



# **FORECASTING STOCKS- TIME SERIES ANALYSIS**

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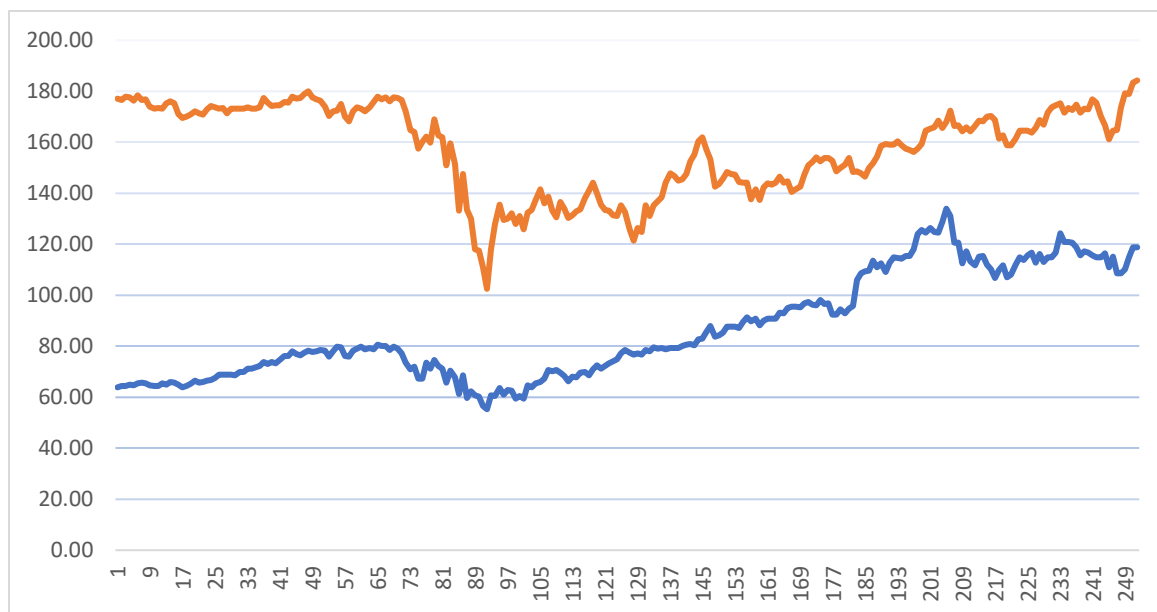
## INTRODUCTION:

The assignment contains three parts, given the data of Apple Inc and Honeywell Inc with a specific time of 252 days, where we need to analyze the present data to forecast the future stocks using time series and forecasting methods and the regression analysis.

## SHORT-TERM FORECASTING:

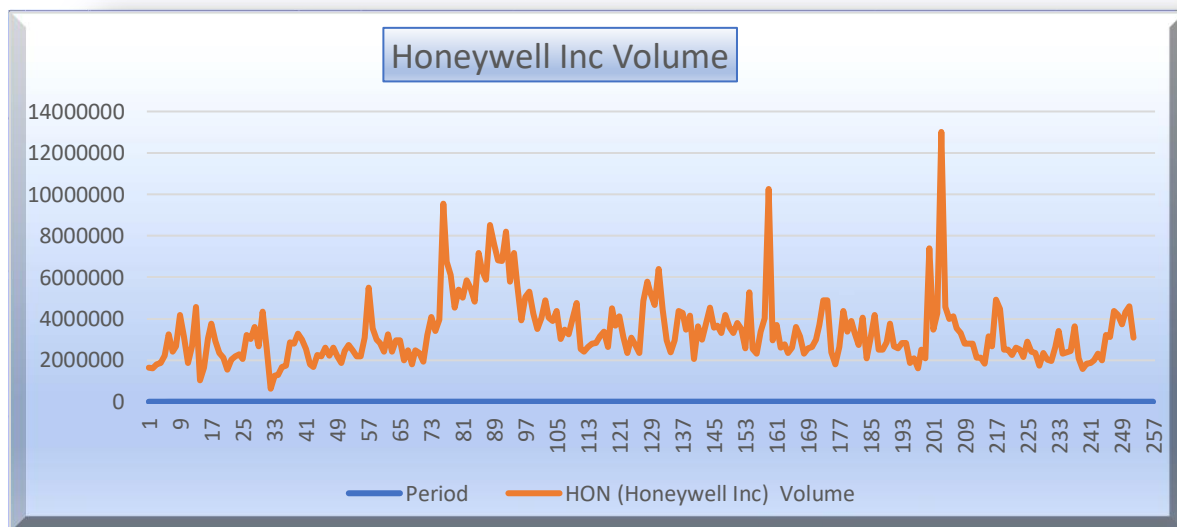
## SUMMARY:

(i) To analyze the prices over the period, Apple Inc which is represented in blue color and the Honeywell Inc, which is represented orange in color, for the period of 252 days. When both the stocks are compared these are totally different and completely unique in the terms of trend. If we observe keenly, Honeywell Inc which is in orange color, has reduced from 140 percent to 100 percent in the period of 85 – 92, but apple maintaining the same line, one thing to observe is both have increased their price in the period between 190 -197.





To analyze the trends of the Apple and Honeywell stocks, period vs volume analysis is done, in this we can observe that the volume of apple products has been its peak in the time between 73-81 for up to, 4000000000 and has been the lowest in the time between 121-129 between 0-500000000 stocks, it has been maintaining its peaks and lows between the time of 177 – 233. The highest it has got is in between 73-81 ranging the stocks from 4000000000 – 2500000000.



When compared to Apple Inc, Honeywell Inc has its highest in the time between 193-217 ranging their stocks from 12000000-8000000, for the

start of the year, where it has started , it's the same at the end of the year, it has got a systematic increase and decrease in the volumes as per the period, the only irregular part was during the period of 57 – 105, it has generated more volumes up to 1000000000 and then sudden decrease in volumes to 20000000.

## (ii) EXPONENTIAL SMOOTHING:

The results as per the calculation would be as shown below.

<b>For Apple Inc,</b>				
<b><math>\alpha=0.15</math>, the forecast price of time period 252 is 114.20 with MAPD 3.91%</b>				
<b><math>\alpha=0.35</math>, the forecast price of time period 252 is 114.51 with MAPD 2.48%</b>				
<b><math>\alpha=0.55</math>, the forecast price of time period 252 is 116.04 with MAPD 2.08%</b>				
<b><math>\alpha=0.75</math>, the forecast price of time period 252 is 117.04 with MAPD 1.96%</b>				
<b>For Honeywell Inc,</b>				
<b><math>\alpha=0.15</math>, the forecast price of time period 252 is 173.74 with MAPD 2.84%</b>				
<b><math>\alpha=0.35</math>, the forecast price of time period 252 is 177.66 with MAPD 2.19%</b>				
<b><math>\alpha=0.55</math>, the forecast price of time period 252 is 180.50 with MAPD 1.90%</b>				
<b><math>\alpha=0.75</math>, the forecast price of time period 252 is 182.08 with MAPD 1.77%</b>				

From the results above, it is observed that, when the alpha value is greater the short-term forecast is getting increased, and the mean absolute percentage deviation is getting decreased. When the percentage of mean absolute percentage deviation is smaller, the forecast generated would be that better. In this case, when the alpha value is 0.75, the forecast of the time when 252 is predicted to be 117.04 and with the least MAPD percentage of 1.96%, this is the case in Apple Inc, whereas in the case of Honeywell Inc, the least percentage is 1.77% when the alpha value is the greatest which is 0.75, in this case, the predicted value of the price in the period of 252 is 182.08.

## (iii) ADJUSTED EXPONENTIAL SMOOTHING:

The results as per the calculation would be as shown below.

when  $\alpha = 0.55$

For Apple Inc,			
$\beta = 0.15$ , the forecast price of time period 252 is 116.41 with MAPE 1.96%			
$\beta = 0.25$ , the forecast price of time period 252 is 116.94 with MAPE 1.94%			
$\beta = 0.45$ , the forecast price of time period 252 is 118.01 with MAPE 1.93%			
$\beta = 0.85$ , the forecast price of time period 252 is 119.26 with MAPE 1.98%			
For Honeywell Inc,			
$\beta = 0.15$ , the forecast price of time period 252 is 181.90 with MAPE 1.96%			
$\beta = 0.25$ , the forecast price of time period 252 is 182.68 with MAPE 1.93%			
$\beta = 0.45$ , the forecast price of time period 252 is 183.57 with MAPE 1.88%			
$\beta = 0.85$ , the forecast price of time period 252 is 183.78 with MAPE 1.84%			

From the results above, it is observed that, when beta value is greater, the mean absolute percentage error is greater. If we see in the case of Apple, when beta value is equal to 0.85, in the period of 252, the predicted value is 119.26 with the mean absolute percentage error of 1.98 percentage, when compared to Apple Inc, when the beta value is equal to 0.85, the predicted forecast is 183.78 with the mean absolute percentage error as 1.84%. We can conclude that in the time of 252, when the beta value is 0.45, it is best forecasted.

## LONG-TERM FORECASTING:

(i) Calculating the forecasted values using WMA method. The given weights are 0.5, 0.3 and 0.2.

The actual values are extracted from <https://finance.yahoo.com/>.

For Apple Inc,

Actual Values	Forecast Values
116.32	117.46
115.97	117.70
119.49	117.95
119.21	118.19
119.26	118.43

For Honeywell International Inc,

Actual Values	Forecast Values
196.99	153.71
201.98	153.67
199.29	153.64
197.24	153.61
201.54	153.58

- From the above tables we can see that the forecast values for Apple Inc are closer to the actual values.
- But the forecasted values for Honeywell International Inc are less than actual values by a large difference.
- Hence, the linear trend function used to get the forecasted values of Honeywell stocks is not accurate.

(ii) We calculate the MAPE of the forecasts to determine if the forecast is accurate.

Apple Inc	
MAPE	5.81%

Honeywell International Inc	
<b>MAPE</b>	<b>9.68%</b>

From the above MAPE values, we can see that the Linear trend method is much less in accuracy than the Exponential smoothing method because of the higher MAPE value.

## **REGRESSION :**

- Using simple regression to get the forecasted stock values , we get the following values.

For Apple Inc,

Actual Value	Forecast Value
116.32	117.46
115.97	117.71
119.49	117.95
119.21	118.19
119.26	118.44

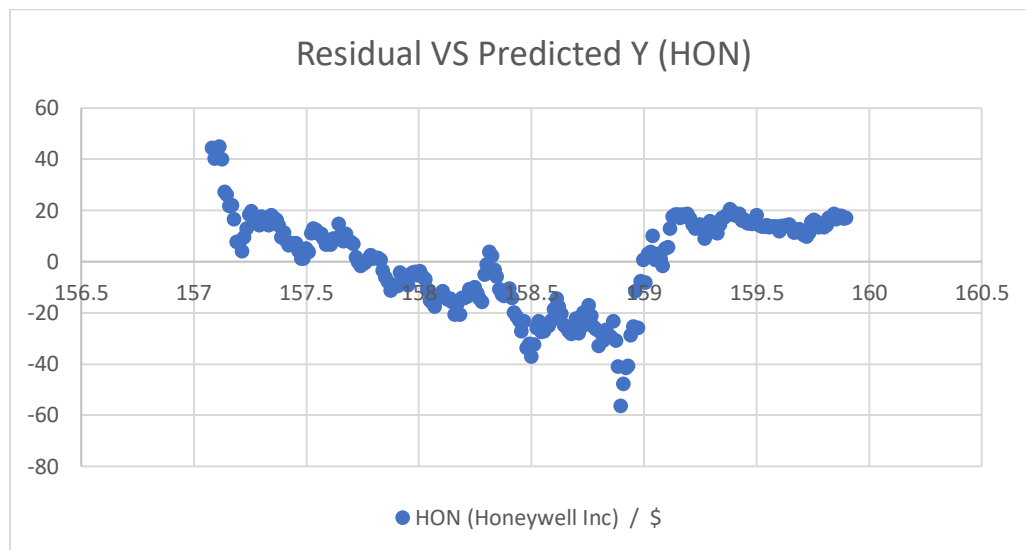
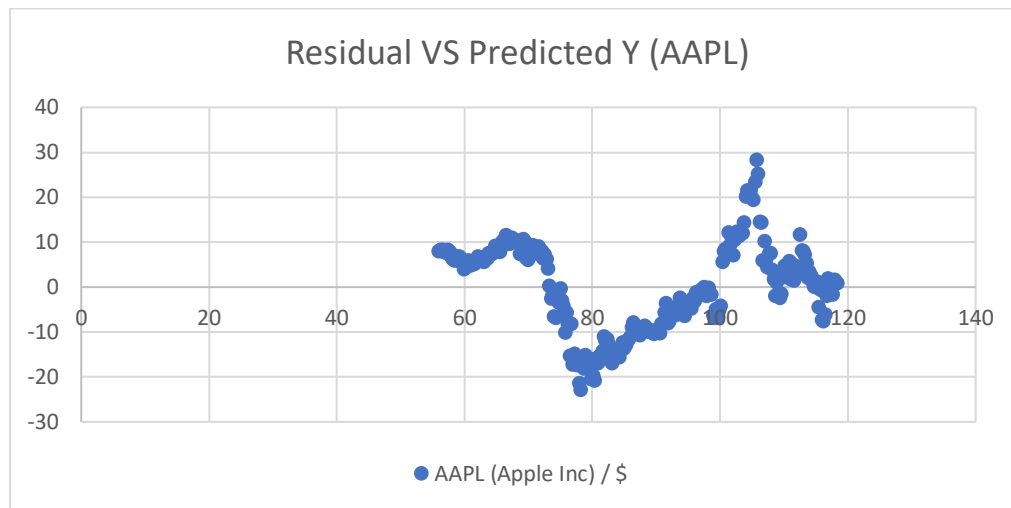
For Honeywell Inc,

Actual Value	Forecast Value
196.99	157.13
201.98	157.12
199.29	157.10
197.24	157.09
201.54	157.08

From the above tables, we can see that the forecasted values for Apple Inc are much closer than the forecasted values in Part 1 and Part 2. Hence, Regression method would fetch better results for Apple Inc.

But for Honeywell International Inc, the forecasted values are not close. Hence, for Honeywell International Inc, Part1 would fetch better results.

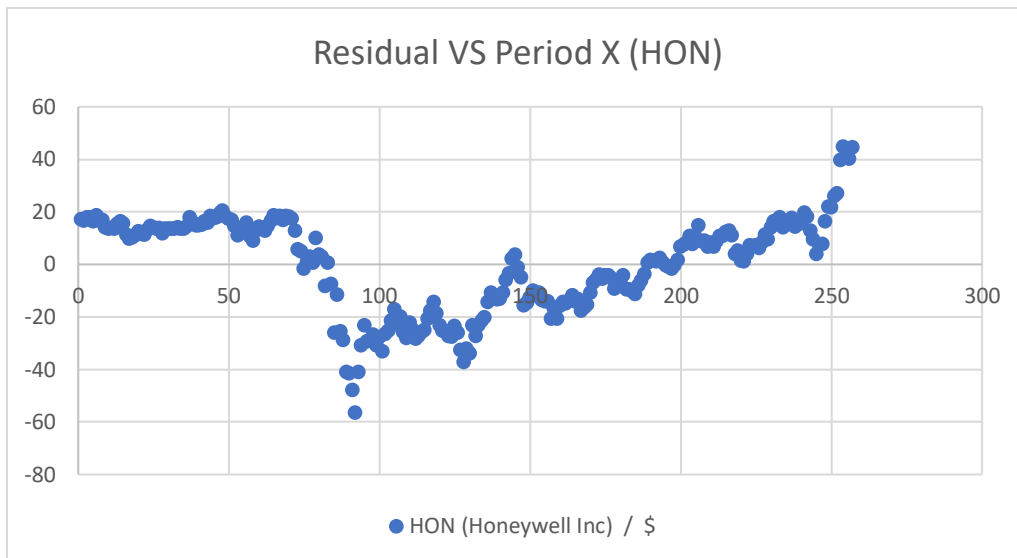
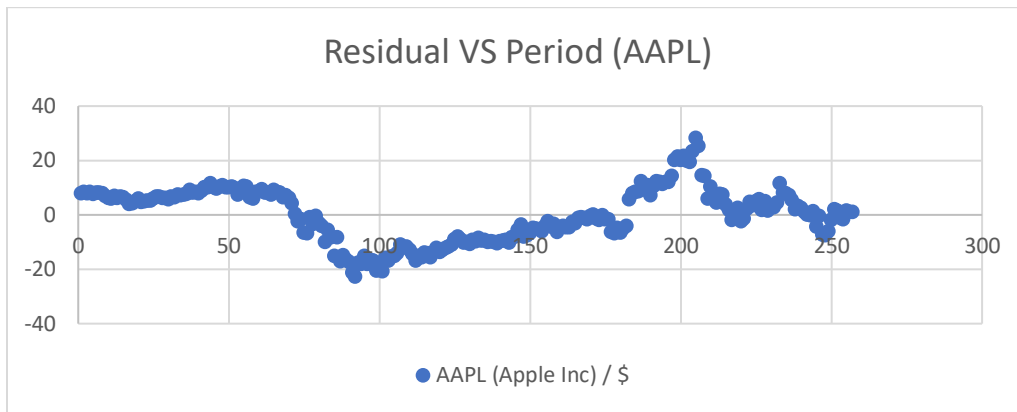
(ii) Residual Analysis:



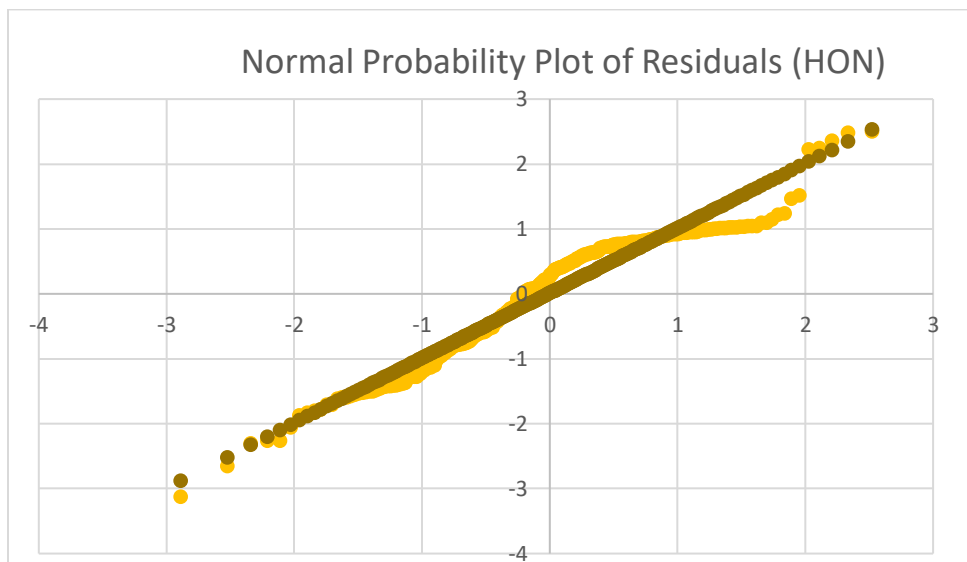
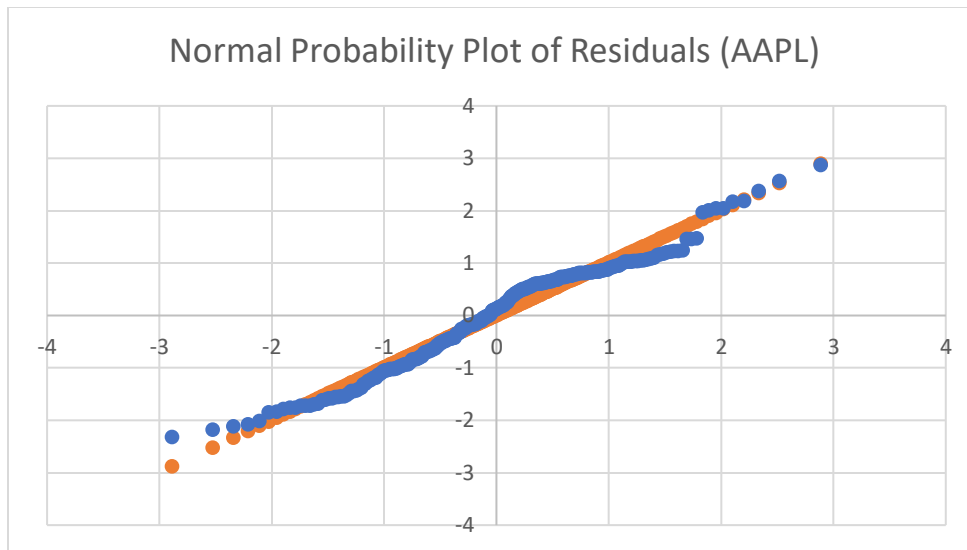
From the above graphs, we can see that there is a downwards trend in the starting periods, after which there is an upwards trend. As



there is a constant deviation of the points from the 0 line, we can say the residuals are homoscedastic.



In the above graphs, we can see there is a rise and fall motion in the stock price of both Apple Inc and Honeywell International Inc stocks. There is an upwards and downwards trend with respect to the time variable. Hence the residuals are not independent.



From the above graphs, we can see that the normal probability line fits the residuals well for both the companies. We can conclude that both the residuals are normally distributed.

- The Chi-Square P-value for both the companies are less than 0.05. Hence, we can conclude that the residuals are normally distributed.

## **Conclusion:**

After the above analysis, as the stock prices of Apple Inc have differed much lesser than the Honeywell International Inc stocks, and considering the probability of getting returns, I would invest about 65% of my portfolio at AAPL and the remaining 35% at HON.

## **REFERENCES:**

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