



## The Implication of Fuzzy Comprehensive Evaluation Method in Evaluating Internal Financial Control of Enterprise

Chunyan Shao

School of Accounting

Shandong Economic University

Jinan 250014, China

E-mail: haichangli@126.com

### Abstract

Internal financial control is an important part of internal control in enterprise, and it is also an important part of the structure of enterprise governance. It is an important way of improving competitive power of enterprise to strengthen and consummate the internal financial control of enterprise. So a reasonable method should be used to evaluate the internal financial control of enterprise. On the basis of the evaluation index system of the internal financial control of enterprise, fuzzy comprehensive evaluation method is utilized to evaluate the internal financial control of enterprise synthetically which accords with the characteristic of the internal financial control of enterprise and has maneuverability.

**Keywords:** Enterprise, Internal Financial Control, Fuzzy Comprehensive Evaluation Method, Maximum Subordination

### 1. Introduction

Internal financial control is the application of the control theory in corporate finance activities. It is the collective of a range of methods, techniques, procedures and concept by use of the basic principles and methods of control theory to bound and evaluate the financial activities in order to achieve the financial targets (Huang Juan, Wei Lang, 2003). Internal financial control of the enterprise is an important part of internal control and corporate governance. It is an important way of improving business competitiveness to strengthen and improve the internal financial control. Hence it is need to build an all-round, multi-angle evaluation index system of reflecting the level of internal financial control, to use reasonable means to evaluate comprehensively the level of internal financial control, to strengthen and perfect the internal financial control of the enterprise in multi-angle views in order to improve the level and quality of internal financial control and then help to improve the competitiveness of enterprises comprehensively. As the related procedures and factors of internal financial control is complex and fuzzy, the text is to use fuzzy comprehensive evaluation method to evaluate the quality and level of internal financial control in order to promote the enterprise to be aware of its own situation of internal financial control, and then to take measures to enhance the competitiveness of businesses.

### 2. Introduction of Fuzzy Comprehensive Evaluation Method

Fuzzy comprehensive evaluation method is a mathematical method to comprehensively evaluate things that are not easy to be clearly defined in the real world by using the thinking and methods of fuzzy mathematics. Fuzzy mathematics was born in 1965, its founder is professor Chad (LAZadeh) who is an automatic control expert of the United States. For more than 30 years, fuzzy mathematics has a rapid development in theory and a wide use in practice. Fuzzy comprehensive evaluation method is a method to comprehensively evaluate systems by using fuzzy set theory of fuzzy mathematics. Through the fuzzy evaluation information about the priority of various alternatives can be achieved as a reference for decision makers to make decision.

When Fuzzy comprehensive evaluation method is used, we should create fuzzy comprehensive evaluation index system first of all. The establishment of fuzzy comprehensive evaluation index system should be guided by the following basic principles: (1) The overall evaluation index system should be complete; (2) The evaluation index in evaluation index system must be measurable and comparable; (3) The human element in the evaluation index should be highlighted and human factors of evaluation in education should be fully infiltrated; (4) The level of evaluation in evaluation index should not be divided too thin.

Specifically, the application steps of fuzzy comprehensive evaluation method are as follows:

2.1 To determine the factors set in Judge

According to the nature of the characteristics of the first level index in the evaluation index system, the factors set in the evaluating relationship are as follows:

$$U = \{u_1, u_2, u_3, \dots, u_n\}.$$

2.2 To determine the evaluation (comments) set in judge

The evaluation set is set to be followed:

$$V = \{v_1, v_2, v_3, \dots, v_m\}.$$

2.3 To establish the single-factor evaluation matrix R from U to V

Each factor  $u_i (i \leq n)$  should be evaluated single-factor. As there are different types of evaluation level (or reviews), the evaluation result of each factor is a fuzzy set of evaluation set V which can be written as the fuzzy vector  $R_i = (r_{i1}, r_{i2}, r_{i3}, \dots, r_{im}) (i=1, 2, \dots, n), R_i \in \mu(V)$ . The results of these evaluations meet the normalized conditions and the sum of the weight of the vector is 1, that is, for every i, there is:  $r_{i1} + r_{i2} + r_{i3} + \dots + r_{im} = 1$ .

All of the single-factor evaluation constitutes the fuzzy relationship R from U to V:  $R = (r_{ij})^{nm}$

That is,

$$R = (r_{ij})_{mn} = \begin{pmatrix} r_{11} & r_{12} & r_{13} & \dots & r_{1m} \\ r_{21} & r_{22} & r_{23} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & r_{n3} & \dots & r_{nm} \end{pmatrix}$$

2.4 To determine the weight of index

Weight means the proportion of each evaluation index in the evaluation index system based on importance. The impact of different factor in factors set is inconsistent with things that have been judged. If a weight is given to a factor, the weight distribution set A of factors can be seen as a fuzzy set of factors set U which is recorded as:  $A = \{a_1, a_2, a_3, \dots, a_n\}$ . It is required to meet the normalized conditions:

$$\sum_{i=1}^n a_i = 1, \text{ and } 0 < a_i < 1.$$

2.5 To get the results of evaluation

The results of evaluation can be get through multiplying the vector of the index weight and the matrix R of single-factor evaluation:

$$B = A \cdot R = (b_1, b_2, b_3, \dots, b_m)$$

2.6 To get the conclusion of judge

The set B is normalized, that is, each weight is divided by the sum of all the weight in the set B. The subordination of the first i-level of evaluation to  $R_i$  is the share of  $v_i$  in the results of comprehensive evaluation. According to the principle of maximum subordination, the corresponding evaluation level of the maximum subordination is the hierarchy of a judge in the set B, which is the conclusion of the comprehensive evaluation.

**3. The evaluation index system of internal financial control in enterprise**

When Fuzzy comprehensive evaluation method is used to evaluate the internal financial control of the enterprise, the

fuzzy comprehensive evaluation index system is firstly needed. As internal financial control is a complex and systematic project in business, it is necessary to establish a comprehensive and multi-angle evaluation index system to reflect the level of internal financial control in order to reflect the overall level of the internal financial control objectively, accurately and completely. The evaluation index system of internal financial control should be designed from all of the aspects in internal financial control, such as control subject, control content, control environment and control objective and so on.

### 3.1 Control Subject

The control subject of internal financial control is the perpetrator of the activities in the internal financial control of business, which should be evaluated from such aspects as professional quality, moral qualities and learning potential.

### 3.2 Control Content

The control content of internal financial control is the target of internal financial control in enterprise, including the control of fund-raising activities, investment activities, asset management activities and earnings management activities.

### 3.3 Control Environment

The control environment of internal financial control is factor that has impact on internal financial control, including internal and external factors. Specifically, the control environment includes the following major areas: legal environment, market mechanism, corporate governance, organizational structure, human resources environment and information systems.

### 3.4 Control Objective

The control objective of internal financial control is the purpose that the enterprise is to get through internal financial control, which should be evaluated from such aspects as risk assessment, financial supervision, transaction costs reduction and deviations amendment.

Thus the evaluation index system of internal financial control is established as that in the following table:

Insert Table 1 Here

## 4. Evaluation of Internal Financial Control in Enterprise Based on Fuzzy Comprehensive Evaluation Method

The following is the example of a corporate which is used to show the application of fuzzy comprehensive evaluation method in the internal financial control of enterprise.

### 4.1 To determine the factors set of evaluation in Internal Financial Control of Enterprise

The evaluation of internal financial control in enterprise is an issue of complex multi-objective decision-making. In this paper, four factors in the table are selected as the evaluation factors set  $U$  in internal financial control:  $U = \{u_1, u_2, u_3, u_4\} = \{\text{control subject, control content, control environment, control objectives}\}$ .

### 4.2 To identify the comments set of evaluation in Internal Financial Control of Enterprise

As the evaluation of factors of internal financial control in enterprise is vague, the comments set  $V$  of the evaluation of factors is divided into five levels:

$$V = \{v_1, v_2, v_3, v_4, v_5\}$$

$$= \{\text{Excellent, good, medium, pass, fail}\}.$$

### 4.3 To establish the single-factor evaluation matrix $R$ from $U$ to $V$

A group of broadly representative experts (10) are selected to compose of the expert evaluation team of internal financial control in enterprise, who are charged of evaluating internal financial control of the enterprise. After members of the Expert Group learn more about internal financial control of the enterprise, the experts independently decide the level of the evaluation factors to the internal financial control of enterprise.

After the experts' fuzzy evaluation on indicators of the above-mentioned four factors, the result is as follows:

As far as internal financial control subject is concerned, 2 of the experts think it excellent, 3 think it good, 4 think it middle, 1 thinks it pass, 0 thinks it fail.

Then the subordination of the level of comments on the factor of control subject influencing internal financial control of enterprise: 0.2, 0.3, 0.4, 0.1, 0. It Can also be written in fuzzy vector  $R_1 = (0.2, 0.3, 0.4, 0.1, 0)$ .

Similarly, results of the evaluation on the other three factors are as follows:

$$R_2 = (0.1, 0.2, 0.4, 0.2, 0.1);$$

$$R_3 = (0, 0.2, 0.4, 0.3, 0.1);$$

$$R_4 = (0.1, 0.4, 0.4, 0.1, 0).$$

The results of these evaluations meet the normalized conditions and the sum of the weight of the vector is 1. According to the results of above four single-factor evaluation, the single-factor evaluation matrix is as follows:

$$R = (r_{ij})_{4 \times 5} = \begin{pmatrix} 0.2 & 0.3 & 0.4 & 0.1 & 0 \\ 0.1 & 0.2 & 0.4 & 0.2 & 0.1 \\ 0 & 0.2 & 0.4 & 0.3 & 0.1 \\ 0.1 & 0.4 & 0.4 & 0.1 & 0 \end{pmatrix}$$

4.4 To determine the weight of index

According to the influence on internal financial control of each factor in factors set of evaluating internal financial control of enterprise, the weight of each factor is as follows:

Factor	Control subject	control content	control environment	control objective
Weight	0.2	0.3	0.3	0.2

The weight meets the normalized conditions: 0.2+0.3+0.3+0.2=1

The weight set of each factor can be set as a fuzzy set of factors set:

$$A = \{ a_1, a_2, a_3, a_4 \} = \{0.2, 0.3, 0.3, 0.2\}$$

Or be written in the form of fuzzy vector:

$$A = (0.2, 0.3, 0.3, 0.2)$$

4.5 To get the result of evaluation

The comprehensive result of experts in evaluating the internal financial control of enterprise is as follows:

$$B = A \cdot R$$

$$= (0.2, 0.3, 0.3, 0.2) \cdot \begin{pmatrix} 0.2 & 0.3 & 0.4 & 0.1 & 0 \\ 0.1 & 0.2 & 0.4 & 0.2 & 0.1 \\ 0 & 0.2 & 0.4 & 0.3 & 0.1 \\ 0.1 & 0.4 & 0.4 & 0.1 & 0 \end{pmatrix}$$

$$= (0.09, 0.26, 0.4, 0.19, 0.06)$$

The result showed that 9 percent of the experts believe that the internal financial controls of the enterprise is excellent, 26% believe good, 40% believe medium, 19% believe pass, 6% believe fail.

4.6 To get the conclusion of evaluation

The sum of the weight in the results set B-vector is 1 and meets the normalized conditions. According to the principle of

maximum subordination, the evaluation level “medium” corresponding to the maximum subordination in set B should be the evaluation conclusion of internal financial control in enterprise. Namely: the level of internal financial control of the enterprise is medium.

**5. Conclusion**

The evaluation of internal financial control in enterprise can show all employees the current level of internal financial control, and promote all employees in enterprise to take action to build and enhance internal financial control of enterprise. As the internal financial control is a fuzzy thing, the fuzzy comprehensive evaluation method is operational in evaluating it and is an effective method.

**References**

Da, Xiangjun & Li Ying. (2006). Construct on internal environment of the system of internal financial control. *Market Modernization(Published in late)*. (9):3.

Huang, Juan & Wei Lang. (2003). The thought on the concept of internal financial control. *Finance Accounting*. (4):48-49.

Wang, Jigan. (2003). Prediction and decision-making. *Hohai University Press*.12.

Xu, jianhua. (2007). The thought on perfecting internal financial controls of enterprise. *Business Accounting(The second semimonthly)*. (6):55-56.

Yan, Xiuhui & Xiong Huagen. (2007). Discussion on Internal Control and Enterprise Risk Management. *Research on Aviation Industry Economic*. (5):45-48.

Yang, hong. (2003). Discussion on internal financial controls of enterprise. *Neimenggu Finance Accounting*. (10):48-49.

Zheng, Xiuyun. (2007). Discussion on Internal Finance Control and Management in Enterprise. *Technology Information*.(20):166;91.

Table 1.

evaluation index system of internal financial control in enterprise		
target layer	index of first level	index of second level
Internal Financial Control in Enterprise	Control Subject	professional quality
		moral qualities
		learning potential
	Control Content	control of fund-raising activities
		control of investment activities
		control of asset management activities
		control of earnings management activities
	Control Environment	legal environment
		market mechanism
		corporate governance
		organizational structure
		human resources environment
	Control Objective	risk assessment
		financial supervision
		transaction costs reduction
		deviations amendment