



INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS

ISSN 2320-7345

REVIEW OF VARIOUS FORECASTING TECHNIQUES USED FOR FINANCIAL FORECASTING

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Abstract: - Forecasting is major factor and most promising activity in the financial market. The purpose of the research is to review various techniques adopted for forecasting the exchange rate. This study has reviewed the various models and techniques to predict financial market by taking into consideration the models namely artificial neural network, particle swarm optimization, genetic programming and fuzzy logic. From the systematic prior literature review, it was clear that, ANN performs well in predictive ability and provides result faster than other models.

Keywords: forecasting, financial market, exchange rate, artificial neural network, fuzzy logic, genetic programming and particle swarm optimization.

1. Introduction:

Forecasting or prediction is a process that given outputs set by a provided set of variables as inputs. Variables would be basically historical data. Predicting believes that future occurrences are on the basis on past or presently observable events. It was expected that certain aspects of prior patterns would proceed into the future. Prior relationship could be identified through observation and study [1]. Prediction of ER (exchange rate) is one of most prominent applications of modern TS (time series) prediction. For becoming an effective dealer in foreign EM (exchange market), one has to be clear with the factors that are accountable for currency to depreciate or appreciate. Methods that were developed for currency ER forecasting classified into three namely TS methods, econometric methods (EM) and methods of soft computing. The complexity in forecasting currency ER because of their high complexity and volatility was a big problem in foreign markets in the finance, as many EM were not able to give significantly better prediction than model of random walk [2]. TS methods have their shortcomings for multidimensional TS with mutual dependencies of non-linear. Next to that, investigators have employed tools for soft computing like FL, ANN (Artificial neural network) and their hybrids to ER forecasting [3]. ER is a significant variable that dominates decision taken by users of the foreign EM especially importers, bankers, business, investors, financial institutions, policy makers and tourists both in emerged and emerging world. Timely prediction of ER would able to provide significant data to the partakers and decision makers in the field of internal finance, policy making and buy and sell [4]. Foreign EM was one of the biggest and most liquid FM. Overseas currencies are special ER and financial assets are significant indicators of finance in the global FM. Issue of

predicting the foreign ER movement attracts more attentions. At the same time, forecasting the foreign ER poses substantial experimental and theoretical challenges. ER could be classified into two classes' namely technical analysis and fundamental analysis [5].

This study has reviewed the various models and techniques to predict financial market by taking into consideration the models namely artificial neural network, particle swarm optimization, genetic programming and fuzzy logic through systematic review of existing literature review.

2. Literature Review:

2.1 Particle Swarm Optimization:

Beheshti and Nekoukar [6] developed the modified PSO applications for training the functions of radial basis (RB). Such methodology was adopted for predicting the stock market prices in Iran. Other than accuracy of high predicted in the proposed model, such hybrid technique (HT) would not give any method to optimize the functions of RB structure. Applied algorithm adopted fixed parameters that need an additional time-consuming step for optimization. Next to that, Shen et al [7] introduced a novel HT that make use of an algorithm namely artificial fish swarm (AFS) for training function of RB NN for modeling the composite indices. It was noted that prediction outcomes were good, but AFS algorithm was unused for optimizing the network structure of RBF and it needs certain parameters to be tuned through a trial and error approach which is time consuming. When compared with simple PSO method and simple GA (genetic algorithm) which were adopted for training function of RB NN, AFS algorithm gives a slightly higher error for prediction but researchers feel that developed algorithm has opportunity for enhancement and development.

Hsieh and Chang [8] developed PSO based on BPN (Back Propagation Network) forecasting ER. In this research PSO is adopted for selecting the optimal neurons in the input layer and then forecast ER by BPN that is referred as PSOBPN model. This model was adopted to predict foreign ER. Proposed model had optimal selection and shown superior forecast capability associated with stable prediction outcomes. It would able to match the fluctuation trend closely. In addition to this, it was observed that optimal neurons in the input layer which depend on PSO mostly would provide optimal solution. Such methods would replace conventional ANN that used method of try and error for finding the neurons in the input layer.

Sermpinis et al [9] have developed a hybrid NN of PSO (Particle Swarm Optimization) and adaptive radial-basis functions (ARBF-PSO), a leverage of time differing trading strategy on the basis on GJR (Glosten, Runkle and Jagannathan) volatility predicts and a NN fitness function for the purposes of financial forecasting. This could be performed by ARBF-PSO outcomes with those of three unique architectures of NN, a k-NN (Nearest Neighbors algorithm), ARMA, MACD (Moving Average Convergence/Divergence) model along with naive strategy. More particularly, statistical and trading performance of all these models is examined in a prediction simulation of euro to US dollar, Euro to British Pound and Euro to Japanese Yen.

Chang [10] evaluated the performance between GARCH model and PSOBPN model for ER prediction. It was demonstrated that in short term, model of GARCH was better than model of PSOBPN and the root mean square error (RMSE) of GARCH model outperforms than long and medium term. Apart from these, it was noticed that in medium term, only certain outcomes of RMSE related to model of PSOBPN was worse than model of GARCH. Thus it was concluded that PSOBPN model outperforms well as a whole. In addition to these, other researchers also employed PSO based model to predict foreign ER [10-14].

2.2 Fuzzy Logic:

Authors have adopted FL to forecast the foreign ER and foreign data streams [15-20]. Gradojevic [21] discussed about neuro-fuzzy (NF) decision-making in trading the foreign exchange and other applications. It was found out that non-linear ANN ER microstructure model integrated with FL controller develops a set of strategies of trading, on average, earning a higher return rate when compared with strategy of buy and hold. It was found out that after encompassing costs of transactions, the gains from technology of NF do not decrease and maximize on some periods. It was applied that model of NF to the issue of identifying the market of foreign exchange as reflected by trading signals of chartists during strong depreciation periods.

Kablan [22] have expanded ANFI (Adaptive Neuro-Fuzzy Inference) systems for developing an expert system which is potential of adopting fuzzy reasoning integrated with the recognition of pattern capability of NN to be adopted in financial trading and forecasting. David [23] explained about topology of FL (Fuzzy Logic) expert advisor for market of foreign exchange. Expert advisor would acts a robot for trading the foreign exchange using FL. It was indicated that the FL based expert advisor robot has the ability of making up to eighty per cent consistent

profitable trades. It was demonstrated that emerging expert advisors that could reach a higher profitable trades percentage on the basis on this topology.

Alizadeh et al [24] presented an ANFI system for United States dollar or Japanese Yen ER forecasting. ANFI could be utilized to better solutions to clients rather than completely models of black-box like NN. Proposed NF rule based system were applied some fundamental and technical indexes as variables for inputs. For generating MFs (Membership functions) this research adopted fuzzy clustering of space of output. NF model is tested with 28 candidate variables of input for both currencies. For comparing SYM (Sugeno-Yasukawa Model), multiple regressions, feed forward multi-layer NN are benchmarked. It was concluded that the ANFI system demonstrates its superiority in case of minimizing prediction error, flexibility and robustness.

Liu [25] combined rule-based FL with an ANFI system was used for building a model for forecasting the movement of foreign ER. Although FI system models trained have very good ability for prediction, their performance is not accurate when ER dramatically modifies. This increases the probability that models of FL could be further enhanced so they must not able to show which occur relationship but upgrade itself in perspective of new data. It was suggested that the system requires background knowledge that would permit it to reinterpret and or integrate aspects in the data into new aspects that could lead to more simpler or accurate patterns.

2.3 Genetic Programming:

Li and Taiwo [26] developed multi-objective GP based system for financial forecasting. It was constructed based on the prior tool for decision making in financial GP [27-31]. Developed system enhances financial GP in numerous ways. First and forecast, proposed system is faster in acquiring in terms of multiple conflicting objectives that is contributed to inherent property of multi-objective EA (evolutionary algorithms) that is a set of Pareto front optimal solutions could be acquired when algorithm is executed only one time. Second one, proposed system is simple and friendly from the view of users. It is friendly since it removes quantity of user-supplied parameters prior needed by financial GP. It becomes simple as for the customer it is not necessary to give a priori domain knowledge that is needed for proper usage of such parameters [26].

Bylander and Schwaerzel [32] have predicted financial time series (FTS) by GP with high-order statistics and trigonometric functions. Performance analysis for the extra FTS showed that GP models with the sets of value-added function performed well than buy and hold strategy, basic GP model and Akaike selected models of ARMA. It was recommended that deploying trigonometric functions and functions of high-order statistics would be valuable add-on for other GP applications in same domain or other. It was also suggested that incorporating extra measures in statistics for example exponential moving average would further maximize the proposed approach.

Diaz [33] discussed about speculative strategies in foreign ER on the basis on predicting GP. From the findings of the predictive analysis, it was gives proof against unpredictability of ER evolution and against the fact that ER adopts the process of random walk. When considering both sign and point prediction, GP performs statistically better forecasting than the model of random walk other than Yen/dollar forecasting one-period-ahead. Thus it can be understood that GP outperforms statistically better in terms of prediction when compared with the random walk model.

Ravi et al [34] have predicted foreign ER using methods of computational intelligence. 6 architectures of non-linear ensemble are proposed for predicting foreign ER in paradigm of computational intelligence. BP neural network, Multivariate ARS (adaptive regression splines), Wavelet NN, SVR (support vector regression), genetic programming (GP), Group method (GM) of handling the data (HA), DENFIS (Dynamic evolving neuro-fuzzy inference system) are selected as the ensembles members. ER data of US dollar for British pound, Japanese Yen and Deutsche mark is adopted for testing and comparing the ensembles performances. GM of HA and GP outperformed well than other ensembles. It was noticed that assembling in paradigm of computational intelligence is a sound substitute to the expanded techniques for forecasting foreign ER.

2.4 Artificial Neural Network:

There are numerous researchers who employed ANNs to forecast the SM, market and financial indexes [35-46]. Cao et al [47] have compared the effectiveness of French and Fema model and ANN model for forecasting financial values in Chinese SM. It was observed that ANNs perform well in predictive power [48] than linear models. Pendharkar [49] have adopted ANN applications for predicting the issue of bankruptcy. It was found out that ANNs outperform the SDA (statistical discriminant analysis) for hold-out samples and training.

Sarker and Kamruzzaman [50] compared ANN oriented models with ARIMA ((auto regressive integrated moving average) to predict the foreign ER. In this research, we proposed and examined three ANN based models using SCG (Scaled conjugate gradient), SBP (Standard Back propagation) and BP with Baysian regularization for forecasting

various currencies against dollar of Australia. It was found out that all ANN based models performed well than ARIMA model. It was shown that ANN based model could predict foreign ER closely.

Merh et al [51] compared hybrid approaches of ARIMA and ANN for predicting future value of index and SM in India. It was revealed that hybrid ANN_ARIMA and BSE oil and gas ANN could able to manage input set of data and forecast future closing price on the other hand ARIMA_ANN and ARIMA fails to predict future values. Dannie and Rose [52] developed a flexible model namely NCSTAR (Neuron Coefficient Smooth Transition Auto Regression), an ANN for predicting as well as modeling the non-linearities in monthly ER. Most of the studies have shown that ANN outperformed well than other models.

On the other hand, Pacelli [53] compared and analyzed potential of various mathematical models (MM) namely ANN, ARCH (Auto-regressive conditional heteroschedasticity) and GARCH models for forecasting the daily ER U.S/Euro dollar determining the best performing models among these. When potential of different MM were compared such as ANN, GARCH and ARCH models, conventional indicators to evaluate the models ability indicated that GARCH and ARCH models in their static formulations, outperformed better than ANN. ARCH model demonstrated the best predictive potential with a static approach. At the same time, it was noticed that Goksu and Erdogan [54] examined about forecasting Turkish Lira (TL) and Euro ER with ANN. It was clear from the analysis that ANNs performs well in predicting the future Euro and TL ER.

Bhatt and Malik [55] developed a model for predicting the foreign ER and compare develop efficiency of developed model with the prior techniques. Model was developed to forecast exchange from euro to dollar, rupee to dollar, pound to dollar exchange. It was observed that ANN outperforms faster to estimate the foreign ER. In addition to this, it was also noted that developed model provides better percentage in terms of accuracy. Further, it was also noticed that there was a slight variance identified between predicted ER and real ER.

3. Conclusion:

Financial forecasting in terms of various models and techniques was discussed in this paper. The vast growth and developments in financial forecasting research was summarized in the literature review reveal the significance of this research in enhancing financial forecasting. This study has reviewed the various models and techniques to predict financial market by taking into consideration the models namely artificial neural network, particle swarm optimization, genetic programming and fuzzy logic through systematic review of existing literature review. Even though, researchers have been deploying numerous models for predicting the financial forecasting namely fuzzy logic, genetic programming, ANN, PSO and so on. From the above literature, it was clear that ANN outperform well than other existing techniques. However, other techniques also performed well in prediction but ANN outperforms well. It is clear from the evidence that ANN was deployed to forecast the stock market, financial indexes and market indexes. ANN performs well in predictive ability and provides result faster than other models. When stock market or foreign ER values was predicted using ANN it gives accurate outcomes that is percentage of accuracy will be high than any other mathematical models. Apart from these, applications of ANN can also be used for the predicting the problem faced by bankruptcy as well. In future, this study will develop a model and deployed on genetic programming algorithm on the basis on the ANN.

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