Construction and Application of Evaluation Index System for Supply-Side Structural Reform

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ABSTRACT

Based on the five priority tasks of "cutting overcapacity, reducing excess inventory, deleveraging, lowering costs, and strengthening areas of weakness" of the supply-side structural reform, this article decomposes the quantifiable indicators and data of each task one by one, constructs a comprehensive index system reflecting the main objectives of supply-side structural reforms. Then the indicator system adopts a unified quantification method, and the weight is determined through analytic hierarchy and information entropy method, and the effectiveness of the supply-side structural reform is evaluated. On the whole, in addition to the steady and slight decline in China's effectiveness of the five priority tasks in 2018, the effectiveness of China's five priority tasks has been significant year by year since 2012. As far as the different standards are concerned, the characteristics of differentiated changes are shown: the effectiveness of cutting overcapacity fluctuates greatly, the effectiveness of de-inventory, lowering costs, and strengthening areas of weakness has been improved more obviously, while the effectiveness of deleveraging has deteriorated year by year.

Keywords: Supply-side structural reform, evaluation index system, analytic hierarchy process, information

entropy

1. INTRODUCTION

Supply-side structural reforms have become an important measure to transform the economic development mode. As reforms continue to advance, performance evaluation becomes more and more important. Constructing the evaluation index system of supply-side structural reform is helpful to recognize the current situation and shortage of reform, so as to guide practice. How to evaluate the performance of a wide range of structural reforms is particularly important. The academic research on the supply-side structural reform is mainly qualitative analysis, and there are relatively few quantitative evaluations and empirical tests on the supply-side structural reform. Wu Yanghong [1] constructed a supply-side structural reform evaluation index system based on the transmission mechanism of supply-side structural reforms to promote economic growth, comprehensively used the combination weighting method to assign weights to the evaluation index system, and used it to score the national macroeconomic performance. The results show that the performance evaluation comprehensive index scores have steadily increased, among which the ecological structure score is significant, while the system fairness score is not very ideal, so the government should increase the supply of fairness systems. Zhu Qigui [2] proposed that in the comprehensive deepening of the supply-side structural reform, it is necessary to further improve the relevant assessment and evaluation system to

effectively play the role of the "baton". The assessment and evaluation of supply-side structural reform must focus on the fundamental purpose, focusing on the assessment and evaluation of human capital, innovation drive, economic vitality, structural optimization, and reform effectiveness. Fu Yamei [3] quantitatively evaluates the implementation performance of the supply-side structural reform since the proposal. The results show that the total performance index of China's supply-side structural reforms from 2014 to 2018 ranged from 2.0 to 4.3. Around the time when the reform was proposed, the overall index has been significantly reversed, which shows that the implementation of supply-side structural reforms has indeed achieved significant results.

2. SUPPLY-SIDE STRUCTURAL REFORM EFFECTIVENESS EVALUATION INDEX SYSTEM

2.1. Principles of Index System Construction

In the process of establishing the effectiveness evaluation system of five priority tasks-cutting overcapacity, reducing excess inventory, deleveraging, lowering costs, and strengthening areas of weakness, this article mainly follows the following principles: 1. Systematic principles: There must be a certain logical relationship between the indicators. They not only reflect the effects of the five

priority tasks from different sides, but also a certain internal relationship between the indicators. 2. Principles of main factors: The indicators should be able to comprehensively reflect the main aspects of the effectiveness of the five priority tasks. And take the effectiveness of the five priority tasks as evaluation goals. 3. Quantitative principle: In order to avoid the influence of subjective evaluation on the results, the selected indicators should be the indicators counted and published in the relevant bulletins and statistical yearbooks, or the indicators calculated directly or indirectly through the relevant official data. These quantitative indicators can also objectively reflect the qualitative content of the evaluated indicators to a certain extent. 4. The principle of comparability: In order to be able to compare the indicators vertically in different periods and horizontally across regions, the selection and construction of indicators need to follow the principle of comparability, and the indicators are usually constructed in a ratio.

2.2. Index Selection

On the basis of a comprehensive analysis of the connotation of the five priority tasks and following relevant principles, this article constructs an effectiveness evaluation index system of the five priority tasks, with a total of 71 indicators. Among them, the effectiveness of cutting overcapacity mainly includes indicators such as the capacity utilization rate of key industries and the completion of the task of eliminating outdated capacity. Reducing excess inventory mainly includes the changes in the area of houses for sale and the area of houses sold. Deleveraging mainly includes indicators such as the macro leverage ratio, the leverage ratio of various sectors, and the proportion of loans in social financing. Lowering costs mainly includes indicators such as logistics costs, energy and electricity prices, tax cuts and fee reductions. Strengthening areas of weakness mainly includes indicators such as regional coordination, urban-rural gap, financing environment, technological innovation, people's living standards, natural environment, opening-up level, informatization level, and marketization level. The specific effectiveness evaluation index system of the five priority tasks is shown in Table 1.

Table 1 The effectiveness evaluation index system of the five priority tasks

Target layer	Criterion layer	Domain layer	Index layer	Indicator attributes
The effectiveness of five priority tasks of cutting overcapacity, reducing excess inventory, deleveraging, lowering costs, and strengthening areas of weakness	The effectiveness of cutting overcapacity	Capacity utilization rate in key industries	Industrial capacity utilization	Positive
			Capacity utilization: crude steel	Positive
			Capacity utilization: electrolytic aluminum	Positive
			Capacity utilization: float glass	Positive
		Eliminate backward production capacity in key industries	Eliminate backward production capacity: electricity: The amount of task completion: National	Positive
			Eliminate backward production capacity: coal: The amount of task completion: National	Positive
			Eliminate backward production capacity: Ironmaking: The amount of task completion: National	Positive
			Eliminate backward production capacity: Steelmaking: The amount of task completion: National	Positive
			Eliminate backward production capacity: Electrolytic aluminum: The amount of task completion: National	Positive
			Eliminate backward production capacity: Cement (clinker and grinding): The amount of task completion: National	Positive
			Eliminate backward production capacity: plate glass: The amount of task completion: National	Positive
	The effectiveness of reducing excess inventory	Area of commercial housing for sale	Commercial housing area for sale: cumulative year on year	negative
			Commercial housing area for sale: residential: cumulative year on year	negative
			Commercial housing area for sale: Office buildings: cumulative year on year	negative
			Commercial housing area for sale: Houses for business use : cumulative year on year	negative
		Area of commercial housing sold	Sales area of commercial housing: Residential: cumulative year on year	Positive
			Sales area of commercial housing: cumulative year on year	Positive
			Sales area of commercial housing: Office buildings: cumulative year on year	Positive
			Sales area of commercial housing: Houses for business use : cumulative year on year	Positive

Target layer	Criterion layer	Domain layer	Index layer	Indicator attributes
	The effectiveness of deleveraging	The leverage ratio of various sectors	Government sector debt as a proportion of GDP	negative
			Resident sector debt as a proportion of GDP	negative
			Financial corporate sector debt as a share of GDP	negative
			Non-financial corporate sector debt as a share of GDP	negative
			M2/GDP: Constant price	negative
		The proportion of loans in social financing	The proportion of RMB loans in the Social Financing Scale Stock	negative
		The proportion of shares issued in social financing	The proportion of Domestic stocks of non-financial companies in the Social Financing Scale Stock	Positive
	The effectiveness of lowering costs	Logistics cost	Logistics expense ratio: industrial, wholesale and retail enterprises	negative
		Tax cost	National Public Finance Revenue: Tax revenue as a percentage of GDP	negative
			National Public Finance Revenue: Non-tax revenue as a percentage of GDP	negative
		Energy cost	The average selling price of electricity	negative
			China Coal Price Index: National comprehensive	negative
			Petroleum and product price index: cumulative year-on-year	negative
			Market Price: Liquefied Natural Gas LNG: National	negative
	The effectiveness of strengthening areas of weakness	Regional coordination	Percentage of completed fixed asset investment in the western region	Positive
		Urban-rural coordination	Proportion of rural fixed asset investment completed	Positive
			Proportion of completed investment in fixed assets in urban municipal public facilities construction	Positive
			Urban-rural income gap	negative
		Financing environment	Weighted average interest rate of RMB loans of financial institutions	negative
			Fixed-rate corporate bonds: Issuance rate (AAA): 10 years	negative
			BCI: Corporate Finance Environment Index	Positive
			China Innovation Index: Innovation Environment Index	Positive
			Innovation environment index: Index of the proportion of science and technology appropriation in financial allocation appropriations in financial appropriations	Positive
		Technological innovation	China Innovation Index: Innovation input index	Positive
			Innovation input index: full-time equivalent of R&D personnel per 10,000 people	Positive
			Innovation input index: the proportion of R&D expenditure in GDP	Positive
			China Innovation Index: Innovation Output Index	Positive
			Authorization: Invention Patent: Domestic and Foreign: Cumulative Number	Positive
			The number of published scientific papers	Positive
			The number of registered scientific and technological achievements	Positive
			China Innovation Index: Innovation performance index	Positive
			National: rate of high quality products	Positive
			Innovation effectiveness index: scientific and technological progress contribution rate index	Positive
		Livelihood guarantee	Number of beds in hospitals and health centers per 10,000 people	Positive
			Urban per capita road area	Positive
			Park green area per capita	Positive
			Proportion of the economically active population with college degree or above	Positive
			Urbanization rate	Positive
		Ecological environment	National sulfur dioxide emissions/GDP (comparable price)	negative
			National industrial solid waste discharge/GDP (comparable price)	negative
			Wastewater discharge/GDP (comparable price)	negative

Target layer	Criterion layer	Domain layer	Index layer	Indicator attributes
			National smoke and dust emissions/GDP (comparable price)	negative
			Unit GDP energy consumption: National	negative
			Proportion of thermal power generation	Positive
		Opening up	Economic extroverted degree (total import and export/GDP)	Positive
			The proportion of high-tech exports in goods exports	Positive
			Informatization Index	Positive
		Informatization level	Number of computers used per 100 people	Positive
			Number of websites owned by every 100 companies	Positive
			Proportion of companies with e-commerce transaction activities	Positive
		Marketization level	Private economy as a proportion of GDP	Positive
			Completed private investment in fixed assets: cumulative proportion	Positive

2.3. Index Evaluation Method

In the process of effectiveness evaluation, the main calculation steps include: Dimensionless data processing; Calculate the weight of each indicator; Synthesize evaluation results.

1. Dimensionless data processing. Among them, the processing method of the positive indicator is to forward the data corresponding to the indicator to the 0-1 interval, and the processing method of the negative indicator is to reverse the data corresponding to the indicator to the 0-1 interval.

2. Calculate the weight of each indicator. Here, we use information entropy to calculate the weight of each indicator. First, the dimensionless data is shifted one unit to the right, and then the data is normalized. Then, use the dimensionless data obtained in step 1 to calculate the entropy value H of each index. Taking into account the data requirements of the entropy method, the calculation formula is:

$$F_i = -\frac{1}{\ln(n)}\sum_{i=1}^{n} x_{ij} \ln(x_{ij}) \qquad (1)$$

Next, use the result of formula (1) to calculate the discrimination degree F_j, the calculation formula is:

$$F_j = 1 - F_i \qquad (2)$$

Finally, the weight w of each evaluation index is calculated, and the calculation formula is:

$$w_j = \frac{F_j}{\sum_{k=1}^{n} F_k} \qquad (3)$$

3. Synthesize evaluation results. By multiplying and summing the non-dimensionally processed value with the corresponding index weight, the evaluation results corresponding to each criterion layer and target layer are obtained.

3. APPLICATION OF EVALUATION INDEX SYSTEM FOR SUPPLY-SIDE STRUCTURAL REFORM

The weight of the dimensionless processed data is calculated through information entropy, and the weights of the indicators under each criterion and the final weights of all indicators under the evaluation index system of the five priority tasks are obtained.

By multiplying and summing the non-dimensionally processed values and the corresponding index weights, the evaluation results of the effectiveness from 2012 to 2018 are obtained, as shown in Table 2.

Table 2 2012-2018 China's evaluation results of the effectiveness of the five priority tasks

	2012	2013	2014	2015	2016	2017	2018
Comprehensive effectiveness	0.313	0.380	0.403	0.441	0.575	0.680	0.674
Effectiveness of cutting overcapacity	0.444	0.385	0.597	0.255	0.227	0.595	0.687
Effectiveness of reducing excess inventory	0.185	0.382	0.145	0.400	0.819	0.860	0.627
Effectiveness of deleveraging	0.754	0.603	0.549	0.371	0.406	0.451	0.267
Effectiveness of lowering costs	0.378	0.444	0.395	0.472	0.679	0.682	0.754
Effectiveness of strengthening areas of weakness	0.200	0.299	0.339	0.470	0.612	0.686	0.708

On the whole, in addition to the steady and slight decline in China's effectiveness of the five priority tasks in 2018, the effectiveness of China's five priority tasks has been significant year by year since 2012. As far as the different standards are concerned, the characteristics of differentiated changes are shown: the effectiveness of cutting overcapacity fluctuates greatly, the effectiveness of de-inventory, lowering costs, and strengthening areas of weakness has been improved more obviously, while the effectiveness of deleveraging has deteriorated year by year. As far as cutting overcapacity is concerned, in 2015 and 2016, the capacity utilization rate was low and the elimination of backward production capacity was less, so the effect of cutting overcapacity was relatively poor. In terms of reducing excess inventory, under the effects of a series of policies such as housing no speculation and city-specific policies, housing sales have maintained a relatively high growth rate, sales area has continued to decrease, and reducing excess inventory has achieved remarkable results. As far as deleveraging is concerned, except for the improvement in the leverage ratio of government departments, the other indicators have not improved significantly, and even worsened year by year. This is mainly due to the fact that the internal and external environment facing China in recent years has become more and more complex and severe, the downward pressure on the economy is greater, and deleveraging is difficult to effectively advance. In terms of lowering costs, thanks to the implementation of logistics, energy and power, information and communication cost reduction and government tax and fee reduction policies, the cost reduction effect has continued to improve. In terms of strengthening areas of weakness, through effective promotion of shortcoming measures in areas such as regional coordination, infrastructure construction, financial markets, technological innovation, urban and rural development, people's livelihood construction, public services, opening up, environmental protection and ecological construction, and talent team building, the effectiveness of strengthening areas of weakness has improved year by year.

4. CONCLUSION

Based on the five priority tasks of "cutting overcapacity, reducing excess inventory, deleveraging, lowering costs, and strengthening areas of weakness" of the supply-side structural reform, we evaluated the effectiveness of the supply-side structural reform. On the whole, in addition to the steady and slight decline in China's effectiveness of the five priority tasks in 2018, the effectiveness of China's five priority tasks has been significant year by year since 2012. As far as the different standards are concerned, the characteristics of differentiated changes are shown: the effectiveness of cutting overcapacity fluctuates greatly, the effectiveness of de-inventory, lowering costs, and strengthening areas of weakness has been improved more obviously, while the effectiveness of deleveraging has deteriorated year by year.

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