Module 3 Project ALY 6050

Forecasting a Time Series

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Introduction

Time series forecasting is a method for projecting future occurrences by examining previous patterns and assuming that future trends will be similar to historical trends. Forecasting is predicting future values using models fitted to the last data. Time series forecasting is required for prediction issues with a time component since it gives a data-driven approach to effective and efficient planning(Anais Dotis-Georgiou, 2021).

In this assignment, I will forecast the future values of one or more time series using the forecasting methods in this module. I will also utilize linear algebra to conduct simple or multiple regression. Eventually, I employ one or more of the error norms established in the module to evaluate the predictions' accuracy.

Part 1

In this part, I utilize a simple line plot of both time series to detect seasonal, irregular, or trend behaviors. In the report, I summarise the observations from both time series.
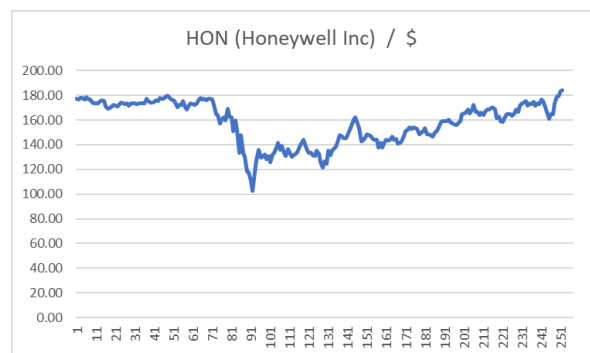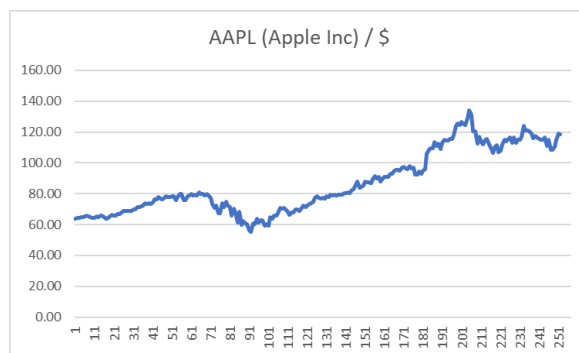
As can be seen, in the charts, there is no apparent seasonal trend, and the data seems random also, the HON stock price doesn't change during the entire time window, while the AAPL stock price increased by almost 50% during the time window.

Rows	AAPL Forecast (alpha 0.15)	AAPL Forecast (alpha 0.35)	AAPL Forecast (alpha 0.55)	AAPL Forecast (alpha 0.75)	HON Forecast (Alpha 0.15)	HON Forecast (Alpha 0.35)	HON Forecast (Alpha 0
250	114.55	112.48	111.18	110.11	168.64	165.94	164.84
251	113.66	111.12	109.75	108.96	169.39	168.63	169.66
252	113.15	110.81	110.03	109.93	170.86	172.33	174.91
253	113.39	112.19	112.63	113.55	172.07	174.63	177.11
254	114.2	114.51	116.04	117.51	173.75	177.66	180.5
255	114.88	115.97	117.5	118.39	175.33	179.97	182.58

The table above shows the exponential smoothing to forecast the prices at the end of periods

	AAPL Forecast (alpha 0.15)MAPD	AAPL Forecast (alpha 0.35)MAPD	AAPL Forecast (alpha 0.55)MAPD	AAPL Forecast (alpha 0.75)MAPD	HON Forecast (Alpha 0.15)MAPD	HON Forecast (Alpha 0.35)MAPD	HON Forecast (Alpha 0.55)MA
Mean	17.57	17.72	17.75	17.77	14.49	14.67	14.76

As seen in the table above, alpha = 0.15 is best for Both stocks. I think this happened because a lower alpha produces better forecasting.

Row	AAPL Forecast Trend(alpha 0.55) (Beta 0.15)	AAPL Forecast Trend(alpha 0.55) (Beta 0.25)	AAPL Forecast Trend(alpha 0.55) (Beta 0.45)	AAPL Forecast Trend (alpha 0.55) (Beta 0.85)	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.15)	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.25)	AAPL Forecast Adjusted(alpha 0.55) (Be 0.45)
250	-0.70	-1.01	-1.47	-2.52	110.49	110.17	109.71
251	-0.81	-1.12	-1.45	-1.59	108.95	108.63	108.3
252	-0.64	-0.77	-0.68	-0.01	109.38	109.26	109.35

Row	AAPL Forecast Trend(alpha 0.55) (Beta 0.15)	AAPL Forecast Trend(alpha 0.55) (Beta 0.25)	AAPL Forecast Trend(alpha 0.55) (Beta 0.45)	AAPL Forecast Trend (alpha 0.55) (Beta 0.85)	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.15)	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.25)	AAPL Fo... Adjusted... 0.55) (Be... 0.45)
253	-0.16	0.07	0.8	2.21	112.47	112.7	113.42
254	0.38	0.91	1.97	3.23	116.41	116.94	118.01
255	0.54	1.05	1.74	1.73	118.04	118.54	119.24

Row	HON Forecast Trend(alpha 0.55) (Beta 0.15)	HONL Forecast Trend(alpha 0.55) (Beta 0.25)	HON Forecast Trend(alpha 0.55) (Beta 0.45)	HON Forecast Trend (alpha 0.55) (Beta 0.85)	HON Forecast Adjusted(alpha 0.55) (Beta 0.15)	HON Forecast Adjusted(alpha 0.55) (Beta 0.25)	HON For... Adjusted... 0.55) (Be... 0.45)
250	-0.78	-1.06	-0.91	0.00	176.25	175.97	176.12
251	0.06	0.41	1.67	4.1	177.09	177.44	178.7
252	0.84	1.62	3.28	5.08	177.87	178.65	180.31
253	1.04	1.77	2.79	2.63	178.07	178.79	179.82
254	1.39	2.17	3.06	3.28	178.42	179.2	180.09
255	1.49	2.15	2.62	2.25	178.52	179.18	179.65

the tables above show the calculation for Adjusted forecasting for stocks.

	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.15)MAPE	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.25)MAPE	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.45)MAPE	AAPL Forecast Adjusted(alpha 0.55) (Beta 0.85)MAPE	HON Forecast Adjusted(alpha 0.55) (Beta 0.15)MAPE	HON Forecast Adjusted(alpha 0.55) (Beta 0.25)MAPE	HON For... Adjusted... 0.55) (Be... 0.45)MA...
Average	0.0197	0.0195	0.0194	0.019	0.1386	0.1384	0.1383

As seen in the table above, the least amount is for beta = 0.45, which shows that closer to 0,5 is the best beta to work with.

Part 2

A weighted moving average is a method for smoothing out time-series data to decrease "noise" in the data and more readily discover patterns and trends. A weighted moving average takes the average of a set number of preceding periods to calculate an "average" value for a particular period while giving greater weight to more recent periods(Zach, 2020).

Period	3-period weighted moving average for AAPL	3-period weighted moving average for HON
245	113.39	164.64
246	114.14	164
247	111.07	164.09
248	109.92	169.21
249	109.43	174.68
250	112.17	177.94
251	115.89	181.16
252	117.94	182.9

then I used the trend function in excel

Row	Trend for AAPL	Trend For HON
245	70.4635288	78.99954687
246	70.465316	78.55666626
247	70.46710319	78.11378566
248	70.46889038	77.67090506
249	70.47067757	77.22802446
250	70.47246477	76.78514386
251	70.47425196	76.34226325

Row	Trend for AAPL	Trend For HON
252	70.47603915	75.89938265

The MAPE for the 3-point weighted average is less than the MAPEs of part 1, indicating this is a better way to forecast data.

Part 3

the graphs below show predicted y with the regression method for AAPL
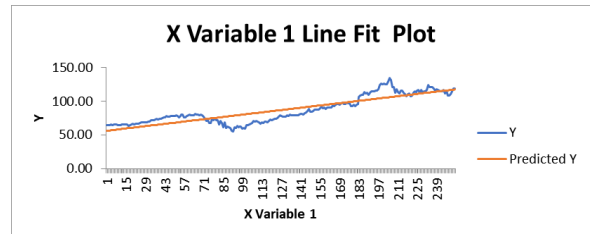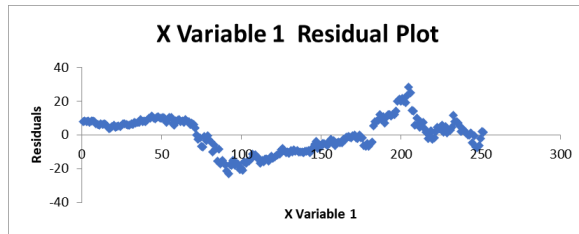
Regression Statistics for AAPL	
Multiple R	0.87267351
R Square	0.76155905
Adjusted R Square	0.76060529
Standard Error	9.95987692
Observations	252

ANOVA for AAPL		1	2	3
	df	SS	MS	F
Regression	1	79208.2994	79208.2994	
Residual	250	24799.7871	99.1991482	
Total	251	104008.086		

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95
Intercept	55.804	1.259	44.339	0	53.326	58.283	53.326
X Variable 1	0.244	0.009	28.257	0	0.227	0.261	0.227

According to the calculation and R Square being 76%, the regression line is an excellent fit for AAPL

the graphs below show predicted y with the regression method for HON
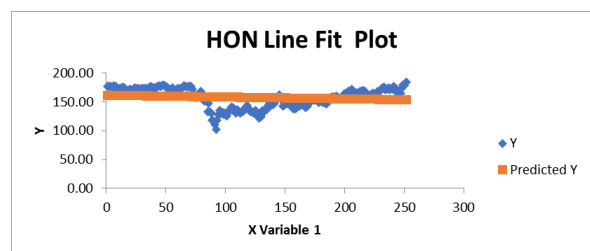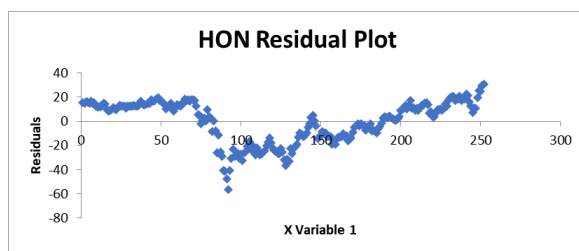
Regression Statistics	
Multiple R	0.133
R Square	0.018
Adjusted R Square	0.014
Standard Error	17.088
Observations	252

ANOVA		1	2	3
	df	SS	MS	F
Regression	1	1313.94025	1313.94025	4.49957473
Residual	250	73003.5798	292.014319	
Total	251	74317.5201		

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95
Intercept	161.65	2.159	74.86	0	157.397	165.903	157.397
X Variable 1	-0.031	0.015	-2.121	0.035	-0.061	-0.002	-0.061

According to the calculation and R Square is 1%, the regression line is not a good fit for the HON data, and 3 - a point average would be much better.

Question

well, according to the regression method, the AAPL stock has a promising future backed up by the exponential smoothing method, while all methods show a looming lot for HON stock; therefore, I would put 100% of investment in the apple stock.

references

Anais Dotis-Georgiou (2021). *An introduction to time series forecasting*. [online] InfoWorld. Available at: https://www.infoworld.com/article/3622246/an-introduction-to-time-series-forecasting.html#:~:text=Time%20series%20forecasting%20is%20a,data%20to%20predict%20future%20values. [Accessed June 16. 2022].
Excel-easy.com. (2022). *Regression Analysis in Excel*. [online] Available at: https://www.excel-easy.com/examples/regression.html [Accessed June 17. 2022].
Zach (2020). *How to Find Weighted Moving Averages in Excel - Statology*. [online] Statology. Available at: https://www.statology.org/weighted-moving-average-excel/ [Accessed June 17. 2022].