

# Early Warning Analysis of Company's Financial Risk based on Fuzzy Evaluation Method

Yang Long <sup>a</sup>

*Business School, China West Normal University, Nanchong, China*

**Keywords:** Financial Risk, Financial Early Warning, Hierarchical Analysis Method, Fuzzy Evaluation.

**Abstract:** With the rapid development of the automotive industry, there are more and more uncertainties in the production and operation process, which makes the possibility of financial risks increasing day by day. Therefore, risk identification and prevention are particularly important for enterprises, especially in the rapidly developing and promising automotive industry. Taking Company A as an example, this paper firstly analyzes the nature and characteristics of the industry, the company's production and operation, financial data and other information to extract financial risk assessment indicators and establish a financial early warning indicator system. Secondly, the financial risk early warning model is constructed by combining the hierarchical analysis method (AHP) and fuzzy evaluation method, and finally, the established financial risk early warning model is analyzed based on the financial data of Company A in recent years. The study aims to improve the financial risk early warning capability of the enterprise, which is a contribution to the field.

## 1 INTRODUCTION

With the rapid development of China's economy and the influence of world economic integration, China's auto industry has risen at a very impressive pace. According to the China Association of Automobile Manufacturers (CAAM), after sixteen years of development, China's automobile production and sales volume has changed from 2.07 million units in 2000 to 25.02 million units in 2016 (Hou, Peng, 2019). Undeniably, with the rapid development of the automobile industry, there are more and more uncertainties in its production and operation process, and these uncertainties make the possibility of financial risks increasing day by day. The auto industry itself is characterized by rapid product replacement, numerous enterprises and strong competition, which are also increasing financial risks in a subtle way (Hou 2019). Forty-seven percent of Chinese companies fail because of financial problems, and the failure is not due to the lack of profitability, but to the lack of risk prevention and control ability, which leads to cash flow breakage. Therefore, the identification and prevention of risks is particularly important for the automotive industry,


which is growing rapidly and has great potential for development (Hou 2019). Among the financial risk early warning methods, the fuzzy comprehensive evaluation method is suitable for financial risk early warning by converting the qualitative into quantitative and giving a definite conclusion to the uncertain and complex environment. This paper takes Company A as an example to use fuzzy comprehensive evaluation method for financial risk early warning management research has certain theoretical significance and practical significance.

## 2 THEORIES RELATED TO FINANCIAL RISK EARLY WARNING

### 2.1 The Concept of Financial Risk Early Warning

"Early warning" refers to the calculation of the likelihood of risk occurrence based on actual data and certain research methods, and the provision of alerts or signals before the occurrence of risk, in order to

---

<sup>a</sup> <https://orcid.org/0000-0001-7145-2547>

prevent the occurrence of risk when conditions are available and reduce the losses caused by risk. Early warning of enterprise financial risk refers to the use of theories of financial management and business management to analyze and judge the business activities of the enterprise based on financial and non-financial data, so as to find out the potential risks of the enterprise, calculate the level of risks, analyze the reasons for the risks and give an early warning signal to the enterprise. It enables business operators to take appropriate preventive measures to avoid the occurrence of dangers and reduce the losses caused by the occurrence of risks in the enterprise (Xiong, Zhang, 2019). To escort the production and management decisions and the survival and development of the enterprise.

## 2.2 The Function of Financial Risk Warning

**Monitoring function:** The financial risk early warning system predicts the risks that may occur in the operation of the enterprise, based on the financial data in the operation of the enterprise and the national standard value of the same industry, and issues an alarm whenever the risk reaches a certain level, so that the enterprise decision makers can feel the existence of risk and play a monitoring role for the enterprise (Huang, Li, 2018).

**Pulse-taking function:** Based on the results of risk analysis and evaluation, financial risk warning identifies risk factors, finds out the reasons for the occurrence of risk factors, and furthermore finds out the problems against the actual situation of the enterprise, gives the pulse of the enterprise, and provides decision support to managers.

**Treatment function:** Based on the risk forecast results, the financial risk warning identifies the risk factors affecting the enterprise through the pulse function, finds out the problems existing in the enterprise operation, further proposes improvement measures to the enterprise, and provides treatment solutions to the managers.

**Protection function:** Through regular financial risk warning, the company continuously finds out the financial risks faced by the company, takes the pulse of the company, provides treatment plans for the operators, prevents and controls the occurrence of risks in the operation, and protects the company.

## 3 EARLY WARNING MODEL FOR CORPORATE FINANCIAL RISK

### 3.1 Background Analysis

Company A was founded in 1984, and since the first pickup truck was produced in 1996, the sales volume has been growing year by year, and the market share is in the leading position in China. And starting from the Middle East market, it has gradually expanded into foreign markets. Company A was listed on the Hong Kong H-share and domestic A-share markets in 2003 and 2011, respectively.

From the analysis of Company A's production and operation in 2016, the return on net assets in 2016 was significantly lower. When analyzing the risk profile in 2016, more attention needs to be paid to the reasons for the decrease in the return on net assets and the resulting impact on the survival and development of the company (Yan, Wang, 2018). Identify control measures and prevent them so that the enterprise can gain more profits and develop more stably. Company A has a generally high market share of each product and the company's overall financial situation is good (Zhang, Chen, Wang, 2017). At present, China's automobile industry is developing rapidly and the competition is fierce. To make the enterprise invincible in the long run, it is not enough to manage afterwards by analyzing the previous financial reports alone, but to manage beforehand by combining with regular financial risk warning.

### 3.2 Determination of Financial Risk Early Warning Indicator System

**Current Ratio:** Current ratio is the percentage of current assets to current liabilities. Current assets are assets that can be realized or applied in the short term, and current liabilities are debts that need to be repaid in the short term, and the short term generally refers to a business cycle. The definition shows that the current ratio is a measure of a company's ability to liquidate its current assets to repay its debts.

**Gearing ratio:** Gearing ratio is the percentage of total liabilities to total assets. With this indicator, the importance of capital provided by creditors can be measured and the interests of creditors can be protected in this way.

**Total Asset Turnover:** Total Asset Turnover is the net operating income as a percentage of average total assets. The higher the total asset turnover ratio, the

stronger the company's sales capacity and reflects the efficiency of the company's asset operations.

**Accounts Receivable Turnover Ratio:** Accounts Receivable Turnover Ratio is the percentage of net credit sales revenue to the average accounts receivable balance. It indicates the speed of collection of accounts receivable, that is, the speed of conversion to cash. It also indicates how well accounts receivable support sales revenue. A higher accounts receivable turnover ratio indicates that accounts receivable are recovered quickly and that the funds used for operations are turned over more quickly.

**Inventory Turnover:** Inventory turnover is the cost of goods sold as a percentage of average inventory balance. Inventory turnover ratio indicates the speed of inventory turnover, that is, how quickly inventory is converted into cash or accounts receivable within a certain period of time. The higher the inventory turnover rate, the lower the average inventory balance. That is, the stronger the inventory realization ability, signifying the stronger the short-term debt servicing ability.

**Operating Profit Margin:** Operating profit margin is the percentage of operating profit to total business revenue. The higher the operating profit margin, the more profit the enterprise makes from sales in the course of operation, indicating stronger profitability.

**Return on total assets:** Return on total assets is the percentage of net profit to the average total assets. The return on total assets reflects the relationship between the effectiveness of asset utilization and capital utilization. The higher the return on total assets, the higher the business management level and the stronger the competitive strength of the enterprise.

**Return on net assets:** Return on net assets is the percentage of net profit to average shareholders' equity. The higher the return on net assets, the more effective the utilization of assets.

**Operating growth rate:** Operating growth rate is the percentage of the growth of operating revenue this year to the total operating revenue of the previous year. Operating growth rate reflects the growth status and development ability of the enterprise's operating income.

**Operating profit growth rate:** The operating profit growth rate is the percentage of the total operating profit of the previous year. The growth rate of operating profit reflects the growth of operating profit and development ability of this year.

**Growth rate of total assets:** The growth rate of total assets is the percentage of the growth of total assets of this year to the total assets of the beginning

of the year. The growth rate of total assets reflects the growth and development capability of total assets.

## 4 EARLY WARNING ANALYSIS OF FINANCIAL RISK OF COMPANY A

### 4.1 Calculation of Financial Risk Early Warning Indicators

After establishing the financial risk early warning index system and early warning model of Company A, the financial data of the company from 2012 to 2016 were applied to the financial risk early warning to analyze the financial risk of the company. According to the balance sheet data in Company A's accounting annual report, the financial data from 2012 to 2016 were sorted and selected against the financial risk early warning model, and the financial data were organized in the table, and then the values of each evaluation index of Company A's financial risk were obtained as shown in Table 1.

Table 1: Table of evaluation index values.

Tier 1 Indicators	Secondary indicators	Early warning indicator values		
		2016	2015	2014
Debt Service Risk	Current ratio (%)	128.4	127	135
	Gearing ratio (%)	41.0	46.6	45.4
Operational Risk	Total assets turnover (times)	1.23	1.06	1.02
	Accounts receivable turnover ratio (times)	122.31	101.83	86.06
	Inventory turnover rate (times)	17.47	15.0	14.5
Earnings Risk	Operating profit margin (%)	14.0	12.9	15.1
	Return on total assets (%)	11.5	12.1	14.1
	Return on net assets (%)	22.47	20.1	24.0
Development Risk	Operating growth rate (%)	12.1	21.4	10.2
	Operating profit growth rate (%)	3.56	0.40	(4.40)
	Total assets growth rate (%)	(0.28)	17.2	16.6

## 4.2 Results of Fuzzy Comprehensive Evaluation

### 4.2.1 Results and Tests of Financial Risk Early Warning Analysis in 2015.

Determining the affiliation matrix of each early warning indicator: the standard values of enterprise performance evaluation of the automotive vehicle manufacturing industry in 2015 are chosen in this paper. According to the results of Table 1, the index affiliation matrix of 2015 year is obtained as shown in Table 2.

Table 2: Company A's 2015 metric affiliation matrix.

Tier 1 Indicators	Secondary indicators	Two-level fuzzy judgment matrix				
		Very safe	Safer	Fair	Dangerous	Very dangerous
Debt Service Risk	Current ratio		0.94	0.06		
	Gearing ratio	1				
Operational Risk	Total assets turnover			0.94	0.06	
	Accounts receivable turnover ratio	1				
	Inventory turnover rate	0.02	0.98			
Earnings Risk	Operating profit margin		0.40	0.60		
	Return on total assets	0.11	0.89			
	Return on net assets	0.77	0.23			
Development Risk	Operating growth rate		0.75	0.25		
	Operating profit growth rate				0.30	0.70
	Total assets growth rate	0.87	0.13			

The first-level fuzzy synthesis evaluation of the company's financial risk: according to the above calculation, the relative importance weight vector  $Q1=(0.333,0.6667)$  of each secondary indicator of company A about debt service risk, using the fuzzy synthesis operation formula  $A=Q_i \cdot R_i$ , we get the first-level fuzzy synthesis evaluation matrix of the company about debt service risk:  $A1=(0.6667,0.3333,0.0200)$ . The first-level fuzzy integrated evaluation matrix of the company's operational risk is calculated as follows:  $A2=(0.2322,0.1198,0.6091,0.0389,0)$ ; the weight vector of the relative importance of the second-level indicators of operational risk is calculated as  $Q2=(0.6480, 0.2298,0.1222)$ ; the weight vector of the relative importance of the second-level indicators of profitability risk is calculated as follows:  $A2=(0.2322,0.1198,0.6091,0.0389,0)$ ; the weight vector of the second-level indicators of profitability risk is calculated as  $Q3=(0.7380,0.0944,0.1676)$ , the first-level fuzzy integrated evaluation matrix of the company regarding the profitability risk is calculated:  $A3=(0.1394,0.4178,0.4428,0,0)$ ; the weight vector of the relative importance of the second-level indicators regarding the development risk is calculated as  $Q4=(0.6660,0.2220,0.1111)$ , the first-level fuzzy integrated evaluation matrix of the company regarding the

development risk is calculated as  $A3=(0.1394,0.4178,0.4428,0,0)$ ; the weight vector of the second-level indicators regarding the development risk is calculated as  $Q4=(0.6660,0.2220,0.1111)$ . The first-level fuzzy integrated evaluation matrix  $A4=(0.0967,0.5145,0.1667, 0.0667,0.1555)$  is calculated. It can be seen that Company A's solvency, operating capacity, profitability and development capacity are within the safe range.

Second-level fuzzy comprehensive evaluation: According to the fuzzy synthesis formula:  $C=Q \cdot A$ , from the above calculation, the relative importance vector  $Q=(0.0448,0.2674, 0.4627,0.2251)$  for each first-level index of company A. The first-level fuzzy comprehensive evaluation result A is formula (4-3), and the second-level fuzzy comprehensive evaluation result is  $C=(0.1782, 0.3552,0.4062,0.0254,0.0350)$ . The comprehensive evaluation score is calculated by the formula  $Z=C \cdot V$ , where  $V=(100,80,60,40,20)$ , and we get  $Z=72.3$ , it can be seen that the financial situation of Company A is in the range of mild risk and is a normal operating enterprise. Among them, the solvency reaches excellent indicators and the financial risk is very small, but the operating capacity, profitability and development capacity still have small risks, and a few indicators are not satisfactory,

especially the development capacity is slightly poor. The early warning situation for Company A in 2015 basically matches with the actual operating condition of the company, and the early warning results are consistent with the current situation of the enterprise, which can verify that the risk early warning model constructed for Company A is scientifically It can be verified that the risk warning model constructed for Company A is scientific and effective.

#### 4.2.2 Early Warning Analysis of Financial Risks in 2016.

Determine the subordination matrix of each early warning indicator: based on the financial risk

evaluation index values calculated from the 2016 financial statements, the subordination matrix R is obtained by referring to the 2016 enterprise performance evaluation standard values of the automotive vehicle manufacturing industry set by the Bureau of Financial Supervision and Evaluation of the State-owned Assets Supervision and Administration Commission of the State Council, corresponding to the judgment set  $V = \{v_1, v_2, \dots, v_m\} = \{\text{safe, mild, moderate, severe, serious}\}$  to find out the affiliation matrix R. In this paper, we choose the enterprise performance evaluation standard values of the automotive vehicle manufacturing industry in 2016, and finally get the index affiliation matrix for 2016 as shown in Table 3.

Table 3: Company A's 2015 metric affiliation matrix.

Tier 1 Indicators	Secondary indicators	Two-level fuzzy judgment matrix				
		Very safe	Safer	Fair	Dangerous	Very dangerous
Debt Service Risk	Current ratio		0.94	0.02		
	Gearing ratio	1				
Operational Risk	Total assets turnover			0.23	0.77	
	Accounts receivable turnover ratio	1				
	Inventory turnover rate	0.36	0.64			
Earnings Risk	Operating profit margin		0.50	0.50		
	Return on total assets	0.18	0.82			
	Return on net assets	1				
Development Risk	Operating growth rate	1				
	Operating profit growth rate		0.63	0.37		
	Total assets growth rate			0.11	0.89	

The first-level fuzzy comprehensive evaluation of the company's financial risk: according to the above calculation, it is known that the relative importance weight vector of each secondary index of company A about debt service risk:  $Q_1 = (0.3333, 0.6667)$ , using the fuzzy synthetic operation formula  $A = Q_i * R_i$ , the first-level fuzzy comprehensive evaluation matrix of the company about debt service risk is obtained:  $A_1 = (0.6667, 0.3266, 0.0067, 0, 0)$ ; the relative importance weight vector of each secondary indicator of operational risk:  $Q_2 = (0.6480, 0.2298, 0.1222)$ , and the first-level fuzzy integrated evaluation matrix of operational risk:  $A_2 = (0.2738, 0.2272, 0.4990, 0, 0)$ ; the relative importance weight vector of each secondary indicator of profitability risk:  $Q_3 = (0.6480, 0.2298, 0.1222)$ . vector:  $Q_3 = (0.7380, 0.0944,$

$0.1676)$ , the first-level fuzzy integrated evaluation matrix of the company on profitability risk:  $A_3 = (0.1846, 0.4464, 0.3690, 0, 0)$ ; the weight vector of the relative importance of the second-level indicators on development risk:  $Q_4 = (0.66702222, 0.1111)$ , the first-level fuzzy integrated evaluation matrix of the company on development risk:  $A_4 = (0.1846, 0.4464, 0.3690, 0, 0)$ ; the weight vector of the second-level indicators on development risk:  $Q_4 = (0.66702222, 0.1111)$ , the first-level fuzzy integrated evaluation matrix of the company on development risk The first-level fuzzy integrated evaluation matrix of the company about development risk:  $A_4 = (0.6667, 0.1400, 0.0944, 0.0989, 0)$ . It can be seen that the solvency, operating capacity,



profitability and development capacity of Great Wall Company are within the safe range in 2016.

Secondary fuzzy comprehensive evaluation: according to the fuzzy synthesis operation formula:  $C=Q*A$ , the relative importance weight vector  $Q=(0.0448,0.2674,0.4627,0.2251)$  for each level of indicators of Company A, the secondary fuzzy comprehensive evaluation result was obtained as  $C=(0.3386, 0.3134,0.3257,0.0223,0)$  after fuzzy synthesis operation. The comprehensive evaluation score is calculated by the formula  $Z=C*V$ , where  $V=(100,80,60,40,20)$  to get  $Z=79.4$ , which shows that the financial situation of Company A in 2016 is in the range of mild risk and is a normal operating enterprise, which is better than the financial situation in 2015. Among them, solvency and development capacity reach excellent indicators with minimal financial risk, but operating capacity and profitability still have some risk and a few indicators are not good enough.

## 5 EARLY WARNING ANALYSIS OF FINANCIAL RISK OF COMPANY A

In this paper, the improved fuzzy comprehensive evaluation method is used to construct a financial risk early warning model for Company A. The financial statements and related data from 2012-2016 are used to study the financial risk early warning analysis of Company A. The financial risk early warning model is established and empirical analysis is conducted. The study has certain contribution to the subsequent research in this field. Although some conclusions were obtained and some results were achieved in the research process of this paper, there are still shortcomings and we hope to explore them more deeply in the future research process.

## REFERENCES

- Hou X. H. Research on the construction and application of financial risk early warning indicators of Internet insurance companies. *Hunan Forum*,2019,32(03):89-101.
- Hou XH, Peng JJ. Research on financial risk early warning of Internet insurance companies based on entropy value method and efficacy coefficient method. *Financial Theory and Practice*,2019,40(05):40-46.
- Hou XH. Research on early warning of financial risk of Internet insurance companies based on fuzzy

comprehensive evaluation method. *Hunan social science*,2019(04):88-99.

Huang J,Li LQ.Study on the application and optimization of financial risk early warning system of KY company. *Friends of Accounting*, 2018(11):150-153.

Xiong Y,Zhang Yutang. Research on early warning of financial risks of listed companies based on F-score. *Management Modernization*,2019,39 (01):111-115.

Yan Chun,Wang Zeyi. Research on early warning model of financial risk of life insurance companies based on Pls-Logit model. *Technology and Innovation Management*,2018, 39(01):102-110.

Zhang JG,Chen F,Wang B. Research on financial risk early warning of manufacturing companies based on PSO optimization SVM . *Friends of Accounting*, 2017(14):52-56.