Research on operating benefit comprehensive evaluation model of large-scale electric power company

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Keywords: Electric power company, operating benefit, comprehensive evaluation.

Abstract: An operating benefit index system is constructed, and evaluation functions are made clear through establishing an operating benefit comprehensive evaluation model. Operating benefits of large-scale electric power companies are comprehensively evaluated for realizing scientific and normative operating benefit evaluation methods.

1. Introduction

Enterprises should analyze comprehensive level of own operating benefits during daily operating decision and investment decision-making. All kinds of index and various indexes in the same category are integrated for evaluating operating conditions. Since the condition of enterprise operating activities in some time point and some aspect can be reflected unilaterally by single financial index, many indexes should be comprehensively considered from many aspects and many dimensions in order to evaluate operating benefits of large-scale electric power company. It is urgent o establish a scientific and normative operating benefit comprehensive evaluation model in order to meet the demand.

2. Model construction methods

2.1 AHP

AHP refers that a complicated multi-objective decision - making problem is regarded as a system, the objective is decomposed into multiple objectives or standards, thereby it can be divided into several levels of multiple indexes (or standards and constraints), single hierarchical arrangement (weight) and total order ordering can be calculated through qualitative index fuzzy quantitative method, thereby it can be regarded as a systematic method of objective (multi-index) and multi-plan optimization decision-making system. The mode of dimension evaluation is adopted in the model, many aspects affecting the operating benefit is evaluated, each dimension is basically independent, and each index is also independent under each dimension. Each dimension is divided into two levels: core index and overall index. Overall situation of six dimensions of operating benefits in the company is analyzed from two levels.

2.2 Method of comparative analysis

Objective matters are compared to recognize the essence and rules thereof, and evaluate correctly. The thought of method of comparative analysis is fully used for reference in the analysis process by the model. All indexes are fully compared especially during the process of calculating the score of each index. Since the calculation principle of the model lies in determining the upper and lower limiting values of each index (core index and overall index). When the upper and lower limiting values are determined, many indexes are determined through comparison method. The upper and lower limiting values of the index can be determined through comparing the values of single index among different units. scientific dimensionless quantity of the index is finally obtained according to the internal formed by upper and lower limiting values, and the final score can be obtained through

summary and weighting finally. Obviously, comparison method is used for determining upper and lower limiting values of each index in the process, thereby obtaining scientific dimensionless quantity of each index, and judging concrete score of the index of the unit accordingly.

2.3 Standardized method

It is necessary to standardize indexes (dimensionless) in order to compare essential indexes of different dimensions. Firstly, the maximum and minimum values of each index are determined according to multi-year data. Then, the possible development trend of the index is predicted. The upper and lower limits of the index are determined according to the maximum and minimum values of the index. Finally, dimensionless transformation formula is adopted for obtaining the standardized value of all indexes.

The index is converted into reverse index firstly according to formula $x' = \left| x - x^{mid} \right|$, and it is handled according to reverse index then aiming at comparative fit index. In fact, since the index value may exceed the determined threshold scope. The index should be handled as follows: when the y is higher than 1, y is 1. When y is less than 0, y is 0. Standardized method has the maximum advantage that index ‘personality characteristics’ of indexes at different dimensions is removed, thereby ensuring the horizontal comparison among all dimensions.

3. Construction of index system

3.1 Benefit evaluation connotation

Company operating benefit evaluation refers that company operating performance and asset condition are analyzed, company earning power, capacity for action, etc. are judged through analyzing company profit and loss statement and balance sheet, and the balance state among fund, asset and liabilities is made clear. Benefit evaluation has the fundamental purpose of recognizing and correcting operating disadvantages through analyzing results, thereby further improving the benefits.

3.2 Evaluation content composition

Company operating benefit comprehensive evaluation index system is divided into six modules according to concrete aspect of creating benefits by production and operation of power enterprises on the basis of three financial evaluation index (debt paying ability, operation ability and profitability) regulated for enterprises in China 'General Rules on Financial Affairs of Enterprises', respectively including asset efficiency module, operating quality module, investment benefit module, debt paying ability module, profitability module and development ability module. Concrete contents are shown as follows:

Asset efficiency: asset efficiency mainly refers to company operation asset level. Assets include current asset and non-current asset, etc. Indexes in the aspect of turnover rate are usually used for measuring the operating management of the company to assets. The indexes of asset efficiency module generally include total assets turnover, velocity of liquid assets, etc.

Operating quality: operating quality refers to operating effects of company assets, which covers grid asset, fixed asset, electricity sales income and other aspects. The asset operation level is generally measured with income, cost or yield produced by assets each unit. Indexes of operating quality module include electricity sales income of unit grid assets, grid cost price difference ratio of unit quantity of electricity, etc.

Investment benefit: investment benefit refers to investment level and return of all kinds of company investments such as grid investment, capital construction investment, etc., and the investment effect is measured by sales and income increment generated by all kinds of investment proportion and investment. Indexes of investment benefit module mainly include increased sold electricity quantity of unit grid investment, proportion of grid investment in fixed-asset investment, etc.

Debt paying ability: debt paying ability refers to asset amortization long-term liabilities and current liability ability of enterprises, tolerance capacity and guarantee degree to debts, and enterprise

financial condition and operating ability are usually reflected by the proportion between all kinds of asset and liabilities. Indexes of debt paying ability module include asset-liability ratio, current ratio, cash ratio, etc.

Profitability: profitability refers to enterprise ability to obtain earnings, namely enterprise fund or capital appreciation ability, it is usually manifested as enterprise earnings, such as the quality and level of operating income, operating cash flow, etc. The indexes of profitability module include net assets income rate, interest cover of surplus cash, etc.

Development ability: development ability refers to enterprise sustainable operating ability. It is the enterprise ability to expand operating scale on the basis of inherent asset and rights thereof. Enterprise development potential is usually measured with increase of asset and earnings. Indexes of development ability module include sales growth rate, hedging and proliferating ratio, etc.

3.3 Index system construction

It is necessary to establish a company operating benefit comprehensive evaluation index system in order to construct a company operating benefit evaluation model. The index system mainly includes essential index database, core index database and overall target database, wherein essential index database is the basic index of company company and operation. It is the data generated by company practical operation, it is reflected on basic operating statistical table and financial statement. Input data can be provided for model calculation. Core index database is obtained on the basis of essential index through calculation, it is more authoritative, recognized and commonly-used index in the industry, which can be used for measuring corresponding module more comprehensively and has higher weight in the model. It is an important reference index. overall index is regarded as supplement to core index, which belongs to secondary core index. The distributed weight should be smaller. In generally, there are a total of 30 indexes in the essential index database, core index database contains a total of 7 indexes, and overall target database contains a total of 20 indexes.

4. Function calculation and threshold determination

4.1 Evaluation function construction

Single index evaluation function has the core concept dimensionless concept. Core index and overall index are evaluated one by one. Firstly, threshold scope of each index is determined through wave method and comparison method. Therefore, upper and lower limiting values of each index are determined, respectively including F_2 (threshold upper limiting value) and F_1 (threshold lower limiting value); secondly, core index and overall index are calculated according to single-index evaluation function, thereby obtaining the evaluation results. Secondly, weighing summary is carried out according to determined weight coefficient, and the operating benefit evaluation results of all units are finally obtained. Model calculation functions are shown as follows:

$$K(x)=\begin{cases}\dfrac{\mathrm{f(x)-F_1}}{\mathrm{F_2-F_1}}\times 100, \text{Applicable to positive index}\\ \dfrac{\mathrm{F_2-|f(x)-F_{mid}|}}{\mathrm{F_2-F_1}}\times 100, \text{Applicable to comparative fit index}\\ \dfrac{\mathrm{F_2-f(x)}}{\mathrm{F_2-F_1}}\times 100, \text{Application to negative index}\end{cases}$$

Where in:

$K_{(x)}$ refers to score of benefit index x (core index and overall index);

$f_{(x)}$ refers to single-point index value of concrete operating benefit;

F_1 refers to threshold lower limiting value of benefit index $f_{(x)}$;

F_2 refers to threshold upper limiting value of benefit index $f_{(x)}$;

Positive index shows that the index bigger and better, such as profit growth rate, total assets turnover, etc.; comparative fit index shows that the index has an intermediate comparative fit value, such as asset-liability ratio level, too high level shows that the enterprise has higher debt risk, too low

level shows that the enterprise utilizes financial lever at lower level, it does not rely on capital force to expand operation; negative index shows that the index is smaller and better, such as ten-thousand yuan maintenance fee, etc. The index level is lower, the company operating benefit is better.

4.2 Index threshold setting

4.2.1 Setting method

The setting methods of thresholds mainly include wave method, comparison method and expert inquiry method, wave method and comparison method are mainly adopted in the model.

1) Wave method: In the evaluation index, some indexes belong to evaluation indexes which are used more commonly in electric power industry or state-owned large-scale enterprise. Universal bench-marking level and universal evaluation standards recognized in the industry have been summarized in the long-term practice. We fully learn from industry internal standards for distinguishing thresholds aiming at the indexes, and there are a total of 14 such indexes.

2) Comparison method: Comparison method concretely includes medium principle method, mean principle method and majority principle method. Majority principle method is mainly utilized in benefit evaluation model. Majority principle method refers to the evaluation threshold is determined by the intervals of most index values.

3) Expert inquiry method: Expert inquiry method to a method that expert processional knowledge, personnel experience and risk understanding are utilized to determine the evaluation indexes. It has universal practicability, which can be used for determining the evaluation indexes under various backgrounds. Since expert inquiry method has greater subjectivity, it is affected by factors in all aspects, and the model has the most important feature of objective independence, therefore expert inquiry method is not adopted in the paper.

4.2.2 Threshold setting

Aiming at 27 risk evaluation indexes: comparison method is applied for 13 indexes, wave principle method is applied for another 14 indexes, specific assessment requirements of SASAC and concrete financial criteria released by the Ministry of Fiance are used as reference for determining thresholds aiming at core index and overall index.

5. Weight coefficient determination

Delphi method is mainly adopted for determining weight coefficient in the study.

5.1 Questionnaire setting

In the study, corresponding expert sequencing questionnaires are designed according to the above difference. 100 experts are randomly selected inside and outside the company system, the systems include financial and non-financial experts, experts in electric power industry and non-electric power industry, financial academic experts, practical financial workers, etc.

5.2 Weight coefficient calculation

The weight coefficient of all indexes are determined again in the study according to average proportion of ordinal number.

5.3 Coefficient determination and modification

After more than 100 ranking tables are received, they are calculated aiming at various ranks. Concrete suggestions of related experts are consulted. The weight coefficient table of the model is formed.

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