An Empirical Study of the Relationship between Capital Structure and Financial Performance -- Based on Neural Network Analysis

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Abstract

The annual asset-liability ratio and ROE, respectively, as a measure of capital structure and financial performance to 1995-2009 all domestic listed companies in the real estate industry as the research object, are used in empirical research, from the industry perspective on the relationship between capital structure and performance. The empirical results show that: the existence of a long-term stable relationship asset-liability ratio and ROE. This suggests that companies achieve optimal performance and financial performance, capital structure over the years should be considered.

Key Words: capital structure; financial performance; neural network

1 Introduction

Capital structure theory is an important area of modern corporate finance theory, but also the important practical problems of company faced by the financing decision. Its goal is to achieve the maximization of corporate value or performance optimization. Therefore, the impact of research on the performance of the capital structure and capital structure analysis of whether there is optimal, is very important. The performance of a business is always affected by certain factors in the previous year or a few years ago, of course, also be affected by capital structure in previous years,.

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From this perspective, the combination of longitudinal and transverse study the relationship between them has a certain value. Therefore, this article uses the neural network analysis method to study the relationship between capital structure and performance. Since each company is pursuing the company to maximizing value or performance optimization, and on a particular industry, is also true. To the industry as a whole as the object of study is more universal, not because of some special factors affecting the results of individual companies, which will have the whole industry in general reference. Therefore, this paper studies the relationship between capital structure and performance from the industry perspective.

2 Literature Review

In the complicated capital structure theory genre, scholars study on the relationship between capital structure and performance of the main five mainstreams.

The first view is that there is a negative correlation between capital structure and performance. Lu Jingwen, Zhushu Fang (2008), 234 listed companies in our country for the study of the relationship between listed companies' capital structure and corporate performance empirical analysis, the study result: the company's capital structure and corporate performance of listed negatively correlated. Lijia Juan (2010) , 11 listed company's capital structure and performance of the empirical analysis, the result is the relationship between China Aerospace listed company's capital structure and corporate performance also showed a more significant negative correlation. Foreign scholars Jesen, Solberg and Zorn (1992), on the relationship between managers and debt analysis, the results show that the business performance and debt ratio is negatively correlated.

The second view is that: there is a positive correlation between capital structure and performance. Song Li, Zhang Bingbing (2010), on the state-owned holding company in Liaoning Province were analyzed from continuing operations, performance and business results showed a positive correlation between capital structure. Juan, Yang Fenglin (1998), 461 listed companies in Shanghai Stock Exchange for the study, empirical study of its capital structure condition, capital structure and performance studies show a positive correlation. To study the relationship between capital structure and corporate performance, Long Ying, Zhang Jialin (2003) in China's power industry, listed companies as the research object, its empirical research, the results also show a positive correlation between the two. Foreign scholars Masulis (1983) analyzed the relationship between capital structure and corporate performance; enterprise performance level obtained positive correlation between its liabilities conclusions.

A third view is that: between capital structure and performance is independently of each other. Du liWen, Jiang Yong (2009), Shanghai and Shenzhen listed companies are selected for the study, results showed the existence of no significant negative correlation between capital structure and corporate performance. Cheng Taiyou (2004) also made a related study, the results showed that between capital structure and corporate performance relationship is not significant, increase or decrease the asset-liability ratio has little effect on the company's performance.

The fourth point of view: a quadratic linear correlation between capital structure and performance. Lu Jingwen, Zhushu Fang (2008) ,China's listed companies as the research object, select the 234 listed companies from 2003 to 2006 data, the relationship between listed companies' capital structure and performance of the empirical analysis found that the capital structure of listed companies; In addition to corporate performance was negatively correlated, there is a secondary linear correlation.

The fifth point of view: the relationship between the performance of the capital structure and performance between the two on the graph inverted "U" shape. That reached a critical point before the two are positively correlated over the critical point is a negative correlation between the two. Long Ying, Zhang World Bank (2009) ,39 listed companies in Anhui Province as samples to study relationship between capital structure and corporate performance to establish panel data model, the result of the relationship between capital structure and performance of both the performance of the graph was inverted "U" shape. Zhu Haiyan (2010),the 2008 A-share companies in Shandong Province as samples, empirical analysis of the relationship between the two was found, Shandong Province, the capital structure of listed companies and corporate performance inverted "U" relationship.

In summary, the studies on the capital structure and performance between domestic and foreign divergent conclusions. Between them there is no uniform conclusion. As the impact of the social environment and time, at different times, different backgrounds and different regions, select a different research methods and indicators to study the relationship between performance and capital structure will there is a big difference. However, the above literature, mostly through research sectional data to data from a year of study, that is, from a horizontal perspective, explore the relationship between capital structure and performance, which mainly reflected the relationship between the static aspects. This statistical method allows conclusions timeliness affected, yet few scholars have come from a longitudinal study of the relationship between capital structure and financial performance, and that is, long-term relationships between them, the last time the variable itself is also considered the impact come. In general, the current capital structure will be affected prior period capital structure, or performance is also affected by the capital structure of the previous period. At the same time, the causal relationship between capital structure and performance is not necessarily occur simultaneously, in the process, there may be a lag time. Thus, long-term relationship between research performance and capital structure is particularly important.

3 Study Design

3.1 indicator selection

Capital structure refers to the debt capital and equity capital ratio between corporate funding sources, taking into account the volatility of the market value of equity capital and capital structure indicators of instability at market value, So this article chooses the book asset-liability ratio of the usually used in empirical studies (D/A) as the independent variable. Performance indicators reflect the operating margin, ROE, ROA, EPS, etc., but to some extent, these indicators have equivalent effect. If these indicators are chosen, may lead indicators repetitive action will result from the relevant variables affect the empirical results. Therefore, we selected reflect the value of the company's equity ROE (ROE) as the dependent variable, because it can reflect the level of corporate investment income of its own funds. Generally, the higher the ROE, the ability to gain access to the company's own capital, the stronger, the better operational efficiency, corporate investors, the higher the level of assurance creditors. It is also a wide application range, versatility, not sector specific, comprehensive evaluation of international business at a very high utilization rate indicator.

3.2 Sample data and Processes

Empirical studies of domestic data processing in the past, removed a negative profit enterprise or corporate book assets is negative, generally ST and PT companies were deleted. This treatment, it makes empirical findings occurring in the capital structure of survivorship bias, making the firm's capital structure as a whole is low. Taking into account the factors affecting the industry brings, we use the 1995 to 2009 data corresponding to all listed companies in China's real estate industry, the use of SPSS software and dealt with accordingly. Since this study is a long-term relationship between the industry performance and capital structure, and therefore need to calculate the corresponding index data annually. Asset-liability ratio and ROE here is the annual asset-liability ratio and ROE in real estate. Because different companies gearing ratio and ROE in the industry weights are not the same, simply all the company's assets-liability ratio and ROE plus industry asset-liability ratio and ROE will get a total average after The deviation, so this article is calculated using the following method: Industry gearing ratio (DA) = total amount of the trade liabilities / total assets in the industry
Industry ROE (ROE) = the total net profit of the industry total / average net assets of the industry

Among them, the annual trade balance ratio denoted as DA, the annual industry ROE recorded as ROE, calculated data of the two indicators are shown in Table 1.

Table 1

Years	ROE T1	Asset-liability ratio X1
1995	0.1294	0.569 8
1996	0.0966	0.5152
1997	0.075 4	0.480 3
1998	0.0313	0.492 7
1999	0.064 2	0.503 5
2000	0.0708	0.4911
2001	0.031 6	0.516 9
2002	0.040 6	0.540 1
2003	0.039 5	0.5635
2004	0.0373	0.5889
2005	0.053 8	0.6036
2006	0.0970	0.626 7
2007	0.1464	0.6343
2008	0.111 4	0.637 7
2009	0.1341	0.6544

4. Empirical Analysis

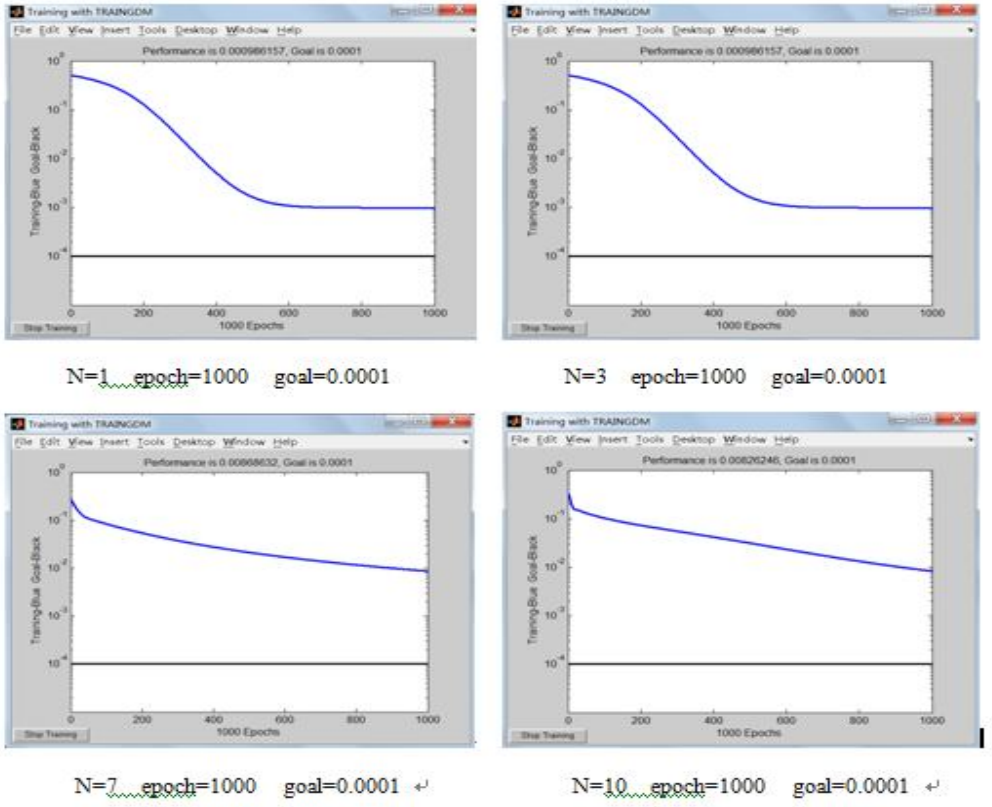
4.1 BP neural network

BP artificial neural network model commonly used error back propagation algorithm, first of all, when given an input mode, it transfers from the input layer to the hidden layer node and then transferred to the output layer node after node processing the output layer to produce a output mode; If you do not get the expected results, then transferred to the back-propagation process, the cycle of alternating training until the error output is reduced to the range one would expect, the learning process is over the network. At this point the new sample input has trained network, you can get the desired output values.

4.2 Modeling

4.2.1 To Determine the Number of Hidden Layer Neurons

Improve the accuracy of network training can increase the number of neurons in the hidden layer of a way to get through. Specific design, is often by different neurons for training contrast, and appropriately with a little margin. Let the number of hidden layer neurons named N, the number of learning named epoch, the error accuracy named goal, Pictured iterations epoch = 1000, error precision goal = 0.0001, the different number of hidden layer neuron network training map. When the number of hidden layer neurons N = 1 or 3, the function approximates error value. Therefore, to determine the hidden layer 5 or less, in this context, this paper to determine the optimal number of nodes in the hidden layer with comparative law.



The figure for the number of hidden layer neurons network training

4.2.2 The Number of Learning and Learning Rate Adjustment

The number of learning termination (epoch) is controlled learning conditions. General setting a larger number of learning, can make the network Multiple cycles learning and training, in order to achieve a more stable network structure. But setting too large number of learning, sometimes it causes the output error increases. Frequency error accuracy than the impact of learning acts on the network training results more significantly.

The learning rate (lr), is the right decision every training cycle arising from changes in the value of the amount. Large learning rate may result in an unstable system;

Small learning rate results in a longer training time, may converge very slowly, cannot guarantee error value network error surface out of the trough and eventually become the smallest error value. Generally, learning rate is selected in the range of 0.01 - 0.8, tend to select a smaller learning rate to ensure stability.

Learning time time, are learning neural network model in general, due to the number of errors by the accuracy and learning Impact, and a large amount of computation, the learning process needs to take a lot of time, so the learning time without restriction.

Training error precision goal, is to control the conditions of the training ends. General Setting's smaller error precision, you can make too many cycles network learning and training, in order to achieve a more stable network structure. But in some cases set too small error precision, will make the output error increases.

Momentum coefficient between 0-1, when is 0, the change in weights and thresholds on the resulting negative gradient calculated To determine the degree; When 1, the change in weights and thresholds is equal to the amount of change in their moment before. Since the input layer nodes identified as 5, through continuously adjusted by the number of neurons in hidden layer with a different number of nodes in the hidden layer combinations trained network average relative error rate test samples obtained as shown in the following table:

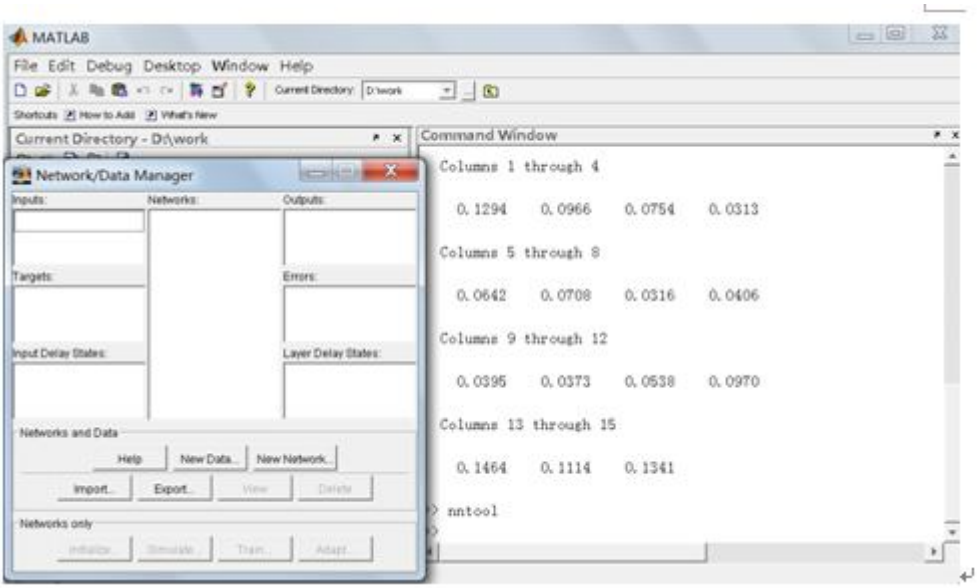
4.3 Training Steps are as Follows

4.3.1In the command window, type nntool call Neural Network Toolbox

The gearing ratio of 1995-2009 as the BP neural network input matrix X1, the 1995-2009 annual ROE target matrix T1 BP network, as follows:

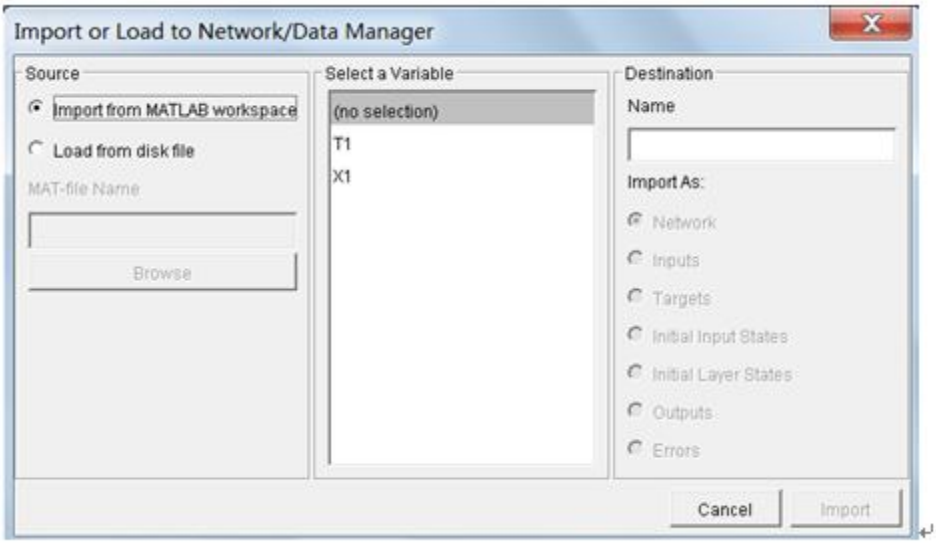
X1 = [0.5698 0.5152 0.4803 0.4927 0.5035 0.4911 0.5169 0.5401 0.5635 0.5889 0.6036 0.6267 0.6343 0.6377 0.6544]

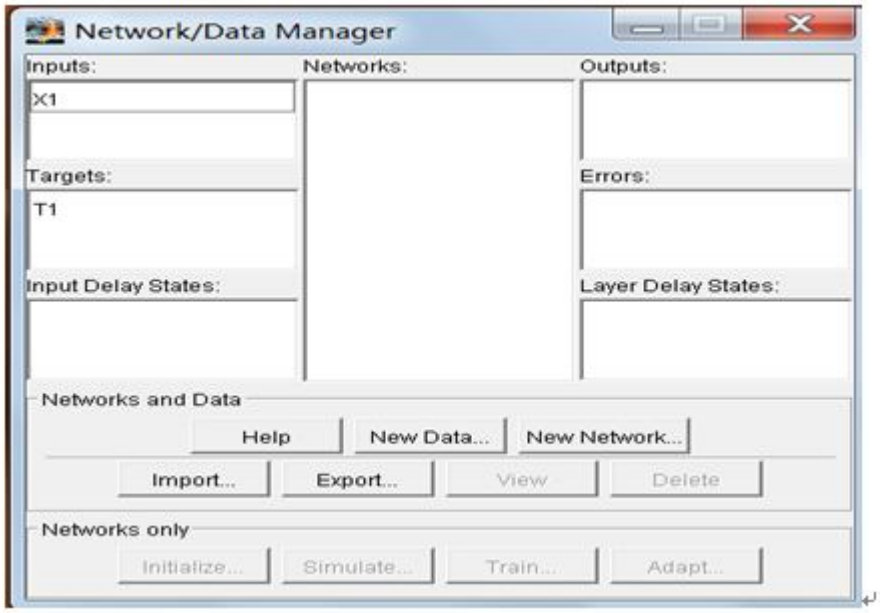
T1 = [0.1294 0.0966 0.0754 0.0313 0.0642 0.0708 0.0316 0.0406 0.0395 0.0373 0.0538 0.0970 0.1464 0.1114 0.1341]



4.3.2 Imported Inputs and Target Values

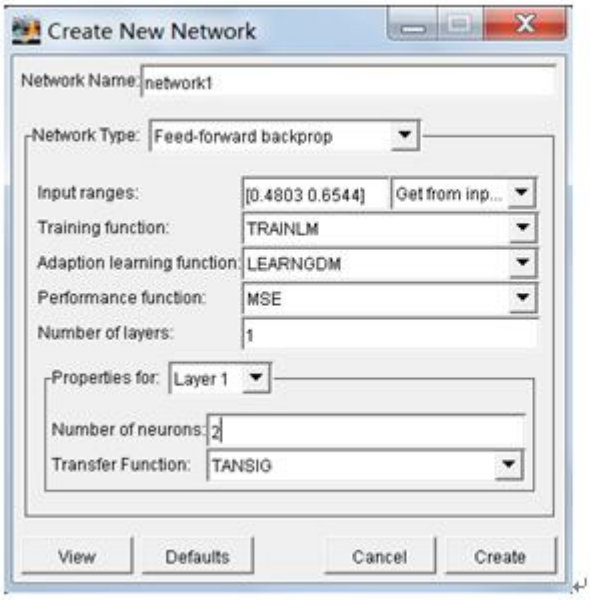
Respectively, the input vector and target output added to the corresponding window [Inputs] and [Targets];

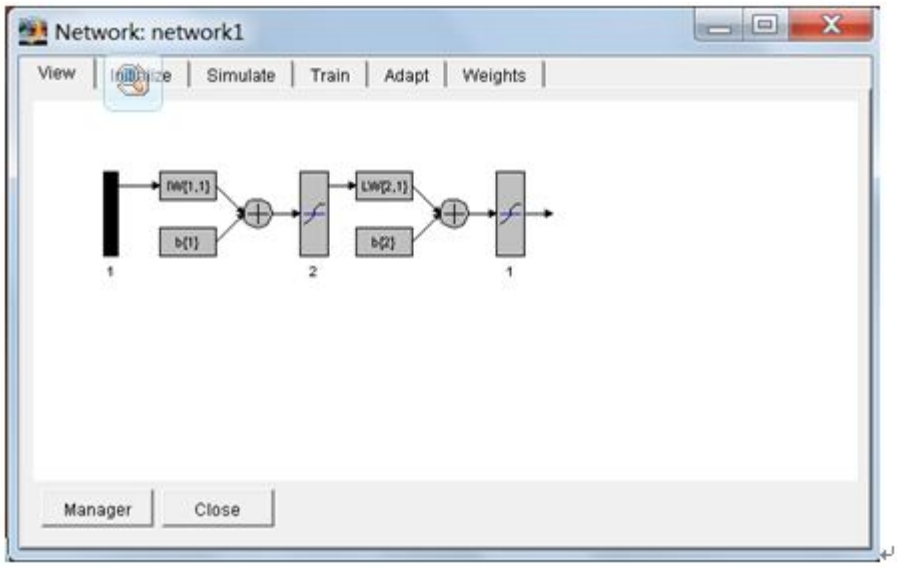




4.3.3 Creating a Network

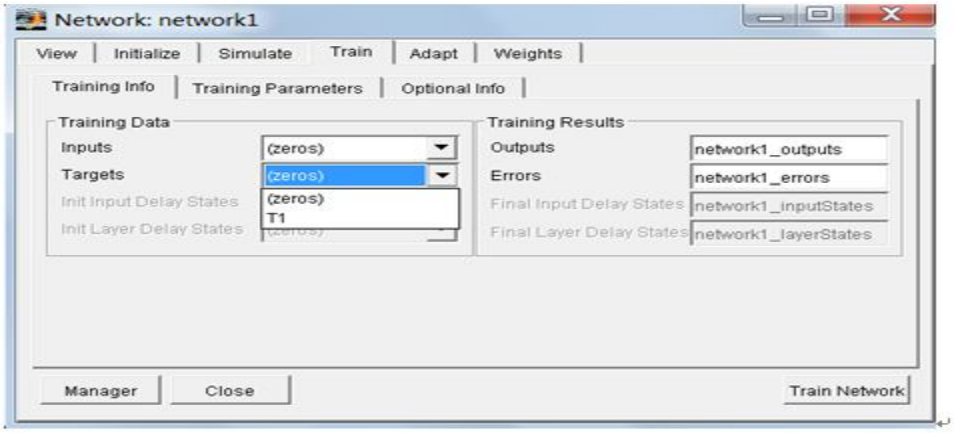
Determine the number of hidden layer neurons, The improvement of accuracy of network training, can increase by a hidden layer neurons number method. When specific designing, the training is often based on different number of neurons, and properly add some allowance. The following diagram select the number of hidden layer nodes is 2, activation function of hidden layer nodes is TANSIG function, the output layer node functions PURELIN.

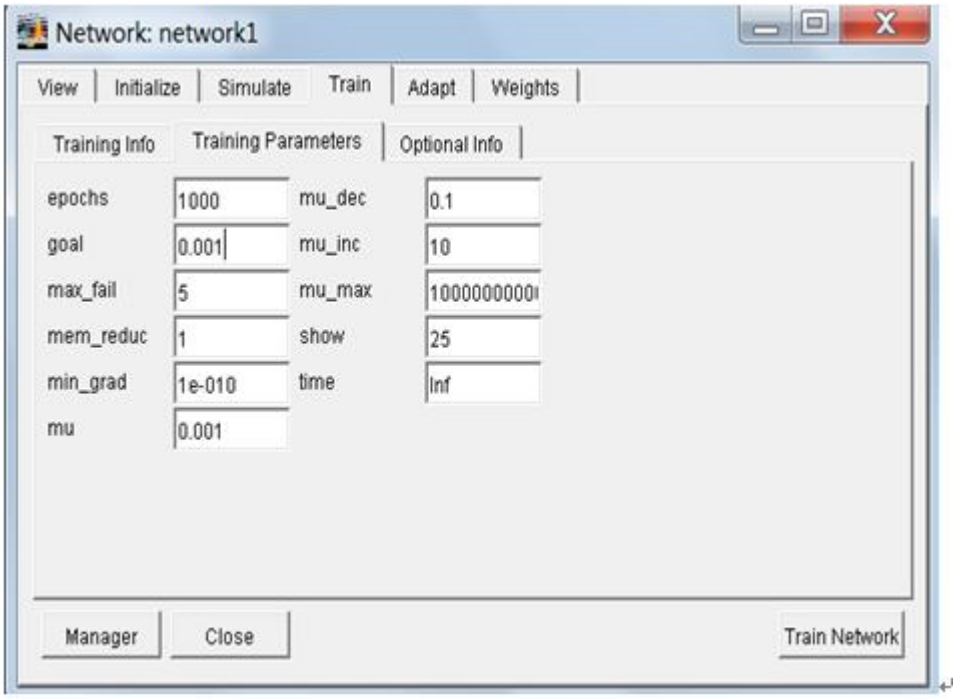




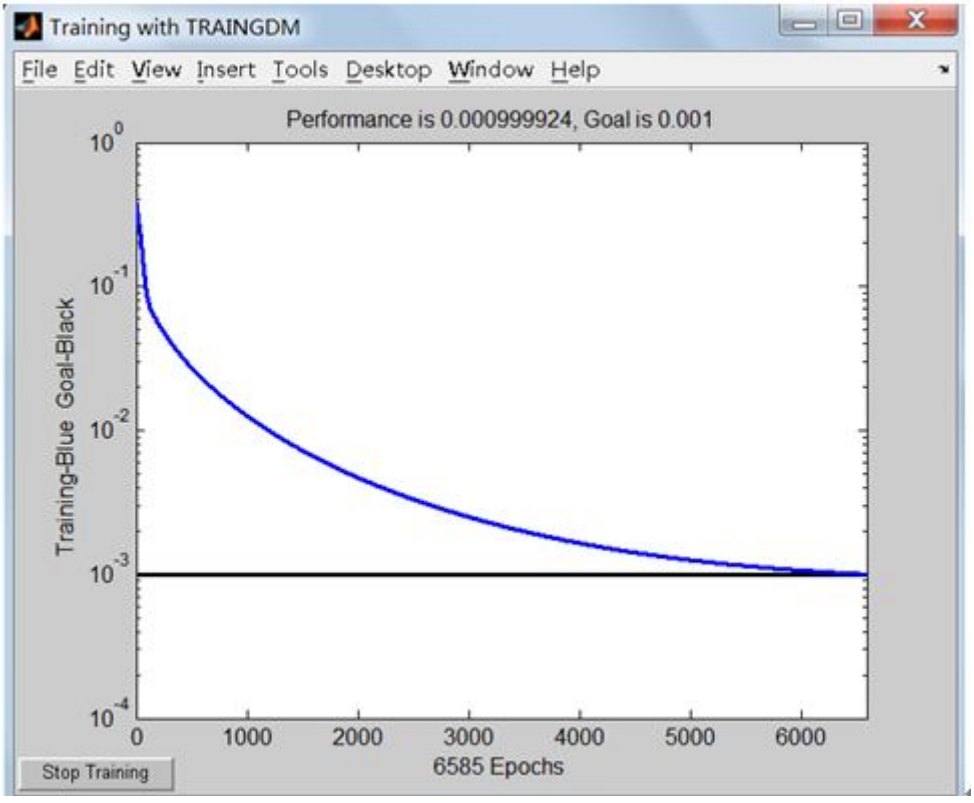
4.3.4 Training Network

Select the input value and the target value of the training data



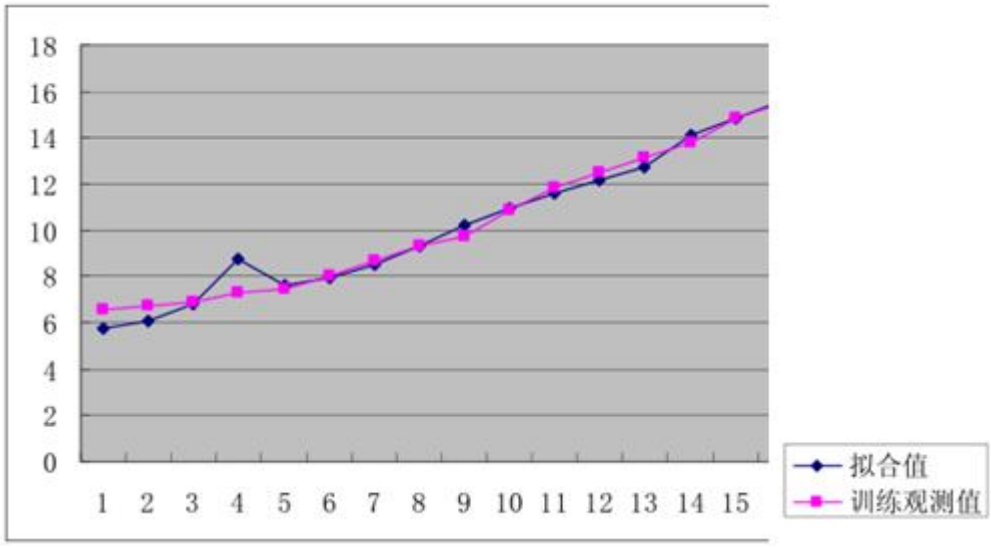


4.3.5 Click Train Network, Output Training Map



N = 4 epoch = 10000 goal = 0.0001

Output training sample error, restore the simulation value can be calculated absolute and relative errors. Because the paper discusses the correspondence between the capital structure and financial performance between network training to fit the observed values of the training is worth a line chart, model fitting better, as shown below:



Network training to fit the observed values worthy of a line chart and training

5. Conclusion

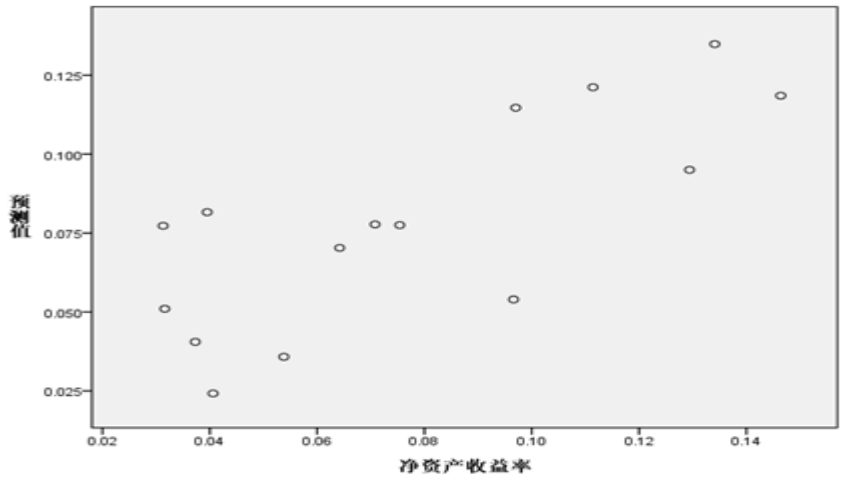
In this paper, the real estate industry as the research object, By studying the industry, capital structure and performance of a long-term relationship with industry asset-liability ratio and return on net assets as the measure and formation of time series data, based on the analysis of industry, the relationship between capital structure and performance to the following conclusion:

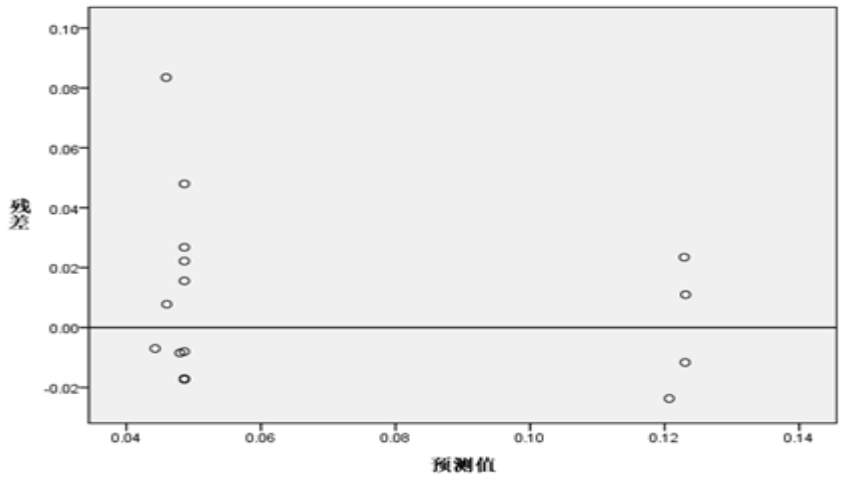
Industry asset-liability ratio and ROE is there between the capital structure and performance long-run equilibrium relationship, asset-liability ratio increasing will promote increased ROE. This will enable the industry to improve performance, but also to enhance the profitability of that capital. Due to the increase in the gearing ratio means that companies take advantage of the ability to finance operating activities improved creditors, which provides a good platform for the increase in gross profit, and therefore will lead the company's profitability increased.

Research methods and the results of theoretical research have some significance to the capital structure, while the companies work in practice how to determine the capital structure has a certain reference value. This paper confirms the capital structure and performance with the correlation between capital structure and may have a lag effect on performance. Therefore, an enterprise to enhance profitability and maximize corporate value, then only need to consider the impact of capital structure, but also the need to consider the capital structure over the years.

Attached: BP neural network model built in SPSS

(1) In analyzing the drop-down menu, select the type of neural network and;
(2) in the variable option, select the dependent variable T and covariates X1;
(3) Set the percentage of training samples and test samples for each set of initial parameters;
(4) repeated testing, adjusting various parameters, output optimal network structure results predicted values and residual plots;





References

Lu Jingwen, Zhu shufang. Empirical Study on Capital Structure and Corporate Performance [J]. Accounting Communications, 2008 (11).

Song Li, Zhang Bingbing. State-owned Holding Company Cpital Structure and Corporate Performance Study [J]. Journal of Accounting, 2010 (3).

Li Jiajuan. China's Space Types of the Capital Structure and Corporate Performance of Listed Companies Empirical Research [J]. Industrial Technology Economy, 2010 (3).

Sun Jingshui. Intermediate Econometrics [M]. Shanghai University of Finance and Economics Press, 2009.

Zhang Li. The RMB Real Exchange Rate Fluctuations and the Empirical Study of Currency Substitution [J]. Journal of Financial Research, 2010 (2).

Du Liwen, Jiang Yong. Correlation Between Capital Structure and Corporate Performance of Listed Companies Empirical Research [J]. Journal of Accounting, 2009 (9).

Zhang Junhua. Capital Structure, Capital Structure and Corporate Performance [J]. Journal of Accounting, 2011 (4) : 78-80

Guo Shanshan. The Gem Companies Financial Performance Evaluation System of Research [J]. Journal of Modern Business, 2011 (8) : 190-190

Chai Yuke. Empirical Research on Relationship Between Capital Structure and Growth of Listed Companies, Based on the Analysis of the Listed Companies of Henan Province [J]. Journal of Commercial Age. 2011 (23) : 73-74

Bai Chaoli. Relationship Between Capital Structure and Corporate Performance Review [J]. Journal of Accounting Friend. 2011 (9) : 79-81