Application of GIS in the Analysis of Urban Economic Migration

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Abstract. As an intuitive embodiment of the city's comprehensive strength, urban competitiveness, combined with the theory of regional gravity center, makes a comparative analysis of the urban economic migration of urban competitiveness in different years, which helps to analyze the spatial and temporal development differences of regional cities, thus providing a new perspective for the analysis and research of urban competitiveness. In the market economy, land price plays an important role in optimizing the allocation and intensive use of urban land resources. Therefore, it is of great practical significance for the government to reasonably allocate urban land resources and standardize the order of land market to master the spatio-temporal change law of urban land price and study the driving mechanism of land price change. This paper analyzes the urban economic migration with the help of GIS technology and carries out research at the same time, analyzes the spatio-temporal change law of the form, analyzes the urban form measurement, expansion intensity and expansion speed, and explores the driving forces and constraints affecting the urban spatial form. From this, we can obtain the spatio-temporal trajectory of GIS in urban economic migration and evolution, and the analysis and research of this trajectory can understand the direction of regional economic development and the balance of development.

Keywords: GIS, Urban economy, Migration analysis

1. Introduction

As the center of population concentration, politics, economy and culture, cities have always played an important role in regional and national development, and the level of competitiveness of cities is the most intuitive response to this role. In reality, although the institutional barriers to migrant population in cities are weakening, with the deepening of the reform of urban economic system, all kinds of citizen treatment and welfare enjoyed by urban residents for a long time are also disappearing. The attractiveness of cities to farmers, especially to agricultural transfer of labor, has declined greatly. As an intuitive embodiment of the city's comprehensive strength, the urban competitiveness, combined with the regional center of gravity theory, makes a comparative analysis of the urban economic migration of urban competitiveness in different years, which helps to analyze the spatial and temporal development differences of regional cities, thus providing a new perspective for the analysis and research of urban competitiveness [1-2]. The migration of urban economy can directly reflect the changes and trends of regional economic development. The urban geometric center of gravity refers to the central position of the urban geographic coordinates. The urban geometric center of gravity refers to the central position of the urban geographic coordinates. By comparing with the economic center of gravity space and the economic center of gravity space, we can judge whether the development of the region is balanced. The position of the economic center of gravity and the geometric center of gravity is obviously deviated from that of the economic center of gravity and the geometric center of gravity, indicating that the economic development in the region is unbalanced.

In the market economy, land price plays an important role in optimizing the allocation and intensive use of urban land resources. Therefore, it is of great practical significance for the government to reasonably allocate urban land resources and standardize the order of land market to master the spatio-temporal change law of urban land price and study the driving mechanism of land price change [3]. This paper analyzes the urban economic migration with the help of GIS technology and carries out research at the same time, analyzes the spatio-temporal change law of the form, analyzes the urban form measurement, expansion intensity and expansion speed, and explores the driving forces and constraints affecting the urban spatial form. Through the analysis of the long-term economic analysis period in the study area, there is still a large number of surplus labor force that needs to be transferred out in the urban economy. This shows that at this stage, China not only needs to rely on the development of non-agricultural industries to absorb a large number of agricultural surplus labor, but also needs to rely on corresponding policies and systems to increase the "push" and "pull" efforts in the flow of rural

population and labor force, so as to speed up the urban economic process and realize the optimal allocation of population and non-agricultural industries in space [4]. From this, we can obtain the spatio-temporal trajectory of GIS in urban economic migration and evolution, and the analysis and research of this trajectory can understand the direction of regional economic development and the balance of development.

2. Correlation analysis of urban economic migration

2.1 Urban economic system and calculation method

Urban economy is a relatively permanent, highly organized and densely populated spatial entity within a certain geographical scope. Within it, various components and numerous functional activities are not randomly distributed, but are regularly linked together according to a certain arrangement order and form a certain structure. City economy is the result of comprehensive social structure, economic structure, institutional policies and other factors, and it is an intuitive embodiment of the city's own ability in the process of development [5-6]. The index system design of urban competitiveness should follow several principles: systematicness, scientificity, feasibility, independence, hierarchy, etc. The formation of land price is different from the formation of other common commodity prices. According to Marx's land rent price theory, the formation of land price is not the monetary expression of value, but is determined by the capitalization of land rent provided by land, and the existence of differential land rent is the main factor that affects the level and change of regional land price [7].

Because the units of various attribute indicators in the urban economic evaluation index system are different, it is impossible to compare them directly, and the influence directions of different attribute indicators on the comprehensive competitiveness of cities are not exactly the same, some of them are positive indicators, that is, the larger the value of such indicators is, the greater the enhancement effect on the comprehensive competitiveness of cities. Some are reverse indicators, and the larger the value of these indicators, the greater the weakening effect on the comprehensive competitiveness of cities. The factors that affect the amount of land rent that urban land can provide are complex and diverse, so the final formation of urban land price is the comprehensive embodiment of many factors in a certain city [8]. Then, the evaluation score of the influence of each attribute index on the weight coefficient in the three-dimensional competitiveness of urban economic, social and environmental development is calculated, and finally, the evaluation score of the three-dimensional competitiveness of urban economic, social and environmental development is calculated.

2.2 Analysis of drivers for migration

In some relatively developed coastal areas of China, the lagging process of urbanization has seriously restricted the further development of the economy and the continuous optimization of the industrial structure in these areas. The fundamental reason for China's lagging urbanization is related to the agricultural labor transfer mode of "leaving the land without leaving the hometown", "entering the factory without entering the city", and the institutional barriers of cities to the migrant population [9]. For urban economic migration, the circular variance not only reflects the deviation from the average migration direction, but also reflects the number of migration directions, which can be used as a reference index to measure the openness of a region. The main factors affecting urban land price include administrative factors, city size, economic development level, infrastructure, urban location, etc. Four typical driving factors are selected as shown in Table 1.

Table 1 Relative development speed of each driving factor

	X1	X2	X3	X4
Northeast region	1.136	1.135	1.012	1.194
Southwest region	1.234	1.350	1.063	1.473

It should be noted that the city size includes the economic size, population size and land use size of the city, respectively using the gross regional product, the number of non-agricultural population and the area of built-up areas. As a regional production and living center, a convenient transportation network can shorten the logistics cycle and reduce the transportation cost, so as to obtain more excess profits on the unit land and affect the urban land price. The migration attraction center is that it has a relatively small population of its own, but has a strong attraction. On this basis, the comprehensive population migration index and comprehensive population migration index of Jiangsu, Zhejiang and Shanghai in 2018 and 2020 are calculated respectively. As shown in Table 2.

Table 2 Indicators of Attraction Center of Migration Population

Region	2014		2021	
	Comprehensive immigration selection index	Comprehensive migration selection index	Comprehensive immigration selection index	Comprehensive migration selection index
Shanghai	612.18	51.76	668.49	20.23
Jiangsu	137.77	78.26	145.20	61.24
Zhejiang	104.96	187.59	325.58	64.42

If the degree of marketization of land and labor force is used instead of village virtual variables, we find that neither of them will have a significant impact on migration behavior. It is worth noting that although both of them have no significant influence on migration behavior, both of them show negative correlation.

3. Research on the Application of GIS in the Analysis of Urban Economic Migration

3.1 Measurement and Analysis of GIS in Urban Spatial Form

When the city has a high compactness, the land resources are used efficiently, while the urban form with a low compactness index is scattered, resulting in unreasonable use of resources and waste of a lot of manpower and material resources. The compactness index is an index to measure the shape of the wheel temple in the built-up area, which can reveal the evolution law of the urban spatial form. This index can be used to calculate the compactness of urban built-up areas based on the relationship between the polygon area and perimeter. GIS plays a leading role in the economic level and population size of urban economic migration places in influencing factors of migration population, and the distance between two places and the uncertainty of people's cognition of remote destinations also have a profound impact on migration decisions, while the status of migration places has a small impact on population migration [10]. Therefore, the transportation geographic location is the concentrated embodiment of the urban location, so the urban location related factors select the total freight volume indicators related to the urban transportation geographic location. After measuring and analyzing the urban spatial form of GIS, and testing the four driving factors in the second chapter, the migration tracks of the gravity centers of each factor in the east-west and north-south directions are obtained as shown in Figure 1.

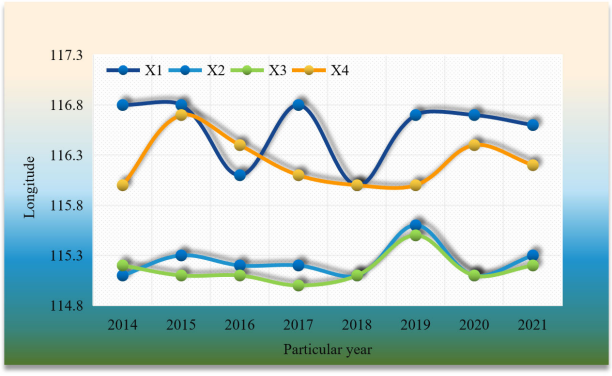

Figure 1 Land price gravity center migration and driving factors in the east and west directions

Through correlation analysis on the gravity center migration of relevant driving factors in the east-west and north-south directions, the correlation coefficient matrix of the gravity center migration of each driving factor in the two directions and the urban land price gravity center migration is obtained. Through GIS, the measurement range of urban land price level is consistent, and the data of municipal districts are used for each factor. From the moving track of the economic center of gravity, it can be found that the moving direction of the economic center of gravity is clear and fast in the first and third stages. In the second stage, the moving direction of the center of gravity is not clear, the direction is not clear, and the speed is slow. In the calculation of distance indicators, the railway mileage of provincial capital cities is selected as the actual distance between provinces. The distance between Tibet and the central cities of the Yangtze River Delta is expressed by highway mileage, while the distance between Hainan and the central cities of the Yangtze River Delta is replaced by the value of Guangxi Province. After analyzing the distribution of urban competitiveness through GIS, it is found that the center of gravity refers to the point where the moment of urban competitiveness distribution on the spatial plane reaches equilibrium in a certain period in a certain region, so its location migration will be affected by the urban competitiveness from all directions.

3.2 Application of GIS in the shift of urban economic center of gravity and economic policy

In the first stage, it moved rapidly to the northwest. In the first stage, it moved rapidly to the northwest. The reason for the widening gap between the east and the west was that during the Tenth Five-Year Plan period, the strategic adjustment of the economic structure was vigorously carried out, which promoted the improvement of the overall quality of the industrial economy. In the second stage, the direction of GIS migration trajectory often changes. In the second stage, the direction of gravity migration trajectory often changes. Basically, there is a 180 degree reversal in the migration direction in 2-3 years, but the moving speed is slow. According to the analysis of GIS in urban economic migration, the shift to the northwest, from the overall trend, the shift of social competitiveness center to the south is opposite to the shift of economic competitiveness center, which indicates that the development of social competitiveness of northeast urban agglomeration lags behind the development of economic competitiveness. During this period, the pains of internal transition and the depression of external economic environment make the urban economic development falter. The trend of the center of gravity in the third stage is basically the same as that in the first period. If the trend of the center of gravity in the third stage is basically the same as that in the first period, the direction and speed of the center of gravity migration are restored.

With the strong support of the national policy, the northwest quickly recovered its economic development power under GIS. The social competitiveness of the northeast and northwest regions has been in the top two places, while the social competitiveness of the southern cities is in a backward state, but its growth rate is faster than that of the first two regions. In 2010, it was selected as an economic transformation demonstration city in

China and an economic transformation demonstration city in China, which is the result of the city's "two-oriented" transformation development model. From a large-scale analysis, most of the attractive areas of urban economic migration under GIS are concentrated in the south of China, and they are developing in clumps, especially the strong attractive areas have been completely connected in series. From a small scale, the attractive areas have a tendency to expand to the northwest and southwest.

4. Conclusions

Limited by the data source of land price level, the cities studied are mostly distributed in the eastern part of China, while the number of cities in the central and western regions is small; In addition, the time series is a little insufficient for the study of the trajectory of the center of gravity migration, and the target cities and research years can be expanded in future studies. Therefore, in view of this situation, the application of GIS in urban economic migration analysis has been further studied, and the regional accessibility level has a stronger impact on the scale of migration population than the linear distance and economic level difference between the two places. In addition, the impact of railway and highway accessibility is different. The negative correlation between the railway accessibility coefficient and the size of the immigrant population is stronger, and it is mainly reflected in the near and far areas. In GIS urban economy quantitative analysis of the transfer track of urban land price gravity center, policy regulation factors and international market factors could not be specifically quantified and could not enter the evaluation system; In addition, each factor itself has a certain degree of correlation, so the establishment of the evaluation system is relative. While carrying out economic construction and environmental development, we should also give consideration to social development. Therefore, in the future, it is a new idea to realize the sustainable development of the city to improve the overall competitiveness of the city from the perspective of education, culture, health and other social public services, focusing on Anshan, Benxi and other northern resource-based cities.

References

1. Liu Y, Dong X S, Hui Y E, et al. Assessment of the urban fire risk prevention based on the GIS spatial analysisprinciple——takingZhumadian downtown area as a case study sample[J]. Journal of Safety and Environment, 2019, 54(12):21-37.
2. Balsas C. GIS Buildout Analysis and Urban Planning[J]. Urban and Environmental Studies in China, 2021, 63(009-001):38-41.
3. Williams, TM, Shelley, et al. GIS ANALYSIS OF HISTORICAL MAPS: A CASE STUDY FROM AN 1885 SURVEY OF THE CONGAREE RIVER[J]. MATH COMPUT FOR NAT-, 2017, 56(17):34-66.
4. Chen M, Dai F. Service Range and Optimized Layout of Urban Parkland in Jianghan District of Wuhan Based on GIS[J]. Journal of Landscape Research, 2017, v.9(06):32-35+41.
5. Khanna M, Roe B E, Vercammen J, et al. Village Political Economy, Land Tenure Insecurity, and the Rural to Urban Migration Decision: Evidence from China[J]. 2018, 33(8):24-51.
6. Daoudi M, Hachemi K, Bamousa A O. Geomorphologic Domination on Urban Sprawl of Southern Riyadh, Saudi Arabia Using Differential Interferometric Synthetic Aperture Radar (DInSAR)[J]. International Journal of Earth Science, 2021, 012(006):P.541-559.
7. Chophe T, Jamtsho T. A micro-level analysis of rural-urban migration in Bhutan[J]. Study on Heat Belt Agriculture, 2019, 18(Suppl.1):12-19.
8. Aghasi N. Application of GIS for Urban Traffic Accidents: A Critical Review[J]. Geographic Information System (English), 2019, 11(1):15-33.
9. Xia F, Liu H, Zhang J, et al. Migration characteristics of microplastics based on source-sink investigation in a typical urban wetland[J]. Water research: A journal of the international water association, 2022, 25(Apr.15):213-245.
10. Ariani N M, Wijaya M, Priambudi B N. Understanding Spatial Planning Policies in Responding to Urban Heat Island Using GIS Analysis in The Kendal Industrial Area[J]. IOP Conference Series: Earth and Environmental Science, 2021, 887(1):012021-012028.