Studies on Financial Center Selection Using Spatial Statistical Analysis and Combination Evaluation

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Abstract: For a long time, due to the level of economic development and natural resource endowment, China has had an obvious spatial-structural non-equilibrium. As an essential part of the economic system, finance exhibits relatively solid regional characteristics. Financial resources and related factors driven by them rapidly gather in the central cities, resulting in the gradual formation of regional financial centers. Financial centers realize the optimal allocation of available resources and drive regional economic growth through financial agglomeration, expansion diffusion, spillover, and economic growth. In this paper, spatial statistical analysis is successfully applied to the issue of financial agglomeration in China. The research results indicate that although China's regional economic growth has a statistically significant spatial aggregation distribution, the spatial aggregation distribution for financial development demonstrates a relatively insignificant level. Economic agglomeration far precedes the financial counterpart. The spatial agglomeration level of China's regional financial development is persistently increasing, as more-developed areas have particular driving effects on the financial development of surrounding provinces and cities. This pattern reflects the huge supporting role of regional financial centers on the economy and finance of surrounding areas.

Keywords: Financial Center, Spatial Statistical Analysis, Combined Evaluation, Mann-Kendall Test.

1 INTRODUCTION

At present, there are many financial centers of different types, levels, and scales distributed all over the world. By observing these financial centers' development status or comparing their evolution process, there is limited theory of of financial centers due to their diverse historical backgrounds, qualifications, and endowments. However, regarding the economic impact, all financial centers have the same objective to exhibit radiation effects on the region or country with uneven agglomeration. At the same time, all regional financial centers have strong spatiotemporal characteristics, for they are products of their times and have their unique evolution process. Being the financial hub of the region, they play the role of the central node.

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The research object of this paper is the regional financial centers in Mainland China. Their formation and development also have apparent temporal and spatial characteristics.

Mining its spatiotemporal evolution mechanism can promote the coordinated development of regional finance and is conducive to the optimal allocation of financial resources. At the same time, as an emerging market, China and its construction and development of financial centers are crucially influenced by the international environment and the domestic situation. Based on this, this research focuses on the background of the following two aspects.

On the one hand, China's regional financial centers present solid spatiotemporal characteristics. The regional financial center is a spatial concept and plays a pivotal role in gathering, distributing, and amalgamating financial resources within a relatively complete geographical unit. In a country with a vast territory and long-term unbalanced regional economic development, the spatial characteristics of regional financial centers are more prominent.

First, the formation and distribution of China's regional financial centers are spatially different. Due to the significant differences in natural endowments, economic development, and institutional factors across China, the formation mechanism of China's regional financial centers also has spatial differences. Some regional financial centers are naturally formed with their natural resource endowment as their advantage and gradually centered on their geographical location. Some are based on differences in economic development, formed gradually, with market agglomeration as the driving force. Others are based on the government's positioning as a financial center formed through government leadership. The spatial differences in the formation mechanism also make China's regional financial centers unbalanced: the distribution of regional financial centers in the eastern region is relatively dense, while those in the Midwest and Northeast are not dominant in quantity and scale.

Secondly, the spatial effects of China's regional financial centers are also different. Regional financial centers of different scales and levels have different agglomeration and radiation effect ranges. Its effect on allocating financial resources and upgrading industrial structure in the region has a strong spatial dependence. There are also asymmetric two-way spillover effects between regional financial centers and other spaces [6]. China's regional financial centers also have prominent time characteristics. Due to the staged differences in the economic development of various regions in China, the major regional financial centers also differ significantly in the timing of their formation. As early as the end of the 1920s, Shanghai was already a regional financial center with world influence. Meanwhile, Beijing's financial influence can also radiate to the whole country. At the same time, the construction and development of the ASEAN Free Trade Area accompany the rise of the Nanning regional financial center, nearly a century behind Beijing and Shanghai in terms of time. Many regional financial centers in China have gradually developed and grown, relying on different locations and economic advantages after the economic reform. Due to the difference in formation time, the stages of development of China's regional financial centers are also quite different. According to the latest Global Financial Center Index (GFCI) made by Z/Yen Group, Shanghai, Beijing, Shenzhen, Qingdao, and Dalian have been considered international financial centers, while Guangzhou and Tianjin serve as secondary financial centers. However, most regional financial centers in mainland China are still in the construction and development stage. Although they have clarified their development ideas and issued supportive policies, there is still a long way to go to realize the function of an actual financial center.

The future development of China's regional financial centers will also be very different. Currently, most of China's regional financial centers have gotten rid of blind imitation and disorderly competition and set up corresponding target positioning according to their qualifications and endowments. In the future, the development of regional financial centers will be more differentiated. Moreover, form a situation of misplaced development and healthy competition. However, it is not excluded that some financial centers will decline and eventually be eliminated in future competition, and new centers will take advantage of the trend.

On the other hand, the new international and domestic situation has a far-reaching impact on regional financial centers. The global financial turmoil triggered by the US subprime mortgage crisis has been nearly ten years old. However, the global economy and finance have yet to recover. The latest World Economic Outlook and the Global Financial Stability Report published by the International Monetary Fund (IMF) published in 2016 issued similar warnings about a weak economy, weak recovery, and rising risks to financial stability. The world economy has not yet emerged from the shadow of the financial crisis. We are still in the post-financial crisis era. This crisis has profoundly affected and changed the international financial landscape. As the global economic and financial center of gravity" move east," the status of financial centers in East Asia is rising. In particular, the financial center of mainland China has developed rapidly. The post-financial crisis also gave birth to the fourth industrial revolution, driven by the Internet of Things technology, big data and cloud computing, artificial intelligence, and 3D printing technology. The new revolution of production, service, and life informatization and intelligence. At the same time, also heralds the arrival of a new era of financial reform. In particular, big data and mobile Internet finance have quietly changed the operation and supervision system of modern finance' Facing such unprecedented challenges and opportunities [10]. The development of China's regional financial centers has a long way to go. Facing the sluggish recovery of the global economy, they should better play the function of financial resource circulation and integration. Facing the rise of East Asian financial centers, they should strengthen inter-regional financial cooperation, mutual benefit, and win-win. They must be determined to innovate, improve the efficiency of financial operations, and enhance financial regulatory functions.

In recent years, with the steady development of China's economy, China has become the third-largest economy in the world, and China's economic strength has supported multiple economic centers, which drive China's economy forward. At the same time, the construction of financial markets in many cities has gradually improved, and they have the conditions to build international financial centers or regional financial centers. Moreover, many cities have successively issued calls for the construction of financial centers at different levels through different means, and the construction of financial centers in various cities is proceeding in an orderly manner. All signs indicate that our country has the conditions to establish multiple financial centers. However, the construction of a financial center is a multi-level, multi-objective, multi-factor, and complex-structured systematic project [1]. Some things could be improved in building financial centers in multiple cities simultaneously. Competition and waste of resources Various financial center cities tend to adopt preferential policies similar to investment promotion competitions, overemphasize extensive preferential conditions, and ignore their characteristics. Local governments at all levels may pay too much attention to the number of financial institutions, Ignoring the creation of a peaceful financial environment [9].

In addition, China has a vast land area, objective differences exist in the economic development of different regions, and the imbalance in financial development is particularly prominent. The construction of a financial center also requires the state's macro-control objectively. In forming a financial center, the strategic orientation of the central government has an important impact on the healthy development of the city. This paper creatively applies the method of spatial statistical analysis and combined evaluation to the research of China's regional financial centers. The results may have good reference value for the national strategic choice in the process of China's financial center construction.

2 LITERATURE REVIEW

The concept of "Agglomeration" comes from "Industrial Agglomeration," first proposed by Alfred Marshall, referring to the process in which a particular industry is concentrated to a relatively high degree in a particular area, and the elements of industrial capital are continuously gathered. However, early studies on industrial agglomeration mainly focused on manufacturing and other industrial fields. As a particular financial service industry, the rise of the financial agglomeration phenomenon has naturally aroused extensive attention and research in academic circles. However, the academic circle has not yet reached a unified definition regarding the concept and connotation of "financial agglomeration". Moreover, although financial agglomeration belongs to the category of industrial agglomeration, the financial service industry, as a particular industry, has unique attributes (including high mobility, economic core, and dominance) that make its agglomeration connotation different from general. There are essential differences in industrial agglomeration, mainly manifested in the degree of agglomeration, content, speed, motivation, and scope of influence (Huang Jieyu & Yang Zaibin, 2006). Most theoretical research abroad is about analyzing the connotation of industrial agglomeration. Marshall (1890) put forward the concept of industrial agglomeration for the first time in his classic book "Principles of Economics," and based on external economies of scale. The theoretical thought of the concept defines its connotation as being in a specific area.

Reasonably measuring the level of financial agglomeration is the primary content of studying financial agglomeration. Scholars have fully used appropriate research methods on industrial agglomeration and used different indicators to measure the degree of financial agglomeration, which better reflects the spatial layout characteristics of the financial industry within a specific range. Ding Yi et al. (2009) first combined the influencing factors of the financial industry to screen and establish an evaluation index system for the level of financial agglomeration. Based on the economic data at the provincial level in China, they used principal component analysis to measure the degree of financial agglomeration, which reflected more comprehensively. The degree of financial agglomeration in various provinces and municipalities in China. It not only measures the degree of financial agglomeration in each region but also analyzes the mutual influence of each region on the degree of financial agglomeration. Ren Yinghua (2010) took the financial service industry in Lujiazui, Shanghai, as an example and built an evaluation index system for financial agglomeration core capabilities. Combining the AHP and the characteristics of financial formats, he designed a fuzzy comprehensive evaluation model to measure the core capabilities of financial agglomeration.

3 METHODS AND RESULTS

Spatial statistics emerged in the 1970s, and its basic idea is to introduce the interdependence of individuals, such as regions or institutions, into the model. For more than 30 years, foreign climatologists, geographers, economists, scientists, and anthropologists have been widely involved in the research and application of this method [7]. In the 1990s, Zhang describe spatial statistics. However, the popularization and application of spatial statistics in China are relatively slow due to the constraints of calculation and other aspects. Until recent years, the breakthrough and popularization of foreign spatial statistical software calculations allow more and more domestic scholars have begun to join in the study, research, and application of spatial statistics. Spatial statistical analysis refers to the statistical analysis of spatial data, which establishes the statistical relationship between data through spatial location, and understands data related to geographical location, spatial dependence, spatial autocorrelation, or spatial association. The spatial statistical analysis method believes that a specific geographical phenomenon or a particular attribute value on a regional unit is usually related to the same phenomenon or attribute value on an adjacent regional unit [3].

Almost all spatial data have spatial dependence or spatial autocorrelation characteristics. The spatial autocorrelation coefficient is the primary index to measure spatial autocorrelation. Commonly used methods for testing global spatial autocorrelation include the global Moran I test (global Moran I index), the Geary test (Global Geary C coefficient), and the Getis test (global Getis index). Methods for testing local spatial autocorrelation include the local Moran I test (local Moran I index), local Geary test, local Getis test, and Moran scatter diagram [2]. Among them, the global Moran The I index generally reflects the distribution pattern of the entire study area; the global Geary C coefficient has a negative correlation with the global Moran I index and is also an index for analyzing global spatial autocorrelation; the global Getis index examines the clustering type of spatial distribution from a global perspective, that is high-value agglomeration or low-value agglomeration; the local Moran I index reflects the distribution pattern state between each research area and surrounding areas, that is, whether there is an aggregation distribution; the Moran scatter plot reflects the relationship between a specific regional unit and its adjacent units Local spatial correlation mode [4]. These analysis methods involve the construction of a spatial weight matrix, the measurement and inspection of spatial autocorrelation, and the identification of spatial correlation. The following introduces the global Moran I test for testing whether each regional unit has global spatial autocorrelation and the test for the Moran scatterplot method of the spatial correlation pattern that the regional unit belongs to [5]. Suppose the observed value of the variable on each observed regional unit is known. In that case, the global Moran I index can be used to reflect the distribution of the index in the whole research area. The global Moran I test consists of two parts: constructing the spatial weight matrix and measuring spatial autocorrelation [8].

A binary symmetric spatial weight matrix Wnxn is usually defined to express the spatial proximity relationship of a regional unit. The form is as follows:

$$W = \begin{matrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \cdots & \cdots & & \cdots \\ w_{n1} & w_{n2} & & w_{nn} \end{matrix}$$

Among them, wij represents the proximity relationship between regions i and j, which can be measured according to distance or adjacency standards. The definition of the spatial weight matrix based on the distance criterion is as follows:

$$W_{ij}\begin{cases}1, when\ the\ distance\ beyween\ i\ and \\ j\ is\ less\ than\ d \\ 0, other\end{cases}$$

The definition of the spatial weight matrix based on the adjacency criterion is as follows:

$$W_{ij}\begin{cases}1, when\ i\ and\ j\ are\ adjacent \\ 0, other\end{cases}$$

The Moran I index is defined as follows:

$$\boldsymbol{I = \frac{\sum_{i=1}^{n}\sum_{j\neq 1}^{n} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{S^2 \sum_{i=1}^{n}\sum_{j\neq 1}^{n} w_{ij}}}$$

Under the assumption of a normal distribution, the formulas for the expected value and variance of Moran I are as follows:

$$\boldsymbol{E(I) = -\frac{1}{n-1}}$$

$$VAR(I) = \frac{n^2 w_1 + n w_2 + 3w_0^2}{w_0^2(n^2-1)} - E^2(I)$$

Standardized statistics can be used to test whether there is a spatial autocorrelation relationship in an observation of a regional unit:

$$Z = -\frac{I - E(I)}{\sqrt{VAR(I)}}$$

The value range of Moran I is between 0 and 1. When IZI > 1.96, the value of Moran I is positive, indicating that the data are positively correlated and the observed variables have a statistically significant space Cluster distribution. The closer the value of Moran I to 1, the stronger the positive spatial autocorrelation of the observed variable; when IZI> 1.96, the value of Moran I is negative, indicating that the data is negatively correlated, and the observed variable is meaningful. In addition, the closer the value of Moran I is to 1, the stronger the negative spatial autocorrelation of the observed variable is. On the contrary, when the value of Moran I is closer to 0, the data is randomly distributed and does not have spatial autocorrelation.

Table 1 Global Moran's I Test of GRP per capita

Year	Moran Index(I)	E(I)	Var(I)	z	p
2002	0.0362	-0.0333	0.0211	0.4783	0.3156
2003	0.0807	-0.0333	0.0211	0.7851	0.2148
2004	0.0990	-0.0333	0.0211	0.9105	0.1814
2005	0.0977	-0.0333	0.0211	0.9016	0.1841
2006	0.0881	-0.0333	0.0211	0.8359	0.2005
2007	0.1024	-0.0333	0.0211	0.9343	0.1762

The paper conducts a spatial analysis of the two variables, the financial-related ratio and the proportion of the added value of the financial industry in the regional GDP, respectively, according to the method introduced above. The adjacency standard determines the spatial weight matrix, as the elements of the spatial weight matrix corresponding to two adjacent regions are set to 1. Otherwise, they are 0. The global Moran I test is carried out on the two variables of the related financial ratio and the proportion of the added value of the financial industry in the regional GDP. For comparison, this paper also conducts a spatial analysis of the per capita GDP of 31 provinces and cities from 1997 to 2007. The empirical results are shown in Table 1.

Table 2 GLOBAL MORAN'S I TEST OF FINANCIAL INTERRELATION RATIO (FIR)

Year	Moran Index(I)	E(I)	Var(I)	z	p
1997	0.2969	-0.0333	0.0211	2.2726	0.0116
1998	0.2920	-0.0333	0.0211	2.2391	0.0125
1999	0.2892	-0.0333	0.0211	2.2198	0.0129
2000	0.2840	-0.0333	0.0211	2.1837	0.0146
2001	0.2814	-0.0333	0.0211	2.1658	0.0150
2002	0.2840	-0.0333	0.0211	2.1842	0.0145
2003	0.2957	-0.0333	0.0211	2.2644	0.0119
2004	0.2975	-0.0333	0.0211	2.2770	0.0113
2005	0.3074	-0.0333	0.0211	2.3450	0.0094
2006	0.3107	-0.0333	0.0211	2.3675	0.0089
2007	0.3070	-0.0333	0.0211	2.3423	0.0097

Table 3 GLOBAL MORAN'S I TEST OF THE SHARE OF VALUE-ADDED OF FINANCIAL INTERMEDIATION TO GRP

Year	Moran Index(I)	E(I)	Var(I)	z	p
2002	0.0170	-0.0333	0.0211	0.3462	0.3632
2003	0.0384	-0.0333	0.0211	0.4937	0.3121
2004	0.0337	-0.0333	0.0211	0.4612	0.3228
2005	0.0401	-0.0333	0.0211	0.5056	0.3050
2006	0.0367	-0.0333	0.0211	0.4821	0.3156
2007	0.0653	-0.0333	0.0211	0.6791	0.2483

From Table I that the Moran index I during the sample period is all positive. The Z values of the test are all greater than 1.96, and probability p values are all less than 0.05, indicating that at a confidence level of 0.05, The observed values of the per capita GDP of each province and city show a positive spatial correlation. The economic growth of each province and city shows a clustered distribution with statistical significance. Correspondingly, it can be seen from Table2 and Table 3 that even if the sample period starts from 2002, the spatial autocorrelation test results of the financial correlation ratio and the proportion of the added value of the financial industry in the regional GDP are still not significant, indicating that China The phenomenon of spatial aggregation distribution of financial development in various provinces and cities is not evident yet. However, it can be seen from Table 1 that the index and test values show an upward trend, and their significance level gradually increases, indicating that the spatial aggregation of financial development in various provinces and cities in China is getting higher and higher. From the spatial agglomeration of economic growth and the spatial agglomeration of financial development, economic agglomeration is far ahead of financial agglomeration.

4 CONCLUSION

This paper examines the phenomenon of regional financial agglomeration in China by using the global Moran I test for spatial statistical analysis, with reference to regional economic growth. It could be concluded that the economic growth of China's provinces and cities shows a statistically significant aggregation distribution, while the financial development is not statistically significant. However, the Moran index I and the test value Z basically show an increasing trend, and their significance levels gradually increase, indicating that the spatial agglomeration of financial development in China is getting higher and higher. This work indicates that the economic agglomeration is far ahead of financial agglomeration. (Sarkis, 2000)

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