



Analysis on the Degree of Coupling Coordination Between Higher Education and Regional Economic Development in China: Take Sichuan Province of China as an Example

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Abstract: To explore the relationship between China's higher education and the level of regional economic development, the coupling coordination degree of panel data from China's Sichuan province across 2011-2018 is analyzed based on self-constructed evaluation index system and with a integration of various methods including entropy value method, coupling coordination degree model and grey forecasting model. The results show that the coupling coordination degree between higher education and economic development in five Sichuan districts is not high, among which Chengdu Plain Economic Zone is much higher than the other four: southern Sichuan Economic Zone, northeast Sichuan Economic Zone, Panxi Economic Zone and northwest Sichuan Ecological Demonstration Zone. The study also predicts that in the five years, the coupling coordination degree of the five districts in Sichuan will be still not high, and none of them will broke through the incoordinate stage and entered the coordination stage. Moreover, the difference between the prefecture-level cities in Chengdu Plain Economic Zone is the largest.

Keywords: higher education, regional economic development, coupling coordination degree, grey prediction, Sichuan Province of China

As an important hub in southwest China, Sichuan is in the main position of the western development and "One Belt And One Road" construction in the new era. In June 2018, the third plenary meeting of the 11th Sichuan Provincial Committee proposed to build a new regional development pattern of "one branch, multiple branches and five districts in coordination". This strategic deployment has important guiding significance for the coordinated development of higher education and regional economy in Sichuan. As of 2019, Sichuan has a regular residential population of 83.75 million, with a GDP of 4.661.58 billion yuan, 126 regular colleges and universities, and 1.662 million full-time undergraduates and junior college students. In general, Sichuan is a province with a large population, prosperous economy, and abundant education resources, and its social and economic development has maintained positive momentum. But its development of higher education does not match with the comprehensive power of Sichuan Province, also can't fully meet the national major strategy and sichuan's high quality development. Meanwhile a prominent phenomenon is observed that there exists unbalanced development among various regions in the province, especially when Chengdu, provincial capital city, is compared with other cities (states) in the sense of volume. Therefore, it is very necessary to explore the synergistic development relationship between Sichuan higher education and regional economy, which is conducive to strengthen the overall planning of regional development, realize complementary advantages, co-frequency resonance and dislocation development of various regions, and improve the overall strength and urban competitiveness of the whole province.

1. Research design

1.1 Research area

According to sichuan economic development situation and the administrative division of geography, it is divided into five regions: the Chengdu Plain Economic Zone (CEZ; Chengdu, deyang, Mianyang, Leshan and Meishan, from Ziyang, Suining, ya), Economic Zone in Southern Sichuan (Ezs; Zigong, Luzhou, Neijiang and Yibin), Economic Zone in Northeastern Sichuan (EzN; Guangyuan, Nanchong, Dazhou, Guangan and Bazhong), Panxi Area (PA; Panzhihua and Liangshan Prefecture), Northwest Sichuan Ecological Demonstration Area (NED; Ganzi Prefecture, Aba Prefecture).

1.2 Data source

This study selects panel data from 2011 to 2018 to analyze the synergistic relationship between higher education development level and economic development level in the "five districts" of Sichuan Province. The data are mainly from

Sichuan Statistical Yearbook, Sichuan Education Yearbook, etc., and the relevant index data are converted and calculated according to the research purpose.

1.3 Index system construction

According to the principles of comprehensiveness, scientificity and operability, indicators reflecting the development of sichuan higher education and regional economy are selected from the dimensions of scale, structure and quality. Among them, Higher education includes nine indicators: the number of institutions of higher learning, the number of students enrolled, the number of college students per 10,000 people, the number of graduates, the number of full-time teachers, the proportion of junior college students in college students, the proportion of full-time teachers with senior professional titles, the number of students supported by each full-time teacher, and the proportion of educational expenditure in GDP. Regional economic development includes GDP, total investment in fixed assets of the whole society, local fiscal revenue, the proportion of added value in the secondary industry, the proportion of added value in the tertiary industry, the proportion of employed persons in the tertiary industry, per capita GDP, per capita disposable income of urban residents, per capita disposable income of rural residents and so on.

1.4 Research methods

In this study, entropy method ^[1], coupling coordination degree model ^[2] and grey prediction model ^[3] were mainly used to analyze the coupling coordination level between higher education and regional economy in Sichuan.

1.4.1 Coupling coordination degree model

The specific formula is as follows:

$$C=2\sqrt{f(x)g(y)}/[f(x)+g(y)],D=\sqrt{D\times T},T=\alpha f(x)+\beta g(y)$$

Notions in the above formula,

C : coupling degree of the system,

$f(x)$ and $g(y)$: the comprehensive evaluation index,

D : coupling coordination degree,

T : the comprehensive coordination index,

α, β : the undetermined coefficients. In this paper $\alpha=\beta=0.5$.

1.4.2 Grey prediction model

In order to predict the coupling and coordination degree between higher education and regional economic development in the future, this paper uses grey prediction model to make time series prediction. Its differential equation is as follows:

$$(dx_1/dt)+ax_1=\mu$$

In the formula, A is the development gray level, and μ is the endogenous control gray number.

The corresponding prediction model is as follows:

$$x_1^T \hat{X}_1(k+1)=[x_n(1)-(\mu/a)]e^{-ak}+(\mu/a)$$

In the formula, $k=(1,2...n)$, and the accuracy of the prediction model needs to be tested. If the test results simultaneously meet $P>0.7$ and $C<0.65$, the predicted value of this index can be calculated; otherwise, the residual model should be modified.

2. Research process and result analysis

2.1 Time series analysis of the coupling and coordination degree between higher education and regional economic development in Sichuan Province

According to the coupling coordination degree formula, the coupling coordination degree of the "five districts" in Sichuan from 2011 to 2018 was calculated, and the specific results are shown in Table 1.

Table 1. Coupling coordination degree of "five regions" in Sichuan province from 2011 to 2018

Regional	2011	2012	2013	2014	2015	2016	2017	2018
CEZ	0.421	0.424	0.433	0.429	0.427	0.436	0.438	0.429
EZS	0.347	0.348	0.333	0.336	0.335	0.342	0.352	0.346
EZN	0.308	0.311	0.313	0.312	0.312	0.323	0.327	0.321
PA	0.365	0.362	0.341	0.33	0.332	0.334	0.356	0.338
NED	0.36	0.34	0.317	0.308	0.306	0.297	0.292	0.288

The chart shows that from 2011 to 2018, the CEZ of higher education evaluation index is relatively stable, comprehensive evaluation index of economic development undergoes a minor decrease, higher education and economic development is basically synchronized, but comprehensive evaluation index of economic development is always higher than that of higher education evaluation index, and the disorder of coupling coordination degree has been a mild recession phases. The comprehensive evaluation index of higher education in EZS showed a downward trend, while the comprehensive evaluation index of economic development showed an upward trend. The higher education lagged behind the economic development, and its coupling coordination degree was always in the stage of moderate imbalance decline. Both the comprehensive evaluation index of higher education and the comprehensive evaluation index of economic development in EZN showed an increasing trend. Higher education and economic development were basically synchronized, and the coupling coordination degree was always in the stage of moderate imbalance decline. Both the comprehensive evaluation index of higher education and the comprehensive evaluation index of economic development in PA have decreased, and the coupling coordination degree of higher education lags behind the economic development is always in the stage of moderate imbalance and decline. Both the comprehensive evaluation index of higher education and the comprehensive evaluation index of economic development in the NED showed a downward trend, and the economic development lagged far behind the higher education, and the coupling coordination degree was always in the stage of moderate imbalance and decline. In general, the degree of coupling coordination between higher education and economic development in the five districts of Sichuan is "high in the central area and low in the periphery". No matter form higher education comprehensive evaluation index, the comprehensive evaluation index of economic development, and the coupling coordination degree of higher education and regional economic development value, the chengdu plain economic zone are ranked first, far higher than the other four areas, indicates that the chengdu plain economic zone of higher education and economic development level is much higher than other area.

2.2 Development prediction of coupling coordination degree in Sichuan Province from 2021 to 2025

Since the relevant statistical data of 2019-2020 has been basically determined, the coupling coordination degree of these two years is no longer predicted in this study. Therefore, according to the grey prediction model, the predicted value of coupling coordination degree of the two systems in the "Five Regions" of Sichuan Province from 2021 to 2025 is calculated. The specific results are shown in Table 2.

Table 2. The predicted value of coupling coordination degree of "five regions" in Sichuan in 2021-2025

Regional	2021	2022	2023	2024	2025
CEZ	0.437	0.438	0.437	0.438	0.441
EZS	0.357	0.36	0.362	0.364	0.368
EZN	0.335	0.338	0.339	0.343	0.347
PA	0.346	0.346	0.346	0.344	0.348
NED	0.245	0.233	0.222	0.212	0.204

According to the above table, from 2021 to 2025, the coupling coordination degree development of the "five districts" in Sichuan will roughly continue the change characteristics of 2011-2018. CEZ is still the region with the highest level of coupling coordination, but it is still in the stage of mild imbalanced decline. The coupling coordination degree of the EZS, EZN, PA and NED is in the stage of moderate disequilibrium decline, and the difference of the prefecture-level cities in CEZ is the largest, while the difference of the other four prefecture-level cities is small. In the next five years, the coupling

coordination degree of CEZ, EZS, EZN and PA will all show an upward trend, while the coupling coordination degree of NED will show a downward trend. In general, the coupling coordination degree of the “five districts” in Sichuan is not high in 2021-2025, and none of them will be through the mismatch stage and enter the coordination stage.

3. Research conclusion

By constructing the index system of higher education and economic development in the five districts of Sichuan Province from three aspects of scale, structure and quality, this study studied the comprehensive evaluation index and coupling coordination degree of higher education and regional economic development in the five districts of Sichuan Province from 2011 to 2018, and the following conclusions can be drawn.

(1) Higher education and regional economic development of the coupling coordination degree of five area in Sichuan shows low “four high” development pattern. The basis of CEZ of the coupling coordination degree is significantly higher than that of EZS, EZN, PA and NED. CEZ at the disorder of mild recession stage, the coupling coordination degree of EZS, EZN, PA and NED is in the stage of moderate imbalance decline.

(2) In the next five years, sichuan coupling coordination degree of development of the “five areas” is predicte extending the trends of 2011-2018, its whose coupling coordination degree is not high, still did not break into coordination phase disorder, and the CEZ of each prefecture level difference, the biggest and the other four areas between each prefecture level difference is smaller.

References

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