The Harmonious Development of Ecological Civilization Construction and Financial Agglomeration in Guizhou

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Abstract: To promote the construction of ecological civilization and the coordinated development of financial agglomeration, this paper first analyzes the interaction mechanism between ecological civilization construction and finance agglomeration using the pressure-state-response framework. Then, the level of ecological civilization construction and the level of financial agglomeration in the nine cities of Guizhou were measured by using the 2015 cross section data and the intuitionistic fuzzy analytic hierarchy process and intuitionistic fuzzy number scoring function. Finally, the coupling coordination degree between ecological civilization construction and financial agglomeration in nine cities of Guizhou is calculated by using the coupling coordination model, and relevant policy recommendations are put forward. The empirical results show that there are significant regional differences between Guizhou's ecological civilization construction and financial agglomeration, Guiyang and Zunyi have a higher degree of coupling coordination, and Bijie has a lower degree of coupling coordination.

1. Introduction

Promoting the structural reform of financial supply side, advocating and developing green finance and speeding up the establishment of green financial system are the inevitable and objective requirements of China's green development [1]. In August 2016, Guizhou was approved by the State Council to build a national ecological civilization pilot area, and in June 2017, the State Council approved the construction of a green financial reform and innovation pilot area in Gui'an New Area. The two pilot areas complement each other, providing a good opportunity for Guizhou to vigorously develop green finance and promote the construction of ecological civilization. Financial agglomeration can drive the green financial innovation of financial institutions in the agglomeration area. Therefore, the analysis of the current situation of the coordinated development of ecological civilization construction and financial agglomeration is conducive to promoting the coordinated development of ecological civilization construction and green financial innovation.

At present, the external scholars mostly focus on financial agglomeration and ecological efficiency, but less on the coordination between ecology and finance. Porteous (1995) [2] studied the motivation and effects of financial agglomeration; Hellweng (1994) [3] focused on the measurement and application of ecological efficiency; Maciej Dzikuć and Marek Tomaszewski (2016) [4] took Poland as an example; the economic benefits of green investment would optimize the regional financial structure. In recent years, domestic scholars have studied the relationship between ecology and finance. Zhan Dongxin et al (2017) [5] put forward the important role of developing green

finance on ecology and economy through theoretical analysis. Some scholars have studied the coupling relationship between ecology and finance. Yuan Yingying (2011) [6], Qujin (2015) [7] and Jiang Jun (2018) [8] have used the coupling model to evaluate the coupling and coordination relationship between ecology and finance, and have carried on the time series research and analysis. Baicai Quan et al (2014) [9] regards financial agglomeration and ecological efficiency as an open system with high complexity and multi-level. Taking 31 provinces under the Central Government in the Mainland of China as the research object, this paper studies the coupling relationship between financial agglomeration and ecological efficiency, explores the law and characteristics, and puts forward suggestions for the coordinated and sustainable development of regional economy in China. Pan Xingxia and He Yiqing (2014) [10] elaborated the coupling mechanism of the three subsystems of regional ecology, economy and finance, constructed the coupling and coordination model of the ecological-economic-financial system by using the method of entropy weight, and carried out an empirical study with the Poyang Lake Eco-economic Zone as an example. Chen Linxin (2017) [11] integrates financial agglomeration, economic growth and ecological efficiency into a logical system framework, uses the coupling coordination function to describe the spatial and temporal characteristics of the three-dimensional system coupling and coordination.

In summary, foreign scholars have little research has been done on the coordinated development of Finance and ecology. Domestic scholars seldom incorporate a province's ecological environment and financial industry into a symbiotic system for coupling analysis. This paper evaluates the level of ecological civilization construction and financial agglomeration in Guizhou Province by using the intuitionistic fuzzy analytic hierarchy process. The same method is used to measure both of them in order to avoid large differences in evaluation results due to different models, and then affect the accuracy of the coupling coordination degree. Finally, based on the evaluation results of the two, the coupling and coordinated development of ecological civilization construction and financial agglomeration in Guizhou is studied in depth, and the countermeasures and suggestions are put forward in order to promote the coordinated development of the two.

2. PSR of Interaction between Eco-civilization Construction and Financial Agglomeration

Pressure-State-Response (PSR) is a tool for analyzing the interaction between environmental pressure, state and response. David J. Rapport and Tony Friend first proposed in 1979, and then developed by the United Nations Economic Cooperation Organization and the United Nations Environment Programme in the 1980s and 1990s to study the framework of environmental issues.

The PSR model includes pressure index, state index and response index. The PSR model reflects the interaction between human and environment. Human beings obtain the necessary resources for their survival and development from the natural environment through various behavioural activities, while discharging waste to the environment, thus changing the natural resources reserves and environmental quality, and the state of nature and environment. Change, in turn, affects human socioeconomic activities and welfare, and society responds to these changes through environmental, economic and sectoral policies, as well as through changes in awareness and behaviour. Such cycling constitutes a stress-state-response relationship between human and the environment. First of all, laws, policies and economic means escort the good operation of the financial industry, thus enhancing the degree of industrial agglomeration of the financial industry. Secondly, the external economies of scale generated by financial enterprise clusters will attract other industries to join, and constantly enhance the degree of financial agglomeration. The expansion of production and operation activities in the financial industry and other industries has resulted in environmental pollution, ecological damage and resource waste, which has put pressure on the ecological environment. Improving ecology requires financial institutions to invest a lot of money, and will improve the level of agglomeration. To improve environment, we should restrict human behaviour. Financial supports the development of related industries by increasing investment, and the agglomeration effect can be feedback. The level of ecological civilization construction has been improved. Further, the improvement of environment is more conducive to promoting the marketization and capitalization of ecological resources in Guizhou, and further improving the level

of financial industry agglomeration. Ecological civilization and financial agglomeration interact and influence each other, and form a good circular result of common development.

3. Index System and Data Source

The selection of indicators plays an important role in accurately evaluating the level of ecological civilization construction and financial agglomeration. This paper follows the principles of comprehensiveness and representativeness, pertinence and comparability when constructing the index system of the level of ecological civilization construction. It not only emphasizes the sustainable development of nature, human beings and society, but also takes into account the carrying capacity of the ecological environment, and promotes the harmonious development of human beings and nature on the basis of improving the ecological civilization of the whole society. Reference [12], the paper formulates the principles including the ecological environment and the ecological environment. Four first-level indicators including ecological economy, ecological livability and ecological culture and 23 second-level indicators are established. Taking into account the actual situation of Guizhou's financial industry and the principles of index establishment, an index system including four first-level indicators and 13 second-level indicators of the overall financial scale, banking, securities and insurance industries was established.

The index data of ecological civilization construction in this paper are from China Regional Economic Statistical Yearbook, Guizhou Statistical Yearbook, Nine Cities Statistical Yearbook, District Water Resources Bulletin, Environmental Bulletin and National Economic Development Bulletin. Among them, the proportion of added value of cultural industry in GDP in Zunyi City and Bijie City, the per capita housing area in Anshun City, Qiandongnan Prefecture and Southwest Guizhou Prefecture, the per capita green space of parks in Southwest Guizhou Prefecture, sulfur dioxide emission in Southern Guizhou, the comprehensive utilization rate of industrial solid waste in Tongren City and Southern Guizhou Prefecture, the per capita green space of parks in Southeastern Guizhou and Southwest Guizhou Prefecture, and the increase The share of GDP in value comes from local news bulletins or estimates based on historical data. The data of financial agglomeration indicators come from China Insurance Regulatory Commission, Guizhou Statistical Bureau and the statistical official websites of municipalities and governments. According to the types of indicators, the indicators can be divided into benefit type, cost type and middle type. The standardization methods of indicators reference on [13].

4. Research Method

4.1. Comprehensive Evaluation Steps Based on IFAHP

Step 1: Determine the index system.

Step 2: Establish an intuitionistic fuzzy judgment matrix. Through expert scoring, an intuitionistic fuzzy judgment matrix $R=(r_{ij})_{n*n}$, i, j is established to represent the rows and columns of the intuitionistic fuzzy judgment matrix, in which $r_{ij}=(u_{ij}, v_{ij})$ and u_{ij} represent the membership degree, i.e., the degree of feriority of index i to index j, v_{ij} denotes non-membership, i.e. the degree of inferiority of index i to index j, and π_{ij} denotes hesitation, $\pi_{ij}= 1-u_{ij}-v_{ij}$.

Step 3: Consistency test. The consistency test of the intuitive judgment matrix is carried out. If consistency is satisfied, jump to step 5; otherwise move to step 4.

Step 4: Revise the intuitive judgment matrix which does not satisfy the consistency test. Set the parameter σ for iteration, $\sigma \in [0,1]$, until it passes the consistency test.

Step 5: Calculate the weight.

Step 6: Using intuitionistic fuzzy number operator to calculate the combined weights.

Step 7: Define function $U = u + u(1-u-v)$ [14]. The bigger the ranking is, the higher the score is.

4.2. Coupling Degree Model and Coupled Coordination Model

Coupling refers to the phenomenon that two or more systems affect each other through

interaction; they can coordinate with each other. Coupling is a dynamic relationship of interdependence, coordination and mutual promotion among subsystems. References [15]-[18], the coupling degree model and the coupling coordination model of ecological civilization construction and financial agglomeration are constructed to analyze the coupling relationship between them. Suppose that U_1 represents the score of Guizhou's ecological civilization construction level and U_2 represents the score of Guizhou's financial agglomeration level. Establishing a coupling model between ecological civilization construction and financial agglomeration:

$$C = 2\left\{(U_1 \times U_2)/(U_1 + U_2)(U_1 + U_2)\right\}^{1/2}$$

Coupling degree is used to measure the degree of interaction between systems or elements. Coordination degree is the relationship of coordination and virtuous circle between systems or elements, reflecting the degree of system coupling. When C=1, it shows that the coupling degree between systems is in the optimal coupling, when C=0, it shows that the elements between systems are independent and develop in disorder; when 0<C<0.3, the coupling between systems is at the initial stage of coupling development; when 0.3<C<0.8, the coupling between systems is at the stage of development; when 0.8<C<1, the system is highly coupled and at the stage of maturity [18]. However, only relying on the coupling degree analysis may make the conclusion inconsistent with the reality. For example, when the level of ecological civilization construction and financial agglomeration are very low, the coupling degree between the two may be very high, which can not truly reflect the level of coordinated development of the two. This is obviously inconsistent with the common sense, because the coupling degree model only shows whether the system interacts, but it can not show the coupling synergy. In order to truly reflect the coordinated development level of the two, it is necessary to combine the coupling degree with the coupling coordination model. Therefore, a coupling coordination model is established: $D = (C \times T)^{1/2}, T = \alpha U_1 + \beta U_2$. C is the coupling degree, D is the coupling coordination degree, T is the comprehensive coordination index of ecological civilization construction and financial agglomeration, reflecting the contribution of their overall development level to the coordination degree, and alpha and beta are the undetermined coefficients, representing the Contribution Coefficients of ecological civilization construction and financial agglomeration. In the actual calculation, the assignment of α and β is 0.5.The degree of coupling coordination is further divided into 10 levels, each of which represents a degree of coordination, and each level is subdivided into three coordination types.

5. Empirical Results and Analysis

5.1. Empirical Research Based on IFAHP

As the scoring function shows, the comprehensive evaluation value of ecological civilization construction level in southeastern Guizhou is 0.4342, with the highest score and the lowest score being Liupanshui, which is 0.2303. The others are South Guizhou, southwest Guizhou, Tongren, Guiyang, Zunyi, Anshun and Bijie, which are 0.4096, 0.3891, 0.3775, 0.3587, 0.3262, 0.3234 and 0.2893 respectively. The level of ecological civilization construction in nine cities of Guizhou is quite different. The comprehensive evaluation value of financial agglomeration level in Guiyang City was 0.6552, with the highest score, followed by Zunyi, Anshun, Southern Guizhou, Southeast Guizhou, Tongren, Liupanshui, Southwest Guizhou and Bijie, which were 0.3931, 0.1103, 0.0894, 0.0644, 0.0546, 0.0528, 0.0413 and 0.0180, respectively. We can see that the level of financial agglomeration in nine cities differs greatly. Except Guiyang and Zunyi are higher, the other seven cities are far below the average level of the whole province. The proportion of financial agglomeration is 22.22%, while the proportion of financial agglomeration is 77.78%.

5.2. Coupling Analysis in Guizhou Based on Coupling Model

U_1 and U_2 are substituted into formulas above. The coupling degree of nine prefectures in Guizhou is moderate, which belongs to the development stage. Guiyang and Zunyi have higher coupling degree. The results show that Guizhou is a collapsed province with high level of coupling

and coordination. Generally speaking, the degree of coupling and coordination between the level of ecological civilization construction and the level of financial agglomeration in nine prefectures of Guizhou has spanned five levels: moderate imbalance, slight imbalance, imbalance on the verge of imbalance, reluctant coordination and primary coordination. Specifically, Bijie is the lagging-type coupling coordination level of moderate imbalance financial agglomeration; Southwest Guizhou, Tongren and Liupanshui all belong to the lagging-type coupling coordination degree of mild imbalance financial agglomeration, and the areas that are on the verge of imbalance financial agglomeration lagging are southeastern Guizhou, southern Guizhou and Anshun. The results of coupling evaluation of Guiyang and Zunyi are primary coordination and reluctant coordination respectively. Guiyang belongs to the lagging type of primary coordination financial agglomeration, while Zunyi is the level of coupling coordination development of reluctant coordination type of ecological environment damage. Bijie, Southwest Guizhou, Tongren and Liupanshui are all the four cities that hinder the development of regional economy. They are all unacceptable levels of coordinated development. Southeastern Guizhou, Southern Guizhou, Anshun and Zunyi are in the transitional development zone, while Guiyang is in the acceptable zone. More directly, Guiyang has the highest degree of coupling and coordination (0.6963); followed by Zunyi (0.5984); the others are South Guizhou, Anshun, Southeast Guizhou, Tongren, southwest Guizhou, Liupanshui and Bijie 0.4374, 0.4346, 0.4089, 0.3789, 0.3560, 0.3321 and 0.2686, respectively. Except Zunyi is ecologically damaged, the financial agglomeration level of other eight cities and municipalities in Guizhou is low, and the development lags behind the level of ecological civilization construction. The comprehensive evaluation value of financial agglomeration level of six prefectures outside Guiyang, Zunyi and Anshun is even less than 0.1. The development of financial industry has seriously affected the development and progress of regional economy.

6. Conclusion and Suggestions

This paper makes a theoretical analysis of the interaction between financial agglomeration and ecological civilization through the PSR model, and qualitatively analyses the coordinated development of nine cities and municipalities in Guizhou through the coupling degree model and the coupling coordination model. Based on the empirical results of the coupled model, we can draw the following conclusions:

(1) On the whole, the evaluation level of the coupling degree between ecological civilization construction and financial agglomeration in Guizhou has spanned four levels. There is no optimal level of coupling, nor the worst level of coupling, but overall, the level of coupling coordination is still low. The level of financial agglomeration and the level of ecological civilization construction in each prefecture and city need to be improved.

(2) Spatially, Guiyang and Zunyi are the areas with high degree of coupling and coordination, while other areas have low degree of coupling and coordination. It shows that the degree of coupling coordination in economically developed areas is higher than that in economically underdeveloped areas.

This paper finds that there is a high correlation between the level of ecological civilization construction and the level of financial agglomeration, and there is a more significant interaction relationship, namely coupling relationship. With the aid of coupling model, the coupling relationship between ecological civilization construction and financial agglomeration in Guizhou is discussed and analyzed, which has important theoretical and practical significance for promoting the development of green finance and further improving the level of financial agglomeration.

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