

Research on Prediction of Cash Flow of Corporation in Short-term

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Abstract. The continuity development of business management relies on good enough cash flow but not high-profit. Accurate cash flow prediction can ensure adequate liquidity. The paper focuses on cash flow of enterprise in short-term. It selects a method with better prediction effect from Time Series Analysis Method and Neural Network Method by comparing prediction results of several different methods. The selected neural network method is then used to adjust and predict cash flow in short-term. Example analysis proves that the predict effect after adjustment is better.

Keywords: cash flow prediction; time series analysis; neural network; data adjustment

1. Introduction

Cash flow is general name of cash inflows and cash outflows in corporate. Business managers can acknowledge corporate earnings according to cash flow within a period of time. Based on cash flow process, we can find inefficient, loss and non-added value operations in long-term and short-term cash revolving cycle, so as to adjust business decision-making behavior. Cash flow management mainly includes cash flow prediction, control and analysis [1, 2]. Prediction aims at ascertain company's future cash movement with some statistical methods and moving average, exponential smoothing as well as linear regression laws to understand amount and time of company's future cash inflows and outflows, so as to master future cash surplus and deficiency, timely arrange cash financing and investment. Control mainly includes control on income, expenses and cash balances. Analysis aims at timely finding problems in corporate finance management by analyzing business cash budget performance and financial situation with structural analysis, changes trend analysis and financial ratio method. In fact, it is to perform cash flow management from qualitative and quantitative aspects [3]. Quantitative forecasting methods is relatively simple, but there is no affect factor information about cash flow in the method, the accuracy and precision of which is relatively low [4].

The paper mainly uses several different prediction methods and compares the predicted result, so as to select relatively good prediction method to improve accuracy. The paper is organized as follows: section 2 introduces two prediction methods; section 3 gives specific steps to build cash flow prediction model; section 4 presents a prediction example and section 5 concludes our work.

2. Prediction Methods

2.1. Time Series Method

Time series is to obtain series of observation values chronologically. The cash flow data is a kind of time-series data. A typical essential characteristic of time series is dependence of adjacent observation values. Time series analysis concerns about techniques of the dependences. The needed model for time series analysis is random model. Stationary random model assumes that the process keep balance along a constant average. To many time series to be predicted, they are not change around a stationary mean, which is more suitable to be described with non-stationary model. According to different non-stationary character of time sequence,

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non-stationary time series modeling method has removed the direct method and the trend term trend of extraction. The former includes ARIMA model and seasonal model method, while the latter includes stepwise regression and gray model method [1]. We select ARIMA as time series method in the paper.

The ARIMA is generally described with the following formula [2]:

$$\varphi(B)z_t = \phi(B)\nabla dz_t = \theta(B)a_t \quad (1)$$

Where, z_t is original random process or time series; a_t is a white noise process or independent and identically distributed random variables; B is the backward operator, $Bz_t = z_{t-1}$; ∇ is backward difference operator, which can be expressed with $B \nabla z_t = (1-B)z_{t-1}$; $\nabla^d = (1-B)^d$ is d -order difference.

$$\phi(B) = 1 - \phi_1 B - \phi_2 B^2 - \dots - \phi_p B^p \quad (2)$$

$$\theta(B) = 1 - \theta_1 B - \theta_2 B^2 - \dots - \theta_q B^q \quad (3)$$

Where, $\phi_1, \phi_2, \dots, \phi_p$ and $\theta_1, \theta_2, \dots, \theta_q$ are parameters to be determined. The $\varphi(B)$ is called autoregressive operator, which is p-polynomial of B , namely it is p-order. Assume it is stationary, $\varphi(B) = \phi(B)\nabla^d$ can be called as generalized autoregressive operator, which is also stationary. The $\theta(B)$ is sliding average operator. It is q polynomial of B , namely q-order assuming it is reversible.

ARIMA model actually eliminate polynomial trend in non-stationary time series with differential $(1-B)^d$, namely firstly perform stationary processing on non-stationary data, and then install stationary data to establish ARMA model. Finally, we can arrive at model including non-stationary items and stationary items.

2.2. Neural Network Method

Currently, in the system modeling and prediction, the most commonly used id static multi-layer feed-forward neural network. Here the most complete BP network is used for prediction. BP network is a kind of one-way transmission multi-layer feed-forward network with three or more layers, including input layer, hidden layer and output layer [3]. These layers are fully connected and there is no connection among neurons of each layer. Generally used transfer function of BP network includes Sigmoid function, tangent function or linear function. As the transfer function is everywhere differentiable. As to BP network, the divided region is made up of non-linear hyper-planes, which is relatively smooth surface. So the classification is more accurate than linear division and has better fault tolerance. On another hand, network can be strictly adhering to gradient descent learning, the analytic of weight correction is very clear.

3. Establish of Cash Flow Prediction Mode

3.1. Index Selection

Based on main content of working capital management, we can select the following absolute indexes and relative indexes. The absolute indexes include cash inflows, cash outflows, net cash of inflow and outflow, accounts receivable, inventory. Relative indexes include accounts receivable turnover, inventory turnover, asset turnover and others.

The selected eight indexes are directly related to cash flow as main indexes. In addition, there are five secondary indexes as main business revenue, main business cost, net profit, net cash flow from financing activities and investing activities net cash flow and so on. Here is cash flow prediction in short-term, the time scale is mainly short-term monthly, quarterly-based, supplemented by six months, and years.

3.2. Model Establishment

The establishment of model mainly includes the following steps:

Step 1: Using monthly or quarterly data of selected indexes, predict with ARIMA method and neural network method. Among them, the ARIMA method conduct prediction focusing on above eight main indexes, while neural network method perform prediction with main indexes and secondary indexes as input variable and main indexes as output variables. Adjust there parameters to achieve optimal prediction result and then compare result of these methods. Analyze difference among them, and finally arrive at end-use prediction and prediction result.

Step 2: Data adjustment. Low level cash flow data impact more compared with cash flow data at high level due to particular sudden impact of the company's incident, so we use cash flow data at high level to adjust that at lower level with unexpected sudden impact.

The adjustment methods mainly include:

(1) Curve approaching. Data in long-term and short-term must form curve. For the abnormal period, we can approach short-term curve to long-term curve in the whole abnormal period so as to adjust trend of short-term curve to achieve adjustment result.

(2) Interpolation substitution. In the abnormal period, data in lower level can replace value in high level curve, but not remain the original value.

(3) The weight setting in ARIMA and neural network method is relative low, but the amount must depend on specific situation.

Step 3: Re-predict short-term index data with the adjusted index data and compare with the original prediction result so as to arrive at analysis result.

4. Case Study

Based on related information from some stock exchange agent, in January 24, 2009, Board of Directors unanimously agreed to add investment on a corporate to construct a U-line specialty glass production line. The predicted total investment is up to 7.3 billion. Using cash flow data of the company as prediction object and based on determined 8 main indexes and 5 secondary indexes to collect season data since 2009 as well as half-year data since 2010. The season data is prediction content and half-year data is additional content.

4.1. Season Data Prediction

Using ARIMA method and neural network method in SAS, we can achieve prediction model based on the selected data as above. As the sample data is relatively small, we can arrive at result as shown in Table 1 using data in Sep. 2009 as object.

Table 1. Predicted cash flow comparison with ARIMA and neural network method

Type	Cash inflow	Cash outflow	Net cash inflow and outflow
Original value	653407137	374438661	278968476
Mat prediction value	632180237.8	399048502.6	277450535.1
Mat original value-prediction value	21226899.17	-24609841.55	1517940.894
Second time mat prediction value	632180237.8	399048502.6	277450535.1
Mat original value- Second time mat prediction value	21226899.17	-24609841.55	1517940.894
Accounts receivable	Stock	Accounts receivable turnover	Inventory Turnover
342151644	312502900	5.6	3.21
340726741.3	314500246.2	5.459052	3.09522
1424902.707	-1997346.183	-0.3133	0.3415
340726741.3	314500246.2	5.459052	3.09522
1424902.707	-1997346.183	0.140948	0.11478

In the table, the value of SAS refers to predicted value with ARIMA method; MAT means value predicted with neural network method. Based on the data in the table we can know that the difference between ARIMA model and original data is relatively large, while neural network model can accurately correspond to original data. The prediction result with neural network method has less error than that with ARIMA method. The neural network method can better predict data, especially in case of little sample data. So the neural network method is selected in the paper.

4.2. Model Adjustment

Based on the additional investment situation, we adjust half-year data with operating cash flow data. The adjustment method is interpolation substitution method, namely to replace original season data with half-year data to form the curve. The half-year data can be described with simple linear curve. The adjustment year is 2009. Neural network method is still used after adjustment. The mode training is similar with the above situation and prediction result is shown in Table 2.

Table 2. Neural network prediction result comparison after adjustment.

Type	Cash inflow	Cash outflow	Net cash inflow and outflow
Original value	653407137	374438661	278968476
Mat prediction value	632180237.8	399048502.6	277450535.1
Mat original value-prediction value	21226899.17	-24609841.55	1517940.894
Second time mat prediction value	645762036.5	372081947.3	277721396
Mat original value- Second time mat prediction value	7645100.507	2356713.735	1247080.046
Accounts receivable	Stock	Accounts receivable turnover	Inventory Turnover
342151644	312502900	5.6	3.21
340726741.3	314500246.2	5.459052	3.09522
1424902.707	-1997346.183	-0.3133	0.3415
341705628.8	313745577.5	5.62359	3.20637
446015.1789	-1242677.461	-0.02359	0.00363

From table 2 we can see that the accuracy of prediction result with adjusted neural network has some improvement.

5. Conclusion

From the above case study we can know that neural network method has better prediction effect than ARIMA method. Meanwhile, after short-term abnormal data adjustment, the prediction effect has some extent improvement. As the selected case data comes from announced cash flow table, the data amount is relatively small. If we used relatively large amount of cash flow data within company for prediction, the result will be better. At the same time, more methods can be used for prediction, such as dynamic compensation method, which will be researched in the near future.

6. References

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