AHP-Based Corporate Finance Comprehensive Evaluation System

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Abstract: This article first discusses the theoretical basis of Analytic Hierarchy Process (AHP), and use the principle of the AHP, proposed a comprehensive financial situation of the enterprise evaluation method, and use examples for analysis.

Keywords: AHP; Financial evaluation system; Construction

1 Introduction

Rapid economic development in the market today, the financial position and financial results to reflect the economic strength and profitability is an important symbol, but also users of the various statements about an important aspect of business. Therefore, for an enterprise, in order to properly and comprehensive evaluation of its operating performance and status, must build a comprehensive evaluation index system, and based on the importance of the various indicators and their combinations situation, the corresponding weight set and evaluation. In this paper, use the basic principle AHP, to explore construction of the corporate finance comprehensive evaluation system.

2 The basic principle AHP

AHP is a combination of qualitative and quantitative, systematic, hierarchical methods of analysis for a more complex structure, decision-making criteria are more difficult to quantify and decision-making problems. Its core idea is to decision-making based on total goals, sub-goals, evaluation criteria, specific measures until the order is decomposed into different levels of structure, the use of the eigenvector solution to determine the matrix and the method by weighting and hierarchical merge, find the bottom layer, the top level (total goals) of the relative importance of the pros and cons of the bottom levels of the elements sorted. The specific analysis procedure is as follows:

2.1 The establishment of a hierarchical model

The complex problem down into its constituent elements, dominated by the relationship of these factors in turn grouped to form a hierarchical structure, the same level as independent factors. The top layer is called the target, the bottom layer called the program, and the remaining layers is called the rule layer.

2.2 The determine the structural matrix of pairwise comparison

In the establishment of a hierarchical structure based on the model, and in accordance with the proportion of 1 to 9 scale layer on the indicators of the relative importance of all relevant factors and the level of relevance to the assignment, create a more matrix, qualitative factors into the quantitative so that the next layer on layer of each element relative to the proportion of an element.

2.3 Calculate weights and the consistency test

Many ways to calculate the weight, the most commonly used method is the square root method and normalization method. Normalization method in which specific steps are as follows: first, to determine the elements of the matrix by the column normalized; the second step, the normalized sum of each row; the third step, the sum of the vector divided by n that was the weight vector.

Meanwhile, in order to avoid the logic error that must be consistency between the various elements tested. The methods are: first, calculate the consistency index (CI), CI = (λmax-n) / (n-1), (which, λmax is the largest eigenvalue of matrix; the second step, find the corresponding average random consistency index(RI), as shown in Table 1; the third step is to calculate the consistency ratio(CR), CR .= CI / RI., when CR <0.1, the matrix that is acceptable to determine, when the CR.> 0.1, the judge should matrix appropriate amendments.

Table 1. Table random consistency index

Order	1	2	3	4	5	6	7	8	9
CI.	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

2.4 Calculate the Combined weights and the consistency test

Based on weights on each floor and consistent test, calculated the lowest weight relative to the total target, and make the program selection. And from top to bottom layer consistency test.

3 Case Study

To an industrial enterprise, for example, based on its financial statements for the relevant information and the

basic principles of AHP, build the comprehensive financial evaluation system of the company.

3.1 Build a comprehensive evaluation index system of corporate financial model

Accordance with the China's "enterprise financial system," the relevant provisions of the structure of the finan-cial situation of enterprises comprehensive evaluation system shown in Figure 1.Among them, the corporate finance comprehensive evaluation system A is the target layer, criteria layer including profitability indicators(B1), operational capacity indicators (B2), solvency indicators (B3), and development capacity indicators(B4), the other indicators for the program level.
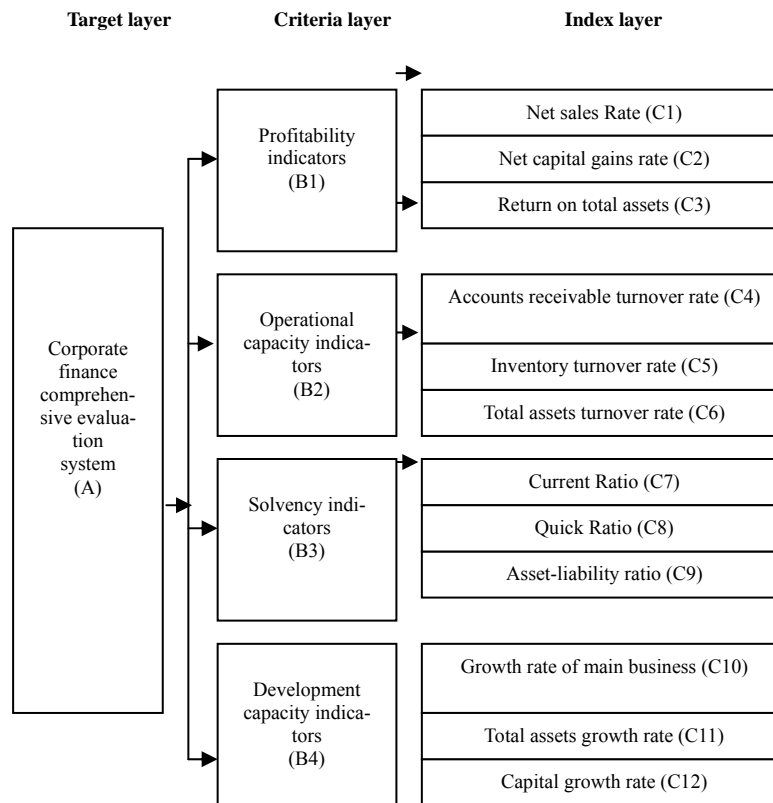

Figure 1. Finance comprehensive evaluation index system

3.2 To determine the weight of each indicator and the consistency test

3.2.1 Calculate weights of criteria layer and the consistency test

First, build the structure of A-Bi matrix, the specific data according to the evaluation of different purposes, the use of expert opinion to determine the method to determine A-Bi matrix and column vector used to calculate the normalized level of the index criteria (Bi) relative to the target layer A weight, and the same test, the results shown in Table 2.

According to Table 2, CR <0.1, Through the consistency test.

3.2.2 Calculate weights of index layer and the consistency test

Accordance with the above ideas, to determine B1-(C1, C2, C3); B2-(C4, C5, C6); B3-(C7, C8, C9); B4-(C10, C11, C12); the matrix, the weight and the consistency test, the results in table 3, table 4, table 5 and table 6.

By the Table 3, Table 4, Table 5, Table 6 shows that the every CR <0.1, by the consistency test.

3.2.3 Calculate combined weights and the consistency test

Table 2. A-Bi comparison matrix and weights Calculate

A	B1	B2	B3	B4	weight
B1	1	2		1/3	0.225
B2	1/2	1		1/6	0.131
B3	1/6	1/4		1/9	0.047
B4	3	6	9	1	0.597

$\lambda max=4.17$ CI=0.04 RI=0.89 CR=0.0476

Table 3. B1(C1-C3) **comparison matrix and weights Calculate**

B1	C1	C2	C3	weight
C1	1	2	4	0.557
C2	1/2	1	3	0.320
C3	1/4	1/3	1	0.148

$\lambda max=3.018$ CI=0.006 RI=0.52 CR=0.012

Table 4. B2-(C4-C6)comparison matrix and weights Calculate

B₂	C4	C5	C6	weight
C4	1	1/2	4	0.360
C5	2	1	3	0.512
C6	1/4	1/3	1	0.128
λmax=3.109 CI=0.036 RI=0.52 CR=0.07				

Table 5. B3-C7-C9 comparison matrix and weights Calculate

B3	C7	C8	C9	weight
C7	1	1/2	3	0.309
C8	2	1	5	0.581
C9	1/3	1/5	1	0.110
λmax=3.004 CI=0.003 RI=0.52 CR=0.002				

Table 6. B4-C10-C12 comparison matrix and weights Calculate

B4	C10	C11	C12	weight
C10	1	3	2	0.539
C11	1/3	1	1/2	0.164
C12	1/2	2	1	0.297
λmax=3.009 CI=0.003 RI=0.52 CR=0.006				

Based on the above results, the evaluation of the available weight distribution and composition of the weights shown in Table 7.

Combination of consistency test CR=∑CI/∑RI,

And, $\sum CI = \sum_{i=1}^{4} P_{Bi} * CI_{Bi}$, $\sum RI = \sum_{i=1}^{4} P_{Bi} * RI_{Bi}$

则，CR=∑CI/∑RI=0.008/0.52=0.0154, by the consistency test, so their combined weight as the final decision-making.

Table 7. Weight, combined weights of the table and the consistency test

Index	weight	Sub indicators	Sub weight	Combined weights
B₁	0.225	C₁	0.557	0.125
		C₂	0.320	0.072
		C₃	0.148	0.033
B₂	0.131	C₄	0.360	0.047
		C₅	0.512	0.067
		C₆	0.128	0.017
B₃	0.047	C₇	0.309	0.015
		C₈	0.581	0.027
		C₉	0.110	0.005
B₄	0.597	C₁₀	0.539	0.322
		C₁₁	0.297	0.177
		C₁₂	0.164	0.098

组合一致性检验	CI=0.008	RI=0.52	CR=0.0154

3.3 The Comprehensive   Assessment

According to the actual situation of each enterprise, each enterprise index C1 ~ C12 specific value, according to the formula $F = \sum_{i=1}^{12} WiVi$ Computation of a composite value, where the Wi is weight of a combination of indicators, Vi is a specific value for each indicator of measurement object. then, the integrated financial data determined by a number of financial experts voted excellent, good, medium and low, poor range; Finally, each firm's specific data and compare the range identified by experts, we can know each firm's comprehensived financial position .

4 Conclusion

This article discusses the use of AHP comprehensive evaluation of the financial situation of the problem, so a combination of qualitative and quantitative, to overcome the lack of uniform standards and evaluation requirements and subjectivism; to overcome the evaluation of human factors, the will; overcome inaccurate shortcomings, such as the neglect of profitability look in the solvency and so on. Of course, in this method to determine the weight with a certain degree of subjective, will directly affect the accuracy of evaluation, but as long as the continuous practice, constantly revised and improved, the level of analysis used in financial analysis, financial situation will certainly improve the a new level, provide the basis for scientific decision making.

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