

Research on Capital Operation Capability Evaluation of Energy State-owned Enterprises Based on Analytic Hierarchy Process

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Abstract. Improving the capital operation capacity of state-owned enterprises is an important goal of the reform of the state-owned capital authorized operation system. In the field of energy, reforming and improving the capital operation capacity of energy state-owned enterprises can effectively promote energy transformation. This paper uses the capital operation capability evaluation model constructed based on AHP to find that the capital operation capability of five typical energy central enterprises presents the results of "National Energy Group> PetroChina Group> State Grid Corporation> State Power Investment Corporation> China Southern Power Grid Corporation", which are all lower than the benchmark enterprise China Resources, but The average level is roughly comparable to that of China's new country.

Keywords: capital operation; analytic hierarchy process; energy state-owned enterprises

1. Introduction

At present, profound changes are taking place in my country's energy field, including the implementation of the new energy security strategy of "four revolutions and one cooperation", the construction of a new power system with new energy as the main body, and the promotion of the goal of "carbon peaking and carbon neutrality", etc. The academic community generally believes that promoting energy reform not only requires policies and measures at the industry level, but also requires energy state-owned enterprises to speed up the reform and transformation to stimulate the vitality of enterprises [1-2]. From the perspective of the current state-owned enterprise reform implementation, improving the capital operation capability of the headquarters of state-owned enterprise groups is an important goal of the reform of the state-owned capital authorization management system, and it is also an important measure to stimulate the market vitality of enterprises.

This paper attempts to use the Analytic Hierarchy Process to evaluate the capital operation capability of my country's major energy central enterprises. Analytic Hierarchy Process (AHP) is a decision-making method proposed by American scholar Satty for multi-level complex decision-making systems. It has been widely used, and has accumulated many related improvement and evaluation results, which can provide reference for this study [3-4].

2. Construction of Capital Operation Evaluation Model

Analytic Hierarchy Process (AHP) is to decompose the target into multiple targets or criteria, and then decompose it into several levels of multi-index, and calculate the single-level ranking and total ranking through the qualitative index fuzzy quantification method, which is used as a systematic method for target and multi-scheme optimization decision-making. The implementation steps are as follows: the first step is to determine the index information and establish a hierarchical structure system; the second step is to construct a judgment matrix and calculate each weight index; the third step is to check the consistency; the fourth step is to standardize the original index data and calculate Comprehensive evaluation results and analysis.

2.1. Build a Hierarchical Hierarchy System

This paper takes the capital operation capability as the final core evaluation index, and builds the corresponding evaluation index system according to the four core characteristics of capital operation: value, liquidity, marketability, and value-added. See Table 1 for details.

Table 1. Hierarchical structure of index system

Target Layer A	Criterion Layer B	Indicator variable layer C
capital operation capability	value level B1	total assets C1
		operating income C2
		assets and liabilities C3
		asset securitization rate C4
	liquidity level B2	total asset turnover C5
		fixed asset turnover C6
		accounts receivable turnover C7
		the number of its listed platforms C8
	marketability B3	enterprise function type C9
		state-owned capital authorization management policy C10
		group's per capita asset operation C11
		total profit C12
	value-added level B4	return on total assets C13
		return on net assets C14

2.2. Construct judgment matrix and weight set

First, a judgment matrix is established by the expert analysis method. That is, through a pairwise comparison, a_{ij} is the result of the importance comparison of element i and element j , and the statistics form a judgment matrix.

Secondly, implement single-level sorting, that is, according to the judgment matrix, calculate the importance weight of each index related to the index of the previous layer. That is, the eigenvalues and eigenvectors that satisfy the following relations are calculated for the judgment matrix. Corresponding to the eigenvector whose maximum eigenroot of the judgment matrix is λ_{max} , after normalization, it is written as:

$$W = (w_1, \dots, w_n)^T, \quad a_{ij} = w_i/w_j \quad (1)$$

The element of W is the ranking weight of the relative importance of a factor at the same level to a factor at the previous level.

2.3. Consistency check

Since the establishment of the judgment matrix is subjectively weighted, it is necessary to carry out a consistency check on the established judgment matrix. The judgment matrix consistency test is calculated according to the consistency ratio, and the expression is:

$$CI = \frac{\lambda_{max} - n}{RI(n-1)} \quad (2)$$

Among them, CR is the consistency ratio, λ_{max} is the maximum eigenvalue of the judgment matrix, n is the order of the judgment matrix, and RI is the average random consistency index of the judgment matrix, which is a constant related to the order of the matrix. For matrices with unqualified consistency, the judgment matrix needs to be re-established.

2.4. Standardization of raw data

This paper selects CNPC, State Grid Corporation, China Southern Power Grid Corporation, State Energy Group, State Power Investment Group and other central enterprises as the evaluation objects, and at the same time, China Resources Group and China Guoxin, which have a benchmarking role in capital operation, are used as reference. The former is state-owned capital investment company, which is a state-owned capital operating company. Collect relevant data through public channels, set the optimal value of each indicator to 100, and process other indicators as follows:

1) For quantitative data with positive influence and unbounded optimal value

$$X_i^* = \frac{X_i}{X_{max}} \cdot 100 \quad (3)$$

In the formula, X_i is the original value of enterprise i under a specific index, X_{max} is the maximum value among the seven enterprises under the index, and X_i^* is the index value of enterprise i after standardized processing.

2) For quantitative data with positive influence and bounded optimal value

$$X_i^* = \frac{X_i}{X_{op}} \cdot 100 \quad (4)$$

In the formula, X_i is the original value of enterprise i under a specific index, X_{op} is the boundary optimal value of the index, and X_i^* is the index value of enterprise i after standardization.

3) For quantitative data with "positive U-shaped" effects

$$X_i^* = \begin{cases} \frac{X_i - X_{min}}{X_{op} - X_{min}} \cdot 100 & \text{if } X_i \leq X_{op} \\ \frac{X_i - X_{op}}{X_{max} - X_{op}} \cdot 100 & \text{if } X_i \geq X_{op} \end{cases} \quad (5)$$

In the formula, X_i is the original value of a specific index of enterprise i, X_{op} is the optimal value, X_{min} is the minimum value of the index, X_{max} is the maximum value, and X_i^* is the standardized value of the index of enterprise i. This method applies to the asset-liability ratio, with 0 as the minimum value, 100% as the maximum value, and 48.5% as the optimal value according to the Standard Value of Enterprise Performance Evaluation (2021) prepared by the State-owned Assets Supervision and Administration Commission. Then, reprocessing is performed according to $X_i^{**} = \frac{X_i^*}{X_{max}^*} \cdot 100$.

4) For qualitative indicators

For the indicator "enterprise function type", from the perspective of benefiting the capital operation of state-owned enterprises, this paper believes that there is a law of "commercial category 1 > commercial category 2 > public welfare category", which are assigned as 100, 50, and 0 respectively.

For the indicator "State-owned capital authorized operation policy", it mainly considers whether the state-owned enterprise is positioned as a state-owned capital investment and operation company (supporting the authorization policy of the State-owned Assets Supervision and Administration Commission), and assigns "Yes" to 100 and "No" to 0.

3. Results

Through the above steps, the capital operation capability evaluation results of major energy central SOEs are finally obtained. In general, State Energy Group has the highest capital operation capacity, but it is also lower than China Resources Group, followed by PetroChina Group; State Grid Corporation is at the midstream level, slightly lower than China Guoxin, slightly higher than State Power Investment Corporation; China Southern Power Grid Corporation the lowest score.

Further analysis of the advantages and shortcomings behind the formation of the capital operation capacity of energy central enterprises can be seen. For PetroChina, its advantages are its large scale,

high asset securitization rate, and high level of capital appreciation, while its shortcomings are strong policy constraints and low return on equity. For State Grid Corporation, the advantages are the large scale of the enterprise, the moderate asset-liability ratio, and the high per capita asset operation of the group. The disadvantages are the low level of asset appreciation, strong policy constraints, and low asset securitization rate. For the National Energy Group, the advantages are weak policy constraints, high asset securitization rate, and high level of capital appreciation. The shortcomings are the average enterprise scale and low asset turnover rate. For the State Power Investment Group, the biggest advantage is that the policy constraints are weak. For China Southern Power Grid, the biggest shortcoming is the strong policy constraints and the low level of capital appreciation.

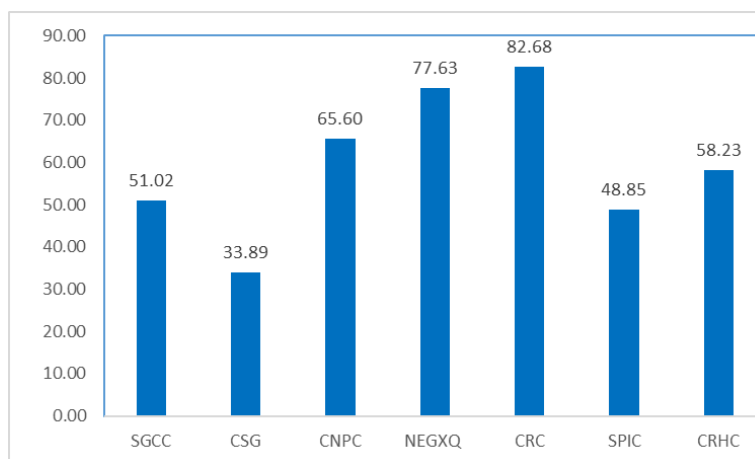


Figure 1. Evaluation results of the capital operation capability of 7 central SOEs

4. Conclusion

Improving the capital operation capacity of energy state-owned enterprises is an important goal of state-owned enterprise reform and an important measure to promote energy transformation. Based on the AHP, this paper constructs an evaluation model for the capital operation capability of state-owned enterprises, and evaluates five typical energy central enterprises. The results show that the capital operation capacity in descending order is "National Energy Group> PetroChina Group> State Grid> State Power Investment Group> China Southern Power Grid", which are all lower than the benchmark enterprise China Resources Group, but the average level is about the same as that of China Guoxin Corporation.

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