An Application of Combination Prediction Model and Macroscopic Analysis in Predicting Asset-liability Ratio

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Abstract: *This paper analyzed the significance of predicting the asset-liability ratio and the importance of choosing macroscopic data to formulate a model. It used GMDH predicting model. AC predicting model. ARCH model with macroscopic data and combination predicting model to predict the asset-liability ratio of Sichuan industrial enterprises. It analyzed and authenticated the results of the four predicting models. At last. it evaluated the effect of the four models in predicting the asset-liability ratio.*

Key Words:

GMDH Model; AC Model; ARCH Model; Combination Predicting Model; Asset-liability Ratio

1 Introduction

The asset-liability ratio reflects the size of assets proportion offered by creditors in the whole assets of enterprises. and it also reflects the risk procedures of offering enterprises credit funds by creditors. and it reflects the management and business ability of enterprises by borrowing debt[1]. If the production and operational capability of enterprises is good and the operating condition is at a good state. the asset-liability ratio will be at a higher level. On the contrary. the asset-liability ratio will be relatively low. The prediction of asset-liability ratio is an important means for enterprises to predict its development potential. and it is also one of the important methods for government to master regional macroeconomic situation. In so many prediction methods. GMDH predicting model and AC predicting model in Self-organizing Data Mining theory and Method have been a hotspot in macroeconomic prediction research. National Bureau of Statistics formally introduced prosperity survey methods to national statistical report systems. So prosperity data is quite important for predicting macroeconomic indicators[2][3].

This paper used GMDH predicting model. AC predicting model. ARCH model with prosperity data and combination predicting model to predict the asset-liability ratio of Sichuan industrial enterprises. It analyzed and authenticated the results of the four predicting models in order to use more appropriate predicting model to predict macroeconomic indicators.

2 Predicting Model and Empirical Analysis

5.1 GMDH auto-regressive prediction model

The earliest auto-regressive data mining-Group Method of Data Handling was first put forward by A.G.Ivakhnenko academician from Ukraine Academy of Sciences. GMDH auto-regressive prediction model was produced by the combination of GMDH algorithm thought and auto-regressive thought. GMDH predicting method only uses predicted indicator data which doesn't include other indicator data. It takes the historical data of predicting indicator as input variables. and it screen models by using external criterion until obtaining an optimal model.

There are seven implementation steps in GMDH auto-regressive algorithm[4][5][6].

Let Sichuan enterprises asset-liability ratio data from the first season of 2002 to the third season of 2006 to be the training set of this model. which includes 19 data points. And the fourth season of 2006 to the fourth season of 2007 to be the detection set of predicting results. Use GMDH model to predict and use Knowledge Miner software to deal with data and get predicting model y_1 : y_1 = 1.000e+ y_1 (t-1) + 9.999e+1. The predicting results are shown in Table 1.

2.2 AC model algorithm

AC (Analog Complexing) algorithm is Analog Complexing merging algorithm. It was put forward and developed by Lorence. AC algorithm can be taken as a sequence model recognition method of predicting. clustering and classifying complex objects. Generally speaking. AC algorithm includes three steps:

1) the production of patterns to be selected: To a given m-dimensional sequence with N observed value $x_t = \{x_{1t}, \cdots, x_{mt}\}(t = 1,2,\cdots N)$. the definition of a pattern is from the i row with k-row table $P_k(i)$. and this k is called the length of the pattern $(i = 1,2,\cdots, N-k+1)$.

2) the change of patterns to be selected;

Let $x_{l,i+j} = a_{0l}^i + a_{1l}^i x_{l,i+j}, j = 0,1,\cdots,k-1; i = 1,2,\cdots,N-k+1; l = 1,2,\cdots,m.$. parameter a_{0l}^i can be explained to be the state difference between referenced pattern and similar pattern $P_k(i)$. and parameter a_{1l}^i can be explained to be some uncertain factors.

3) the choose of patterns to be selected: The main purpose of this step is recognizing the similarity between patterns. We call the similarity as pattern similarity. In order to measure the similarity of a to-be-selected pattern $P_k(i)$ on referenced pattern P^R which has been changed as step (2). it need to measure the distance between k observed values with m system variables in the two patterns.

Let Sichuan enterprises asset-liability ratio data from the first season of 2002 to the third season of 2006 to be the training set of this model. which includes 19 data points. And the fourth season of 2006 to the fourth season of 2007 to be the detection set of predicting results. Use AC model to predict and use Knowledge Miner software to deal with the data and the results of this predicting model are shown in Table 1.

2.3 ARCH model theory and the steps of modeling

ARCH model is called autoregressive conditional heteroscedasticity. It was put forward by Engle in 1982. Autoregressive Conditional Heteroskedasticity model is very important in the study of nonlinear time series. It can take all the available information as conditions. and use some auto-control way to reflect the difference of variance. ARCH model is usually used in modeling random disturbance term of agent model. It can extract the information of residual effectively. and it offered a method which uses past error to explain the future predicting error. This paper analyzed the correlation between prosperity data and asset-liability ratio data by analyzing the prosperity index and asset-liability ratio data, and then used prosperity data as independent variables to determine their correlation coefficients. And then it establish model to predict asset-liability ratio.

The several steps of the process of ARCH predicting model based on prosperity data in Sichuan enterprises asset-liability ratio predicting are as follows:

(1) the correlation analysis between asset-liability ratio and enterprises prosperity data;

(2) using obviously correlative variables from step (1) to establish corresponding ARCH model;

(3) the detection and analysis of established model;

(4) using the established model to predict asset-liability ratio and make some analysis.

This paper chose the prosperity index indicators which have high correlation with asset-liability ratio from the 1st season of 2002 to the 4th season of 2007 to establish ARCH model. In order to eliminate the influence of some factors such as price index, this paper computes the original data to ratio data, and uses the ratio data to make correlation analysis. The prosperity data this paper chosen were as follows: entrepreneur confidence index, enter price prosperity index, the rate of increase of GDP index, production prosperity index, capital prosperity status, enterprises financing prosperity status.

According to the four steps of ARCH analysis, using SPSS statistical software to establish ARCH model on asset-liability ratio [8]. and the results of ARCH model are shown in Table 1.

2.4 Combination predicting model

Combination predicting is a method that combinates several different predicting methods properly by using the information offered by these methods comprehensively in order to improve the prediction accuracy. Professor C.Granger, who is the 2003 Nobel Laureate in economics and from university of California in USA, evaluated on combination predicting model that combination predicting model offers a simple and practical method which may produce better forecast results.

Suppose that there are n predicting models established to predict the asset-liability ratio (in this paper n=3). The forecast value on goal variable of each model is respectively $f_1(t), f_2(t) \cdots f_n(t)$, and then the combination predicting

model is $f(t)=\sum_{i=1}^{n}\omega_i f_i(t)+c$. Where c is a constant, $\omega_1,\omega_2,\omega_3,\cdots\omega_n$ are the weights of the predicting value of each prediction method in combination predicting model. The determination of constant c and the weights $\omega_i(i=1,2,...,n)$ is according to the principle of least square method.

Let the prediction results of GMDH auto-regressive prediction model, AC model, ARCH model apply into the combination predicting model, and then use SPSS software to solve this problem to get the value of constant c and the weights $\omega_i(i=1,2,...,n)$. The values are as follow: .

$$c=80.475553,\omega_1=-0.209209,\omega_2=-0.128178,\omega_3=0.046507$$

Put the value of parameters into the combination predicting model (h) and get the prediction results in Table 1.

2.5 Predicting results

Table 1: The results of the four prediction models

	Actual value (%)	GMDH Predicting		AC Predicting		ARCH Predicting		combination predicting	
		Predicting value	Predicting error	Predicting value	Predicting error	Predicting value	Predicting error	Predicting value	Predicting error
the 4th season of 2006	62.26	62.92	0.66	62.44	0.17	64.29	2.02	62.29	0.03
the 1st season of 2007	62.06	63.02	0.96	63.09	1.03	61.39	-0.66	62.05	-0.01
the 2nd season of 2007	62.58	62.50	-0.08	62.78	0.19	62.94	0.35	62.27	-0.31
the 3rd season of 2007	62.21	62.47	0.26	62.39	0.18	62.28	0.06	62.30	0.09
the 4th season of 2007	62.07	62.44	0.36	63.04	0.97	62.99	0.92	62.25	0.18

Data resource: Statistical Bureau of Sichuan Province

3 The results analysis of each prediction model

Each of the four prediction models has its own character in predicting the asset-liability ratio of Sichuan enterprises. And the forecast results of each prediction model are in Table 2.

Table 2: the prediction effect comparison of several prediction models

	the 4th season of 2006	the 1st season of 2007	the 2nd season of 2007	the 3rd season of 2007	the 4th season of 2007	absolute average error	relative average error
GMDH prediction error	0.6614	0.9653	-0.0859	0.2627	0.3663	0.4683	0.7524%
AC prediction error	0.1773	1.0336	0.1981	0.1830	0.9725	0.5129	0.8241%
ARCH prediction error	2.0288	-0.6687	0.3572	0.0673	0.9186	0.8081	1.2985%
Combination prediction error	0.0349	-0.0027	-0.3097	0.0905	0.1826	0.1241	0.1993%

From Table 2, in the prediction of the asset-liability ratio of Sichuan enterprises, the combination model got the best prediction effect. And the absolute average error between its forecast value and its actual value is only 0.1241, and the prediction error of each year keeps at a 0-0.3 fluctuation level, and the relative average error is only 0.1993%, which conveyed that combination prediction model had high prediction accuracy in predicting the asset-liability ratio of Sichuan enterprises.

The effect of GMDH prediction model is worse than combination prediction. The absolute average error is 0.4683, and the relative average error is only 0.7524%. So GMDH is one of the proper methods to predict the asset-liability ratio of Sichuan enterprises.

AC prediction model and GMDH prediction model are both self-organization data mining models. Their similarity in predicting the same group of data was proofed in this paper. From Table 2, the absolute average error of AC prediction model is 0.5129, and the relative average error is 0.8241%, the relative average error is fluctuated in 1% level. So it conveyed that the two self-organization data mining models both had effective results in predicting the asset-liability ratio of Sichuan enterprises.

From Table 2, the effect of ARCH prediction model based on prosperity data in this paper is not as good as other methods. This had a different conclusion with other scholars on GDP[7], the industrial value added etc. prediction using ARCH prediction model based on prosperity data. The reason may be that the macroeconomic indicators such as GDP, the industrial value added etc. are impacted by macroeconomic policies and macroeconomic development trend greatly. The prosperity index is gained by surveying enterprisers on the macroeconomic policies and macroeconomic development trend. But the asset-liability ratio is a relative indicator. Its impaction of macroeconomic policies and macroeconomic development trend is not great as absolute indicators.

To sum up, in predicting macroeconomic indicators we should choose proper prediction models according to the significance of indicators to get satisfactory prediction effect. And then the prediction can help government and related departments to make policies and adjust policies.

4. Conclusions

This paper used GMDH predicting model, AC predicting model. ARCH model with prosperity data and combination predicting model based on least square method and chose the data from the 1st season of 2002 to the 4th season of 2007 to predict the asset-liability ratio of Sichuan industrial enterprises and authenticate the results.

The results of empirical research showed that:

1) Combination prediction model had high prediction accuracy and good prediction effect on predicting the asset-liability ratio of Sichuan enterprises, which is the same with other scholars' research on combination prediction in predicting economic indicators such as GDP[7] etc. This conveyed that combination prediction model is a relatively better model in economy prediction.

2) We should choose different prediction models according to different economic indicators. The use of ARCH prediction model with prosperity data in this paper showed that the effect of its application in predicting the asset-liability ratio of Sichuan industrial enterprises is not ideal, but its prediction effect on GDP[7] is quite good. So it's necessary to choose different prediction models according to different economic indicators.

The much better economic prediction model in this paper has been used in the word to predict the asset-liability ratio of Sichuan industrial enterprises and has got good effects on prediction.

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