Analysis of Economic Activities of Power Grid Enterprises Based on Reform of Transmission and Distribution Price

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Abstract. After the reform of transmission and distribution price, the profit model of power grid enterprises changed, and the composition of profits and costs were affected. The business activities of enterprises changed greatly. Conducting economic activity analysis can strengthen business management, find the crux of corporate problems, and improve operational efficiency. The paper analyzes the impact of the reform of transmission and distribution price on the economic activities of enterprises, and builds an analysis model of economic activities of enterprises based on total profit, main business cost and main business income. The model can provide theoretical support for the analysis of economic activities of power grid enterprises under the situation of electric power reform, and help enterprises to improve management and tap the potential of enterprises, which has certain practical significance.

1. Introduction
In March 2015, the "Opinions of the Central Committee of the Communist Party of China and the State Council on Further Deepening the Reform of the Power System" was issued, marking the beginning of a new round of power market reform. This round of power reform has clarified the key points and basic path of reform, and proposed the institutional framework of “opening the two ends and managing the middle”. As the key to connecting the power generation side and the power sales side, the transmission and distribution price reform is one of the most critical cores of this round of power reform.

So far, many countries have carried out power market reforms, and many scholars have conducted in-depth research on transmission and distribution price reform. Power grid investment and power growth have a significant impact on transmission and distribution prices [1]. Separately verifying the transmission and distribution price is essentially a reform of the transmission and distribution price formation mechanism, and it is also the primary task of realizing the new structure of the "opening the two ends and managing the middle" power system [2]. The new round of power system reform with the reform of transmission and distribution price as the core has completely changed the profit model of the power grid. Power grid enterprises are faced with a more complicated internal and external environment, and their business revenues and operating benefits are facing a major change [3]. Power grid companies can improve profitability from both traditional and new business [4].
After the reform of transmission and distribution price, the operation status of power grid enterprises has changed. In this context, the analysis of economic activities can help grid enterprises find the root causes of changes and make corresponding countermeasures. Economic activity analysis is an important means for enterprises to strengthen economic management and improve economic efficiency. It is a working method for enterprises to comprehensively and systematically study the effects of operations [5-6]. The basic idea is to objectively evaluate the completion plan of the enterprise, reveal the economic development trend of the enterprise, explore the internal potential of the enterprise, sum up the experience and lessons, and improve the economic benefits of the enterprise [7-8]. The construction principles of the enterprise economic activity analysis system include systemic principles, typical principles, concise scientific principles, and comprehensive project principles [9-10]. The analysis indicators of economic activities of power grid enterprises mainly include profit, main business cost, main business income, asset-liability ratio, etc. [11].

Based on profit, cost and income, this paper constructs an analysis system of economic activities of power grid enterprises under the background of reform of transmission and distribution price. Guided by operational efficiency, through the analysis of the composition of income and expenditure, the factors affecting the operating efficiency of power grid enterprises under the new situation are attributed to specific indicators, which provide a basis for power grid enterprises to improve economic activities.

2. Impact Analysis

2.1. Main contents of the reform of transmission and distribution price

In March 2015, the General Office of the State Council issued the “Several Opinions on Further Deepening the Reform of the Power System”. In November of the same year, it issued six supporting documents on the reform of the power system, such as the “Implementation Opinions on Promoting the Reform of Transmission and Distribution Price”, which marked the comprehensive development of transmission and distribution price reform. The specific content of this reform includes the following aspects:

(1) The approved form of transmission and distribution price

Before the reform, the transmission and distribution price was calculated according to the electricity price difference between the purchase and sale, and the government implemented post-event supervision. After the reform, the government approved the transmission and distribution price according to the principle of “cost plus income” and implemented ex ante regulation. The verification of reasonable cost and reasonable income is based on the effective assets of the grid enterprise. The effective assets refer to the assets necessary for the grid enterprises to provide transmission and distribution services.

(2) Approved method for granting income

After the reform, the permitted income includes the three parts of the permitted cost, the permitted income and the tax. The permitted cost consists of depreciation expenses and operation and maintenance fees. It is mainly based on the principle of “stock plus increment” and is comprehensively verified with reference to the historical cost of the grid enterprise. Permitted income refers to the annual allowable return of the approved transmission and distribution enterprises within a control period according to relevant regulations. Permitted income is determined by the effective assets and return on capital that can be accrued. Tax refers to the various taxes and fees that the grid enterprises need to pay to operate the transmission and distribution business during the supervision period.

2.2. Impact of Transmission and Distribution Price Reform on Grid Economic Activities

After the reform of transmission and distribution price, the profit model of power grid enterprises has changed, and the operating efficiency of power grid enterprises has been affected. The impact of transmission and distribution price reform on grid companies is shown in Figure 1:
(1) Impact on corporate profitability

1) Affect the company's income. After the implementation of the electricity reform, the price of power generation and electricity sales has nothing to do with the revenue of the grid. The transmission and distribution price is determined by the government according to the principle of “permitted cost plus reasonable income”. The user or the power selling entity pays the fee according to the transmission and distribution price corresponding to the grid voltage level to which it is connected, which will be lower than the purchase price difference before the transmission and distribution price reform.

2) The difficulty of profit has increased. After the implementation of the new power reform program, in addition to the power transmission business, the company must introduce competition into other businesses. The profit model has undergone a qualitative change, and the reduction in the business sector has resulted in a corresponding reduction in total profit.

3) Cash flow is no longer sufficient. Before the implementation of the electricity reform program, the settlement between the company and the power generation enterprise lags behind the charging time of the electricity fee. This payment method brings a large amount of interest-free cash to the company and reduces the financial cost of the company.

(2) Impact on operating costs

After the implementation of the new electricity reform plan, as the market-oriented transaction power increases, the proportion of electricity purchase costs in the cost will gradually decrease. The proportion of depreciation expenses and maintenance operation costs related to fixed assets will gradually increase, which will become the focus of the company's cost management.

3. Method and model

3.1. Enterprise economic activity analysis method

The economic indicators that reflect the results of business operations are affected by a number of factors. When these factors change, they will affect the changes of economic indicators. The changes of these influencing factors are often different in size and direction. This paper will use the serial replacement method to analyze the changes in the comprehensive economic indicators, so as to understand the extent of the impact of various factors on the indicators.
Assuming that an economic indicator $P$ is changed by $a, b$ and $c$ factors, it will inevitably affect the comprehensive indicator $P$, and the three factors $a, b$ and $c$ may change simultaneously. In the analysis, it is first assumed that the changes in the influencing factors are orderly. When considering the first factor change, other factors remain unchanged. When considering the change of the second factor, the first factor is based on the changed, other factors are unchanged, and so on.

When the plan indicator $P_0$ consists of $a_0, b_0$, and $c_0$, and the actual number indicator $P_1$ consists of $a_1, b_1$, and $c_1$, then

$$P_0 = a_0b_0c_0 \quad (1)$$

$$P_1 = a_1b_1c_1 \quad (2)$$

Comparing equations (1) and (2), the indicator $P$ changes from plan $P_0$ to actual $P_1$, and the difference is $Q(Q = P_1 - P_0)$. This difference is due to changes in $a, b$, and $c$ factors. When the degree of change of the three factors affects the index $P$, it is first assumed that the $a$ factor changes first, and the $b$ and $c$ factors do not change. Use $a_i$ to replace the $a_0$ in the formula (1), thus generating $P_2$ as

$$P_2 = a_ib_0c_0 \quad (3)$$

The effect of $a$ factor change on indicator $P$ can be expressed as

$$q_1 = P_2 - P_0$$

When analyzing the change of $b$ factor, it should be analyzed on the basis that $a$ factor has changed. Replace $b_1$ in (3) with $b_0$, so that $P_3$ is

$$P_3 = a_ib_1c_0 \quad (4)$$

The effect of $b$ factor change on indicator $P$ can be expressed as

$$q_2 = P_3 - P_2$$

When analyzing the change of $c$ factor, it should be analyzed on the basis that $a$ and $b$ factors has changed. Replace $c_1$ in (3) with $c_0$, so that $P_4$ is

$$P_4 = a_ib_1c_1 \quad (5)$$

By comparing equations (5) and (2), $P_4 = P_1$, that is, $P_4$ is the actual index. The degree of influence of the $c$ factor change on the indicator $P$ can be expressed as

$$q_3 = P_4 - P_3 = P_1 - P_3$$

The effect of the three-factor variation on the indicator $P$ is added, which is equal to the total value of the change $p$ of the indicator $Q$. The sum of the influences of the three factors on the indicators is equal to the difference between the actual indicators and the planned indicators.

$$q_1 + q_2 + q_3 = (q_2 - q_0) + (q_3 - q_2) + (q_1 - q_3)$$

$$= q_1 - q_0$$

$$= Q$$

3.2. Enterprise economic activity analysis index system

The analysis index system of enterprise economic activities is mainly based on the total profit, main business income, and main business cost. The impact of these three components is further refined. The purpose is to analyze the factors such as profit, cost, income, etc., to find out the main factors of influence, and propose improvement measures, so as to provide a scientific basis for formulating correct decisions and maximizing profits, and enhance the competitiveness of enterprises.

(1) Total profit
The company's total profit mainly consists of main business income, main business costs, taxes and surcharges, other business profits, operating expenses, management fees, and financial expenses. The formula for calculating the total profit of the company is:

Total profit = main business income - main business cost - tax and additional ten other business profits - operating expenses - management expenses - financial expenses + investment income + net non-operating income + profit and loss adjustment

(2) Main business income

The main business income is an important part of the total profit, which has an important impact. The main business income mainly includes two parts: electricity sales revenue and transmission and distribution income. Its calculation formula is:

Main business income = sales revenue + transmission and distribution revenue

Sales revenue = large industrial electricity revenue + general industrial and commercial and other point income + agricultural electricity income + residential electricity revenue

Transmission and distribution revenue = 220kV transmission and distribution revenue + 110kV transmission and distribution revenue + 35kV transmission and distribution revenue + 10kV transmission and distribution revenue + <1kV transmission and distribution revenue

(3) Main business cost

The main business cost is closely related to the company's total profit. For its important components, the company's main business costs mainly include variable costs and fixed costs. Its calculation formula is:

Main business cost = variable cost + fixed cost

Among them, variable cost = purchase cost = purchase electricity × average purchase price

Fixed cost = material fee + salary and welfare + depreciation + repair + other expenses

4. Case Study

Taking the data of a provincial power company from 2016 to 2017 as the research object, due to the limitation of space, this section shows the change of profit, and uses the serial replacement method to analyze the changes in the total profit of the province.

In 2016, the company's total profit was 1.21 billion yuan. In 2017, the company's total profit was 1.27 billion yuan. The company's main business income increased by 6.36 billion yuan, and the main business cost increased by 6.23 billion yuan. The income and cost increased nearly uniformly, mainly due to the decrease in company revenue after the reform of transmission and distribution prices.

Table 1. Changes in the total profit model

| Factor                        | Base period value | Current value | Range of change | Change ratio |
|-------------------------------|------------------|--------------|-----------------|--------------|
| Total profit                  | 121146.5         | 127309.35    | 6162.85         | 100.00%      |
| Main business income          | 8095779.50       | 8732036.04   | 636526.54       | 10324.06%    |
| Main business cost            | 7849164          | 8472106.31   | 622942.31       | 10108.02%    |
| Business tax and surcharges   | 24780.7          | 27682.13     | 2901.43         | 47.08%       |
| Other business profits        | -8127.70         | -5776.23     | 2351.47         | 38.16%       |
| Operating expenses            | 80217.3          | 86494.04     | 6276.74         | 101.85%      |
| Management costs              | 19890.2          | 19668.22     | -221.98         | -3.60%       |
| Financial expenses            | 89964.2          | 93280.82     | 3316.62         | 35.82%       |
| Investment income             | 13715.3          | 1082.99      | -1263.31        | -204.98%     |
| Net non-operating expenses    | 9582.6           | 6490.56      | -3092.04        | -50.17%      |
| Profit and loss adjustment    | 74213.2          | 92707.51     | 18494.31        | 300.09%      |

Using the chain substitution method, assuming that other factors are constant, the change range of each indicator under the profit model is calculated, and compared with the change range of the total profit, the change ratio is obtained. According to the results, the main business income and the main business cost have a greater impact on the total profit, and the second profit and loss adjustment, investment income, and operating expenses also have a greater impact on the total profit. Excluding
the impact of income and cost, the change in total profit is mainly affected by profit and loss adjustment, investment income, and operating expenses. Power grid enterprises can analyze this indicator in detail.

5. Conclusion

After the reform of transmission and distribution prices, the profit mode of power grid enterprises has changed. Due to the changes, the profits, revenues and costs of power grid enterprises have changed. This paper uses the serial replacement method to construct an analysis model of grid economic activity, which is profit-oriented and reduces the root cause to specific indicators. Through the analysis of the data of a province in the third quarter, the profit changes are obtained. In order to find out the problems existing in the company's business activities under the form of electricity reform, it will promote the company to use more modern management methods, improve the management level of enterprises, and provide important and useful basis for the management decisions of the company's management authorities and external economic analysis subjects.

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