

**Z-score Model on Financial Crisis Early-Warning of
Listed Real Estate Companies in China: a Financial Engineering Perspective**

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Abstract: Financial engineers developed quantitative models that help firms making financial decisions in the face of risk and uncertainty. Z-score model is one of the most frequently used risk early warning models in financial engineering, but it needs further research to prove whether it is suitable for China's burgeoning real estate enterprises. The financial data of China's 40 listed real estate companies is processed in this article, and statistic analysis is conducted, so as to judge the effectiveness of Z-score model on financial risk early warning of China's listed real estate companies.

Keywords: Z-score model; Early-warning; Effectiveness

1. Introduction

The development of real estate industry, which is the pillar industry of China's national economy, has a strong influence on the operation of the entire national economy. In recent years, China's real estate industry has experienced an unprecedented period of rapid development. Considering the immaturity of the real estate market, the government has taken measures to regulate and control the real estate market on many occasions, especially after the second half of 2010, when our country launched a series of strict adjustment and control policies. At the same time, due to tight monetary policies, a large number of real estate enterprises are facing tension and even rupture of the capital chain and are very likely to suffer financial crisis. Listed real estate companies have basically represented the development of this industry in China. Therefore, the research over the financial crisis early warning of listed real estate companies is of great significance for studying the development of China's real estate industry.

Scholars in industrial engineering and management sciences focused on the prediction models using in financial risk. To consider the risk of the entire portfolio, an institution must take into account comparing several models and choosing the proper one. In right time, accurate carrying on pre-warning analysis to enterprise's financial affairs is the objective requirement for the market competition system, it is the essential guarantee of enterprise's survival and development too. The research on financial crisis early warning model has experienced many years of development, from early research on model construction to the research specific to the practical financial crisis early warning model construction of Chinese enterprises [1], and then to explore the financial crisis early warning model that is suitable for the industry.

2. Literature Review on Financial Crisis Early-Warning Model

Financial crisis prediction has become an important factor in the healthy development in China's capital market and the problem of financial crisis prediction has become a hot issue. The scholars in financial engineering field generalize, sort and introduce the research progress of financial crisis prediction models. It is necessary to compare, evaluate and analyze the financial crisis prediction models on the basis of financial engineering.

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Since 1932, scholars began to launch on the listed company or private enterprise financial crisis pre-warning model research, from single-variable warning model to the current artificial intelligence and higher discriminating rate pre-alarming model [2]. Although in China, financial crisis early-warning model research began later than abroad, research results can reach the advanced level. Regarding the enterprise, especially the listed company's financial crisis warning research, many experts and scholars from different angles on such questions carried out in depth research. In this paper, it compares the early warning models for enterprises based on the concept of financial engineering cube.

2.1 Single-Variable Model

Single-variable model is a forecast model that uses a financial index as the criterion to judge whether an enterprise is on the edge of bankruptcy. When the financial index involved in the enterprise's financial crisis early warning model deteriorates, it is often a bad signal and a sign of financial crisis.

2.2 Multi-Variable Model Analysis

2.2.1 Z-Score Model

Z-score Model adopts multi-variable linear function and selects those variables with the biggest difference between the two sample groups and the smallest dispersion within each group through statistical techniques so as to convert multiple variables to categorical variables and obtain equation[3].

2.2.2 Principal Component Analysis

Principal component analysis is the best comprehensive simplification of multi-variable flat data sheet. To put it another way, after giving up a small quantity of information on the principle of losing as little data information as possible, the principal axis can still be very effective in indicating the variation of the raw data and reduce the dimensions of the high-dimension variable space.

2.2.3 Logistic Regression Analysis

The objective of logistic model is to seek the conditional probability of observation objects and judge their financial status and business risks on this basis. Logistic model is suitable for the selection model whose dependent variables are of discontinuity and dichotomies [4]. It limits default probability to between 0 and 1 and computes default probability through the logarithmic distribution of functions.

2.2.4 Probit Model

Similarly, Probit regression model also presumes that the enterprise's bankruptcy probability is P and enterprise samples are normally distributed. With its computing method very similar to that of Logistic model, Probit model also first determines the maximum likelihood function of enterprise samples, then obtains the parameters by looking for the maximum value of the likelihood function and computes the bankruptcy probability of the enterprise.

2.2.5 Artificial Neural Network (ANN) Method

Neural network model is a complex network system made up of numerous interconnected simple processing units. Consisting of input layer, output layer and hidden layer, it obtains desired output through network study and data correction and then makes prediction on the basis of the judgment rules that are obtained through learning.

In practice, single-variable analysis is almost obsolete due to its defects. ANN modeling is a very complex and time-consuming model that requires continuous artificial adjustment, so its application is very limited [5]. In contrast, multi-variable linear discrimination method and multiple logical regression model has high practicality and predicative accuracy, so these two methods are widely used.

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