A MATHEMATICAL MODEL FOR STOCK PRICES IN THE COLOMBO STOCK EXCHANGE

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This empirical study attempts to examine whether the stock prices of companies listed on the Colombo Stock Exchange (CSE) follow Random Walk Hypothesis (RWH) and presents a mathematical model of stock prices using a Fractional Brownian Motion Process with Adaptive Parameters (FBMAP) compared with Auto-Regressive Integrated Moving Average (ARIMA) time series model. The research was motivated by the fact that investors are interested in knowing whether past stock prices have a propensity to forecast future stock prices. The period covered by the research was January 2012 to June 2018. The main objective of the study was to investigate whether stock prices follow the RWH and to compare two major forecasting methods. In order to check RWH, we used Chi-square Test, the Runs Test and the Auto-correlation Test. The Augmented Dickey-Fuller Test (ADF Test) was used to verify the stationarity of the data set. In the first phase, best fitted ARIMA model was found using Akaike Information Criteria (AIC), Least Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). In the second phase, proposed FBMAP was used to predict future stock prices. The findings showed that changes in stock prices on the CSE refute the RWH. The study concluded that stock price shifts follow some pattern or trend and that historical price changes can be used to predict future price movements in short-term. The simulation results showed that the FBMAP model is more suitable for forecasting daily closing price than ARIMA model.

Keywords: Augmented Dickey-Fuller Test, Auto-Regressive Integrated Moving Average, Chi-square Test, Runs Test, Fractional Brownian Motion with Adaptive Parameters, Random Walk Hypothesis