

# Financial Risks and Early Warning Analysis of Chemical Enterprises

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With the economic development in society, chemical enterprises are faced with more complicated development issues in their development process. The financial risks of chemical enterprises are attracting more and more attention from people and the early warning analysis against these risks is also improving continuously. Based on the early warning theory of enterprise financial risks, this paper conducts deep analysis of the financial risk factors faced by chemical enterprises, risk early warning process for chemical enterprises and operational mechanism of risk warning model; this paper also designs a financial risk early warning system for chemical enterprises based on fuzzy evaluation method. Through the system calculation, the financial risks of enterprises are displayed according to the severity of the situation to facilitate the decision making of these problems by decision makers.

## 1. Introduction

With the rapid economic development, while the continuous expanding of production scale of chemical industry in China (Hoecht, 2004), the severity of financial risks faced by chemical enterprises (Pauly, 2009; Peng, 2011) is also increases. The chemical industry (Ömer Yildirim, 2012) is an important foundation in the national economy and the stable operation of chemical enterprises (Bhat, 2000; Abratt, 1993) is an important part of the steady and rapid growth of national economy (Brenner, 1979). However, as the market competition becomes more complex, the financial risks faced by enterprises in the production development (Freemantle, 1996) are becoming more and more complicated. How can chemical enterprises (Thayer, 1995) recognize the problem in their development process and how can enterprises take prompt action to ensure that the steady and healthy development of enterprises when the financial risks are within a controllable range. The research on the financial risks of chemical enterprises (Ligterink, 2001), especially the design of the early warning model of financial risks in chemical enterprises, has received increasing attention from chemical enterprises. The early warning model of financial risk in chemical enterprise (Koyuncugil, 2012) mainly uses the operating environment of chemical industry and the internal report of enterprises, summarizes some indicators and designs a certain number of early warning indicator models (Yang, 2005). It can monitor the financial problems in the operational development of enterprises and give the early warning before the crisis, which is an effective monitoring and early warning tool for the operation of chemical enterprises (AINajjar, 2012). This paper mainly analyzes the early warning theory of financial risks and studies the financial risks of chemical enterprises on the basis of this theory. This paper also designs an early warning system of financial risks in chemical enterprises based on the fuzzy evaluation method the operation of chemical enterprises.

## 2. Analysis of the early warning theory of financial risks

### 2.1 Concept and characteristics of financial risks

Financial risks refer to the possibility of the deterioration of financial conditions, which is an important factor that affects the rise and fall of a company. Although enterprises want to maintain a good financial position, it is very difficult to avoid financial risks during the operation of enterprises. Financial risks are usually divided into narrow and broad concepts: the narrow sense of financial risks mainly focuses on the ability of enterprises to use monetary funds to repay matured debts, which can only reflect the financial problems of enterprises

during a certain period; the broad sense of financial risks are more concerned about the overall business process of enterprises and the uncertain internal and external factors that may affect the expected financial revenue of enterprises during the business process are collectively called financial risks.

Financial risks have double impact on the operation and development of enterprises. According to this Figure, the monitoring and controlling the financial risks in enterprises are conducted, which is of great significance for the development of enterprises to play the active role of financial risks and avoid the negative impact brought by financial risks.

## 2.2 Formative factors of financial risks in chemical enterprises

The core content of the financial governance in enterprises is capital movement. The capital movement is mainly composed of capital raising, utilization, consumption, recovery and distribution. In large-scale enterprises such as chemical enterprises, the problem in any link will produce a chain reaction that will cause severe damage to the production of enterprises.

The factors that generate financial risks (Jayadev, 2006) are shown in Figure (1), which can be roughly attributed to internal and external factors.

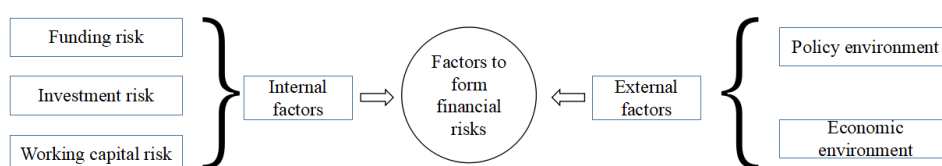


Figure 1: Financial risks factors

## 3. Risk early warning analysis in chemical industry

### 3.1 Basic procedure of risk early warning in chemical industry

The risk early warning of chemical enterprises is indispensable from the accurate recognition of enterprise risks. In order to accurately recognize risks, a set of effective risk analysis procedures is needed. The analytical procedure of enterprise risks is shown in Figure (2). The procedure includes initial risk analysis, capture of risk factors, judgment of the degree of risk, the final definition of the nature of risks and the evaluation of the level of risks to output the degree of evaluated risks for enterprises. This procedure is used to establish the risk early warning system of chemical enterprises.

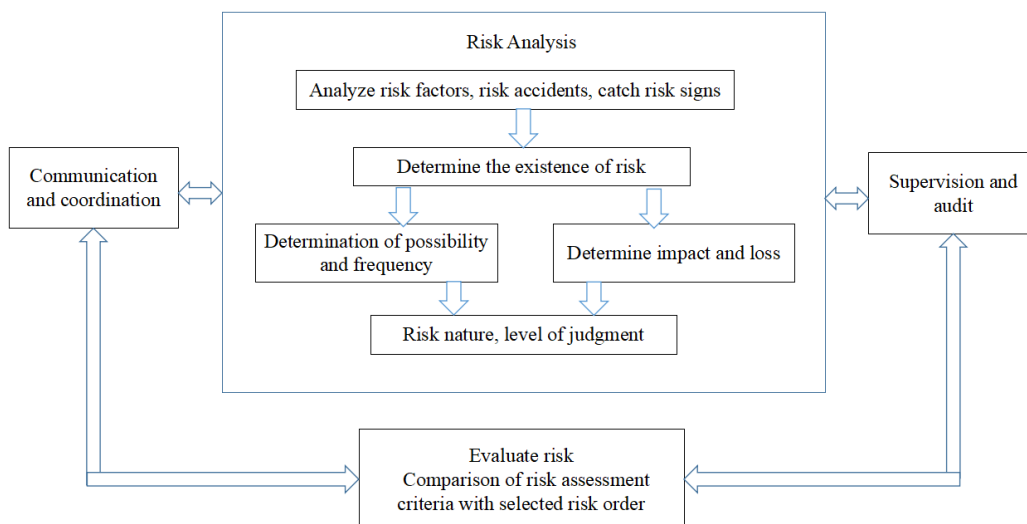


Figure 2: Enterprise risk analysis procedures

### 3.2 Operational mechanism of risk early warning model of chemical enterprises

The risk early warning model of chemical enterprises is a real-time cyclical system, which can not only implement the cycle in accordance with the plan standard, but also achieve the real-time adjustment and modification in the operational process of the system, thus realizing the design philosophy of monitoring and early warning. The operational process of the system is shown in Figure (3).

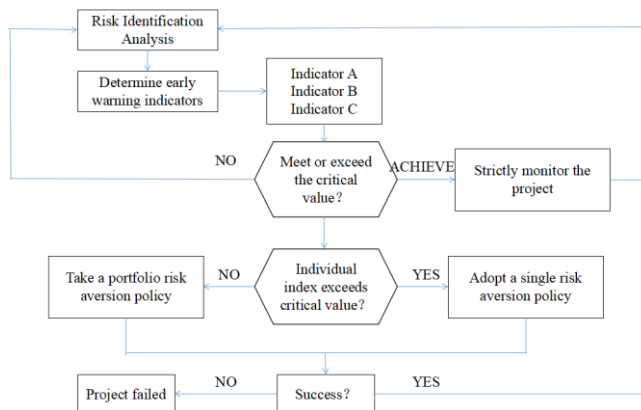


Figure 3: Risk early warning model operating mechanism

In the risk early warning system, the system focuses on the comparison between the determined early warning indicators and the real-time monitoring results, and how to adopt risk aversion strategies after exceeding the indicators. The former can achieve the accurate monitoring of the parameter variation and the latter can provide risk aversion strategies for decision makers. A complete set of financial risk early warning analysis system for chemical enterprises can analyze the causes of the fluctuation in enterprise development and crisis generation and provide corresponding regulating measures, thus realizing the early warning of risks in enterprise operation and helping policy makers avoid the occurrence of uncontrollable financial risks.

### 3.3 Risk warning methods for chemical enterprises

The commonly used risk warning methods are nothing more than three early warning methods of quantitative early warning, qualitative early warning, and combination of quantitative and qualitative early warning, as is shown in the following figure (4). The qualitative early warning system is simple and practical, which can analyze the risks in enterprise operation through index transformation. However, it cannot judge the risk factor of enterprises and cannot predict the variation trend of risks; the quantitative early warning system needs certain algorithm support to complete the capture and detection of risks, which is often slightly complicated. The quantitative and qualitative combination system can conduct the qualitative investigation on some indicators and quantitative investigation on other parts, which is both practical and rapid.

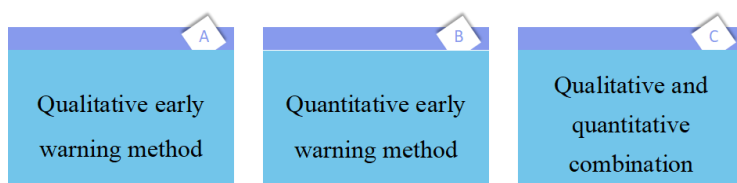


Figure 4: Analyze risk warning methods

These early warning methods can be used to analyze single practical problem. However, each method must have its own limitation. The analysis of practical problems through two or more early warning methods can eliminate the deficiency of using single early warning method. When establishing the risk early warning model, the financial risk warning system can be constructed based on one or various early warning methods.

#### 4. Early warning model of financial risks for chemical enterprises

The fuzzy evaluation method (AHP) is a commonly used method for constructing enterprise financial risks. With its strong logic and credibility, it is widely used in the construction of early warning models. This paper uses the AHP to build the early warning model of financial risks for chemical enterprises. AHP is based on the fuzzy mathematics theory. Through the calculation, the invisible relationship between things is analyzed through data, thus obtaining the objective and effective early warning results. By associating the fuzzy analysis method with the early warning model of financial risks in chemical enterprises, a more accurate risk warning model can be obtained.

##### 4.1 Establishment of risk warning model for chemical enterprises

##### 4.1.1 Establishment of fuzzy comprehensive index system and weight index

The establishment of a reasonable fuzzy comprehensive index system is the basis for the accurate analysis of financial risks in the subsequent early warning system and is also an important guarantee for improving the accuracy and precision of the early warning system. The weight index obtained through the business operation and financial statement is also important for the accuracy of the early warning system. The procedure using the AHP analysis method is shown in Figure (5) below

A ladder hierarchical structure is constructed, which is divided into three layers. The target layer is the warning model of financial risks designed for chemical enterprises. The criteria layer is defined as the financial risks faced by chemical enterprises: the fundraising capacity, investment capacity, operating capacity and development capacity respectively. The scheme layer is the specific indicator of each financial risk item. Taking the operational development capability as an example, there are indexes such as the turnover of all investment, turnover of account receivable and rate of stock turnover in the scheme layer.

The comparative judgment matrix is constructed after constructing the ladder level:

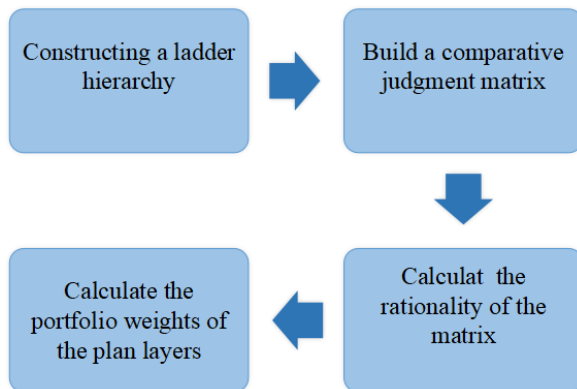


Figure 5: AHP analysis steps

$$B = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \dots & \dots & \dots & \dots \\ b_{n1} & b_{n2} & \dots & b_{nn} \end{bmatrix} \dots \dots \dots \quad (1)$$

In the formula:

$$b_{ii} = 1; b_{ij} = \frac{1}{b_{ji}} (i, j = 1, 2, \dots, n); b_{ij} = \frac{b_{iK}}{b_{jK}} (i, j = 1, 2, \dots, n). \quad (2)$$

To verify the rationality of the matrix, the coincidence indicator and consistency ratio are calculated as follows:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (3)$$

$$CR = \frac{C_i}{R_i} \quad (4)$$

Wherein, represents the largest eigenvalue  $\lambda_{max}$  in the matrix B; when the consistency ratio is less than 0.1, the matrix B is reasonable.

The weight ratio of scheme layer Pi relative to the criteria layer Ck is calculated:

$$Q = (m_1, m_2, \dots, m_n)^T \quad (5)$$

$$q_i = \sqrt[n]{(\prod_{j=1}^n b_{ij})}, i = 1, 2, \dots, n \quad (6)$$

Normalization processing

$$W_i = m_i / \sum_{i=1}^n m_i \quad (7)$$

The weight after the combination is calculated:

$$V = (V_1, V_2, V_3, \dots, V_m) \quad (8)$$

#### 4.1.2 Determination of the comment set

The comment set converts the results of the early warning model calculation into several levels to indicate the severity of financial risks. The calculation result of the early warning model is compared with the comment set, the severity of financial risks is divided into five levels from high to low: safe, mild, moderate, severe and critical and the corresponding score is set to 100, 80, 60, 40 and 20.

#### 4.1.3 Determination of the judgment matrix

Table 1: The relative importance of various factors

Relative Importance	Definition	Explain
1	Equally important	Two goals are equally important
3	Slightly important	One goal is a little more important than the other
5	Very important	One goal is more important than the other
7	Obviously important	A sense of one goal is more important than the other
9	Absolutely important	A strong sense of one goal is more important than the other
2,4,6,8	Intermediate value	When you need a compromise, use it

The comparison matrix is constructed by comparing the data in pairs. The judgment matrix represents the comparison of the relative importance of the element at this level and some element at the above level. The value of the judgment matrix shows the recognition of the relative importance of various factors. Generally, the numeral value is used to represent the degree of importance. The greater the value, the higher the relative importance. The digital scale method is shown in the following table (1).

Assume that there are N schemes. According to a certain criterion in the first level, the N targets are compared in pairs and the relative importance of the ith target (i=1, 2, 3, ..., N) for the jth target is set to  $a_{ij}$  (i=1, 2, ..., n). The obtained matrix can be used to indicate the importance of each target to the corresponding criteria.

#### 4.1.4 Determination of evaluation results

Based on the relative weight  $Q_i$  and the judgement matrix  $B_i$ , the hierarchical comprehensive evaluation matrix of this early warning system is obtained based on the formula  $A=Q_i^o B_i$ . Then, the comprehensive evaluation matrix is mapped to the comment set and the warning signal is output in set standard in the comment set.

## 4.2 Display of risk early warning signals of chemical industry

After the establishment of the financial risk early warning model of enterprises, combined with the comment set, this model calculates the output financial risk early warning index X in order to convert the index into a more direct form of expression. The warning index is converted, as is shown in the following table (2).

Table 2: Warning index conversion table

Evaluation grade	Security	Light	Moderate	Severe	Serious
Early warning signal	Green light	Blue light	Orange light	Yellow light	Red light
Scoring index	[80,100]	[60,80]	[40,60]	[20,40]	[0,20]

This early warning analysis system can not only perform comprehensive early warning, but also perform separated early-warning analysis on single index. When the early warning system completes the conversion of the warning signal, based on their own situations, chemical enterprises can take reasonable measures to avoid the severe or above early warning; enterprises can pay sufficient attention and monitoring for moderate early warning; enterprises can temporarily not to respond to this early warning for mild warning and no warning from the point of view of cost control, and concentrate more time and efforts on addressing severe or above early warning. This early-warning model system converts the calculation data into intuitive warning lights to provide enterprises with early warning analysis as well as listing the severity of the problems so that chemical enterprises can categorize the severity of financial risks.

## 5. Conclusion

This paper focuses on the financial risks of chemical enterprises and studies the financial risks of chemical enterprises and the early warning theory of financial risks for chemical enterprises. The specific findings are as follows:

- (1) Based on the early warning theory of enterprise financial risks, this paper conducts deep analysis of the financial risk factors faced by chemical enterprises, risk early warning process for chemical enterprises and operational mechanism of risk warning model.
- (2) This paper establishes an early warning model of financial risks for chemical enterprises based on the AHP analysis method and output the model analysis results through the display of the risk early warning signals.

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