

## The Research on the Methods to Confirm the Key Control Points of the Internal Accounting Control

*Liuping Chen*<sup>\*</sup> *Sundi Zhao*<sup>\*\*</sup> *Jiangsu University*  
*Wenchen Zhao*<sup>\*\*\*</sup> *St. John's University* *Jingjing Cao* *Jiangsu University*<sup>\*\*\*\*</sup>

**Abstract:** The control points are the key issue of the internal control, and the key control points mean the control joints that play an important part in the process of the operation. If these key control points are not well controlled, the process of the operation disposal will be mistaken and cannot reach the goal. However, for the confirmation of the control points, many studies only do qualitative research from the important aspect instead of quantificational research. They are devoid of a series of scientific methods. This paper advances quantificational methods to confirm the key control points from two aspects of job evaluation and mathematics model.

**Key words:** accounting control; key control points; quantificational methods

Confirming the control points is the key issue of the internal accounting institution in corporations. The key control points mean the control joints that play an important part in the process of an operation. If these key control points are not well controlled, the process of the operation disposal will be mistaken and fraudulent, which leads to the result the goal cannot be reached. In the former researches, many scholars have realized the importance of the key control points. They always refer to the key control point and its conception. But when it refers to how to confirm whether a control joint is a key control point or not, they only take the aspect of importance into account and do little quantificational research. It leads to subjective confirmation of the key control points and greatly impacts the realization of the goal of the internal accounting control. This paper emphasizes the discussion about the quantificational methods to confirm the key control points.

To confirm the key control points, the corporations need to consider three factors hereinafter. (1) The risk factors. Internal accounting control is the necessary joint of the risk governance. Its impetus is from the risk understanding and governance to a great extent. The probability means the probability of the risk that the control point is out of control, the whole corporation and the material operation cannot reach the goal of the internal accounting control. (2) The cost/income factors. Excessive control points of the internal accounting control result in diseconomy. While insufficient control points bring on the validity of the control institution. Setting the control points needs to think over the relationship between the cost and the income, and make every effort to reach the best control effect by reasonable control cost. (3) The important elements and resources factor. In the corporations, every operation or operation joint is involved with factors and resources such as manpower, finance, material

---

\* Liuping Chen, master, associate professor of School of Business Administration, Jiangsu University; Main research field: Financial Theory and Method.

\*\* Sundi Zhao, master, associate professor of School of Applied Science & Technology, Jiangsu University; Main research field: Accounting Theory and Method.

\*\*\* Wenchen Zhao, postgraduate of St. John's University, Queens, New York 11439; Main research field: Accounting Theory and Method.

\*\*\*\* Jingjing Cao, postgraduate of School of Business Administration, Jiangsu University; Main research field: Auditing Theory and Method.

resources, time and communication technique. The impact of these factors and resources on the control points should be taken into account.

## 1. Methods of Job Evaluation

Confirming the key control points is a relatively complex issue, which can use arrangement method, factors comparison, number-checking and Hesse Matrix to make appraisalment.

### 1.1 Arrangement Method

This method arranges the operation joints from the high to the low according to the relative value of all kinds of operation joints and the contribution to realization of the goal of the internal accounting control. The objects of the arrangement are the operation joints themselves. The implementation process of this method is: (1) Select the operation joints (control points); (2) Acquire the data which evaluation needs; (3) Evaluate and arrange, let valuator make arrangement from the top to the bottom. In arranging process, alternate arrangement can be used. That is to say, firstly, select the operation joint of the highest value; secondly, select the lowest one; thirdly, select the second highest and the second lowest and so on. The reason is that it is comparatively easy for people to identify the extreme situation. The arrangement method in appraisalment can also use the match-compare method. Furthermore, this method is more reliable than the simple-arrangement and the alternate-arrangement method.

The arrangement method is most ordinary of all the appraising methods. Its primary advantage is simplicity and convenience. It is easy for understanding and applying, so it is fit to small corporations. Certainly, this method would be affected by some subjective factors. Moreover, it cannot obtain precise function coefficients.

The basic way of arrangement is to compare each control point with other ones according to all appraisalment factors. Now take five control points for example, which contain examine and approve, auditing, check off and keep accounts in the operation of cash receival and payment. Use the match-compare method to confirm the key points. Make comparison according to a certain factor, then mark 1 (relatively important) or 0 (subordination) to show which is more important or less important. At last, add up the scores of each control point to confirm the key points (as shown in Table 1). Invite some experts (suppose 20) according to the scale of the corporation and the complexity of the operations to arrange the five control points hereinbefore. Then gather the experts' advice to confirm the key control points (as shown in Table 2).

**Table 1 Match-compare Table of the Significance of the Key Control Points**

Control points	Examine and approve	Auditing	Settlement	Check off	Keep accounts	Total up	Arrange
Examine and approve		1	1	1	1	4	1
Auditing	0		1	0	1	2	3
Settlement	0	0		0	0	0	5
Check off	0	1	1		1	3	2
Keep accounts	0	0	1	0		1	4

Relatively significance

**Table 2 Arrangement Table of 20 Experts' Appraisalment of the Control Points**

	Examine and approve	Auditing	Settlement	Check off	Keep accounts
Arrange No.1	16	1	0	3	0
Arrange No.2	2	8	1	9	0
Arrange No.3	2	7	3	4	4
Arrange No.4	0	3	2	2	13
Arrange No.5	0	1	14	2	2

### 1.2 Factors-comparison Process

The factors-comparison process is an improvement of the arrangement method. It is a comparatively measured work-appraising method, similar to the arrangement method. The difference between them is that the arrangement compares each point comprehensively. But the factors comparison process chooses various factors and arrangement will be made respectively according to every factor. Finally gather the conclusions of each factor as the function level. Still take the hereinbefore example, consider three factors: the risk, the cost/income, the element and resource. First of all, invite evaluators (about 20) to arrange the significance of the five financing operation joints, which contain examine and approve, auditing, check off and keep accounts. Then get the factors table (as shown in Table 3).

**Table 3 Factors Appraisalment Table**

Benchmark	10	9	8	7	6	5	4	3	2	1
Risk	Examine and approve				Check off	Keep accounts	Settlement		Auditing	
Cost/income		Check off	Examine and approve	Keep accounts		Auditing			Settlement	
Element and resource		Auditing		Examine and approve	Settlement			Check off		Keep accounts

According to the table above,

Examine and approve: 10 (risk) + 8 (cost/income) + 7 (elements and resource) = 25;

Auditing: 2 (risk) + 5 (cost/income) + 9 (elements and resource) = 16;

Settlement: 4 (risk) + 2 (cost/income) + 6 (elements and resource) = 12;

Check off: 6 (risk) + 9 (cost/income) + 3 (elements and resource) = 18;

Keep accounts: 5 (risk) + 7 (cost/income) + 1 (elements and resource) = 13.

After unitary disposing the conclusion above, we get the function coefficient of each control point (as shown in Table 4):

**Table 4 Function Coefficients of Each Control Points**

Control points	Examine and approve	Auditing	Settlement	Check off	Keep accounts
Function coefficient	0.298	0.190	0.143	0.214	0.155

The conclusion from the factors-comparison process will be more accurate than the arrangement method. It can also reduce the subjective factors. But it is not widely used because of its complexity.

### 1.3 The Number-checking Process

The basic idea of the number-checking process is to separate the relative appraisalment factors of every operation joint, then make appraisalment be based on the structural appraisalment table designed before. The common steps are: (1) Analyze the operation and each operation joint; (2) Prepare their instructions; (3) Choose the appraisalment factors; (4) Establish structural appraisalment table for each factor to reflect the extent of differences of each grade. We have to give every factor a proportion, which is consistent with the significance of the factor in the corporation and the operation in order to make the estimation table more reasonable. A typical factor structural estimation table of the number-checking method is given below; (5) Mark each factor according to the structural estimation table; (6) Add up the scores of each factor, we will get the score of each control point.

**Table 5 Factor Structural Estimation Table of the Number-checking Method**

Factors	Lever 1	Lever 2	Lever 3	Lever 4	Lever 5
Risk					
Risk from the whole corporation	20	40	60	80	100
Risk from the operation	30	60	90	120	150
Cost/income					
Cost	15	30	45	60	75
Income	15	30	45	60	75
Elements and resource					
Manpower, finance and material resources	10	20	30	40	50
Time	5	10	15	20	25
Information technique	5	10	15	20	25

Take the instance above for example, invite evaluators to compare and mark the five control points according to the table above. The average conclusion is as follows:

Examine and approve: risk score 250 (lever 3) +cost/income score 120 (lever 5) +elements and resource score 80 (lever 2) =450;

Auditing: risk score 150 (lever 3) + cost/income score 120 (lever 4) + elements and resource score 20 (lever 1) =290;

Settlement: risk score 100 (lever 5) + cost/income score 30 (lever 4) + elements and resource score 60 (lever 4) =190;

Check off: risk score 150 (lever 1) +cost/income score 150 (lever 3) + elements and resource score 40 (lever 5) =340;

Keep accounts: risk score 50 (lever 2) +cost/income score 90 (lever 1) + elements and resource score 100 (lever 3) =240.

After unitary disposing the conclusion above, we get the function coefficient of each control point.

**Table 6 Function Coefficients of Each Control Point**

Control points	Examine and approve	Auditing	Settlement	Check off	Keep accounts
Function coefficients	0.298	0.192	0.126	0.225	0.159

The number-checking process takes the proportion into consideration. So it is more accurate than the factors-comparison method , but more complex than the factors-comparison method. However , it is convenient to use after well designed.

## 2. Mathematical Model Method

It is a complicated and fuzzy problem to confirm the key control points. It just makes approximately evaluation when using the job valuation method. When faced with these complicated and fuzzy problems, relevant matrix process, analytic hierarchy process, fuzzy mathematics process will be more accurate than the job valuation method because of their advantages of objective, systemic and comprehensive.

### 2.1 Relevant Matrix Process

The biggest characteristic of relevant matrix process is that it introduces the conception of proportion to discriminate the function of each appraisalment factor in the holistic appraisalment. The relevant matrix process has three steps. (1) Confirm the index system and the proportion system. In the index system of the control points, which is made up of the appraisalment factors, risk factors, cost/income, elements and resource are the first grade

index. They can be fractionalized into the second grade index (as shown in Figure 1). The proportion reflects the relatively significance of the factors. The proportions corresponding to the group appraisalment index make up of the index and proportion system (as shown in Table 7). (2) Single appraisalment. Usually appraised by the experts, and the number is commonly between 7 and 11.

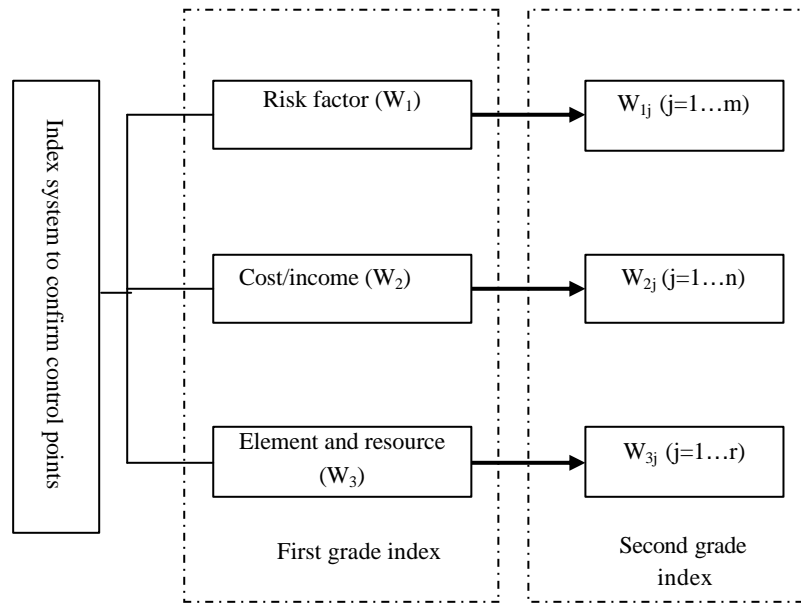


Figure 1 Establish the Confirmed Appraisalment System

Table 7 Index System and Proportion System

Proportion system (V <sub>i</sub> )	Index system (W <sub>i</sub> )
0.40	Risk
0.35	Cost/income
0.25	Element and resource
$\sum_{i=1}^3 v_i = 1$	

Delphi method can also be applied, whose essence is to make use of the knowledge and experiences of the experts, but reduce the infection of authority. Usually the list of experts is kept secret to make sure that the experts will not be disturbed by outside; At the meantime, the feedback and revise will be made 2-3 times to insure its accuracy. (3) Comprehensive appraisalment. It is calculated by the formula shown followed:

$$A_i = \sum_{j=1}^n A_{ij} V_j$$

Where: A stands for integrated appraisalment value, A<sub>ij</sub> stands for single appraisalment value, V<sub>j</sub> stands for the proportion of every item.

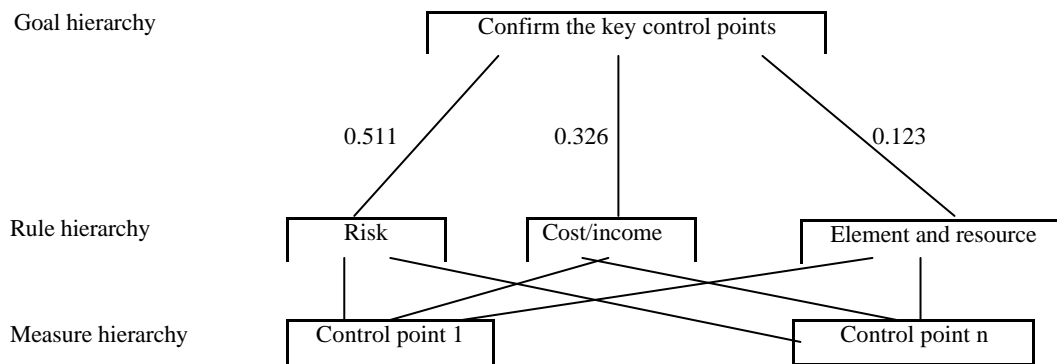
Take the following table for example, still using the five control points mentioned above, to confirm whether they are significant or not. In Table 8, W<sub>1</sub>, W<sub>2</sub> and W<sub>3</sub> stand for the risk factor, the cost/income factor and the element and resource factor respectively. From the integrated appraisalment value in Table 8, we can clearly find out how significant they are.

**Table 8 Relevant Matrix Table Used for Appraising and Confirming the Key Role of the Five Control Points**

Single appraisal value	Index system	$W_1$	$W_2$	$W_3$	Integrated appraisal value
	Proportion	0.40	0.35	0.25	$\sum W_i = 1$
Confirm object					
	Examine and approve	90	77	83	83.7
	Auditing	74	87	81	80.3
	Settlement	64	85	83	76.1
	Check off	82	80	86	82.3
	Keep accounts	85	68	78	77.3

**2.2 Analytic Hierarchy Process (AHP)**

Analytic hierarchy process (AHP for short), which integrates qualitative and quantitative method, is a systematization and hierarchy method of analyzing problems. It is a simple method to confirm some relatively complex and indistinct problems, and absolutely suitable for the case that cannot completely quantify. Analytic hierarchy process is divided into five steps. (1) Establish the hierarchy structure model. Divide the relationship into several hierarchies according to the consequence of the problem. Comparative problem can usually be divided into: the goal hierarchy (the top hierarchy) --- the main problem to solve; the rule hierarchy (the middle hierarchy) --- the appraisal standard to consider; the project and measure hierarchy (the bottom hierarchy). More hierarchies can be introduced into the problem of which consequence is rather complex. (2) Confirm the quantitative standard of ideation judgment, then construct judgment matrix. The degree can be divided into five judgment grades, namely equation, comparatively intense, intense, quite intense and absolutely intense. The grades are denoted by the figures 1, 3, 5, 7 and 9. When the distinction of conjugated things is between the two hierarchies and cannot be confirmed, we can get 2, 4, 6, and 8. (3) Calculate the proportion. (4) Coincident verify. If the coincidence indicator  $CI < 0.1$ , the coincidence of the judgment matrix is supposed to be acceptable. (5) Integrate the collective attitude of the experts. This method is more reasonable for appraising the index system and proportion system. Furthermore, it can advance efficiency and reduce the interference of subjective factor by computer program. Confirming the key control points, the hierarchy structure is shown in Figure 2.



**Figure 2 Hierarchy Analyzing Picture of Significance of the Control Points**

When confirming the key control points, the judgment standard includes risk factor, cost/income factor, element and resource factor. Establish relatively matrix:

$$\mathbf{A} = \begin{bmatrix} 1 & 2 & 5 \\ \frac{1}{2} & 1 & 4 \\ \frac{1}{5} & \frac{1}{4} & 1 \end{bmatrix}$$

Then we can get

$$W = (0.551 \quad 0.326 \quad 0.123)'$$

$$\lambda_{\max} = 3.073, \quad CR = 0.0365 (<0.1)$$

The calculated proportion can be marked to the corresponding appraisal standard in the Figure 2.

Take confirming the control points in the stock and payment operation for example, its control points are: examine and approve, subscribe the treaty, register, check and accept, warehouse, underwrite, auditing, keep accounts, check off, straighten out and so on. Then invite the experts to mark the risk factor, cost/income factor, and element and resource factor of these control points, get the scores  $X = (x_1, x_2, x_3)$ , and use the formula:

$$y = 0.551 x_1 + 0.326 x_2 + 0.123 x_3$$

Figure out the general scores of these control points. Then arrange their significant sequence. Finally, gain the significant sequence: check and accept, underwrite, auditing, examine and approve, subscribe the treaty, register, check off, keep accounts, warehouse and straighten out.

It is not difficult to find out that establishing the matrix A greatly influences the appraisal result. In order to make the appraisal result perfect, establishing the matrix A should be as rational as possible.

### 2.3 Fuzzy Appraisal Process

This process confirms the key control points by some principle of fuzzy mathematics. Its main principle is:

#### 2.3.1 The Theory of Fuzzy Mathematics

Suppose two given limited range:

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

$$V = \{ v_1, v_2, \dots, v_n \}$$

In this two equations, U and V stand for two groups. Suppose U stands for the group of appraisal, and V stands for the group of the result of the appraisal. Fuzzy switch:

$$X \cdot R = Y$$

X in the equation, which is the fuzzy subgroup of U, stands for the appraisal factor; Y, which is the fuzzy subgroup of V, stands for the appraisal result; R is matrix.

#### 2.3.2 Confirm the Significance of the Control Points

Simply, take three quite important appraisal factors into account to confirm the significance of the control points. The three factors, which are the risk, cost/income, element and resource, make up of the range:  $U = \{ (u_1), (u_2), (u_3) \}$ . For the appraisal result, just consider rather significance, comparatively significance, ordinary and not significance. They compose the range of the appraisal result:  $V = \{ \text{rather significance } (v_1), \text{ comparatively significance } (v_2), \text{ ordinary significance } (v_3), \text{ not significance } (v_4) \}$ . To confirm  $u_1$ , we can directly appraise the factors or the inferior factors that appraise the factor and make mathematics disposal. For example, appraising  $u_1$ , the coefficient of rather significance is  $v_{11}$ , the coefficient of significance is  $v_{12}$ , the ordinary coefficient is  $v_{13}$ , the coefficient of not significance is  $v_{14}$ . In the same way, we can appraise  $U_2$  and get the result

$v_{21}, v_{22}, v_{23}, v_{24}$ ; the appraisalment of  $U_3$  are  $v_{31}, v_{32}, v_{33}, v_{34}$ . The qualification condition is  $v_{i1} + v_{i2} + v_{i3} + v_{i4} = 1$ ,  $i = 1, 2, 3$ . Still take the case that confirming the control points in the stock and payment operation for instance, now confirm the significance of the control point of keeping accounts, using Delphi method to appraise each index in the rule hierarchy. Suppose after getting statistics of the appraisalment result, the fuzzy switch matrix can be written out:

$$R = \begin{bmatrix} 0.1 & 0.3 & 0.4 & 0.2 \\ 0.2 & 0.3 & 0.2 & 0.3 \\ 0.1 & 0.5 & 0.3 & 0.1 \end{bmatrix}$$

When not taking weighted mean into account,

$$V = U \cdot R$$

When confirming the key control points, the risk factor is the main consideration, and the cost/income factor following. At last consider the element and resource. These three factors can be distributed according to the proportion. Suppose using Delphi method we can get the proportion  $A = (0.45, 0.35, 0.2)$  of each factor, then the final result can be found:

$$V = A \cdot R = (0.45 \quad 0.35 \quad 0.2) \cdot \begin{bmatrix} 0.1 & 0.3 & 0.4 & 0.2 \\ 0.2 & 0.3 & 0.2 & 0.3 \\ 0.1 & 0.5 & 0.3 & 0.1 \end{bmatrix} = (0.135 \quad 0.34 \quad 0.29 \quad 0.215)$$

According to this result, based on the principle of subjection in the fuzzy mathematics, we can get the following conclusion: keeping accounts is an ordinary control point. Because 0.34 is largest among them and the opposition is “normal”. By this means, the other control points can be confirmed. We will not discuss the detail again. At last we can confirm that check and accept, underwrite, auditing, examine and approve are the key control points.

In conclusion, there are many methods to confirm the key control points in the internal accounting control. This paper explains the processes to confirm the key control points in the internal accounting control from aspects of the means of job evaluation and the mathematics model. Furthermore, these methods will be affected by subjective factors to a certain extent. One factor is the learning level of the invitational experts. The result will have higher veracity if the experts are at higher learning levels, otherwise the veracity will be lower. Another factor is the number of the invitational experts. The result will have higher veracity if more experts take part in, otherwise the veracity will be lower.

**References:**

1. Research group of internal accounting control criterion. *Operation Practice of Internal Accounting Control Criterion*, Chinese Commercial Press, 2001
2. Quanwen Liao. *Assess and Judge System of Manpower Resource*, Shandong People Press, 2000
3. Haifa Sun. *Manpower Resource Governance of Modern Enterprise*, Press of Sun Yat-Sen University, 2002
4. Jianguo Zhang. *Design of Salary System---Structural Design Method*, Press of Beijing University of technology, 2003
5. Changcheng Wang. *Principle and Technique of Salary Truss*, Chinese Economy Press, 2003
6. Qifan Yang, Daoyuan Fang. *Mathematics Modeling*, Press of Zhejiang University, 1999
7. Shiwei Zhang, Yuchu Lu, Wenxing Zhu. *Appliance of Fuzzy Mathematics*, Press of Tongji University, 1991
8. Dayong Chang, Lili Zhang. *Fuzzy Mathematics in Economy Management*, Press of Beijing University of Economics and Business, 1995
9. Wenjin Yu. *Enterprise Internal Control System*, Press of Shanghai University of Finance and Economics, 2001

(Edited by Heng Zhuang, Eric and Jianfeng He)