Northeastern University
ALY 6050
2023 Spring B

ALY 6050 Module Three Project

Project: *Forecasting Financial Time Series*

The project consists of three parts. The submission of this project will consist of two attachments:

1. A Word document that is prepared according to the APA standards of formatting. In the Word document, explain the experiments and their respective conclusions, and additional information as indicated in each problem. Save your word document in the format: ALY6050_MOD3Project_ LastNameFirstInitial.docx
2. Either an Excel workbook or an R script file (.R file) that contains all the work and the calculations indicated in parts 1-3 of the project. Please save your Excel workbook or R script file in the following format: ALY6050_MOD3Project_ LastnameFirstinitial; for example, ALY6050_MOD3Project_ HeR.

Project:

The Excel workbook **ALY6050_MOD3Project_Data_2023SpringB.csv** contains the historical stock prices for Netflix, Inc. (NFLX) and Amazon.com, Inc. (AMZN) for a total time period of one year, consisting of 252 market days.

Part 1: Short-term Forecasting:

(i) Use a simple line plot of both time series to detect seasonal, irregular, or trend behaviors if any. Write a summary of your observations of both time series in your report.

(ii) Perform exponential smoothing to forecast both prices for period ***253***. Use successive values of **0.20, 0,40, 0.60, and 0.80** for the smoothing parameter α. Next, calculate the **MAPD** (Mean Absolute Percentage Deviation) of each forecast; and based on the MAPDs, determine the value of α that has yielded the most accurate forecast for each stock. In your report, describe your results (use a table); and explain why in your opinion such values of α have yielded the most accurate forecasts for the two stocks.

(iii) Use your exponential smoothing forecast of part (ii) with $\boldsymbol{\alpha}$**=0.60** and perform an adjusted exponential smoothing to forecast both prices for period ***253***. Use successive values of **0.20, 0.40, 0.60, and 0.80** for the trend parameters β for both stocks. Next, calculate the **MAPD**s of your forecasts and determine the values of β that have provided the most accurate forecasts for both stocks. In your report, describe your results (use a table) and explain why, in your opinion, such values of β have yielded the most accurate forecasts.

Part 2: **Long-term Forecasting**

(i) For each stock, use a **3-period** weighted moving average to forecast its value during periods 1 through 50. Use the weights 0.5 (for the most recent period t-1), 0.3 (for the period before the most recent t-2), 0.2 (for t-3). Next, use the observed value for period 51 as the base of a linear trend(from periods 51 to 252), and use that linear trend to forecast the values of both stocks for periods 51 through 262. Write a summary of your results in your report (use a table). Describe how accurate this method of forecasting has been by comparing the

forecasted values for periods 253-262 with their actual "Close" values on those specific days (Hint: check the actual values on https://finance.yahoo.com).

(ii) Calculate the **MAPD**s of your forecasts in question (i) above for periods through 4 to 252 and compare them with the values obtained for your forecasts in Part 1. For each stock, describe which method has yielded a most accurate forecast.

Part 3: **Regression:**

(i) For each stock, use simple regression(from periods 1 to 252) of stock values versus the time periods to predict its values for periods 1 through 262. In your report, describe how the accuracy of this prediction(**MAPDs**) has been compared to the methods used in Parts 1 and 2 of the project.

(ii) Perform a residual analysis of your simple regression to verify whether regression is appropriate to use for each of the given data. In particular, determine:

- Whether the residuals are independent
- Whether the residuals are homoscedastic.
- Whether the residuals are normally distributed by plotting a normal probability plot of the residuals
- Whether the residuals are normally distributed by performing a Chi-square test for normality of the residuals.

Part 4: Baseline Model:

(i) Use the most recent price as the prediction of current price for periods 2 through 252. Calculate the **MAPDs**.

(ii) Find which forecasting method(s) can outperform the benchmark.

After completing parts 1-4 and in your report, respond to the following question. Note this question is subjective (although it can be solved analytically), and it does not necessarily have only one correct answer at this stage of the course.

Question: Suppose that you have decided to form a portfolio Π (Pi) consisting of the above two stock types (denote a share value of **NFLX** by X and that of **AMZN** by Y). You are however undecided as to what percentage of your investment should be allocated to the AMZN shares and what percentage should be allocated to NFLX shares. Let these percentages be denoted by P for NFLX and Q for AMZN respectively (Obviously, P + Q=100%). In your opinion, what are good values to select for P and Q?

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Project Rubric

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Criteria	**Ratings**				**Pts**
R (or Excel): Problem Modeling & Set-up	20.0 pts Completely and concisely modeled the problem in Excel (or R) for each method	16.0 pts Accurately modeled the problem in Excel (or R) for each method	10.0 pts Correctly modeled the problem in Excel (or R) for each method, but the model lacks detailed insight into the problem or the set-up is awkward.	5.0 pts Modeled the problem in Excel (or R) for each method, but there are some gaps in the problem modeling and setup	20.0 pts
R (or Excel): Problem Solution & Accuracy	40.0 pts Efficiently obtained correct and accurate solutions in Excel (or R) by using the appropriate analytic tools of the software	32.0 pts Obtained complete and accurate solutions in Excel (or R) by using the appropriate analytic tools of the software	20.0 pts Obtained correct solutions in Excel (or R) using the appropriate analytic tools of the software, but the application of the tool is awkward.	10.0 pts Obtained a solutions in Excel (or R) by using the appropriate analytic tools of the software, but the solution is not complete.	40.0 pts
Word/Report: Problem Description & Introduction	10.0 pts Provides a thorough and concise summary of the problem descriptions and introduced the problem using rich and significant ideas	8.0 pts Provides an accurate and succinct summary of the problem descriptions and problem introduction	5.0 pts Provides an accurate summary of the problem descriptions and problem introduction, but the description is too wordy or not succinct	2.5 pts Provided a summary of the problem descriptions and problem introduction, but it is inaccurate or incomplete	10.0 pts
Word/Report: Description of Problem Analysis	10.0 pts Provides a thorough and precise description of the analytic concepts and theories used in analyzing the problem	8.0 pts Accurately describes the analytic concepts and theories used in analyzing the problem	5.0 pts Describes the analytic concepts and theories used in analyzing the problem, but description lacks appropriate detail or precision	2.5 pts Describes the analytical concepts and theories used in analyzing the problem, but descriptions are incorrect or the analytical concepts and theories are incorrect	10.0 pts
Word/Report: Description of Conclusions	10.0 pts Provides conclusions and results obtained in the project using a high level of critical thinking and reasoning	8.0 pts Provides relevant conclusions and results obtained in the project that reflect critical thinking and reasoning	5.0 pts Provides conclusions and results obtained in the project, but not all conclusions or results are relevant to the problem or not all conclusions reflect good reasoning	2.5 pts Provides conclusions and results obtained in the project, but they are irrelevant and reflect a lack of critical thinking	10.0 pts
Word/Report: Writing Mechanics, Title Page, & References	10.0 pts Completely free of errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	8.0 pts There are no noticeable errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	5.0 pts There are very few errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	2.5 pts There are more than five errors in grammar, spelling, and punctuation; or the usage of title page, citations, and references are incomplete; or the report contains less than 1000 words	10.0 pts
					Total Points: 100.0