

Construction of index system for economic governance capability of mining areas based on principal component analysis

In recent years, the government's governance ability and governance level attracts worldwide attention, but the governance level of local government remains to be improved. The modernization level of the governance capacity of local government becomes an important indicator of its ability to measure governance. The economic base determines the superstructure. Economic governance is an indispensable part of the governance system. In this paper, the target of economic governance in Liaoning, a large province of mineral resources, is taken as the research object. The principal component analysis method is applied to establish the index evaluation system of the economic governance ability and the current economic situation is evaluated. The result is instructive to the improvement of Liaoning economic governance index system and the reference is provided for the improvement of the economic governance ability of other provinces and cities.

Keywords: Modernization of governance ability, economic governance, index evaluation system

1. Introduction

In November 2013, the Party passed the decision of the Central Committee of the Communist Party of China on deepening the reform in the third Plenary Session of the 18th CPC Central Committee, and put forward the proposition of promoting the modernization of the national governance system and governance capacity. The national governance system is divided into five aspects: economic governance, political governance, cultural governance, social governance and ecological governance. Economic governance as an indispensable part of national governance, its meaning is to properly handle public economic affairs and effectively resolve the state of public economic risks to achieve "good governance". That is, in the framework of a stable legal system, the economy will achieve sustained, stable and healthy development. The improvement of the governance efficiency of local governments is a pressing matter of the moment for our social governance process. Although the coordinated development of all aspects is needed, the improvement of

the level of economic governance is the most important manifestation of the governance capacity and governance efficiency of the government. As the country's old industrial base, the northeast region is rich in mineral resources, there are many steel companies, and it is supported by national policies. However, the level of economic development in the northeastern regions is not improved in the national rankings. The development of the northeast region is the focus of the state. Liaoning is one of the most representative provinces in the Northeast. It is of great significance to study the state of economic governance in Liaoning to revitalize the old industrial base in the northeast and promote the economic rise of the northeast.

2. Literature review

The idea of modernizing our country's governance capacity is a concept with Chinese characteristics that suits the needs of the times. Many scholars believe that the promotion of national governance systems and governance capacity modernization is the objective requirement of the modernization of our country getting into a new stage, facing many complicated problem. So we need to concentrate on the key link, correctly handle the government, market, social relations as the core, to promote the modernization of national governance systems^[1-6]. It is also necessary to adopt a comprehensive approach to mobilize all production factors and management elements that are conducive to the modernization of the national governance system and governance capacity, and comprehensively advance the modernization of the national governance^[7-9]. Yang Chen, Wang Bin, Li Qun and others build a modern index system of national governance system and governance capacity, laying the groundwork for the subsequent formulation of the national governance index, and also provide a strong support for quantifying the overall deepening of reform in all provinces^[10,11]. The modernization of national governance capabilities and governance systems are systematically studied by scholars. In addition, some of them gradually focus on economic governance. Wang Yongxing respects to establish a comprehensive monitoring index system to measure the quality of governance in transition economies by comparing the quality of governance in other countries concerned^[12]. On the basis of national conditions,

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the main reason why Tang Huangfeng put forward the way of extensive economic development is the endogenous incentive mechanism deviation^[13]. Tian Fa and Zhou Wuxing assess the economic governance capacity by constructing an economic governance indicator system and find that the absolute gap between governance in the eastern region and the other three regions is widening, while the absolute gap in economic governance capacity between the Northeast and Central and Western regions is narrowing^[14]. Furthermore, many scholars conduct studies on the modernization of economic governance from various aspects. Liu Chengli compares the related theories of economic governance, and designs the ways to modernize the economic governance system and governance ability from two levels of government and market^[15]. Yang Wenbin proposes to build a collaborative governance model for economic functional areas^[16]. Qi Shouyin believes that the application of public economic theory should be highly valued, and build a public economic theory system that effectively serve the practice of national governance modernization through systematic innovation^[17].

In summary, the former studies mainly focus on the modernization of national governance systems and the construction of the comprehensive management system. No evaluation system is established for economic governance in specific provinces. The level of local government economic governance and efficiency reflect on the indicator system. As described above, the evaluation index system of Liaoning's economic governance ability is established hoping to be conducive to the improvement of Liaoning's economic governance index system.

3. Construction of the evaluation index system of Liaoning's economic governance capacity

3.1. INDEX INTERPRETATION

Based on the previous scholars' research and the actual economic situation of Liaoning province, this paper selects 11 indicators that can measure the level of Liaoning's economic development, and constructs the index system of economic governance. 8 economic indicators are selected from other scholars. According to the objective facts of the development of the secondary industry in Liaoning province, the main energy production (coke) and the proportion of the primary and secondary industries to GDP are added. There are relevant indicators. Per capita gross national product (X1) is an important indicator to measure the state of the macro-economic operation in a region. Engel coefficient of urban residents (X2) is the proportion of food expenditure to total consumption expenditure. And the larger the index, the poorer the region is. Resident consumption level (X3) is closely related to GDP. If the economy is in good shape, GDP will increase and the level of consumption will rise. Otherwise, it will decrease. Consumer Price Index (X4) directly affects macro-economic regulation and changes in capital markets. Urban per capita disposable income (X5)

is an important index to measure the income level and the living standard of the urban residents, and the economic development will directly affect the index. Total import and export of foreign invested enterprises (X6) reflects the activity of a region's foreign economic and trade. Production of major energy products (X7) is selected for the reason that the main industry is industry in Liaoning, and the energy output represents the strength of its economic development. Local fiscal tax revenue (X8) is a barometer for the economic development. The degree of agriculture (X9), the degree of industrialization (X10) and the industrial structure allocation (X11) reflect the distribution of the three major industries in Liaoning, as well as the degree of coordination between industries, as indicated in Table 1.

TABLE 1. INDEX CONNOTATION TABLE

Variable	Name	Connotation
X1	Per capita gross national product (100 million yuan)	Local GDP /resident population
X2	Engel coefficient of urban residents	Total amount of urban population food expenditure / total personal consumption expenditure
X3	Consumption level of residents (yuan)	Consumption expenditure by resident average population
X4	Consumer price index (last year =100)	Change in price level
X5	Per capita disposable income of urban residents (yuan)	A household income that can be used freely.
X6	Total import and export of foreign invested enterprises (thousands of US dollars)	Total amount of goods entering and out of our country
X7	Production of major energy products (coke) (ten thousand tons)	Coke production
X8	Local fiscal revenue (100 million yuan)	Including a variety of local tax revenues
X9	the degree of agriculture	Regional primary industry output value / regional GDP
X10	the degree of industrialization	Regional second industry output value / area GDP
X11	the industrial structure allocation	Regional third industry output value / area GDP

3.2. SYSTEM CONSTRUCTION

SPSS19.0 software is used to analyze the weighted principal components. From the correlation coefficient matrix of each economic index, it can be seen that there is a strong correlation between variables, which is suitable for comprehensive factor analysis. It can be seen from Table 2 that the Bartlett's test statistic is 319.631, and the corresponding probability P value is close to 0. If the significance level is $\alpha=0.05$, the correlation coefficient matrix is significantly different from the unit matrix. At the same time, $KMO=0.797$ is approximately equal to 0.8. It can be seen that the original variable is suitable for comprehensive factor analysis.

TABLE 2. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.797
Bartlett's Test of Sphericity	Approx. Chi-Square	319.631
	df	55
	Sig.	0.000

According to the correlation coefficient matrix, the principal component analysis method is used to extract factors and select feature values whose feature rooting is greater than 1, as shown in Table 3. The second column is the common degree when feature roots are extracted according to the specified extraction conditions (characteristic rooting greater than 1). As shown in Table 3, the commonality of each variable is high, and the missing information of each variable is less. The effect of factor analysis is better.

TABLE 3. COMMUNALITIES

	Initial	Extraction
X1	1.000	0.990
X2	1.000	0.697
X3	1.000	0.990
X4	1.000	0.863
X5	1.000	0.990
X6	1.000	0.937
X7	1.000	0.955
X8	1.000	0.962
X9	1.000	0.915
X10	1.000	0.899
X11	1.000	0.873

The following is the extraction of principal component factors. As shown in Table 4, the characteristics of rooting, variance contribution rate and cumulative variance contribution rate are shown. The first set of data (left column 1-3) describes the initial factor solution. For example, the characteristic value of the first factor is 6.030, 54.819% of the original 11 variables are explained, and the cumulative variance contribution rate is 54.819%. The meaning of other factors is analogous to this, and the total variance of the original 11 variables is explained. The second set of data describes the factor solution. It can be seen that the four factorial solutions together account for 91.556% of the total variance of the original variables. The information loss is less and the analysis results are ideal. The third group describes the final factor solution. After the factor rotation, the cumulative variance is still 91.556%. However, the variance of the original variable is explained by allocating each factor, which changes the variance contribution rate and makes the factor easier to interpret.

TABLE 4. TOTAL VARIANCE EXPLAINED

Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
6.030	54.819	54.819	6.030	54.819	54.819	5.910	53.723	53.723
1.772	16.106	70.925	1.772	16.106	70.925	1.580	14.366	68.089
1.266	11.509	82.434	1.266	11.509	82.434	1.312	11.923	80.012
1.003	9.123	91.556	1.003	9.123	91.556	1.270	11.544	91.556
0.499	4.541	96.097						
0.304	2.762	98.859						
0.056	0.510	99.369						
0.045	0.409	99.777						
0.020	0.182	99.959						
0.004	0.034	99.994						
0.001	0.006	100.000						

An orthogonal transformation of the factor load matrix is performed using the maximum variance method to give the factor a naming interpretation. Specifying the rotated factor load is output in the order of the descending order of the first factor load. The analysis results are shown in Table 5. Among them, X1, X8, X7, X5, X3, and X9 have higher loads on the first factor which mainly explains variables. X11, X4, and X2 have a higher load on the second factor that mainly explains these variables. X6 has a higher load on the third factor which highly interprets the variable. X10 has a higher load on the 4th factor which highly interprets the variable. Therefore, the meaning of these factors is clearer.

The regression coefficient is used to estimate the factor score coefficient and the factor score coefficient is output. The results are shown in Table 6, and the factor score function is derived from the factor score coefficient.

TABLE 5. ROTATED COMPONENT MATRIX

	Component			
	1	2	3	4
X1	0.984	0.108	0.096	-0.034
X8	0.972	-0.011	0.109	-0.080
X7	0.970	-0.026	0.077	0.090
X5	0.944	0.294	0.084	0.068
X3	0.938	0.309	0.123	0.006
X9	-0.902	0.075	0.309	0.006
X11	0.216	0.860	-0.013	0.293
X4	0.453	-0.585	0.178	0.533
X2	-0.414	-0.518	0.489	0.133
X6	0.196	-0.054	0.944	-0.066
X10	0.099	-0.166	0.067	-0.926

TABLE 6. COMPONENT SCORE COEFFICIENT MATRIX

	Component			
	1	2	3	4
X1	0.165	0.008	0.044	-0.053
X2	-0.060	-0.237	0.321	0.114
X3	0.136	0.161	0.109	-0.024
X4	0.114	-0.433	-0.010	0.419
X5	0.140	0.141	0.072	0.026
X6	-0.013	0.136	0.759	-0.076
X7	0.173	-0.092	0.000	0.049
X8	0.174	-0.072	0.033	-0.087
X9	-0.190	0.198	0.324	0.016
X10	0.050	-0.097	0.036	-0.734
X11	-0.044	0.588	0.144	0.212

$$F1 = 0.165 \times 1 - 0.06 \times 2 + 0.136 \times 3 + 0.114 \times 4 + 0.140 \times 5 - 0.013 \times 6 + 0.173 \times 7 + 0.174 \times 8 - 0.190 \times 9 + 0.05 \times 10 - 0.044 \times 11 \quad (1)$$

$$F2 = 0.008 \times 1 - 0.237 \times 2 + 0.161 \times 3 - 0.433 \times 4 + 0.141 \times 5 + 0.136 \times 6 - 0.092 \times 7 - 0.072 \times 8 + 0.198 \times 9 - 0.097 \times 10 + 0.588 \times 11 \quad (2)$$

$$F3 = 0.044 \times 1 + 0.321 \times 2 + 0.109 \times 3 - 0.010 \times 4 + 0.072 \times 5 + 0.759 \times 6 + 0.033 \times 8 + 0.324 \times 9 + 0.036 \times 10 + 0.144 \times 11 \quad (3)$$

$$F4 = -0.053 \times 1 + 0.114 \times 2 - 0.024 \times 3 + 0.419 \times 4 + 0.026 \times 5 - 0.076 \times 6 + 0.049 \times 7 - 0.087 \times 8 + 0.016 \times 9 - 0.0734 \times 10 + 0.212 \times 11 \quad (4)$$

According to formulas (1)-(4), each factor score is calculated and a comprehensive evaluation of the economic governance situation in Liaoning province is conducted. The factor-weighted total score method is used to calculate the composite score. The weight is the variance contribution rate of the four factors. A weighted summary is obtained for the economic governance model F of Liaoning province (Formula 5). The related calculation results are shown in Fig. 1.

$$F = 53.723F1 + 14.366F2 + 11.923F3 + 11.544F4 \quad (5)$$

Fig. 1 shows the overall scores of Liaoning economic governance from 1997 to 2016. It can be seen that the economic governance situation in Liaoning declined from 1997 to 2000 due to the impact of the Asian financial crisis. After the year 2000, the situation of economic governance gradually improved, but economic development was still very sluggish, and its comprehensive score on economic governance was still negative. In 2007, the comprehensive score of economic governance was clearly positive, which was due to the rapid expansion of the economy before the outbreak of the economic crisis. In 2008-2009, the decline was negative but the decrease was smaller. The main reason was that due to the slower overall economic development in the Northeast, so it was affected less. As China's "Twelfth Five-Year Plan" has been proposed since 2010, it has been positive and has shown relatively rapid growth, and will maintain high growth for a long time in the future. All in all, if Liaoning's economy is to achieve more rapid development, the local government's economic governance capabilities will be respected to improve

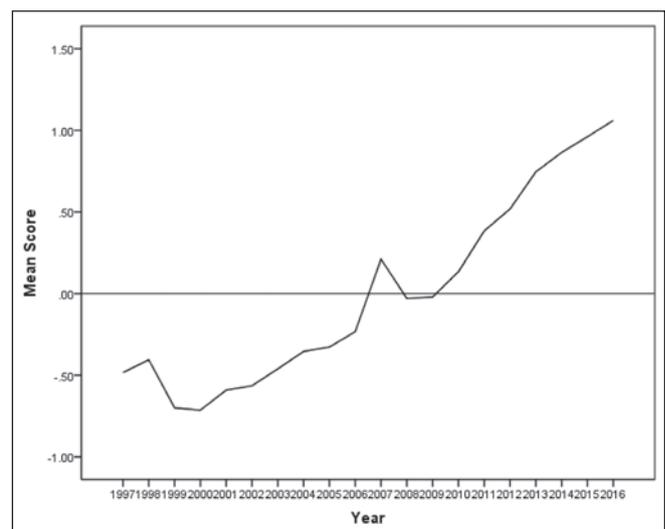


Fig. 1: Comprehensive score of economic governance in Liaoning from 1997 to 2016

4. Conclusions and policy recommendations

11 economic governance indicators from the Liaoning Group's data from 1997 to 2016 are selected, and principal level analysis is used to construct the economic governance evaluation system of Liaoning. According to its comprehensive score, the economic governance level of Liaoning province is raised step by step. It can be seen that Liaoning is firmly moving forward under the good condition of the national economic situation. The economic governance capability of Liaoning local government is remarkable, but its development is slow. The local government is also duty bound.

In the process of establishing a modernization system for local governance capacity, local governments need to start from various aspects to improve their economic governance capabilities. Several suggestions in this paper are as follows:

- (1) It is necessary to coordinate the relationship between the government and the market, reduce the government's direct allocation of resources, and help play to the market's self-regulation ability. The government must also strengthen supervision over the market within the legal framework to make up for market failures.
- (2) To build a fair and sustainable social security system, the self-regulation of the market is used and the income gap will widen. Increasing social security eases social conflicts to a certain degree and safeguards the fairness and justice of the entire society.
- (3) It is necessary to correctly handle the relationship between supply-side reform and demand, seeking a balance between supply and demand.
- (4) It is important to deepen the reform of state-owned enterprises and strengthen internal and external supervision and avoid corruption to promote the sustained and healthy development of state-owned enterprises.
- (5) The government should focus on solving the problem of financing difficulties for SMEs, inspiring SMEs to improve the management system, enhancing the level of governance to stimulate the creativity of SMEs, optimizing the industrial structure, and cultivating new economic growth points.

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