Evaluation System and Effect Analysis of Inland Free Trade Pilot Zones in China

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Abstract: The development of free trade pilot zones plays a crucial role in China's response to the current global economic structure and the cultivation of new domestic economic growth engines. This article establishes a comprehensive evaluation system for the development of inland free trade pilot zones in China, and uses principal component analysis to comprehensively evaluate the development status of free trade pilot zones in Chongqing, Sichuan, Hubei, and Shaanxi from 2017 to 2020. It analyzes the development effects of inland free trade pilot zones and future differentiated development paths.

Keywords: inland free trade pilot zone; comprehensive evaluation system; principal component analysis

1. Introduction

Free trade pilot zones in China are a major national strategy implemented to build a new open economic system. The inland areas are located deep in the continental hinterland, and their level of opening up to the outside world is still lagging behind that of coastal areas. Therefore, the construction of inland free trade zones needs to highlight the characteristics of inland areas (Feng, 2019). China's inland free trade pilot zones are different from coastal free trade pilot zones in terms of location advantages, financial environment, investment environment, industrial structure, and other aspects (Han and Zhang, 2018). Exploring and promoting a new model of open economic development in inland areas will be an effective path for China to promote balanced and coordinated regional economic development in the future (Liu, 2018).

Scholars generally believe that free trade pilot zones have significant positive benefits for the regional economy (Seyoum & Ramirez, 2012; Jenkins & Kuo, 2019). Attracting foreign investment to promote FDI development and clustering high-end manufacturing and service industries will make the free trade zone a strong innovative and high value-added growth pole in China (Pedro & Janaina, 2017). Although China's pilot free trade zones have begun to take shape and achieve certain results, there are still some problems such as unclear leading effects, low degree of opening up in the service industry, and insufficient independent reform authority(Wang et al., 2020). These zones should possess the characteristics of "free trade park", "pilot zone", and "inland port", and establish new rules for international trade (Qi, 2021). Research on evaluation systems for pilot free trade zones mainly focuses on evaluating a single application area or the performance evaluation of individual early-stage zones (Tian and Li, 2015; Liu and Yang, 2016), lacking a comprehensive evaluation system for China's inland free trade areas.

This article mainly evaluates the development of China's inland free trade pilot zones through establishing a comprehensive evaluation system by using principal component analysis. Firstly, a comprehensive evaluation system for inland free trade pilot zones is constructed. Secondly, the principal component analysis is used to comprehensively evaluate the development of four inland free trade pilot zones in Chongqing, Sichuan, Hubei, and Shaanxi. Finally, based on the horizontal and vertical comparison of the ranking scores of these four zones, the differences in their development and existing problems are analyzed.

2. Construction of Comprehensive Evaluation Index System for Inland Pilot Free Trade Zones

Based on the index evaluation system integrating Liu and Yang(2016), Yang(2015), incorporating indicators targeted at the characteristics of inland free trade pilot zones, this article proposes a comprehensive evaluation system for inland free trade pilot zones as shown in

Table 1.

Table 1 Comprehensive Evaluation Index System of Inland Free Trade Pilot Zone

First-class indicators	Second-class indicators	Third-class indicators
Regional government functions	Service efficiency	New urban employment
		The decentralization of management authority
	Legal construction	Disclosure of Judicial Reform Information
	Institutional construction	Progress in implementing reform tasks
		Promoting institutional achievements,
Regional financial reform	Investment facilitation	Foreign investment utilization amount
		Newly added foreign-invested enterprises
	Financing facilitation	Securities market trading volume
		Increment of listed companies
Regional business environment	Industry access	Manufacturing market access
		Financial industry access
		Private fixed investment growth rate
		Foreign fixed investment growth rate
	Trade facilitation	Import amount
		Export amount
		Logistics competitiveness
	Macro-economy	Proportion of private and individual economy
		Premium income
Regional radiation capability	International communication	Consular mission
		Number of overseas visitors
	Economic contact	Number of China-Europe trains
		Import and export volumes of countries along the "Belt and Road"
		Freight volume of civil aviation
	Infrastructure construction	Number of international routes opened
		Road density
		The proportion of transportation, warehousing, and postal services to GDP
Regional innovation capability	Innovation environment	R&D expenditure
		number of technology companies
		talent reserves
	Innovation achievements	Number of patent applications
Authoritative third-party evaluation	Kearney Global City Index	Kearney Global City Index

This index system sets five first-level indicators including regional government functions, regional financial reform, regional business environment, regional radiation ability, and regional innovation ability. Among them, the regional radiation ability highlights the important feature of inland free trade pilot zones. In addition, authoritative third-party evaluations are introduced to make the evaluation more scientific.

3. Comprehensive Evaluation of Inland Free Trade Pilot Zones in China Based on Principal Component Analysis

3.1 Sample selection and data collection

The research object of this article is China's inland free trade pilot zones, so four pilot zones in Chongqing, Sichuan, Hubei, and

Shaanxi are selected as research samples. These four zones were established on April 1, 2017, so data from 2017 to 2020 is selected. The data mainly comes from four regions' statistical yearbooks, China Statistical Yearbook, official policy documents, and official website reports from these zones. In addition, some data from the China Judicial Transparency Index report, as well as the global city index ranking of Kearney are also used.

3.2 Indicator system calculation and comprehensive score

This article uses SPSS21 for data analysis. After conducting principal component analysis, the following principal component extraction results were obtained, as shown in Table 2.

Table 2 Variance Interpretation Rate

Number	Eigenvalue			Principal Component Extraction		
	Eigenvalue	Variance Interpretation Rate%	Accumulated%	Eigenvalue	Variance Interpretation Rate%	Accumulated%
1	10.399	33.546	33.546	10.399	33.546	33.546
2	5.599	18.063	51.608	5.599	18.063	51.608
3	4.521	14.584	66.193	4.521	14.584	66.193
4	3.975	12.821	79.014	3.975	12.821	79.014
5	2.139	6.9	85.914	2.139	6.9	85.914
6	1.499	4.835	90.748	1.499	4.835	90.748
7	0.834	2.69	93.438	-	-	-
8	0.599	1.934	95.372	-	-	-
9	0.545	1.757	97.129	-	-	-
10	0.358	1.154	98.283	-	-	-
11	0.205	0.662	98.945	-	-	-
12	0.14	0.453	99.398	-	-	-
13	0.084	0.272	99.67	-	-	-
14	0.054	0.174	99.844	-	-	-
15	0.048	0.156	100	-	-	-
16	0	0	100	-	-	-
17	0	0	100	-	-	-
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As shown in Table 2, the cumulative contribution rate of the first five principal components has reached 85% of the total information. However, in pursuit of data integrity, we extracted the first six principal components, with a cumulative contribution rate of 90.75%. At the same time, the eigenvalues of the first six principal components are all greater than 1. The specific naming is based on the component matrix and the rotated component matrix, which are presented in Table 3.

Table 3 Principal Component Naming and Indicator Classification

Regional Investment, Financing, and Trade Attraction	Disclosure of Judicial Reform Information	Newly added foreign-invested enterprises	Securities market trading volume	Increment of listed companies	Foreign fixed investment growth rate	Import amount	Premium income
	Freight volume of civil aviation	Number of international routes opened	Number of patent applications	Consular mission	Import and export volumes of countries along the "Belt and Road"		
Regional Government Service Efficiency	New urban employment	Foreign investment utilization amount					

Regional Innovation and Accessibility	Progress in implementing reform tasks	Logistics competitiveness	Number of China-Europe trains	R&D expenditure	Number of technology companies	Talent reserves	
Regional Business Environment	The decentralization of management authority	Export amount	Proportion of private and individual economy	Road density			
Regional External Competitiveness	Manufacturing market access	Private fixed investment growth rate	Number of overseas visitors	Kearney Global City Index			
Regional Macroeconomic Development	Promoting institutional achievements,	The proportion of transportation, warehousing, and postal services to GDP	Financial industry access				

From Table 3, Component 1 contains many indicators, but mainly focuses on representing financial indicators such as securities market trading volume and increment of listed companies, as well as foreign trade indicators such as import and export volumes of countries along the "Belt and Road". Therefore, Component 1 is named as "Regional Investment, Financing, and Trade Attraction". Component 2 contains two indicators of new urban employment and foreign investment utilization amount, which reflects the government's efforts in promoting economic and social development. So component 2 is named as "Regional Government Service Efficiency". Component 3 includes innovation indicators such as R&D expenditure, the number of technology companies, talent reserves, as well as infrastructure indicators represented by logistics competitiveness and the number of China-Europe trains. It is named as "Regional Innovation and Accessibility". Component 4 includes market economy construction indicators represented by the decentralization of management authority and market structure indicators represented by the proportion of private and individual economy. Therefore, Component 4 is named as "Regional Business Environment". The Kearney Global City Index, the number of overseas visitors, and indicators such as manufacturing market access measure regional development from a comprehensive strength perspective, so Component 5 is named as "Regional External Competitiveness". Component 6 includes three indicators. These indicators can effectively reflect regional economic structure, so Component 6 is named as "Regional Macroeconomic Development".

Based on the coefficients in the component score coefficient matrix, the eigenvalues of each principal component in the variance explanation rate table, and the variance explanation rates of each principal component, the final component scores and comprehensive scores were calculated, as shown in Table 4.

Table 4 Principal Component Scores and Comprehensive Rankings of Various Inland Pilot Free Trade Zones over the Years

Region	Year	Rank	Comprehensive score	Regional Investment, Financing, and Trade Attraction	Regional Government Service Efficiency	Regional Innovation and Accessibility	Regional Business Environment	Regional External Competitiveness	Regional Macroeconomic Development
Chongqing	2017	2	-0.93	-1.24	-3.46	1.06	-0.03	0.35	-1.27
Sichuan	2017	1	0.26	2.33	-1.27	1.09	-2.46	-1.52	-0.71
Hubei	2017	3	-1.40	-2.40	-1.28	-1.55	-1.88	0.00	2.05
Shaanxi	2017	4	-1.84	-5.64	0.53	1.41	-0.37	-3.52	0.83
Chongqing	2018	2	-0.50	-0.37	-3.11	0.62	0.75	0.99	-1.42
Sichuan	2018	1	0.97	3.63	-0.29	1.16	-2.19	-0.57	-0.85
Hubei	2018	4	-1.13	-1.92	-0.83	-2.04	-1.54	1.60	1.12
Shaanxi	2018	3	-0.72	-3.97	0.96	2.50	0.16	0.48	0.50
Chongqing	2019	2	0.14	1.20	-2.57	0.05	2.07	-0.12	-1.27
Sichuan	2019	1	1.50	4.72	-0.08	0.65	-1.81	0.14	1.21
Hubei	2019	4	-0.78	-1.03	-0.19	-3.22	-0.82	2.31	0.24
Shaanxi	2019	3	0.05	-2.46	2.24	2.11	0.79	1.19	-0.50
Chongqing	2020	2	0.91	2.40	-1.82	-1.73	5.42	-1.20	1.61

Sichuan	2020	1	3.05	6.28	3.24	1.69	0.37	0.26	1.03
Hubei	2020	4	-0.31	0.10	3.68	-5.11	-0.37	-1.74	-1.95
Shaanxi	2020	3	0.72	-1.63	4.25	1.31	1.92	1.36	-0.61

4. Analysis of evaluation results

4.1 Horizontal comparison

From the perspective of comprehensive ranking, Sichuan ranks first in the long run. It has maintained a leading edge in investment, financing, and trade attraction, and also ranks high in government service efficiency and innovation and accessibility. However, there are still gaps in the regional business environment and external competitiveness. Chongqing ranks second in the comprehensive ranking. It leads in the regional business environment and ranks second in investment, financing, and trade attraction. In 2020, it made great progress in regional macroeconomic development and jumped to first place. On the other hand, its government service efficiency has long been at the bottom of the list, indicating significant government delays and lack of innovation. Its regional external competitiveness also shows a downward trend. Shaanxi leads in government service efficiency, with prominent for innovation and accessibility. Its regional business environment performs well, and its regional external competitiveness shows an upward trend. However, its comprehensive ranking is relatively low, ranking behind in investment, financing, and trade attraction for a long time. Its regional macroeconomic development has also been overtaken by other regions. Hubei is one of the most lagging-behind inland-type Free Trade Pilot Zones, as most factors' rankings are relatively low, and the advantages in few areas have also shown varying degrees of decline.

4.2 Vertical comparison

In recent years, Sichuan Free Trade Pilot Zone has shown an upward trend in most evaluation indicators, making it a model for inland free trade pilot zones. However, its ranking has decreased in regional government service efficiency and regional macroeconomic development. With a large economic volume and a strong Chengdu city due to the strong provincial capital strategy, it may result in the Free Trade Pilot Zone having a relatively small impact on the provincial macro-economy.

There have been significant changes in the ranking of Chongqing Free Trade Pilot Zone's regional macroeconomic development over the past four years. After three years at the bottom, the regional macroeconomic development suddenly jumped to first place, indicating that Chongqing's macroeconomic impact has begun to be rapidly released after three years of accumulation. Other aspects of Chongqing Free Trade Pilot Zone's performance have been relatively stable, but it ranks low in regional innovation and accessibility, which should be focused on to change this situation.

Hubei Free Trade Pilot Zone has not shown any particularly outstanding performance overall. It has only achieved short-term success in the two aspects of regional external competitiveness and regional macroeconomic development, without ultimately expanding its leading edge. Compared to other aspects, the regional government service efficiency is relatively prominent, and the overall construction of Hubei zone should be strengthened.

As the only Free Trade Pilot Zone in the northwest region, Shaanxi has continued to improve in regional external competitiveness over the past four years, and its overall ranking has also shown some progress. It has maintained a leading position in government service efficiency. However, it still needs to improve its performance in the aspects of regional investment, financing, and trade attraction. Its ranking in regional innovation and accessibility, and macroeconomic development has shown a downward trend.

5. Conclusion

This article takes four inland Free Trade Pilot Zones in China as the research object, constructs a comprehensive evaluation system, and through evaluation and analysis, it is found that Sichuan Free Trade Pilot Zone is leading the development among others, except for the business environment, its development is relatively balanced. Chongqing Free Trade Pilot Zone is more prominent in regional business envi-

ronment and regional investment, financing, and trade attraction, and should take advantage of these two advantages to merge with Sichuan Free Trade Pilot Zone for higher-quality development. Hubei Free Trade Pilot Zone shows serious lag in its development compared to Hubei itself. Shaanxi Free Trade Pilot Zone has a good upward momentum in development, but whether it can maintain this momentum in the future needs to form a good development cycle and focus on the development of the financial industry in addition to integrating into the "Belt and Road" strategy.

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