Evaluation of Short-Term Interval Models for Financial Time Series Forecasting

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Abstract

In current years, a variety of time series models have been planned for financial markets forecasting. In each case, the exactness of time series forecasting models are primary to make decision and hence the research for humanizing the efficiency of forecasting models have been curried on. Lots of researchers have compared diverse time series models mutually in order to establish more proficient once in financial markets. In this paper, the performance of four interval time series models including autoregressive integrated moving average (ARIMA), fuzzy autoregressive integrated moving average (FARIMA), hybrid ANNs and fuzzy (FANN) and Improved FARIMA models are compared together. Empirical results of exchange rate forecasting indicate that the FANN model is more acceptable than other those models. Consequently, it can be a suitable alternative model for interval forecasting of financial time series.

Keywords - *Artificial Neural Networks (ANNs), Auto-Regressive Integrated Moving Average (ARIMA), Time series forecasting, Hybrid forecasts, Interval models, Exchange rate.*

I. INTRODUCTION

Exchange rate is one of the most efficient variables in financial environments and its changes can be extremely imperative for economic decision makers. A number of investigations have been proficient in the field of switch over the rate forecasting that number of this investigation represents the mention issue consequence. Currently, despite the numerous economic time series models accessible, correct forecasts of exchange rate are not easy task. Several diverse models have been recommended for time series forecasting, which are normally categorized in to linear and nonlinear models. One of the most significant and widely used linear time series models are autoregressive integrated moving average (ARIMA) models that have enjoyed prolific applications in forecasting social, financial, engineering, foreign exchange, and stock problems. Second class of time series models are nonlinear models. Artificial neural networks are one of these models that are able to estimate various nonlinearities in the data and are flexible computing frameworks for modeling a broad range of nonlinear troubles.

One important advantage of ANNs over than other nonlinear classes is that ANNs are common approximates which can estimated a large class of functions with a high degree of precision. No prior supposition of the model form is requisite in the model building process. As a substitute, the network model is largely indomitable by the characteristics of the data. Generally used neural networks include multi-layer perceptions (MLPs), radial basis functions (RBFs), probabilistic neural networks (PNNs), and general regression neural networks (GRNNs). Single hidden layer feed forward network is the majority widely used model form for time series forecasting. Forecasting correctness is one of the most imperative factors to choose the forecasting model; therefore, numerous researchers have compared dissimilar time series models together in order to establish more correct once. As similar, various researches have been also done in the financial fields. When compared the presentation of artificial neural networks and traditional models to cumulative retail sales forecasting. Meade compared the accurateness of short term foreign exchange forecasting models. In this paper, the concert of four dissimilar interval time series models is compared for financial markets forecasting. The rest of the paper is prepared as follows. In the next section, concepts of four used time-series models are momentarily reviewed.

II. TIME SERIES FORECASTING MODELS

There are numerous diverse approaches for time series modeling. Interval models are an extraordinary class of the quantitative forecasting models. In interval models, an interval is deliberate as optimum forecast of sovereign variable. In this section, four interval models are briefly reviewed.

A. The Auto-Regressive Integrated Moving Average Model

Random errors are unspoken to be autonomously and identically scattered with a mean of zero and a stable variance. The Box–Jenkins method includes three iterative steps of model recognition, parameter inference and diagnostic checking. The basic idea of model detection is that if a time series is generated from an ARIMA process, it should have some theoretical autocorrelation property. By matching the observed autocorrelation patterns with the theoretical ones, it is often possible to recognize one or some potential models for the given time series. Box and Jenkins proposed to use the autocorrelation function (ACF) and the partial autocorrelation function (PACF) of the sample data as the basic tools to recognize the order of the ARIMA model.

Once a tentative model is particular, inference of the model parameters is straightforward. The parameters are probable such that an overall measure of errors is minimized. This can be done with a nonlinear optimization procedure. The last step of model construction is the diagnostic checking of model adequacy. This is basically to check if the model assumptions about the errors are satisfied. A number of diagnostic statistics and plots of the residuals can be used to scrutinize the goodness of fit of the cautiously entertained model to the historical data. If the model is not enough, a new tentative model is hypothetical to be identified, which is again followed by the steps of parameter inference and model verification. Diagnostic in order may help propose alternative model(s). This three-step model construction process is characteristically continual several times until a pleasing model is lastly selected. In an autoregressive incorporated moving average model, the future value of a changeable is understood to be a linear function of numerous past explanation and random errors.

B. The Improved FARIMA Model with Probabilistic Neural Networks (PNNs)

Forecasting interval of the furry autoregressive incorporated moving familiar models is absolute in some definite data conditions. According to opinion, forecasting interval can be too wide, when instruction data set includes the momentous distinction or outlying case. In superior model, the ability of the probabilistic neural networks (PNNs) is used in order to distinguish more probability spaces in forecasting interval of FARIMA model. Theoretically, PNN is a classifier and is able to deduce the class or group of a given input vector after the training process is accomplished. PNN is abstractly built on the organization which, given enough data, is capable of classifying a sample with the maximum prospect of success.

III. APPLICATION OF HYBRID MODELS FOR FORECASTING

In this section, the correctness and effectiveness of four aforesaid models are compared mutually in application of exchange rate forecasting. The sequence of this investigation consists of 42 daily explanation from *5 Nov to 16 Dec 2005*. In all models, the first 35 observations are used to put together the model and the next 7 observations in order to appraise the presentation of the models.

A. The Improved FARIMA Model with PNNs

In improved model, the probabilistic neural network is used after the FARIMA model. The best fitted network is a network with five input neurons and one output neuron. The structure of designed network is given in Fig. 1.

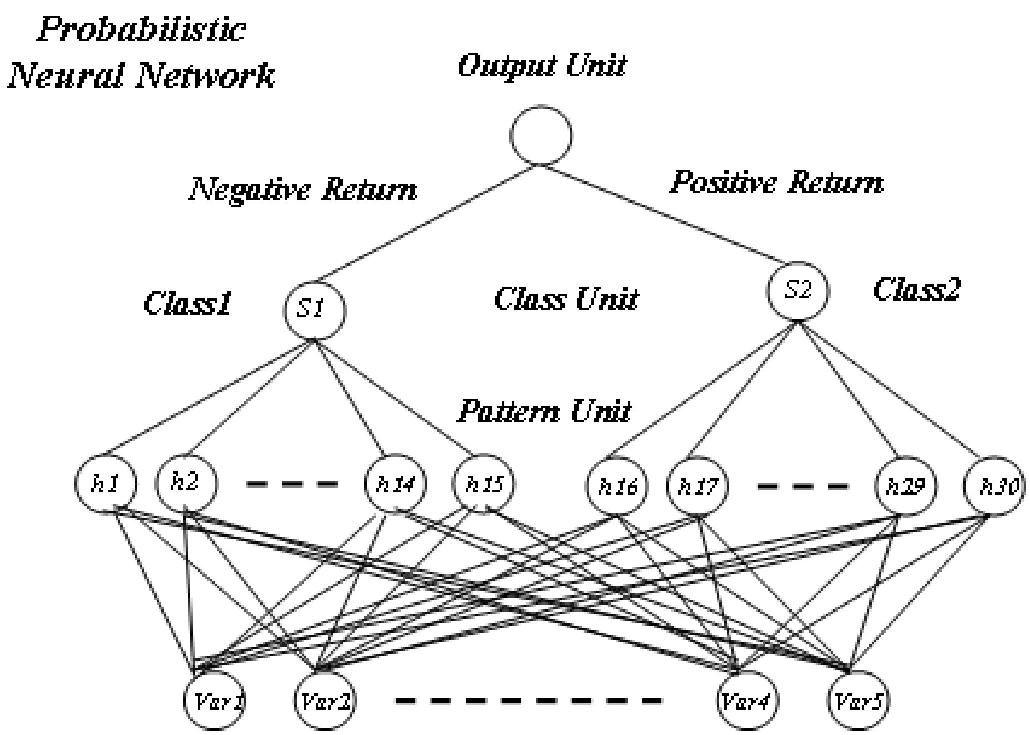

Fig. 1. The Structure of Designed Network

B. Hybrid Artificial Neural Networks and Fuzzy Logic Model

Allowing for the design concepts of artificial neural networks and using *MATLAB7* package software, the best fitted network $N^{(3-3-1)}$ the fuzzy parameters are obtained using (with *h=0*). It must be distinguished that in this case the used triangular fuzzy numbers are measured symmetric, transfer function of the output neuron is deliberate linear and association weights surrounded by hidden and input layer are deliberate crisp. Using the revised hybrid model, the opportunity values of the next 5 transaction days are forecasted.

IV. CONCLUSIONS

The foreign exchange markets are among the most significant and the biggest financial markets in the world with trading taking place twenty-four hours a day roughly the globe and trillions of dollars of dissimilar currencies transacted each day. An individual able to correctly forecast the movements of exchange rates can result in extensive improvement in the overall prosperity of the multinational financial firm, specially for firms, conducting extensive currency transfers in the course of business. Conversely, predicting currency movements has forever been a problematic task for academic researchers and despite the paramount modeling effort registered in the last three decades, it is extensively familiar that exchange rates are enormously complicated to forecast. That is the reason why research on humanizing the efficiency of time series models has been never witnessed a halt. In this paper the presentation of four dissimilar interval time series models (Auto-Regressive Integrated Moving Average (ARIMA), Fuzzy Auto-Regressive Integrated Moving Average (FARIMA), Hybrid ANNs and Fuzzy, Enhanced FARIMA) are compared together in exchange rate forecasting. Experiential results of exchange rate forecasting designate that the hybrid ANNs and fuzzy model is more reasonable than other those models. Hence, it can be used as a apposite alternative model for interval forecasting in financial markets.

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