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Forecasting exchange rates using time series and neural network approaches

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Exchange rates play an important role in controlling the dynamics of the foreign exchange market. Predicting exchange rates has become one of the most challenging applications of financial time series forecasting due to its unpredictability and volatility. The objective of this study was to develop and compare the accuracy of two models; Generalized Auto-Regressive Conditional Hetroskedasticity (GARCH) as the time series model and Feedforward neural network with the Backpropagation algorithm as the Artificial Neural Network (ANN) model for predicting daily currency exchange rate of US Dollar against Sri Lankan Rupee (USD/LKR).

Daily exchange rates of USD/LKR collected from the Central Bank of Sri Lanka, for the period of January 1, 2007 to November 18, 2011 with a total of 1275 observations were used in this study. Past lagged observations of the data series (lag 1 and lag 2) and moving average of 5, 10, 20, 30 and 40 technical indicators were employed as the explanatory variables to build both models. The predictive performance of GARCH model and ANN model were evaluated using a number of widely used statistical metric, namely, Normalized Mean Square Error, Mean Absolute Error, Directional Symmetry, Correct Up trend and Correct Down trend.

The GARCH (1,1) model provide the best performance in time series approach. The best model based on ANN contains two hidden layers, four neurons in first hidden layer and three neurons in second hidden layer together with learning rate = 0.05 and momentum = 0.8 which are the parameters of the learning algorithm. ANN model and GARCH model forecast the daily exchange rates with directional prediction accuracy of 82% and 69% and normalized mean square error with 0.042 and 0.071 respectively. According to the performance of these two models, it can be concluded that the ANN based model performs better when compared with the GARCH model to predict the exchange rate of USD/LKR.

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