

Study on Budget Quota Standards of Water and Electricity Charges for Expressways

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Abstract—At present, there is short of clear, objective and detailed quota standards on water and electricity charge budget of expressway operation units. As a result, water and electricity charge budgeting turns into a process of game between the superior and the subordinate and the process of bargaining[1]. In view of this, this paper demonstrates the necessity and principles for expressway operation units to set budget quota standards of water and electricity charges. On this basis, this paper summarizes the factors influencing water and electricity charges and constructs a model for budget quota standards of water and electricity charges. Finally, this paper takes HM Expressway for example to test the scientificity and effectiveness of budget quota standard model. The results show that the budget quota standard model can significantly reduce the expenditure of water and electricity charges and effectively solve the problem of loose budget of water and electricity charges under the precondition of guaranteeing normal operation of expressways.

Keywords—Expressways; water and electricity charges; budget; budget quota standards

I. INTRODUCTION

Expressways occupy an important position in China's communication and transportation system, and they are closely related to the level of national economic development[2]. Strictly speaking, the budget of repayment expressway department includes revenue budget and expenditure budget, where expenditure budget is the subject of budgeting. However, the budget expenditure of expressway grassroots units is usually gained through proper adjustment of final settlement result in the last year[3]. Without scientific essential data, resource redundancy may be caused easily. Therefore, this paper tries to establish a set of scientific and effective budget quota standard system of water and electricity charges for expressway grassroots units on the basis of cost control and quota budget theory.

II. SETTING BUDGET QUOTA STANDARDS OF WATER AND ELECTRICITY CHARGES

A. Necessity of setting budget quota standards of water and electricity charges

The purpose of setting budget quota standards of water and electricity charges is to improve fiscal expenditure performance and management level, instead of significantly cutting down the quantity of funds available for each grassroots unit. To be specific, the necessity of setting budget quota

standards of water and electricity charges is mainly reflected in the following 3 aspects:

1) *Stabilize the expectation and know the case well*: In the face of large input, long period and high risk features of expressway construction and operation[4], setting budget quota standards of water and electricity charges can allow the manager to integrate financial funds in advance and distribute expenses of future years in a scientific and rational manner.

2) *Save financial funds and increase fund use efficiency*: in the process of financial fund allocation, budget amount of water and electricity charges may result in fund redundancy[5]. Budget quota standard is based on the budget concept, attaches importance to the relationship between budgeting basis and variables and emphasizes fund efficiency.

3) *Reduce budget looseness and enhance motivating effect of enterprise budget*. Too loose expressway budget is difficult to motivate enterprise potential and brings amount a great deal of invalid cost[6]. Through setting budget quota standards, the manager can positively cope with budget slackness and rationally avoid it.

B. Principles of setting budget quota standards of water and electricity charges

1) *Seize the principal contradictions and key factors*: The principal contradictions refer to the key factors which are in the dominate position and play the leading role in various expenditure factors. In the process of setting expenditure quota standards of water and electricity charges, correlation influence is analyzed through Spss software, and some useless independent variables which are difficult to quantify.

2) *Pay attention to correlation rather than causal relationship*: During constructing the expenditure quota model, it is necessary to replace the variables which are difficult to measure and calculate in casual relationship with the key factors in correlation by combining the fund list of expenses over the previous years.

3) *Principle of majority application*: During constructing the quota model, the uniform standards are adopted for intensive management of each grassroots unit. Since the building scale, system setting and responsibility allocation of each grassroots unit are different, the expenditure quota model needs to abide by and adapt to the requirements of most grassroots units.

C. Collecting factors influencing expenditure of water and electricity charges

Water and electricity of expressways refer to water and electricity used for daily life of expressway control station, monitoring center, maintenance station and road administration team as well as water and electricity used for expression production.

Water charge. This expenditure item contains the charges of drinking water, tap water, sewage treatment and farm irrigation water etc. The expenditure of water charges is related to the restricted number of workers, the restricted number of auxiliary laborers, sewage discharge and farm area. Some management stations, maintenance stations, monitoring centers and road administration teams have no farm. In accordance with the principles of setting budget quota standards, sewage discharge and farm area are not the key factors. Thus, in the process of constructing the budget quota model, only the correlation among water charge, the restricted number of workers and the restricted number of auxiliary laborers is sought for water charge. In view of different domestic water application ways in each grassroots unit and different expenditure limit, two different standard models (barreled drinking water and tap water) are set under water charge. N1 and N2 are introduced to express the restricted number of workers and the restricted number of auxiliary laborers.

Electricity charge. Such expenditure includes electricity used for production and life. Both electricity used for tunnels, toll plazas and monitoring centers, and electricity used in daily life are the key points in budget quota research. The expenditure of electricity charge is related to the restricted number of worker, covered area, traffic flow at the entrance, traffic flow at the exit and distance of management section etc. Since electricity charge involves a wide range, this paper introduces moderating variable K1 to differentiate toll station, road administration team, maintenance station and monitoring center.

The electricity charge of toll station control office mainly comes from toll plazas and tunnels. The plaza scale of each toll station and tunnel distance differs, so it is hard to unify the standards. As per the principles of setting budget quota standards and software correlation test, the moderating variable K1 is related to traffic flow. Q1 is introduced to express the traffic flow at the entrance, while Q2 is the traffic flow at the exit.

For toll station control office, $K1 = \sqrt[4]{\frac{Q1 + Q2}{6}}$, where Q1 is the traffic flow at the entrance, and Q2 is the traffic flow at the exit.

The electricity charge of road administration team mainly comes from grassroots units in daily life. The electricity consumption is connected with the type, power and application time of electric appliances. Although it is scientific in theory, it is hard to operation in practice. Thus, this paper creatively introduces the distance of road administration section L1 to express the moderating variable K1.

For the road administration team, $K1 = \sqrt{\frac{L1}{10}}$, where L1 is the distance of road administration section.

The electricity charge of maintenance station and information monitoring center obviously has nothing to do with traffic flow. Hence, in order to differentiate the differences with other grassroots units, this paper introduces maintenance electromechanical administration section to express the moderating variable K1. The following moderating formula is gained through correlation and causality test.

For the maintenance station and information monitoring center, $K1 = \sqrt{\frac{L2}{100}}$, where L2 is the distance of maintenance electromechanical administration section.

It can be seen from the above formula that, under the effect of moderating variable K1, multiple grassroots units with different properties managed by expressway management office can use the same budget quota standard model to estimate the charges.

D. Constructing budget quota model of water and electricity charges

Based on the analysis results of factors influencing the expenses, the following problems are strategically solved or concerned in the process of constructing budget quota model. We carry out periodic management of budget quota standards, to avoid hastiness in the process of essential data statistics; during collecting the essential data, zero-base budgeting method is applied. Various essential data are collected again in an all-round way to change traditional increment budgeting mode and then make the new budget data free from the impacts of originally established facts. In the process of information communication, the harmony between the superior and the subordinate should be enhanced. The superiors trained and communicated with the leader of each unit before budgeting. The subordinates fed back the problems discovered in essential data statistics process to the superiors in time.

The problems were found and solved in model construction process, and the resources were allocated effectively. The accuracy of budgeting improved. Based on this, this paper constructs two budget quota models for expressway water and electricity charges, as follows:

1) Water charge model

$F1 = 400 \times (N1 + N2) + 3500$ (applicable to the units with tap water)

$F1 = 120 \times (N1 + N2) + 1000$ (applicable to the units with barreled water)

2) Electricity charge model

$F2 = 1000 \times (N1 + N2) \times K1 + 2 \times S1 \times K1 + 100000$

III. EMPIRICAL TEST OF WATER AND ELECTRICITY BUDGET MODEL FOR EXPRESSWAYS IN HM EXPRESSWAY

A. Background of HM Expressway

The total distance of HM Expressway is 530km, HM Expressway connects four provinces: Hubei, Anhui, Jiangxi and Henan. At present, there are 21 management offices (including 3 service areas), 3 maintenance stations, 3 information monitoring sub-centers and 11 road administration teams under HM Expressway. Daily water and electricity charge was RMB 7,312,800 in total in 2015, while the total expenditure in 2015 was RMB 12,761,500. The consumption of water and electricity is so large.

B. Measurement and calculation process

The management office of HM Expressway collected essential data of each grassroots unit and checked the authenticity and rationality of the data. The fundamental variables and explanations are shown in *Table 1*. The moderating variable is shown in *Table 2*.

TABLE I. FUNDAMENTAL VARIABLES AND EXPLANATIONS

Code	Fundamental variables and explanations
N1	The number of workers approved by personnel department; the workers refer to the total number of workers in the grassroots units minus the number of auxiliary laborers.
N2	The number of auxiliary laborers approved by personnel department; auxiliary laborers refer to drivers, plumbers, electricians, cooks and odd-job personnel.
Q1	Annual traffic flow at the entrance of toll station (10000)
Q2	Annual traffic flow at the exit of toll station (10000)
L1	Distance of road administration section (km)
L2	Distance of road administration section (km)
S1	Covered area (m2)

TABLE II. MODERATING VARIABLE

Moderating variable	K1	=	$\sqrt[4]{\frac{Q1+Q2}{6}}$	For toll station management office
			$\sqrt{\frac{L1}{10}}$	For road administration team
			$\sqrt{\frac{L2}{100}}$	For maintenance station and information monitoring sub-center

After data auditing passes, computation results of 38 grassroots units are summarized as follows according to the three models constructed above:

$$F1=400 \times (N1+N2) + 3500 = 525,600 \text{ (applicable to the units with tap water)}$$

$$F1=120 \times (N1+N2) + 1000 = 36500 \text{ (applicable to the units with barreled water)}$$

$$F2=1000 \times (N1+N2) \times K1 + 2 \times S1 \times K1 + 100000 = 4,906,100$$

$$F1+F2 = 5468200$$

According to budget quota standards of water and electricity charges in this paper, the expenditure reduces $7312800 - 5468200 = 1844600$. The above budget result shows that budget quota standards of water and electricity charges in this paper can't just guarantee normal operation of expressways, but also cut down the expenditure of water and electricity charges and effectively avoid overestimation of expenditure in budgeting process.

IV. SUMMARY

The budget quota standards of water and electricity charges are the key point during constructing expressway expenditure quota model. Through setting the budget quota standards, on the one hand, expenditure range and direction of each grassroots unit can be known; on the other hand, fiscal expenditure fund allocation and use can obviously predict and reflect the decision and of the future year.

In previous years, sufficient financial funds for the expenditure of expressways were strived for as many as possible through negotiations. Each grassroots unit might hide unit information to gain the greater benefits. The budget quota standard is the budget goal which is set to improve fund use efficiency and enhance internal management. It thus can be seen that practicability and advancement of this research lie in the following: (1) formulate a set of uniform budget quota standards for water and electricity charges suitable for each grassroots unit and carryout concentrated information management; (2) provide new decision reference and basis for preparing the water and electricity charge budget in the next year; (3) construct budget quota standards for water and electricity charges, find out the budget expenditure suitable for sound development of HM Expressway, boost fund use efficiency and facilitate further improvement of HM Expressway budget management.

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