The Financial Crisis Early-Warning Research of Real Estate Listed Corporation Basted Logistic Model

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Abstract. The establishment of the financial crisis warning system is convenient for the listing Corporation to find the signal of financial crisis, and then improve the ability of the listing corporation to resist risks. In this paper, we take the real estate listed companies as the research object. Through screening and optimization, we choose asset-liability ratio and other four indicators (from the initial 26 financial indicators that could reflect the overall financial condition of listed real estate companies) to build logistic financial crisis early-warning models. The results of sample group reflect that there are 75% accuracy and 25% misjudgment rate in 2013; The results of prediction group reflect that there are 80.2% accuracy in 2013.We could predict that the effect is more ideal. For the real listed corporation, they could build early-warning model of financial crisis to avoid financial risks.

1. Introduction

For the real estate industry, on the one hand, it has partial nature of the financial industry, it requires higher demand for funds, long period of investment, meanwhile the asset-liability ratio of real estate listed corporation is generally higher than 80%, while the debt could bring the good effect of financial leverage, a higher debt will also bring more financial risks, even the financial crisis ; On the other hand, as the pillar of the national economy, the real estate industry's health and stability plays a vital role. Therefore, it is necessary for real estate listed corporation to explore the financial crisis early-warning research basted logistic model. At present, the domestic research on financial crisis warning is not very perfect, but due to the development of foreign securities market is relatively mature, the corresponding financial crisis early-warning research is also relatively perfect, it has formed a variety of financial crisis warning system. Under the help of the existing research results, in this paper, the Logistic regression method was used to build financial crisis early-warning model of real estate industry, hoping to improve the prediction accuracy, provide an effective financial crisis early-warning tool.

2. The cause Analysis Of The Financial Risk Of Real Estate Listing Corporation

There are many factors which influencing financial risks of the real estate listed company. In external factors, macroeconomic environment, resources environment, law and policy environment, industry cycle and other external factors may cause financial risk, and even bring financial crisis, meanwhile, the impact of these "external factors" will eventually be reflected through the financial data.

In Internal factors, many real estate listed corporation's capital structure is irrational, it shows the phenomenon of the financial leverage's excessive use and higher asset liability ratio ,and this is the main reason why real estate listed corporation format financial risk. Meanwhile, the short-term debt repayment pressure and higher financial costs are easy to make the enterprise blindly do some diversified investment to spread risk. However these diversified investments will take up a lot of capital under the new industry, and it will ignore the development of the main business so that the main business profit levels appear serious decline.

3. Construction Of The Financial Crisis Early-Warning Model of Real Estate Listed Corporation

3.1 Sample selection and data sources

The range of sample is real estate listed companies selected from Shanghai stock exchange and the Shenzhen stock exchange with sample matching method. Selection criteria: firstly the paper choose 4 ST companies which possess complete financial data, and then choose 4 non ST companies which total asset size is not more than10% compared with 4 ST companies. There are 8 samples in this paper. As shown in table 1

Table 1 Samples

ST companies		Non ST matching company	
SHENZHENINTERNATIONAL Co.,Ltd	000056	000150	YIHUA HEALTHCARE CO.,LTD
GUO XING Co.,Ltd	000838	000797	WUYI OF CHINA Co.,Ltd
TIANRUN Co.,Ltd	002113	002077	DA GANG Co.,Ltd
QIANFENG Co.,Ltd	600733	600736	TECHNOLOGY OF SUZHOU Co.,Ltd

The purpose of building model is to find the signs of the financial deterioration in the first 2 to 3 years before the financial crisis, and then take the corresponding remedial measures to avoid further deterioration. Therefore, this paper choose the first three years of special treatment as forecast year, namely from 2011 to 2013,

3.2 Construction Of The Index System About Financial Crisis Early-Warning Model

3.2.1 The preliminary establishment of index system

It is difficult to use a few simple index to reflect the occurrence of financial crisis, at the same time, we lack some relevant theories to guide, so it is difficult to select some relevant index. In the process of constructing the index system, with the characteristics of real estate industry and the basic principles of "comprehensive and quantitative", this paper mainly extract the 26 alternative indicators from five aspects, like the enterprise's solvency, operation ability, profit ability and development ability and the cash flow ability. As shown in Table 2.

Table 2. Primary index variables

	The Index Name	Index
	Current ratio	X_1
	Quick ratio	X_2
	Cash ratio	X_3
Solvency	Asset-liability ratio	X_4
	Equity ratio ;	X_5
	Current assets ratio	X_6
	Total asset turnover	X_7
	Inventory turnover	X_8
Operation Ability	Accounts receivable turnover	X_9
	Current assets turnover	X_{10}
	Fixed asset turnover	X_{11}
	Total assets net profit margin	X_{12}
Profit Ability	Sales net interest rates	X_{13}
	The cost profit margins	X_{14}
	Return on equity	X_{15}
	Net profit growth rate	X_{16}
	Operating profit growth	X_{17}
Development Ability	Capital preservation increment rate	X_{18}
	Growth rate of total assets	X_{19}
	Capital accumulation	X_{20}
	Net cash net content	X_{21}
	Cash net operating income levels	X_{22}
	Operating profit cash net content	X_{23}
Cash Flow Ability	Operating index	X_{24}
	Cash than current liabilities	X_{25}
	Cash debt ratio	X_{26}

3.2.2 Index selection of Logistic Financial Crisis Early-warning model

1)   The Text of K-S

Before building a early-warning model of financial affairs, the index variables shall be selected through the test of significance to find out some variables as the judging index for the model, which indicating significant difference between financially distressed company and normal company But before the test, it is necessary to judge that whether the values of sample index conform to normal distribution or not via K-S test so as to determine whether the significance analysis on values of sample index can be examined by T test. The results of test K-S is shown in the following Table 3. According to the probability of P which is automatically calculated from SPSS test, it can be noticed that most of probabilities of P of sample index variables are more than the significance level 0.05 except X_8 and X_{21}. Therefore we can conclude that the null hypothesis: the samples conform to normal distribution and the T test can be used to find financial index having significant differences between financially distressed company and normal company.

Table 3 The Text of K-S

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_9
Kolmogorov-SmirnovZ	.895	.418	.853	.643	.928	.667	.513	1.447
	.400	.995	.460	.803	.355	.765	.955	.053
	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
Kolmogorov-SmirnovZ	.472	.663	.897	1.159	.870	1.416	.905	.652
	.979	.772	.397	.136	.436	.056	.386	.789
	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
Kolmogorov-SmirnovZ	1.344	.596	1.344	1.136	.939	.587	.465	.607
	.054	.870	.054	.151	.341	.881	.982	.855

2) The Text of T

The index variables following the normal distribution the normal distribution, like X1 to X7 ,X9 to X20, X21 to X26 ,were selected, and these data were matched and tested by T-text. As for two groups' data of every variables, choosing descriptive statistics like average value and standard deviation between 2011 to 2013. Comparing the difference of the average value in two groups index variables between ST companies and non-ST companies , whether they have significant different and choosing the index having significant financial crisis to contribute next model. The null hypothesis of this test H0: there is no significantly different between financial crisis companies and normal companies. The significance level is 0.05. The result can be seen from the T-text of matching sample, the significance level of X4,X7,X11 to X15,X18,X23,X25 and X26 was lower than 0.05, so the index variables of the financial crisis companies and normal companies were different significantly. The index which were tested by T and had significant financial crisis will be selected by next index.

Table 4 The T-text of matching sample

Variable	Difference In Pairs			t	Sig.
	Mean Value	The Difference of the 95% Confidence Interval			
		Lower Limit	Upper Llimit		
X1	-.791316083	-2.489899699	.907267532	-1.025	.327
X2	-.003358333	-.338814592	.332097925	-.022	.983
X3	.077320667	-.168128767	.322770100	.693	.502
X4	.059767667	-.201584753	.321120086	.403	.045
X5	.913659083	-6.132278256	7.959596423	.285	.781
X6	-.003791167	-.157565460	.149983126	-.054	.958
X7	-.161363750	-.309671824	-.013055676	-2.395	.036
X9	3336.295739000	-3921.608070358	10594.199548358	1.012	.333
X10	-.118693500	-.291332755	.053945755	-1.513	.158
X11	-1.063195917	-14.307717075	12.181325242	-.177	.063
X12	-.12594500	-.25467684	.00278684	-2.153	.044
X13	-7.287147083	-14.759580599	.185286432	-2.146	.045
X14	-.747950250	-1.261922389	-.233978111	-3.203	.008
X15	2.937584333	-4.001064960	9.876233627	.932	.031
X16	-4.023139333	-22.091375356	14.045096690	-.490	.634
X17	3.348462417	-7.219376589	13.916301423	.697	.500
X18	.559597417	-1.328630396	2.447825230	.652	.048
X19	-.153664583	-.456392954	.149063787	-1.117	.288
X20	.559597417	-1.328630396	2.447825230	.652	.528
X22	32.789857833	-30.113286310	95.693001976	1.147	.276
X23	7.388700083	-1.796137300	16.573537467	1.771	.037
X24	3.940427636	-2.025913049	9.906768322	1.472	.172
X25	.132291500	-.124821744	.389404744	1.132	.022
X26	.048288083	-.135236220	.231812387	.579	.045

3) Correlation analysis

There is a linear correlation the initial index. Therefore, this paper makes a simple correlation analysis among the above selected financial indicators. As shown in Table 5

Table 5 Correlation Test

	X_4	X_7	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{18}	X_{23}	X_{25}	X_{26}
X_4	1	-.07	-.72	-.438*	-.227	-.427*	.385	-.166	-.030	.019	-.213
X_7	-.069	1	.791	.034	.515*	.437*	-.27	.028	-.068	.369	.329
X_{11}	-.72	.791	1	.287	.343	.469*	-.172	-.094	.455*	.243	.357
X_{12}	-.438*	.034	.287	1	.132	. 10*	-.16	.201	.003	-.010	.043
X_{13}	-.227	.15*	.343	.132	1	.752**	-.28	.126	-.059	.701	.501*
X_{14}	-.427*	.437*	.469*	. 10*	.752**	1	-0.9	.176	-.013	.118	.296
X_{15}	.385	-.27	-.172	-.157	-.281	-0.89	1	-.240	.017	-.208	-.373
X_{18}	-.166	.028	-.09	.201	.126	.176	-.24	1	-.264	.174	.160
X_{23}	-.030	-.07	.455*	.003	-.059	-.013	.017	-.264	1	.330	.370
X_{25}	.019	.369	.243	-.010	.701	.118	-.21	.174	.330	1	.875**
$X26$	-.213	.329	.357	.043	.501*	.296	-.37	.160	.370	.875**	1

In this correlation analysis, variable correlation coefficient as high as 0.72 between X_{11} and X_4 , at the same time variable correlation coefficient as high as 0.791 between X_{11} and X_7 ,we can conclude that X_{11}, X_4, and X_7 were highly correlated and eliminate X_{11} ; correlation coefficient between X_{14} and X_{15} is 0.89, which is highly correlated, and then further analyze the relationship between two variables and the rest, according to smaller the principle of index correlation ,we exclude X_{14}. In the same way, we exclude X_{12}、 X_{15}、 X_{25} and X_2.

After processing, the correlation of X_4、 X_7、 X_{13}、 X_{18} and X_2 is weak, therefore this article use these five variables to build Logistic model.

3.3 Logistic Financial Crisis Early-warning Model

In the Logistic Regression Early-warning Model, there are two explained variables respectively set as 0 and 1. "0" represents the company did not have a financial crisis, and "1" represents a financial crisis. P is used to represent the probability of financial crisis facing listed real estate company, and this paper adopt the ultimately determined five indicators to establish the Logistic Regression Early-warning Model. The function of probability:

$$p = \frac{e^{\alpha+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_m x_m}}{1+e^{\alpha+\beta_1 x_1+\beta_2 x_2+\cdots\beta_m x_m}}$$

Input data of the 5 variables mentioned above from estimated sample composed of 4 companies with financial crisis and 4 normal companies into SPSS statistical software, and conduct regression analysis by Logistic regression procedures of SPSS statistical software.

Through the comprehensive inspection on the model coefficients, we can see that the chi-square value of this early-warning model is 33.271, and the probability is 0, much less than the significance level of 0.05. Reject null hypothesis, namely the linear relation between each independent variable and P is very significant and it's reasonable to adopt this model; The "negative 2 times log likelihood "of this early-warning model is very much small, demonstrating the high degree of fitting of this model. At the same time, Nagelkerker2 value of 0.857 is close to 1, which reflects the explanation degree of the equation on explained variable deviation, the closer it's to the 1, the higher the fitting degree of the equation is. So the regression early-warning model is :

$$p = \frac{e^{10.588-1.469 x_4 -8.899 x_7 +2.014 x_{13} -7.905 x_{18} -5.417 x_{23}}}{1+e^{10.588-1.469 x_4 -8.899 x_7 +2.014 x_{13} -7.905 x_{18} -5.417 x_{23}}}$$

4. The Validity Test Of Logistic Financial Crisis Early-warning Model

There are 8 research samples, the financial crisis companies and financial normal companies are each 4, the ratio is 1 to 1. In the financial forewarning model, when it appear this situation that "ST companies being mistaken for the ST companies", or "the ST companies being mistaken for ST", we take 0.5 as Critical value of financial crisis probability. If P is greater than 0.5, the sample is the financial crisis enterprise, and vice versa

4.1 The text of sample group

This paper put the sample company's financial data in 2013, 2012 into the model to determine the accuracy of the forewarning model. Prediction results are shown in **Table** 7 and **Table** 8.

Table 7 Sample group classification results- 1 years before the financial crisis(2013)

Observation			Forecast		
			Whether there is a financial crisis		%
			0	1	
Step 1	Whether there is a financial crisis	0	3	1	75.0
		1	1	3	75.0
	%				75.0

Table 8 Sample group classification results- 2 years before the financial crisis(2012)

Observation			Forecast		
			Whether there is a financial crisis		%
			0	1	
Step 1	Whether there is a financial crisis	0	2	2	50.0
		1	1	3	75.0
	%				62.5

From the model judging results of sample group of 1 year before its financial crisis, we can see that among the 4 normal companies, 1 company has been mistaken for ST company, with 75% accuracy and 25% misjudgment rate; among the 4 ST companies, 1 company has been mistaken for non-ST company with 75% accuracy, the predictive effect being somewhat ideal. However, the predictive accuracy of 2 years before the crisis is lower than that of 1 year before the crisis. The judging accuracy of 2 years before the crisis for ST company is relatively high, being 75%. It can be found that as time passed, the financial risk is becoming greater, and the financial situation is getting worse. The closer it's towards the year which produces financial risk, the more accuracy which the Financial Crisis Early-Warning Model has.

4.2 The text of prediction group

To further test the predictive ability and applicability of the Financial Crisis Early-Warning Model, it is necessary to extract a prediction group and predict the financial situation of the group. Adopt "random sampling method" to select prediction group. As to the selected 35 healthy sample firms, conduct statistical calculations by the financial data of 2011 , and then make predictions on whether the financial crisis will occur in 2012 or not; in order to expand the selection range and quantity of prediction group of ST company, select 20 companies listed under special treatment respectively in year 2011, year 2010, year 2009, year 2008 and year 2007, conduct statistical calculations by the financial data of 1 year before the ST to determine whether it's be set with a financial crisis. The random decimation ratio between health companies and companies with

financial crisis is 1 to 0.571. The judging results of the Early-Warning Model are shown in Table9.

Table 9. The classification results of prediction group

Observation			Forecast		
			Whether there is a financial crisis		%
			0	1	
Step 1	Whether there is a financial crisis	0	30	5	85.7
		1	6	14	70.0
	%				80.2

From the model judging results of prediction group, we can see that among the 4 normal companies 5 company has been mistaken for ST company, with 85.7% accuracy and 14.3% misjudgment rate; among the 4 ST companies, 6 company has been mistaken for non-ST company with 70% accuracy and 30% misjudgment rate. In general, prediction accuracy of Financial Crisis Early-warning Model is 80.2%, it has a high credibility for real estate listed corporation and this will help the management of the company's financial system.

5. Conclusion

This paper takes real estate listed companies as the research object, establishes Logistic Financial Crisis Early-warning Model, and carries on inspection. The results show that: the results of financial crisis early-warning model basically conform to the actual situation. Its forecast accuracy of financial crisis is 80.2%, so this model has good forecast ability. After conducting K-S test, T test and correlation test on the initial 26 financial indicators, it's ultimately determined to take five financial variables including asset liability ratio X_4, total assets turnover X_7, sales net profit ratio X_{13}, hedging and proliferating ratios X_{18} and operating profit cash net value X_{23} as independent variables of Logistic model. These five financial indicators can better reflect the financial situation of real estate listed companies. From the evaluation results of the model, we can see that when cut value is 0.5, the accuracy of Logistic model predicting the totality reaches 80.2%, for non-ST companies, its forecast accuracy is 85.7%, and for ST companies with financial crisis, its forecast accuracy is 70%. The regression results of the model show that, by this Logistic Model we can effectively predict the financial crisis of real estate listed companies to effectively establish risk early-warning mechanism, and guarantee the competitive advantage of the enterprise.

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