Analysis of Stock Prices using some Time Series models

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Data:

Daily data on stock prices (namely date, opening, high, low, closing, adjusted closing prices & volume) of –

- Amazon (1999-2022)
- Microsoft (2000-2023)
- Netflix (2002-2020)

Objective:

The objective is to fit the ARIMA (Auto-regressive Integrated Moving Avg.) and ARCH (Auto-regressive Conditional Heteroscedastic) models to the above datasets so as to check how good they are for forecasting stock prices, particularly closing prices and adjusted closing prices, and for analysis of log returns of the price values.

Methodology

At first, we take the log returns of the stock prices' values as they're financial time series and to check for stationarity in each of the datasets, we'll use the Augmented Dickey-Fuller Test. If there's any non-stationarity present, we'll go for the method of differencing to make the data stationary and order of differencing at which it's attained will be used as the differencing order (d) in ARIMA.

We'll take the help of PACF (Partial Auto-Correlation Function) to check how much of a time-lag on which the data points are correlated with each other, which will determine the order of Auto-regressive part in both aforementioned models and ACF (Auto-Correlation Function) will help us determine the order of moving avg. in ARIMA.

The order determined by PACF will be taken as the pre-specified integer in Lagrange-Multiplier Test for testing for ARCH effect and if it's present, we'll go for fitting ARCH model.

We'll divide the datapoints in an 8:2 ratio to use as training and test data respectively and use the measures MAD, MPE & MAPE to check the behavior of error in forecasting.

All calculations and tests performed will be done through R programming.