Research on Performance Management of Local Government Ecological Budget Based on Fuzzy Evaluation Model

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Abstract: With the Continuous Promotion of Performance Management of Fiscal Ecological Budget in China, Special Performance Evaluation of Local Government Has Been Put on the Agenda. the Performance Management of Ecological Budget is an Important Link to Improve the Efficiency of the Government, Which Can Maximize the Economic Benefits in the Financial Capital Planning. Based on This, This Paper First Expounds the Profound Connotation of Ecological Budget, Ecological Budget Performance and Budget Performance Management, Then Constructs a Comprehensive Evaluation System Based on the Fuzzy Comprehensive Evaluation Method. Finally, Taking Yunnan and Guangxi Local Governments as Examples, the Scientific and Operability of the Constructed Evaluation System Was Verified and Analyzed.

1. Introduction

1.1 Literature Review

Kuang Xiaoping and Bao Xiaoming thought that compared with the performance budget system of foreign developed countries, our country is still in the initial stage, so they investigated the scope, strength, motivation and way of performance management reform in different regions. Based on this, they proposed that we should integrate the budget expenditure performance system with the budget revenue performance system to realize the integration of financial management and budget performance management (Kuang and Bao, 2 013). Liu Li once believed that the budget performance management of Chinese government was influenced by the system, culture and politics. Therefore, he proposed that a scientific budget performance management system should be established to exchange less capital investment for more products and services (Liu, 2014). Liu Xiaorong and Dai Huayue once proposed that budget performance management has become one of the major reforms that the state attaches great importance to. It is an urgent task for the current government budget performance management to make a scientific performance management plan, strengthen the performance monitoring system and improve the application mechanism of performance management (Liu and Dai, 2016). Bai Jingming once believed that there was a certain internal relationship between government planning and budget performance management system. The direction of government planning affected the goal orientation of budget performance management system, which was the basic basis for the designation of management system. At the same time, it is proposed that the government should give full play to its macro-control role, optimize the budget performance management system by government planning, and expand the coverage of budget performance management (Bai, 2016). According to Feng Mingrui, China's budget performance management is still in its infancy, and there are still some problems such as the relative lack of laws and regulations, the results of performance evaluation are not open and transparent, the lack of incentive and restraint mechanisms, and the imperfection of performance evaluation system. In this regard, effective countermeasures such as the establishment of basic information database and the establishment of accountability mechanism are put forward (Feng, 2014).

1.2 Purpose of Research

With the continuous development of Chinese market, the performance management of government ecological budget is also undergoing profound changes. Since the performance budget evaluation system was put forward, how to reasonably allocate government financial resources has been highly concerned by the community. The evaluation system of local government budget performance management in China has been initially formed, but the use of funds still needs to be improved, and there is no obvious direction in performance budget management. Therefore, based on the fuzzy evaluation model, this paper studies the performance management of local government ecological budget in order to promote and promote the efficiency of government performance management and realize the reasonable allocation of government financial expenditure.

2. An Overview of Relevant Theories of Government Ecological Budget Performance Management

In 1987, Konrad Otto Zimmermann first proposed the term of ecological budget. In 1994, the first European Conference on Sustainable towns held by ICLEI was officially written into the Constitution (Deng, 2013). Then, in October 1996, in the second sustainable urban movement, ecological budget was introduced into the Lisbon action plan: from charter to action, marking that ecological computing was officially recognized and gradually implemented in member countries (Chang, 2016). Through the establishment of scientific environmental objectives, the physical quantity of resources indicators are screened, and then the actual value of the annual budget indicators is tested. Finally, the completion degree of the budget objectives is reasonably evaluated and the next round of budget is started (Wei, 2013). At the same time, ecological budget is a combination of budget accounting and environmental management, and based on the accounting point of view to expand the description of environmental management, through the responsibility budget, finally formed the environmental management method of budget report.

Ecological budget performance is the government's financial resource allocation and resource planning activities to meet the needs of ecological resource management. Its definition has three levels of significance. First of all, in the planning and budgeting period, the financial funds are used in the ecological allocation in different states, so that the decision-making process and content are in line with the scientific resource budget of ecological decision-making (LV, 2013). Secondly, through the budget mechanism, the ecological financial funds will be used reasonably and efficiently, and the implementation of the ecological resources goals will be planned (Li and Fang, 2016). Finally, the output performance of ecological budget, including the planning of ecological resources and the completion of changes in the stock of ecological resources.

Budget performance management is an important part of improving the function of government, which changes the compliance orientation of traditional budget management mode into result orientation. To maximize the utility of government ecological budget funds through the rational use of financial budget funds (Luo, 2015). In theory, the use of budget performance management can ensure that the government, on the basis of the realization of its work functions, can carry out results evaluation and control, so as to improve the formulation of financial budget objectives and optimize the flow of budget funds.

3. Evaluation Index System Construction

In order to ensure the effectiveness of the government's ecological budget performance management evaluation model, the evaluation indicators are selected to follow the principles of representativeness, comparability and measurability. At present, four indicators are generally adopted in China, namely, government integrity, policy formulation and implementation, state-owned assets management, and market supervision and management. The evaluation results of the government's ecological budget performance management are opaque and the system is not perfect. The volatility of each indicator will have a huge impact on the performance management

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evaluation results. In order to reduce the negative impact, a comprehensive evaluation of budget performance management R is used to express:

$$R = D_1 r_1 + D_2 r_2 + D_3 r_3 + D_4 \qquad (1)$$

Where R is the performance management evaluation result. D_1 is government integrity. D_2 is the policy formulation and implementation. D_3 is the state-owned asset management situation. D_4 is the market supervision and management situation. R_1 is the proportion of administrative personnel involved in corruption cases. R_2 is the stability index of the policy. R_3 is the proportion of non-operating state-owned assets to GDP.

Based on this, this paper proposes the following four indicators:

The first is government integrity:

$$R_P = \left[R / (P \times G) \right] \times 10^5 \qquad (2)$$

In the formula, R_p is the government's integrity. P is the number of people involved in the corruption case. G is the number of administrative staff.

The second is policy formulation and implementation:

$$R_v = \left[R / V \times G \right] \times 10^2 \qquad (3)$$

In the formula, R_v is the policy formulation and implementation. V is the stability index of the policy.

The third is state-owned assets management:

$$R_w = \left[R / W \times G \right] \times 10^2 \qquad (4)$$

In the formula, R_w is the state-owned asset management. W is the proportion of non-operating state-owned assets in GDP.

The fourth is market supervision and management:

$$R_T = \left[R / T \times G \right] \times 10^5 \qquad (5)$$

In the formula, R_T is the market supervision and management situation. T is the satisfaction of the enterprise on the quality supervision and anti-counterfeiting efforts.

4. Construction of Government Ecological Budget Performance Management Model Based on Fuzzy Evaluation

4.1 Description of the Problem

Known finite set $Q = \{q_1, q_2, q_3, \cdots, q_n\}$ and finite set $K = \{k_1, k_2, k_3, \cdots, k_m\}$, where q_i Indicates different evaluation targets (city), and k_i indicates different evaluation indicators (the evaluation indicators established above). Let u_j be the membership function of the j-th evaluation index $k_j \in K$ (uj applies to all qis), that is

$$u_j = u(k_j), u_j \in [0,1] \qquad (6)$$

Then U is a finite fuzzy subset, $U = \{u_1, u_2, u_3, \cdots, u_m\}$.

Now look for a fuzzy set $B = \{b_1, b_2, b_3, \cdots, b_n\}$, $b_i \in [0,1]$, so that b_i can represent the comprehensive evaluation index of the i-th evaluated object.

4.2 Model Solution Ideas and Operations

First, clear the fuzzy relationship.

Since the membership function u_j is applicable to all evaluation objects q_i, $R = Q \times U \to [0,1]$ can be used as an evaluation matrix to establish a fuzzy relationship, that is

$$R = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_n \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \tag{7}$$

Where r_{ij} represents the membership degree of the i-th evaluated object with respect to the j-th evaluation index, $r_{ij} = R(q_i, u_i) \in [0,1]$

Second, the fuzzy vector is clarified.

Definition $S = (Q, U, R)$ is the level 1 evaluation space, and a fuzzy vector $A = \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix}$ is given,

where a_j indicates the relative importance of each evaluation index with respect to the level 1 evaluation space $S = (Q, U, R)$, that is the weight.

Third, build a hierarchical evaluation model.

Let the first level evaluation model be $D = R \otimes A$, that is

$$D = \begin{matrix} D(q_1) \\ D(q_2) \\ \vdots \\ D(q_n) \end{matrix} = \begin{matrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{matrix} \otimes \begin{matrix} a_1 \\ a_2 \\ \vdots \\ a_m \end{matrix} \tag{8}$$

Let the second level evaluation model be $R_1 = Q \times U_1 \to [0,1]$, that is

$$R_1 = \begin{bmatrix} d_{11} & d_{12} & \cdots & d_{1p} \\ d_{21} & d_{22} & \cdots & d_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ d_{n1} & d_{n2} & \cdots & d_{np} \end{bmatrix} \tag{9}$$

Where d_{ik} indicates the first-level evaluation value of the i-th evaluation object when the k-th operator is employed.

Thus, the second level evaluation space $S_1 = (Q, U_1, R_1)$ is obtained. Give a fuzzy vector $G(g_1, g_2, \cdots, g_p)$ (g_i represents the second-level evaluation index weight), and $\sum_{k=1}^{p} g_k = 1, g_k \in [0,1]$ then obtains the second-level evaluation model:

$$B = R_1 \times G = \begin{bmatrix} d_{11} & d_{12} & \cdots & d_{1p} \\ d_{21} & d_{22} & \cdots & d_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ d_{n1} & d_{n2} & \cdots & d_{np} \end{bmatrix} \times \begin{bmatrix} g_1 \\ g_2 \\ \vdots \\ g_p \end{bmatrix} = [b_1, b_2, \cdots, b_n]^T \tag{10}$$

In summary, the set B is a comprehensive evaluation index. The larger the b_i, the higher the evaluation level of the local government's ecological budget performance management. Therefore, according to the relative size of $b_i \in B$, the management level of the evaluated object is evaluated.

4.3 Simulation Analysis of a Numerical Example

Taking Yunnan Province as an example, in the evaluation of ecological budget performance management, the necessary qualitative indicators, i.e. ecological performance management evaluation result $R = D_1 r_1 + D_2 r_2 + D_3 r_3 + D_4$, are composed of the integrity of Yunnan government, policy formulation and implementation, state-owned assets management and market supervision and management, which are solved by fuzzy evaluation method. Fuzzy evaluation method is based on the theory of membership degree. The factors that are not easy to be quantified and fuzzy can be described by mathematical language, and can be evaluated by selecting a reasonable range of values for each index. The specific methods are as follows:

Fuzzy vector $A = \{A_1, A_2, A_3\}$, Use formula(11),which is

$$D_1 = R \otimes A = \begin{bmatrix} 0.096 & 0.570 & 0.637 & 0.854 \\ 0.095 & 0.505 & 0.586 & 0.534 \end{bmatrix} \otimes$$

$$\begin{bmatrix} 0.496 & 0.496 & 0.195 \\ 0.485 & 0.485 & 0.441 \\ 0.355 & 0.355 & 0.166 \\ 0.377 & 0.377 & 0.198 \end{bmatrix} = \begin{bmatrix} 0.485 & 0.322 & 0.545 \\ 0.485 & 0.245 & 0.444 \end{bmatrix}$$

(11)

It can be seen from the above calculation, set up $U_1 = D_1 = [D_1 \quad D_2 \quad D_3] \in [0,1]$, which is

$$B = R_1 \times G = \begin{bmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \end{bmatrix} \times \begin{bmatrix} g_1 \\ g_2 \\ g_3 \end{bmatrix} =$$

$$\begin{bmatrix} 0.485 & 0.322 & 0.545 \\ 0.485 & 0.245 & 0.444 \end{bmatrix} \times \begin{bmatrix} 0.122 \\ 0.230 \\ 0.648 \end{bmatrix} = [0.487 \quad 0.403]^T$$

(12)

That is to say, the ecological budget performance management level of two different prefecture level cities in Yunnan Province is 0.487 and 0.403 respectively. Obviously, the performance management level of Yunnan Province is better.

5. Conclusion

Because of the complexity of the performance management level of local government ecological budget, it is difficult to construct a reasonable evaluation model of ecological budget performance management with classical mathematical methods. Therefore, based on the fuzzy evaluation model, this paper verifies that it is reasonable and feasible to establish the fuzzy evaluation model of ecological budget performance management, and takes Yunnan Province and Guangxi Province as examples, and concludes that Yunnan Province has a good performance management level.

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