An empirical Analysis of Financial Ecological Environment Evaluation of Guangzhou and Shenzhen——Based on Entropy Weight Method and K-means Clustering Method

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Abstract: The sound development of financial ecology is conducive to the development and stability of the national economy. As special economic zones in China, the development of financial ecology in Guangzhou and Shenzhen is of reference significance. Based on the local practice, this paper uses the entropy weight method and K-means clustering method to establish an evaluation system from four aspects including economic environment, financial environment, government and social security, and scientific and technological talents to evaluate the financial ecological environment of Guangzhou and Shenzhen. This paper not only compares the gap in financial ecology between the two cities horizontally, but analyzes the ecological gap between Guangzhou and Shenzhen from the perspective of longitudinal time series. Based on the empirical results, this paper provides policy suggestions on cultivating talents, strengthening supervision and strengthening cooperation for the sound development of regional financial ecology.

Keywords: financial ecology; Guangdong Province; Evaluation system; Entropy weight method

1. Introduction

The development of finance is not only the development of financial subjects, but the improvement of the financial ecological environment that affects financial subjects. The sound development of financial ecology is conducive to the development and stability of macro economy. Zhou Xiaochuan pointed out in the "2005 China Financial Forum" that the improvement of financial ecological environment includes two levels. The first is the ecological environment at the overall and macro levels, including the government, legislation and judicial environment. The second is ecological environment at the local level [1] At present, there are many theoretical studies on the rating system of financial ecology, but few empirical studies. The rating system mostly exists in cross-section data, and the panel analysis of cities is even less. Zhang Xinyu et al. selected 26 regions in the three northeastern provinces as the evaluation objects to build an index system, and calculated the comprehensive score of financial ecological environment in these regions from 2009 to 2018 by factor analysis-grey correlation analysis method [2]. Bai Yujuan et al. evaluated and analyzed the development of the sci-tech finance ecosystem based on the entropy-weight and TOPSIS method [3]. Li Hong et al. focused on China's three economic circles and constructed an evaluation system for the coupling and coordinated development of the green finance-ecological environment compound system [4]. As special economic zones in China, Guangzhou and Shenzhen have reference significance for their financial ecology. Shenzhen is one of the first four special economic zones, and as a special economic zone, it can enjoy preferential treatment such as tariff reduction and exemption. The establishment of Guangzhou Futures Exchange will also affect the financial ecological environment of Guangzhou and Shenzhen in the future. At present, there is insufficient literature on the financial ecological environment in these two regions. Based on the local practice, this paper not only compares the financial ecology gap between the two cities horizontally, but analyzes the ecological gap from the perspective of longitudinal time series.

2. Construction and data source of Guangzhou and Shenzhen financial ecological environment evaluation system

In terms of ecological system construction, Xu Nuojin studied China's financial ecology from three

aspects: financial ecological subject, financial ecological regulation and financial ecological environment [5], and Liu Yuanli studied the level of financial ecology with such indicators as legal basis and legal construction, credit environment, financial development level, economic operation quality and government leading role [6]. At present, there are many theoretical studies on the rating system of financial ecology, but few empirical studies, even fewer studies on the financial ecology of Shenzhen and Guangzhou, two economically developed cities, as well as panel analysis of cities in the rating system. This paper makes up for the shortcomings mentioned above and selects a series of indicators based on the local reality. This paper evaluates Guangzhou and Shenzhen, two financially developed cities, from the two dimensions of time and city. Combined with relevant literature, this paper divides the factors affecting the whole financial ecological process into four aspects: economic environment, financial environment, government and social security, and scientific and technological talents.

The establishment of financial ecology in Guangzhou and Shenzhen is based on the economic environment, and the local economic development has a very important impact on the development of local financial ecology. This paper adopts per capita disposable income, CPI, foreign direct investment, total import and export volume, and urbanization rate as the evaluation indicators. The financial ecology of Guangzhou and Shenzhen is supported by the financial environment. From the perspectives of credit supply, financial market subjects and financial industry, this paper uses RMB deposits of financial institutions, the number of financial institutions and financial employees as indicators to evaluate the financial environment. In the meantime, this paper uses original insurance premium income, insurance density and insurance depth as indicators to evaluate the development of insurance ecology in the financial system. The number of financial institutions and deposits and loans directly indicate the status of the financial ecological environment. Insurance is a stabilizer to ensure the stable development of social economy. In this paper, government strength, social basic pension, unemployment insurance fund levy and the number of insured are used as the evaluation indexes of social insurance with government participation. In this paper, the government strength, which is defined as the government's fiscal expenditure divided by the local gdp, is used as an indicator to evaluate the government's contribution to economic and social development. The sound development of financial ecology requires financial innovation to reduce various risks of finance, so the training of financial talents is particularly important. In this paper, science education expenditure and the number of higher education schools and the number of students are used to represent the talent reserve evaluation. The research objects of this paper are Guangzhou and Shenzhen, the two leading cities in economic development, and the sample data are mainly from the National Bureau of Statistics and Wind database. The sample data mainly include the data of various indicators in Guangzhou and Shenzhen from 2013 to 2020.

3. Evaluate the financial ecological environment of Guangzhou and Shenzhen based on the entropy method

3.1 Research ideas

In the case of a large number of indicator systems, a more reasonable weight is needed to carry out the comprehensive evaluation of financial ecological environment in Guangzhou intuitively. The mainstream methods of assigning weights to the index system are mainly divided into objective and subjective categories. In order to eliminate the influence of subjectivity, this paper chooses the entropy method. In addition to the time series analysis, the model in this paper also includes the horizontal analysis of Guangzhou and Shenzhen, and the entropy method better solves the problem of horizontal comparison between the indicators.

3.2 Research Methods

The entropy method calculates the information entropy of the index, and determines the weight of the index according to the influence of the relative change degree of the index on the whole system. The greater the change degree of the index, the greater the weight. Entropy reflects the disorder degree of a system, which is a common comprehensive competitiveness evaluation method used for objective weighting. Difference coefficient is the amount of dispersion or dispersion between the observed value and a central value. The greater the numerical difference coefficient is, the smaller the information entropy value calculated by the index is, the more sufficient the information contained by the index with the greater the difference coefficient is, and the lower the degree of uncertainty it represents is. So the weight of the index is also greater. According to the amount of information carried by the evaluation index, the weight of each index of the financial environment of Guangzhou and Shenzhen is determined,

so as to determine the final score of the financial ecology of Guangzhou and Shenzhen.The financial ecological evaluation results of Guangzhou and Shenzhen are shown in Table 1.

3.3 Financial ecological evaluation results of Guangzhou and Shenzhen

Table 1: Evaluation results of financial ecology in Guangzhou and Shenzhen

Primary index	Weight w	Secondary index	Weight w
Economic environment	0.386	GDP	0.052
		Per capita disposable income	0.058
		CPI	0.024
		Foreign direct investment (RMB '000)	0.034
		Total import and export volume (RMB 100 million)	0.076
		Urbanization Rate	0.090
		Proportion of tertiary industry	0.051
Financial Environment	0.304	Deposits in RMB from financial institutions (RMB 100 million)	0.055
		Number of financial institutions	0.046
		Financial practitioners	0.055
		Premium income from original insurance (100 million yuan)	0.052
		Insurance Density	0.047
		Insurance penetration	0.050
Government and Social Security	0.147	Strength of government	0.058
		Collection of social basic pension and unemployment insurance funds (RMB '000)	0.055
		Number of insured (ten thousand)	0.034
Technology talents	0.163	Science education expenditure	0.058
		Talent reserve	0.106

The specific weight of each index is obtained through the entropy method. Talent reserve, urbanization rate and import and export volume are the largest proportion in secondary index. The big difference in talent reserve index is mainly due to the gap between Guangzhou and Shenzhen in the number of higher education schools and the number of students. As Shenzhen is a new city, there is a big gap between Shenzhen and Guangzhou in the development of education. Which specifically reflected in the number of higher education schools and educational resources. While the talent reserve is conducive to financial innovation and reduce the risk of financial transactions, it is very important for the financial ecological environment. The operation of the financial industry also needs more high-level talents; The urbanization rate of Shenzhen is almost 100%, and the main difference is that there are still some rural areas in Guangzhou. Shenzhen is far ahead of Guangzhou in terms of import and export volume. Shenzhen is one of the first four special economic zones. As a special economic zone, Shenzhen has a policy of tariff reduction and exemption and Shenzhen's stock exchange has also increased the introduction of foreign capital. Therefore, there is a big gap between Shenzhen and Guangzhou in terms of import and export volume at present. The establishment of Guangzhou Futures Exchange will also increase foreign investment in innovative varieties. Whether it is carbon trading or emerging derivatives trading, the import and export volume of Guangzhou will be greatly improved in the future and the gap between the import and export volume of the two cities may gradually narrow in the future. The CPI, foreign direct investment and the number of insured people account for the smallest proportion. From the specific data, the consumer price index of the two cities fluctuates slightly from 101-102, so the difference is very low. As the opening scope of the two cities is similar in caliber, while there is no obvious preference for foreign investment in Guangzhou and Shenzhen in terms of industrial types, the difference is small. In terms of the number of insured people, it is a comparison of more developed areas, and people's understanding and degree of insurance are similar. Moreover, this index is only statistically analyzed from the perspective of the number of people, without expanding to specific insurance varieties, and is more related to the population, so it accounts for a relatively small proportion in the whole financial ecological environment evaluation system. The following figure shows the financial ecological evaluation scores of Guangzhou and Shenzhen calculated according to the weights. Figure 1 and Figure 2 show the financial ecological evaluation score of Guangzhou and Shenzhen based on the weight
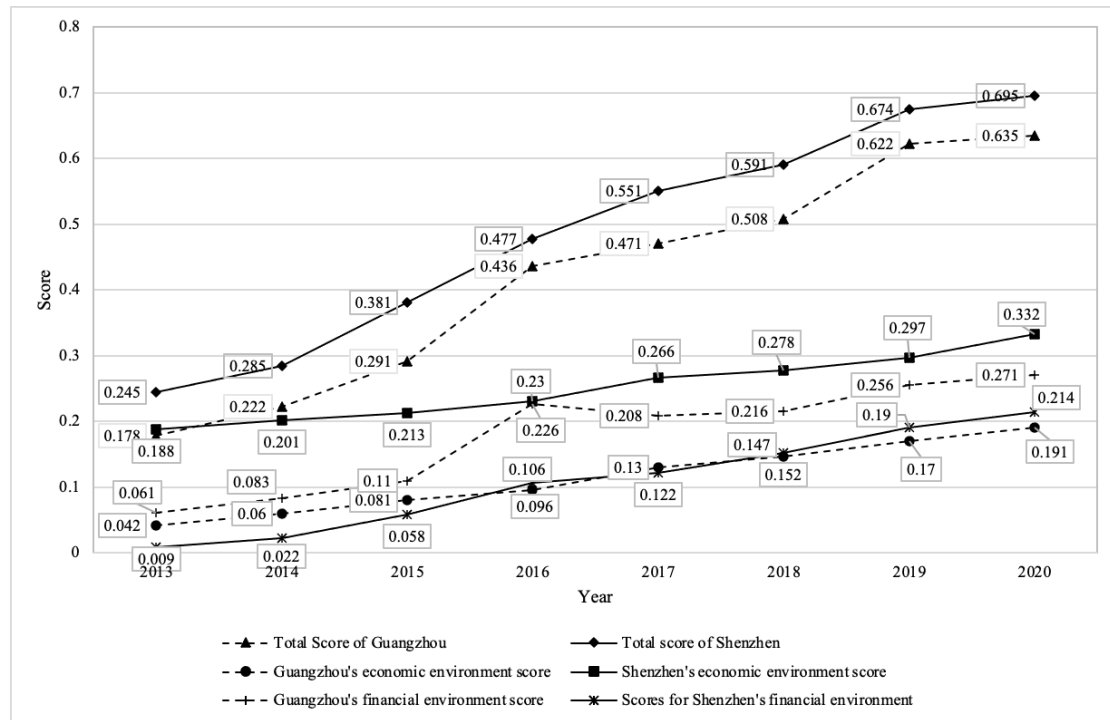
calculation.

Figure 1: Total score of financial ecological environment, economic environment and financial environment in Guangzhou and Shenzhen
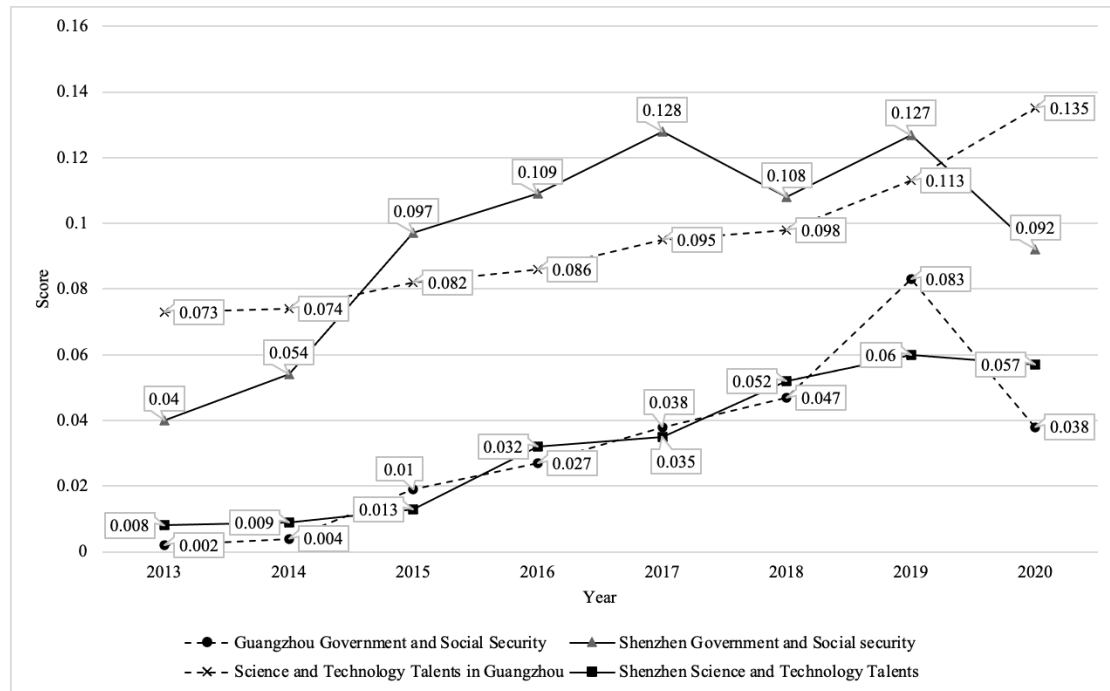

Figure 2: Scores of government, social security and science and technology talents in Guangzhou-Shenzhen financial ecological environment

4. Analysis of financial ecological evaluation system results of Guangzhou and Shenzhen

4.1 Analysis of score results of financial ecological development in Guangzhou and Shenzhen

From the perspective of the total score of financial ecological development in Guangzhou and Shenzhen, the overall score of financial ecological environment in Guangzhou and Shenzhen showed an

upward trend from 2013 to 2020, reaching the highest value in 2020. Whether it is the economic environment score, financial environment, scientific and technological talents or social security, the general trend is upward. From the perspective of growth rate, it is found that the growth slowed down in 2017 and 2020, which is related to the global financial crisis in 2017, the industrial structure transformation of Guangzhou and Shenzhen, and the COVID-19 pandemic; In the vertical comparison, Shenzhen is slightly higher than Guangzhou at each point in time, and Guangzhou is better than Shenzhen in terms of financial environment and scientific and technological talents. In terms of the score value, the economic environment score gap between the two cities reaches 0.1, while the gap of other indicators fluctuates around 0.05. Shenzhen's advantage in economic environment is an important factor that makes its final total score slightly higher than that of Guangzhou. In terms of time trend, the gap in the latest year is significantly smaller than that in the previous 2-3 years. The establishment of Guangzhou Futures Exchange in the near future will also be a key event affecting the financial ecological environment gap between Guangzhou and Shenzhen in the future.

From the perspective of economic environment score, Guangzhou and Shenzhen have increased year by year in the horizontal time series, with a great increase in GDP and per capita disposable income. Comparing the economic environment scores of Guangzhou and Shenzhen, the overall score of Shenzhen is much higher than that of Guangzhou. In terms of import and export, Shenzhen has greater advantages than Guangzhou, and the import and export index is one of the important factors causing the gap in the score of economic environment. From the perspective of urbanization, Shenzhen's urbanization is almost 100%. The GDP data analysis of the two cities is almost parallel and Guangzhou performs better than Shenzhen in the tertiary industry, but these advantages are not enough to make up for the gap between Guangzhou and Shenzhen in urbanization and import and export.

From the analysis of financial environment, the two cities are generally on the rise, reaching the maximum in 2020. In 2015, the growth rate of Guangzhou's financial industry ranked first among all industries. First of all, it carried out the pilot project of good policy small loan guarantee insurance, the establishment of "China Youth Innovation Board" in Guangzhou, and the new financial service zone for small, medium and micro enterprises in Guangzhou, which are the reasons for the rapid growth of Guangzhou's financial environment score in 2015-2016. From the perspective of social security. It can be seen that both Guangzhou and Shenzhen experienced a steady increase from 2013 to 2017, but both experienced a significant decline in 2019. The main reason is that the characteristics of budget implementation in 2019. From the perspective of government strength, the overall financial ecological environment is greatly weakened. From the index of scientific and technological talents, Guangzhou and Shenzhen both show an increasing trend in scores and the rising speed of the score of scientific and technological talents in Guangzhou is gradually increasing. The main reason is that in 2019 and 2020, Guangzhou's universities expanded their undergraduate and graduate enrollment. Shenzhen has a slight decline in 2019-2020. Under the premise is that the number of students in its institutions of higher learning has increased, which is more due to the reduction of Shenzhen government's expenditure on science and technology education, which is related to the tax and fee reduction policy in 2019.

4.2 Analysis of financial ecological development trend in Guangzhou and Shenzhen

Table 2: K-means clustering results Table

Grade	City/Year				
Excellent	GuangZhou 2019	GuangZhou 2020	ShenZhen 2018	ShenZhen 2019	ShenZhen 2020
Good	GuangZhou2017	GuangZhou2018	ShenZhen2016	ShenZhen2017	
Medium	GuangZhou2016	ShenZhen2015			
Poor	GuangZhou 2013	GuangZhou 2014	GuangZhou 2015	ShenZhen 2013	ShenZhen 2014

In this paper, the K-means clustering method is used to analyze the development trend of Guangzhou and Shenzhen according to the total score clustering. K-means clustering is to cluster the more similar and less different samples into a class (cluster) according to the distance or similarity (closeness) between the samples, and finally form multiple clusters, so that the samples within the same cluster have high similarity and the difference between different clusters is high. This is an iterative process. In this paper, the comprehensive scores of financial ecological environment in Guangzhou and Shenzhen from 2013 to 2020 are divided into four categories by K-means clustering method: poor, medium, good and excellent. Table 2 shows the clustering results. It can be seen from the table that with the progress of The Times, the categories of the whole financial ecological environment are gradually improving. Guangzhou and

Shenzhen have moved from poor rating to medium rating in 2016 and 2015 respectively, and reached good rating within one year. In 2018 and 2017, Guangzhou and Shenzhen respectively reached excellent ratings, and maintained an upward trend in the following years.

5. Conclusions and policy recommendations

From 2013 to 2020, the overall score of financial ecological environment in Guangzhou and Shenzhen showed an increasing trend and reached the highest value in 2020.Economic environment, financial environment, scientific and technological talent and social security, the overall trend is rising. Slower growth in 2017 and 2020.

The policy recommendations of this paper are as follows: Firstly, there should be sufficient talent reserve to carry out financial innovation to reduce risks. In this paper, talent reserve accounts for the largest proportion in the financial ecosystem. Financial talents play a very important role in the innovation of financial products, and financial talents are conducive to reducing operational risks in financial transactions. Therefore, the sound development of financial ecology needs the cultivation of talents. Secondly, the sound development of financial ecology requires the sound development of laws and regulations. Developing good financial ecology in accordance with laws and regulations and sound laws and regulations are also conducive to preventing financial risks. At present, there is still a certain gap between financial ecology of our country and that of the developed countries. Laws and regulations need to be further improved, but also to strengthen financial supervision. Thirdly, In the conclusion of this paper, import and export account for a large proportion in the financial ecosystem. The healthy development of financial ecology requires the increase of foreign trade, Therefore, in foreign trade and cooperation, we should comply with the tide of globalization, give full play to the advantages of special economic zones, strengthen foreign economic, trade relations, and strengthen foreign cooperation.

Fourthly, in the process of economic transformation, it is necessary to conform to the local reality and strengthen the ability to prevent risks and shocks. In terms of financial environment, although the financial ecology of Guangzhou and Shenzhen has been rising steadily, the growth rate slowed down in 2020. Therefore, it is particularly important to deepen reform to stimulate growth momentum, cultivate a good investment environment to attract investment, accelerate the construction of financial service zones for small, medium and micro enterprises, and seek high-quality development of financial ecology. In terms of social security, the budget implementation in 2019 caused a certain impact on social security. Finally, In terms of insurance, the government should increase the coverage of social insurance groups, guide the sound development of commercial insurance, and give full play to the role of insurance in disaster prevention and loss reduction, resisting risks and maintaining social stability. Then finance must serve the real economy and never deviate from the real to the virtual.

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