
A study on the daily exchange rate fluctuation in Sri Lanka using stochastic models

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The main objective of this work is to determine the most appropriate model for forecasting the daily exchange rate of the Sri Lanka Rupee (LKR) against the United States Dollar (USD) among the geometric Brownian motion (GBM) and three selected stochastic differential equations (SDEs) used in stochastic analysis of financial markets. As a first step, we obtained the exchange rate data of LKR against USD throughout the day from the <http://www.Xrates.com> website and studied the behavioral pattern. We observed compact fluctuations in exchange rates for 24 hours on one day and large fluctuations on another day. Thus, we identified three types of fluctuations in the 24-hour exchange rate data, namely, small, intermediate, and large. Then, hourly exchange rates were obtained for these three types of fluctuations, that is, on 2021.04.26 for small, on 2021.03.11 for intermediate, and on 2021.04.05 for large. We calculated the drift and volatility parameters for these three types using corresponding exchange rate values obtained for the small, intermediate, and large, respectively. Finally, the three data sets were predicted separately for the next 24 hours using GBM and the three SDE models. The accuracy of the predictions of the GBM and three SDE models were examined using the Mean Absolute Percentage Error (MAPE) statistic for LKR against USD forecasts under consideration. For each of the four models, the corresponding MAPE value was calculated and found less or almost less than 10% in each of the predictions made and it was observed increasing with the increasing fluctuations. One SDE model gave a better approximation for next day 24-hour exchange rate prediction compared to the other models. The results were obtained by using the R software package (4.0.3 version).

Keywords: Exchange rate, Geometric Brownian motion, Stochastic differential equations, Drift and volatility parameters, Mean Absolute Percentage Error

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