Research on the application of the Z-value analysis method in financial risk management of enterprise

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Abstract

As a method of measuring the bankruptcy risk of enterprise invented by the US scholar Altman, the Z-value analysis method is widely applied by people. According to the prediction of the model, an enterprise will go into bankruptcy if the Z-value is less than 1.20; it is the grey area if the value is between 1.20 and 2.90; the enterprise has no bankruptcy risk if it is greater than 2.90. Although the Z-value analysis method has been used for measuring the bankruptcy risk of enterprises for a long time, in fact, it reflects the risks through the financial indicators of the enterprises, so it can be widely used for the financial risk management of enterprise. Through analysing the connotation of the Z-value analysis method, the paper explores the application of the method in the enterprise risk management from the specific calculation perspective and discusses the problems in application. Finally, some policy suggestions are provided for relevant decision-maker.

Keywords: z-value model, enterprise finance, risk management

1 Introduction

Risk management is a way of decision management based on prevention and enterprise risk avoidance. Through the management, it can avoid the enterprise risks in law, finance, social responsibility and investment, reduce the enterprises' loss in the abnormal cases and maintain the stable and sustained business activities. Therefore, for the large companies and those pursuing stability, risk management is particularly important. At the same time risk management is the decision based on facts, which needs to establish the information collection and response mechanism in the enterprise. In addition to the market information the financial information of the enterprise is also the core content. Financial risk is the inherent risk and the key risk of the enterprise. It is an important aspect of enterprise risk management. All along, business risks cannot be fundamentally eliminated but only be prevented and reduced. The Z-value analysis method is to measure the bankruptcy risk of enterprise. It uses the financial data to analyse the enterprise's financial conditions and predict the future possibilities. This paper applies the Z-value analysis method in the specific enterprise risk management and reflects the financial risks of enterprise through the financial data.

2 Relevant theories and research of the financial risks of enterprise

Financial risk of enterprise has been always a research focus which involves various aspects, but no any method can eliminate the risk. Meng Xiangxia combines the management theories of all kinds of enterprise financial risks and finds any theory of financial management has defects [1]. Ling Zhang holds that the financial risks of enterprise are characterized by uncertainty, dispersibility, transfer and decision making; they can be identified; the effective financial risk management can promote the value maximization of the enterprise [2]. Li Sheng argues that the overall financial risk management research is not only the necessary requirement for improving the business management of the enterprise but also the inevitable trend of the financial risk management theory development. With the development of global economic integration, the financing environment of the enterprises has been changing sharply. As a result, the financial risks of the Chinese enterprises are more diversified and complicated; at the same time, the degree of harm of the financial risks to the Chinese enterprises is also increasing, which becomes an important difficulty needing urgent solution for most domestic enterprises. The main purpose of the overall financial risk management is to realize the maximization of the enterprise value with the lowest financial risk. In order to achieve the purpose, it needs to establish a comprehensive and effective financial risk prevention and control system. Compared with the traditional financial risk management, it has the characteristics of systematicness, self-regulation, openness, sustainability and dynamics [3]. Yu Xinhua thinks that in the fierce market competition environment, the role of enterprise risk management is increasingly prominent, but the risk management of the domestic enterprise groups is relatively backward; with the intensification of competitions, the financial risks of those enterprises will be more and more complex and changeable [4]. Huang

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Jinliang analyses the production and production process of financial risks [5]. Ren Yongsheng believes that in the market economy, the financial activities of enterprises will encounter all kinds of risks. Financial risks are objective, which cannot be completely eliminated. When pursing the business objectives, the enterprises should also take into account the risks. The full understanding and analysis of financial risks can reduce the negative impact on the enterprises to a minimum. With the access of our country into WTO, the enterprises are facing more fierce market competition. Once the financial risks appear, the enterprises will suffer heavy losses and even go into bankruptcy if handling them, improperly. In order to control the financial risks, the enterprises must start from the source. The first thing is to analyse the causes of financial risks. They should also have measures to control financial risks, so as to reduce the losses to a minimum when the risks occur [6]. Na Pengjie proposes the view that the financial risk management is the core of the risk management based on analysing the causes of financial risks of the enterprise groups and improves it from strategic finance, organization, internal control, early warning, assessment, information and culture [7]. Song Lei holds that as the core of enterprise risk management, the financial risk management of enterprise has caught redoubled attention from enterprises and governments, but the current financial risk management lacks systematicness and practicality; the financial risk management of enterprise is closely related to the diversification of the enterprise financing way, optimization of the enterprise investment strategy selection, maximization of the enterprise fund utilization and rationalization of the enterprise income distribution, but there are also great conflicts between them [8]. This paper makes an in-depth analysis of the application of the Z-value analysis method in enterprise risk management and discusses the application problems from dynamic management, prevention and prediction.

3 Application of the Z-value analysis method in enterprise risk management

3.1 THE CONNOTATION OF THE Z-VALUE ANALYSIS METHOD

As a method of measuring the bankruptcy risk of enterprise invented by the US scholar Altman, the Z-value analysis method is widely applied by people. According to the prediction of the model, an enterprise will go into bankruptcy if the Z-value is less than 1.20; it is the grey area if the value is between 1.20 and 2.90; the enterprise has no bankruptcy risk if it's greater than 2.90. Altman selected 33 bankrupted companies and 33 companies in operation as the samples and found after detection that the Z-value accurately predicted the fate of 63 companies. The research of the UK and Germany in recent years also proves the role of the Z-value in predicting the financial conditions of enterprise. Thus, the Z-value analysis method has certain predictability of the enterprise risks.

The calculating formula of the Z-value designed by Altman in 1968 was:

$$Z = 0.012 * X1 + 0.014 * X2 + 0.033 * X3 + 0.006 * X4 + 0.999 * X5,$$

where $X1$ is working capital/total assets; $X2$ is accumulated retained earnings/total assets; $X3$ is earnings before interest and tax/ total assets; $X4$ is market value of the owners' equity/total liabilities; $X5$ is sales revenue/total assets.

In 2000 Altman made the following modification on the Z discernibility function:

$$Z = 0.717 * X1 + 0.847 * X2 + 3.107 * X3 + 0.420 * X4 + 0.998 * X5,$$

where the definitions of $X1$, $X2$, $X3$ and $X5$ remained unchanged; the calculating method of $X2$ changed; $X4$ is the book value of the owners' equity/total liabilities. Here, working capital referred to the narrow one, namely, working capital is current assets-current liability; accumulated retained earnings is surplus reserves plus undistributed profit; earnings before interest and tax is net profit plus interest expense plus income tax; sales revenue is revenue from operation.

3.2 APPLICATION OF THE Z-VALUE ANALYSIS METHOD IN FINACIAL RISK MANAGEMENT OF ENTERPRISE

There should be some changes if applying the Z-value analysis method in the enterprise bankruptcy to the financial risk management of enterprise. This is because the bankruptcy risk is the extreme risk, but for the general enterprises, the risks are reflected only to a certain extent, such as whether the financial risks of the enterprise increase and whether the risks are controllable compared with last year. There is a grey area in the enterprise bankruptcy risk: when the Z-value is between 1.2 and 2.9, the enterprise has no bankruptcy risk, but it does not mean the enterprise has no other risks. In fact, the enterprise has risks in all development stages, but at different levels. In the grey area between 1.2 and 2.9, the enterprise has high risks, but not the bankruptcy risk. When the Z-value is greater than 2.9, the enterprise also has risks, but at a low level. Thus, it can be seen that the Z-value calculated with the financial indicators reflects the financial risk of the enterprise to a certain extent. The greater the Z-value is, the lower the financial risk of the enterprise is; the smaller the Z-value is, the higher the financial risk is. In addition, the specific indicators for calculating the Z-value can show the rough sources of the risks.

$X1$ is working capital/total assets. Working capital is the capital that the enterprise invests in current assets, including accounts receivable, inventory, notes payable

and accrued expenses. It reflects the quota of the enterprise's current assets and current liabilities. Current assets minus current liabilities is working capital. Low $X1$ indicates the low proportion of working capital in total assets, which means that the enterprise has the higher risk of paying off its debts. Conversely, High $X2$ indicates the low risk of paying off the debts. The proportion of working capital in total assets can reflect the enterprise's ability to pay its short-term liabilities and the capital operation condition in the short term. The small proportion indicates that the enterprise has difficulties to pay the short-term liabilities. At this time, it needs to actively raise the short-term borrowings to reduce the financial risk. When $X1$ is negative, it means the enterprise cannot repay the short-term debts with current capital. In other words, it becomes insolvent. Then, the production of the enterprise may be interrupted at any time due to the capital turnover issue.

$X2$ is accumulated retained earnings/total assets. Retained earnings is created by the enterprise in the business process without the profit distributing to the owner of the enterprise. Accumulated retained earnings reflects the enterprise's profitability over the years and the profits drawn out for the enterprise's development. Retained earnings is the important source of capital of the enterprise. The utilization of it does not require the additional costs. It is immune to the market influence and restrictions. If retained earnings ratio is too low and the retained earnings is not enough for meeting the demand of enterprise development, the long-term shortage of funds may cause the enterprise to solve the development needs through getting into debt. Retained earnings is the cumulative net profit of the enterprise. The long-term accumulative quota can reflect the development condition of the enterprise. The higher the quota of retained earnings in total assets is, the faster the enterprise develops, the higher the profit is and the lower the financial risk is. If $X2$ has problems, the enterprise is faced with the long-term slow development. At this time, it should consider adjusting the business strategies.

$X3$ is earnings before interest and tax/ total assets. Earnings before interest and tax refers to the profit not deducting interest and income tax. In other words, it's the profit before paying the income tax under the condition of not considering the interest. It reflects the current actual profitability of the enterprise. The higher the proportion of earnings before interest and tax in total assets is, the higher the current profit ratio of the enterprise is and the lower the financial risk is. Conversely, the lower the proportion is, the lower the current profit ratio is and the higher the financial risk is. If $X3$ is low or negative, it means the enterprise has low profitability or suffers losses. Therefore, if $X3$ has problems, the enterprise needs to consider the balance between earnings and cost, reduce the business cost and improve the profitability.

$X4$ is market value of the owners' equity/total liabilities. The market value of the owners' equity refers to the value of the enterprise reflected in the market, showing the public recognition of the enterprise. It's not directly related to the financial data, but the public recognition has great influence on the consumption of the enterprise products. The low market value of the owners' equity indicates the low public recognition. In this case, the future sales of the enterprise may have difficulties, which reduces its profitability and increases its financial risks. The high public recognition of the enterprise will promote the product sales and reduce the financial risks. In addition, the public recognition can also affect the enterprise's financing. The enterprises with the low recognition have greater difficulty in financing. If $X4$ is low, the enterprise should consider two factors: the first is the product quality, which is the key that affects the market; the second is the marketing ability and interpersonal skills. If the products of the enterprise have fatal accidents, it must reduce the market value of the enterprise sharply. If the products have the quality problem, the public acceptance must be low.

$X5$ is sales revenue/total assets. Sales revenue reflects the enterprise's market share and indicates its competitiveness and development speed. In general, the greater $X5$ is, the more the revenue of the enterprise obtained by utilizing the limited assets; the smaller $X5$ is, the lower the revenue of the enterprise is. It can be seen that $X5$ reflects the enterprise's operation results and using efficiency of assets. Thus, if $X5$ is too low, the enterprise should consider the problems of insufficient production, selling or product itself.

Given all that, it can be seen that the Z-value can reflect the financial risks of the enterprise and its specific calculating indicators can help find the sources of enterprise risks, like insufficient products, poor interpersonal skills, big gap between current capital and debts, etc.

3.3 THE RELEVANT PROBLEMS OF THE APPLICATION OF THE Z-VALUE ANALYSIS METHOD IN THE FINANCIAL RISK MANAGEMENT OF ENTERPRISE

According to the analysis, the indicators of the Z-values are mainly reflected in two aspects: the first is the ratio of current assets to current liabilities in the enterprise; the second is the short-term and long-term profitability of the enterprise. Specifically, there are mainly the following aspects:

First of all, the Z-value can reflect the enterprise's risks and their directions, but cannot reflect the sources. Both the ratio of assets to liabilities and the profitability are a general direction. In order to know the specific source of the financial risks, it needs a further analysis. Many factors contribute to the financial risks, such as low productivity, market strategy, level of employees and level of management. Therefore, after the Z-value estimates the risks and risk changes, the enterprise should know the reasons and make the analysis according to the actual circumstances.

Secondly, the calculation methods and indicators of the Z-value are simple, and the risks reflected are not complete. In fact, the sources of risks of many enterprises are undisclosed, or the enterprises cannot predict them in advance, such as sudden product accident, sudden jump in material prices, etc. The elements of those changes will cause the financial risks, but the Z-value cannot fully reflect all changing factors.

Thirdly, the Z-value analysis method is a dynamic analysis method, which needs the long-term tracking. The risks of the enterprise are changing, so is the Z-value. If the Z-value is smaller, it means the financial risks of the enterprise reduce, and vice versa. Any enterprise has certain risks, so it should make the dynamic analysis to predict the Z-value regularly and compare the values in different periods to get the changing rule rather than observing it statically. If the Z-value keeps falling, it means the financial risks of the enterprise are reducing; if the Z-value keeps rising, it means the financial risks are increasing. If the value fluctuates, the financial risks of the enterprise fluctuate. If the value fluctuates slightly, the risks are stable; if the value fluctuates widely, the financial risks of the enterprise rise and fall, which highlights the poor control and management ability of the enterprise.

In fact, the defects of application can be made up by changing the Z-value analysis method. The changing path needs the auxiliary conditions. Here, the principal component analysis method is applied to solve the defects. The details are as follows: according to the specific financial indicators of the enterprise, such as production cost, production efficiency, employee cost, employee efficiency, etc., it's assumed that there are n indicators, namely, $X1$, $X2$, $X3$, $X4$,...,Xn.

$$\begin{vmatrix} X11, X12, X13 \ldots\ldots X1p \\ X21, X22, X23 \ldots\ldots X2p \\ \ldots\ldots \\ Xn1, Xn2, Xn3 \ldots\ldots Xnp \end{vmatrix}.$$

Make the normalization processing to get:

$$\begin{vmatrix} Y11, Y12, Y13 \ldots\ldots Y1p \\ Y21, Y22, Y23 \ldots\ldots Y2p \\ \ldots\ldots \\ Yn1, Yn2, Yn3 \ldots\ldots Ynp \end{vmatrix}.$$

Calculate the relevant coefficient matrix to get:

$$\begin{vmatrix} R11, R12, R13 \ldots\ldots R1p \\ R21, R22, Y23 \ldots\ldots R2p \\ \ldots\ldots \\ Rn1, Rn2, Rn3 \ldots\ldots Rnp \end{vmatrix}.$$

The characteristic value of the matrix is calculated by $|\lambda E - R| = 0$. Then, the proportion of each indicator can be obtained according to Equation (1). The changes of the proportions can show the specific sources of risks.

$$a = \frac{\lambda_j}{\sum_{i=1}^{p} \lambda_i} \quad (1)$$

Therefore, the enterprise can know the degrees and changes of financial risks through the Z-value analysis method and the sources of risks through the principal component analysis method, such as production efficiency, production level, etc.

4 Conclusion and countermeasures

According to the above analysis, the Z-value analysis method can be effectively applied to the financial risk management of enterprise, but there are also many problems. In order to improve its practicality, it is recommended to strengthen the following aspects when measuring and analysing risks with the Z-value analysis method.

First of all, the enterprise should improve its ability of risk identification. The Z-value analysis method just reminds the enterprise of the existence of risks from the general direction, but cannot reflect the sources of risks. Risk identification is a kind of professional management work which should be attached great importance to. If the enterprise is unable to do it, it should hire the exports or intermediary agencies to make the principal component analysis. Otherwise, it cannot solve the risks even when finding them timely. At that time, it will be unable to achieve the goal, and the Z-value risk management will be useless. Thus, the Z-value analysis method must require the enterprise to have the supporting ability for assistance.

Secondly, the enterprise should develop the risk management strategies according to its development. In fact, the financial risks of the enterprise are mainly from technical and management levels of production and operation, sales ability and market competition, The enterprise should develop various risk management strategies according to its environment, like risk avoidance, risk transfer, risk conversion, risk hedging, risk compensation or risk control. It should also make preparations. Otherwise, even if the Z-value can show risks, it cannot take the effective measures timely to make risk management and control.

Thirdly, the top management of the enterprise should fully recognize the advantages and problems of the Z-value analysis method, improve their quality and enhance their ability of risk analysis and treatment. The change of the Z-value and the change and source of enterprise risks largely depend on the risk preference and attitude of the top management as well as their ability of risk treatment. Thus, it is the key measure for realizing the Z-value analysis method to strengthen their understanding and improve their ability; otherwise, it will end in talk.

Fourthly, the enterprise should strengthen the dynamic management and analysis of the Z-value analysis method, pay attention to the changes of the Z-value and coordinate the changes with its ability of risk analysis and control. Although the Z-value analysis method is simple, its application needs to keep consistency to accurately get the change of risks and

analyse the reasons. For example, if X1 remains unchanged in previous years but suddenly drops in recent three years, it indicates that the enterprise has some problems with its working capital. Then, it should make adjustments in time.

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