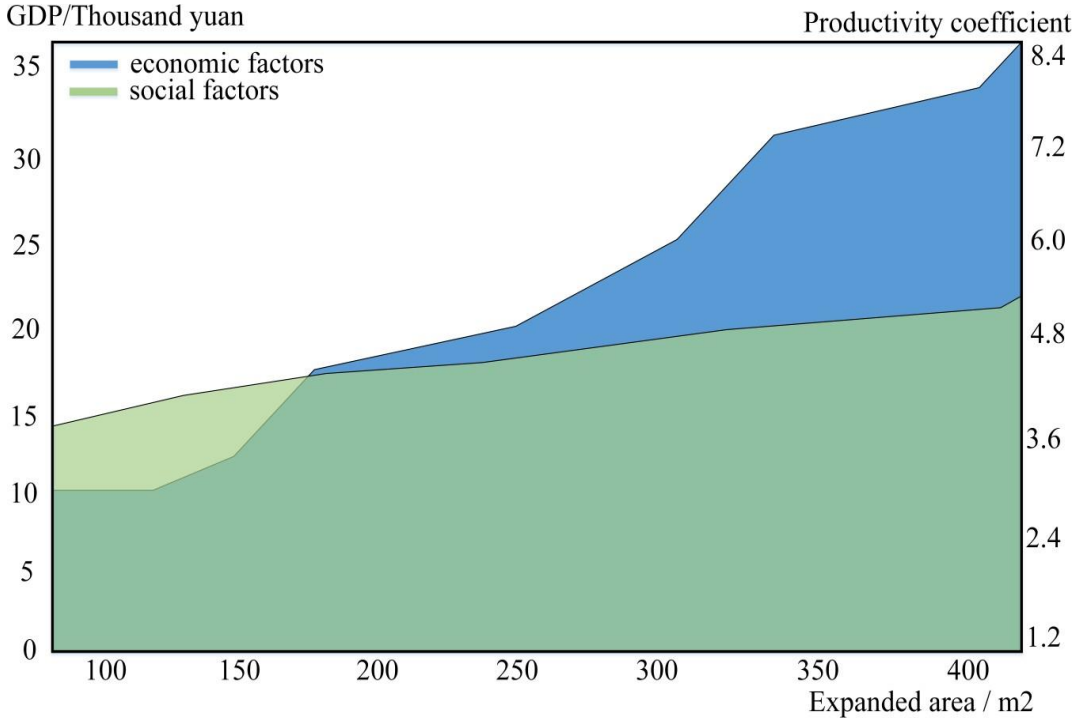

Figure 7: Comparison of the Impact of Economic and Social Factors on Urban Scale.

Analysis of Figure 7 reveals that regional per capita GDP exerts a significant influence on the urban scale expansion within the Chang-Zhu-Tan area. Meanwhile, thecontribution of social development factors, despite their rapid initial increase, has begunto stabilize over time. This observation aligns with the broader understanding that urban and social infrastructure development is driven by multifaceted factors. Notably, changes in the regional economy are positively correlated with the extent of urban scaleexpansion. The validity of these findings is further corroborated through the applicationof spatial analysis models and the examination of data across multiple regions, affirming the consistency and reliability of the study's outcomes.

5.Conclusion

Urban construction and land expansion are pivotal elements of modern urban transformation. Balancing the impacts of urban scale expansion on the regional economy, ecological

environment, and population structure constitutes a critical area offocus. This study selects the Chang-Zhu-Tan area as a case study to elucidate the intricate relationship between urban scale expansion and regional economic development, while also identifying and optimizing the principal factors influencing regional economic growth. Initially, an analysis from a spatial structural perspective reveals the recent trends in urban expansion and construction within Chang-Zhu-Tan, with a notable predominance of residential housing, governmental buildings, and publicinfrastructure, alongside a slow growth in revenue. Subsequently, the study employs spatial regression to assess the regional economic growth rates of Changsha, Zhuzhou,and Xiangtan, investigating economic development disparities through variations in land economic density across these regions. A spatial analysis model is constructed to quantitatively examine the determinants of regional economic development and urbanland expansion, highlighting the dual role of population migration, urban transportationenvironment, and geographical factors as both facilitators and barriers. The findings, derived from rigorous analysis, provide insights into the rationality of the urban expansion of the Changsha-Zhuzhou-Xiangtan Urban Agglomeration, taking into consideration the regional economic growth indices for future scale constructionplanning. The study concludes that there is a positive correlation between the scale expansion of the Changsha-Zhuzhou-Xiangtan Urban Agglomeration and regional economic development, suggesting that mutually beneficial improvements in these areas can foster reciprocal growth.

Statement of Declaration

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