

OESON PROJECT 1

STOCK MARKET ANALYSIS
MICROSOFT/APPLE/TESLA



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PROJECT OVERVIEW



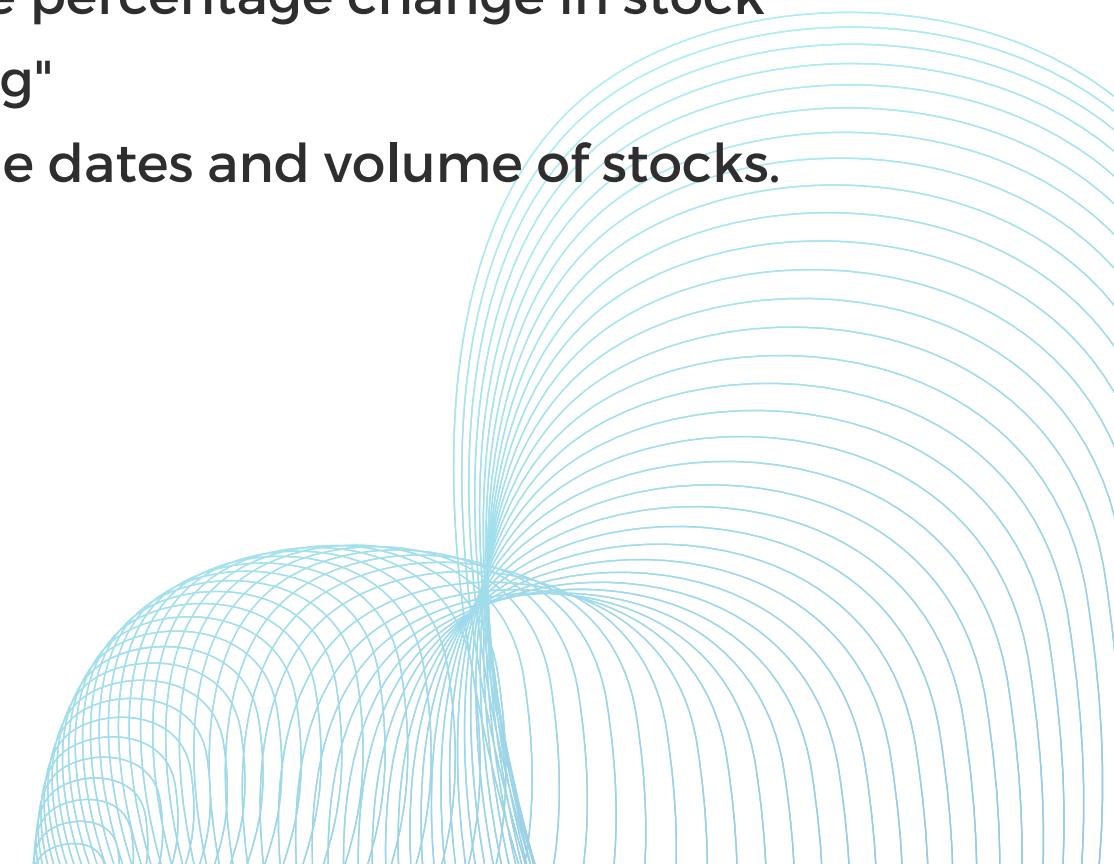
Project Task

1. Analyse an Excel Dataset pertaining to Stock Prices over time according to the Problem Statement. The data is sourced from the S&P 500 Database.
2. Produce descriptive statistics and regression analyses for stock prices of the given data for all three different companies.
3. Include diagrams and charts displaying price trends over time from 2018-2023.
4. Compare all different companies statistics, their individual performance, and give conclusions and insights on the visuals.
5. Final conclusion on which stock is the most promising to invest in.

Project Description

We have been given live stock data values from 3 major companies, Microsoft, Apple and Tesla based on the **S&P 500 Stock Exchange**. This is a stock market index tracking the price of the 500 largest companies listed in the United States and is one of the most commonly followed equity indices.

- Live Data has been sourced from the Yahoo Finance Database
- This dataset contains stock values consisting of opening, closing, highest and lowest stock prices daily.
- Standardized columns which assess the percentage change in stock prices have been labelled as "App%chng"
- Other features of the dataset include the dates and volume of stocks.



DESCRIPTIVE STATISTICS

	Microsoft (MSFT)	Tesla	Apple
Mean	194.47	131.90	98.57
Standard Error	2.08	3.28	1.29
Median	203.58	96.57	95.09
Mode	95.14	24.00	127.82
Standard Deviation	74.23	117.17	46.18
Sample Variance	5510.45	13728.01	2132.24
Kurtosis	-1.29	-1.26	-1.58
Skewness	0.15	0.47	0.12
Range	258.56	399.40	146.64
Minimum	86.06	12.07	36.00
Maximum	344.62	411.47	182.63
Sum	248533.81	168562.10	125977.70
Count	1278.00	1278.00	1278
Confidence Level	4.074	6.43	2.53

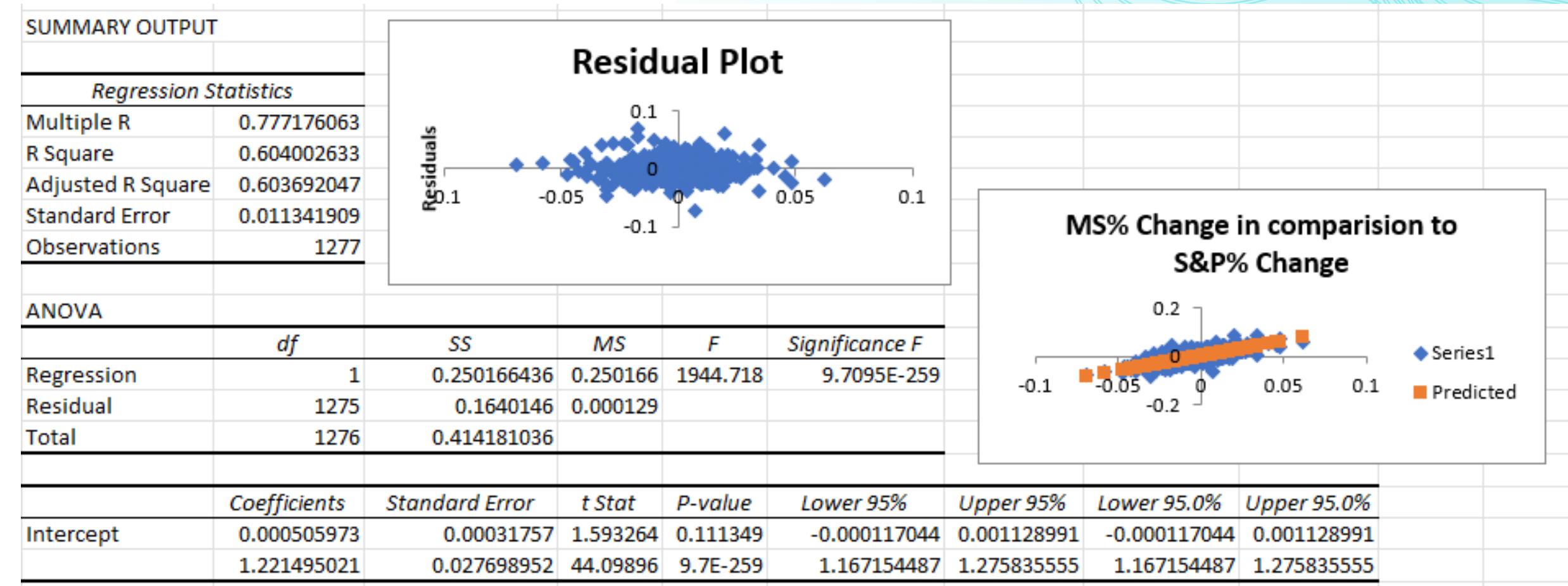
ANALYSIS OF STATISTICS

- **Microsoft's** stocks experience a notable span in its prices, ranging from \$85.01 to a peak of \$344.62. **Tesla** stocks are from \$12.07 to \$411.47. **Apple** stocks range from \$35.55 to \$182.01. **Tesla** has the lowest and highest minimum and maximum values.
- **Microsoft's** median value is at \$203.58 and it has a mode value of \$95.15. This indicates the stock was traded at a lower price during this time, before increasing, with the median and mean having very similar prices. **Tesla** had a period where its stock had extended periods of time at much lower prices in the past at \$24.00 mode, with the median being at \$96.57 and the mean at \$131.90. There are a few high prices in the **Tesla** stock which pulls the average value up. Lastly, with **Apple**, median and mean prices are very similar at \$98.57 and \$95.09 respectively. The mode value is significantly higher at \$127.82 , showing there is a large but stable increase in stock prices.
- **Microsoft** has a small but positive skewness of 0.15 which indicates a consistent increase in stock prices with a mediocre amount of high prices. **Tesla** on the other hand, has a much more positive skewness at 0.47 and so there sharp spikes/ short periods of time where the value of the stock increases, however this is infrequent. Nevertheless, it is less likely to experience sharp decreases. **Apple** also has a small and positive skewness.
- **Microsoft, Tesla** and **Apple** all have negative kurtosis values at -1.29, -1.26 and -1.58 respectively, telling us the distribution of these prices are flatter than a standard bell curve which is consistent with the idea that these stocks experience fewer extreme price jumps. This is a positive sign for long term investors.

COMPARISON OF STATISTICS

- **Microsoft** has the highest mean stock price and total value (sum of stock prices), followed by **Tesla** and then **Apple**, indicating Microsoft has the highest total value.
- **Tesla** has the highest standard deviation and sample variance, indicating higher price volatility, with **Apple** having the lowest standard deviation and sample variance suggesting more stable stock prices. Furthermore, **Microsoft** and **Tesla** have wider confidence intervals than **Apple** so it is harder to predict their stock prices more accurately due to their instability. A narrower confidence interval implies more confidence in estimating the population mean (**Apple** is the most stable investment).
- All three companies feature a negative kurtosis highlighting their stock price distributions are Platykurtic, peaking less than the normal distribution, hence it is less likely for these stocks to experience extreme price movements.
- **Tesla** has the highest variability because it has the highest standard deviation, range, sample variance among all three companies highlighting a higher risk within the investment.
- **Microsoft** and **Apple** are positively skewed and **Tesla** has a more pronounced higher skew with the higher stock prices pulling the mean and median to the right, with there being an occasional significant upward price spikes or positive outliers. Hence, **Tesla** has a higher chance of a sharp increase, so it is more important to buy and sell at the right time. All stocks have positive skewness, so there is lower chance of experiencing negative low-price outliers.
- The count of all three companies is the same at 1278, so the statistics are based on the same number of data points.

MICROSOFT REGRESSION ANALYSIS



- **Regression Statistics**

- **Multiple R:** 0.777 pointing at a strong linear relationship between Microsoft and the S&P 500 stock exchange.
- **R Square:** An R^2 value of 0.604 suggests there is a 60.4% variability between Microsoft and S&P 500.
- **Adjusted R Square:** The number of predictors within the model, at 0.604.
- **Standard Error:** Standard error of regression represents a small average amount of 0.0113 hence this regression model is a good fit for the data.

- **ANOVA**

- The regression model is highly statistically significant with an extremely low p-value, showing the independent variable has a significant effect on the dependent variable. A change in the microsoft stock prices is heavily influenced by the S&P index.

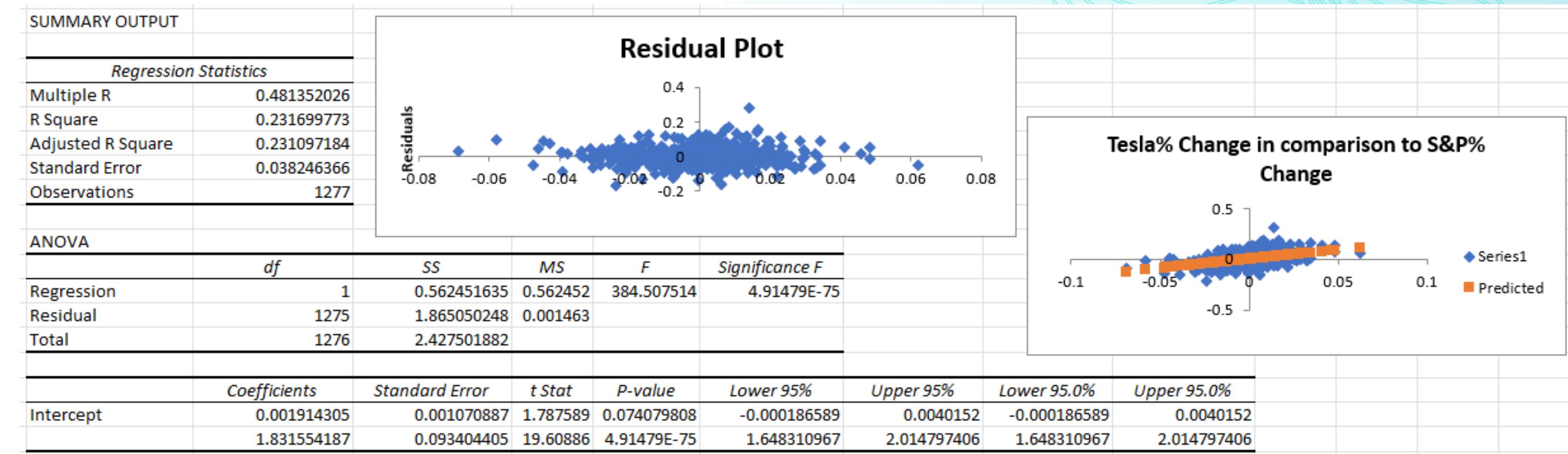
- **Coefficients**

- The coefficient for the independent variable is 1.2215 indicating that for every one-unit increase in the Microsoft % Change, and this is a positive relationship

- **P-Values and T-Stat**

- The p value is close to 0, indicating that Microsoft is a highly statistically significant predictor in comparison with the dependant variable Y
- The t-stat value is much higher than the p-values which shows there is statistical significance in the X variable for predicting Y and a strong correlation between the S&P stock index and the Microsoft stock price.

TESLA REGRESSION ANALYSIS



- **Regression Statistics**

- **Multiple R:** 0.481 pointing at a moderate linear relationship between Microsoft and the S&P 500 stock exchange.
- **R Square:** An R^2 value of 0.23 means approx. 23% of Tesla Stock Price fluctuations can be explained by the S&P 500 stock exchange.
- **Adjusted R Square:** The number of predictors within the model, at 0.23.
- **Standard Error:** A 0.038 standard error is very low indicating a better fit of the model.

- **ANOVA**

- The **F-Statistic** is extremely low, suggesting the model is statistically significant and at least one of the independent variables has an effect on Tesla Stock prices (p-value is low).

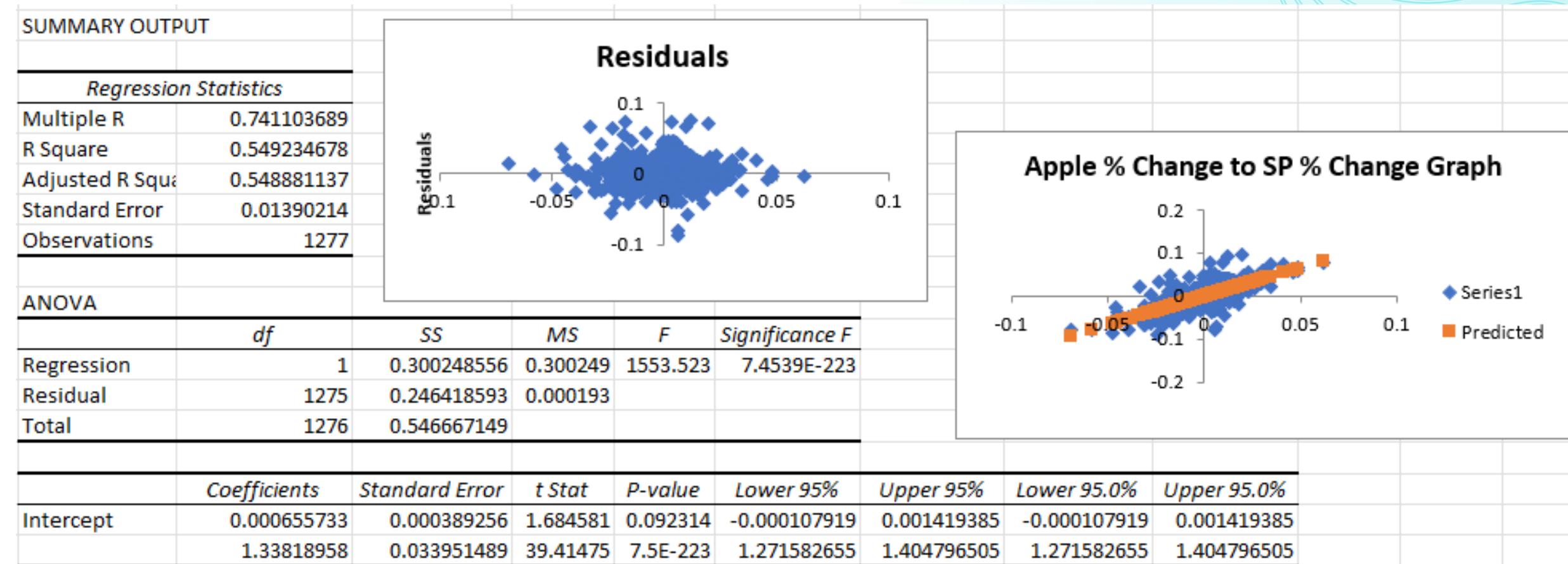
- **Coefficients**

- The coefficient for the independent variable is 1.831 indicating that for every one-unit increase in the Tesla % Change, and this is a positive relationship.
- The **intercept** 0.0019 is the estimated value of Tesla stock prices when the S&P 500 stock exchange is zero.

- **P-Values and T-Stat**

- The **p value** is close to 0, indicating that Tesla is a highly statistically significant predictor in comparison with the dependant variable Y.
- The **t-statistic** value (19.61) is much higher than the p-value (4.91) which shows there is statistical significance in the X variable for predicting Y and a strong correlation between the S&P stock index and the Microsoft stock price.

APPLE REGRESSION ANALYSIS



Regression Statistics

- **Multiple R:** The multiple correlation coefficient (0.74) measures the strength and direction of the linear relationship which is positive and strong.
- **R Square:** An R^2 value of 0.549 suggests there is a 54.9% variability between Apple and S&P 500.
- **Adjusted R Square:** The number of predictors within the model, at 0.549.
- **Standard Error:** A small standard error of 0.0139 suggests a good fit for the model.

ANOVA

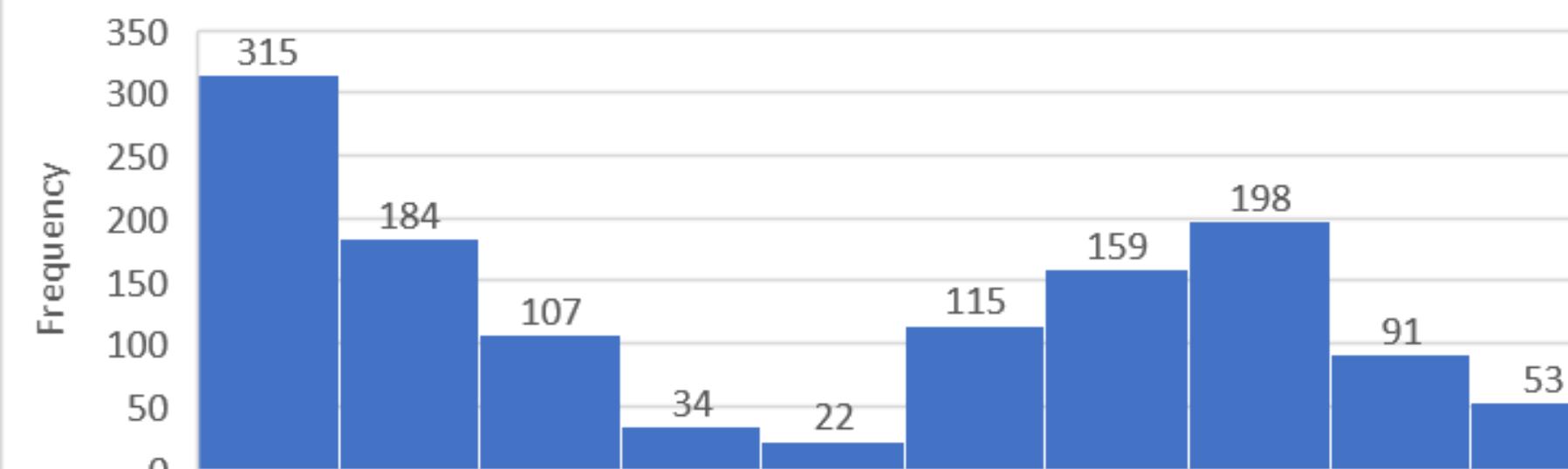
- The F statistic is extremely high, at 1553.52 and the p-value is 7.45×10^{-223} is extremely low, indicating the regression model is highly statistically significant.

Coefficients

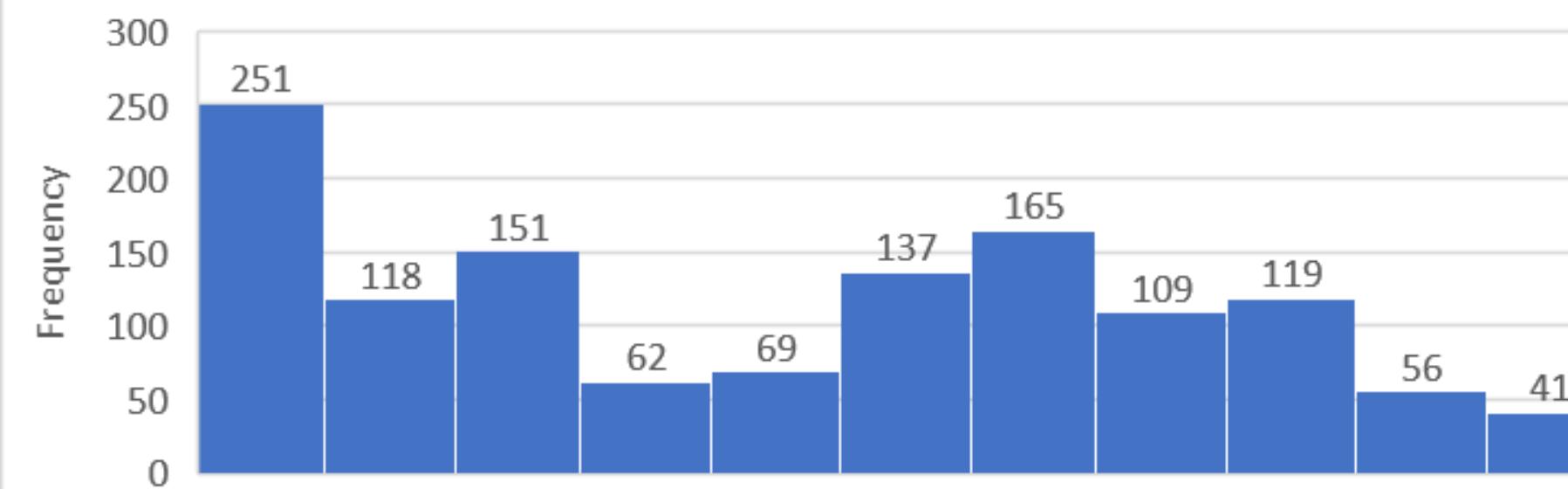
- The coefficient for the independent variable is 1.339 indicating that for every one-unit increase in the Apple % Change, and this is a positive relationship, the S&P 500 index stock price goes up by 1%.
- The T-Stat is much larger than the p-value (1.68 in comparison with 0.092) indicating changes in the independent variable have a significant impact on the dependant variable.

HISTOGRAM ANALYSIS

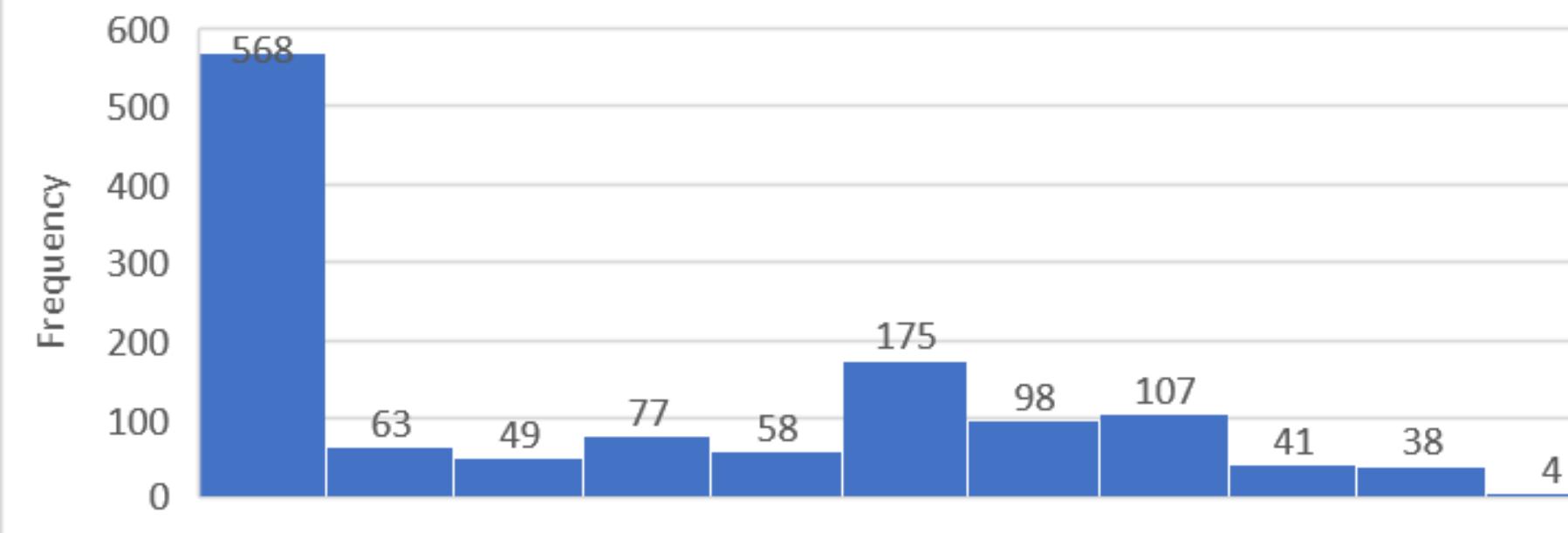
Histogram of the Apple Open Stock



Histogram of the Microsoft Open Stock



Histogram of the Tesla Open Stock

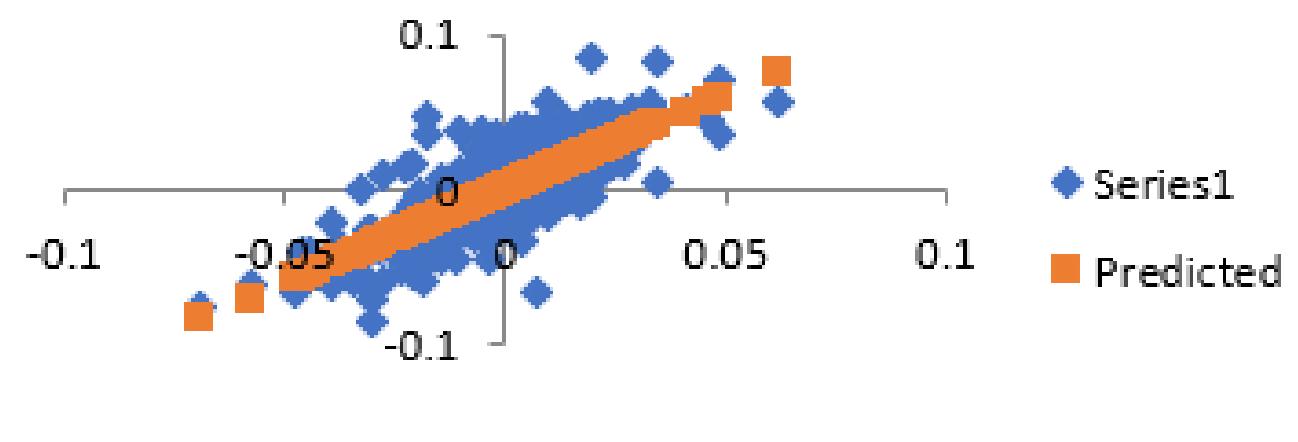


- We can observe the distribution in Stock prices between Apple, Microsoft and Tesla over here, with horizontal ranges from 0-500 with 10-11 bins each the size of 20 . The vertical axis represents the frequencies.
- From Tesla's Histogram, we can see that there is a high proportion of stocks from 0-500, suggesting stocks are generally at a lower value.
- Apple has the highest number of stocks which are higher in value proportionally, followed by Microsoft and then the Tesla Stock Exchange.
- Tesla's stock value is unreliable because of its high variation and small number of high stock values. It has a **uni modal** distribution which indicates that it has a presence of one peak.
- Microsoft and Apples distributions are multimodal, there is more variability and the data is less skewed.
- Tesla's peak at the end highlights the possibility of outliers.

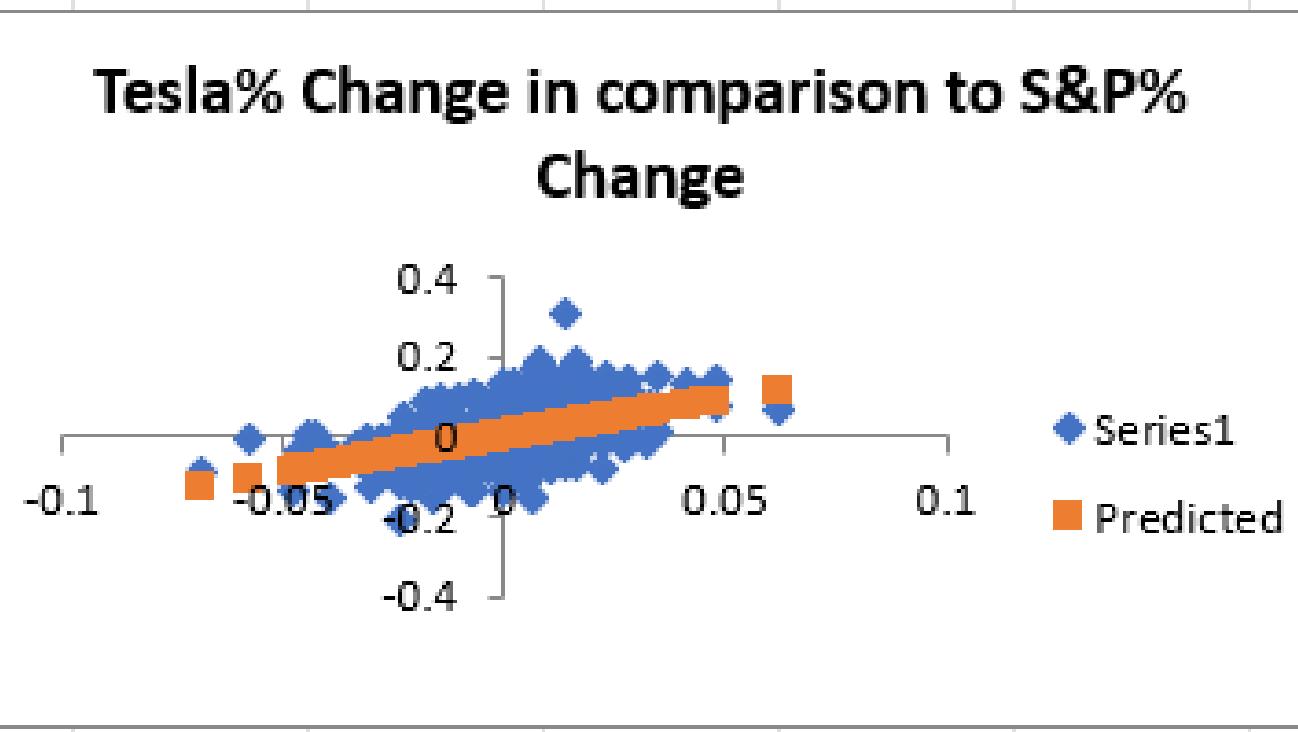
PERCENTAGE CHANGE ANALYSIS

- Microsoft Line Fit Plot is the steepest out of all the other stocks, Tesla and Apple with Tesla having the most gentle line of best fit.
- This indicates that S&P 500 is a dominant predictor of the Microsoft Stock market and for every change within that index, the Microsoft Stock prices change the most too
- The data points are sometimes spread out in terms for Microsoft and S&P 500 percentage change, pointing at circumstances when other factors effect stock prices and Microsoft is not entirely dependent on S&P 500.
- Percentage increases in Tesla are more drastic and the relationship is moderately linear.
- We observe a weaker correlation and some big outliers far away from the line of best fit, and changes in the S&P 500 index only having a smaller increase on the trend.
- The data points in the Apple Line Fit Plot align suggesting a positive linear relationship between index and stock price changes, with the least number of outliers and stock price changes deviating from the line of best fit.

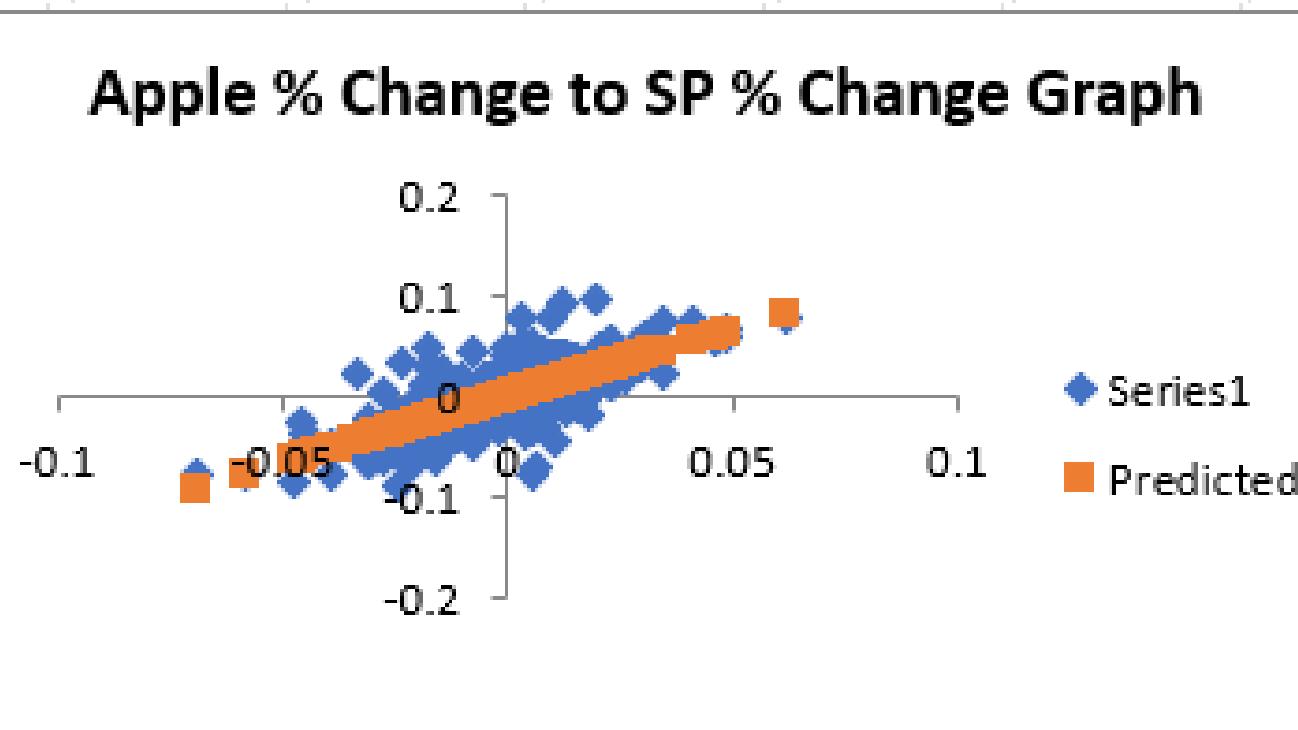
MS% Change in comparision to S&P% Change



Tesla% Change in comparison to S&P% Change

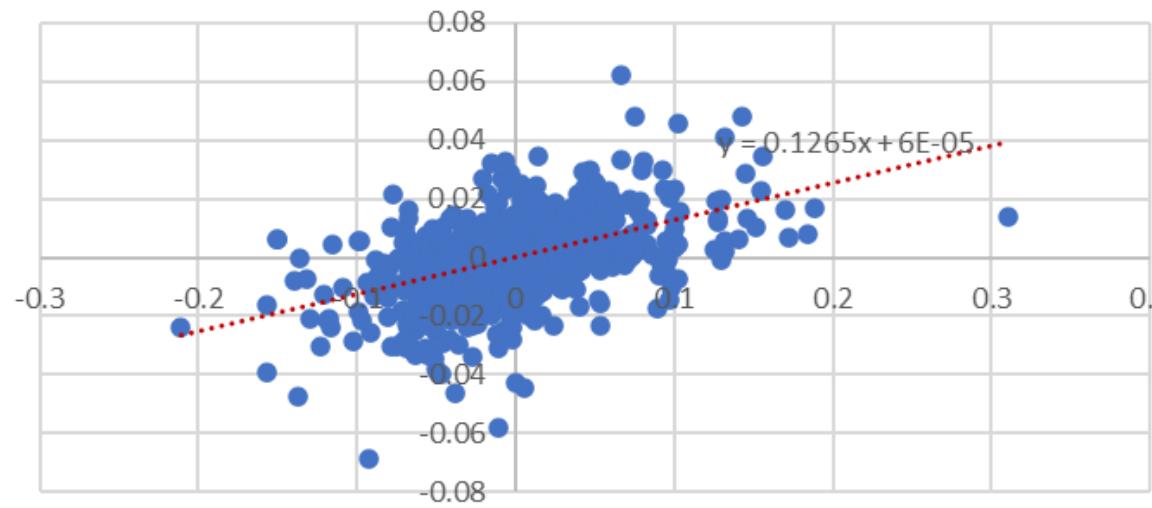


Apple % Change to SP % Change Graph

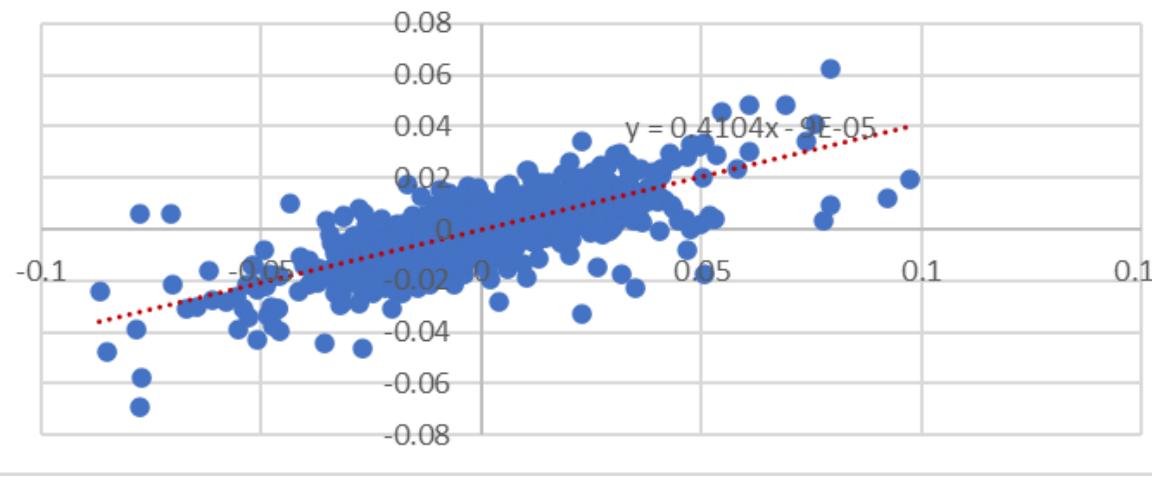


REGRESSION ANALYSIS

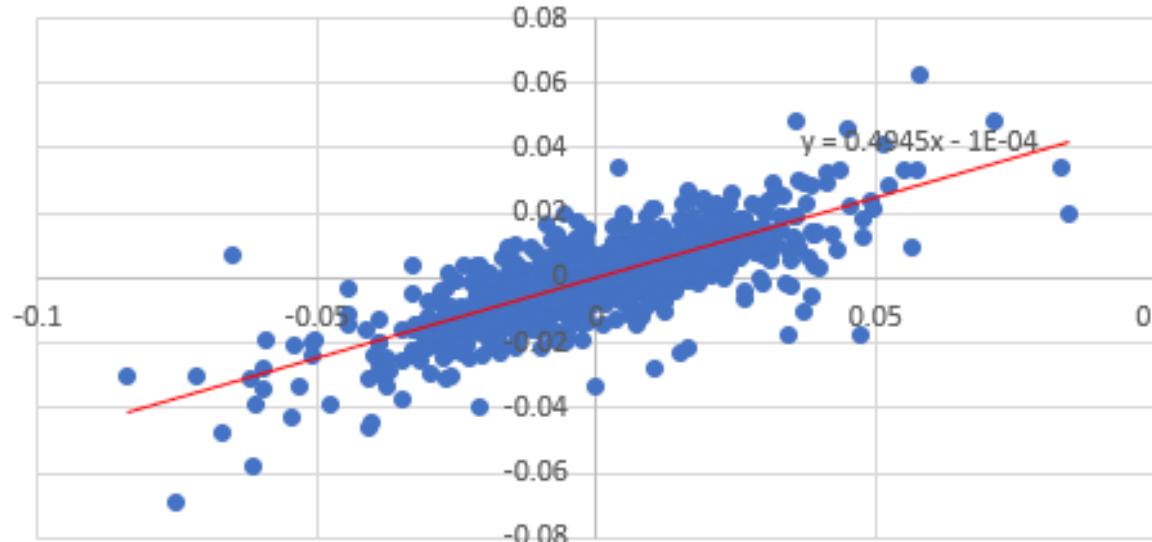
Percentage Change comparison between SP%chng and Tesla&chng



Percentage Change comparison between S&P 500 and App&chng

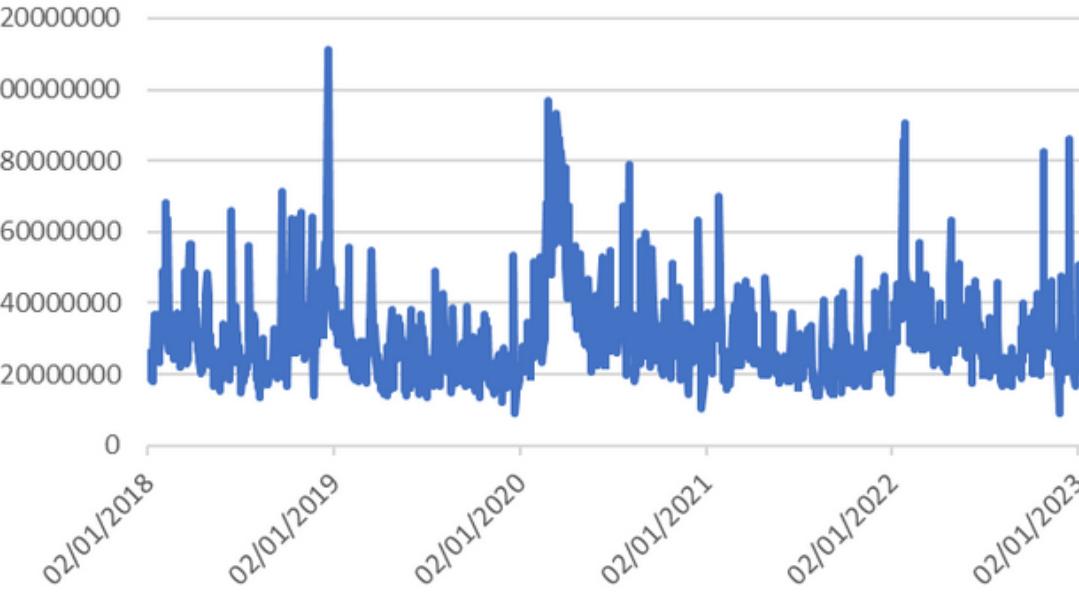


Percentage Change comparison between S&P 500 and MSFT % Change

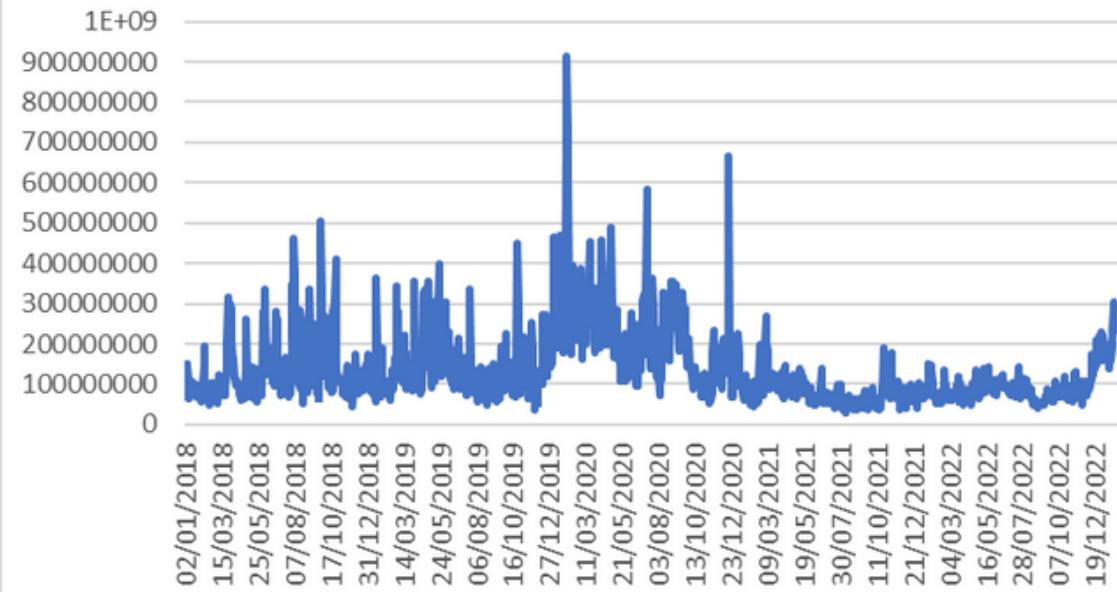


- **Microsoft:** Gradient of 0.4945 - S&P 500 changes play a bigger role on this stock
- **Apple:** Gradient of 0.4104 - S&P 500 changes play a slightly smaller role on this stock nevertheless still a major role.
- **Tesla:** Gradient of 0.1265 - S&P 500 changes have less of a role on this stock compared to others. Larger intercept along with distribution of data points suggests there are more contributing factors to this stock.

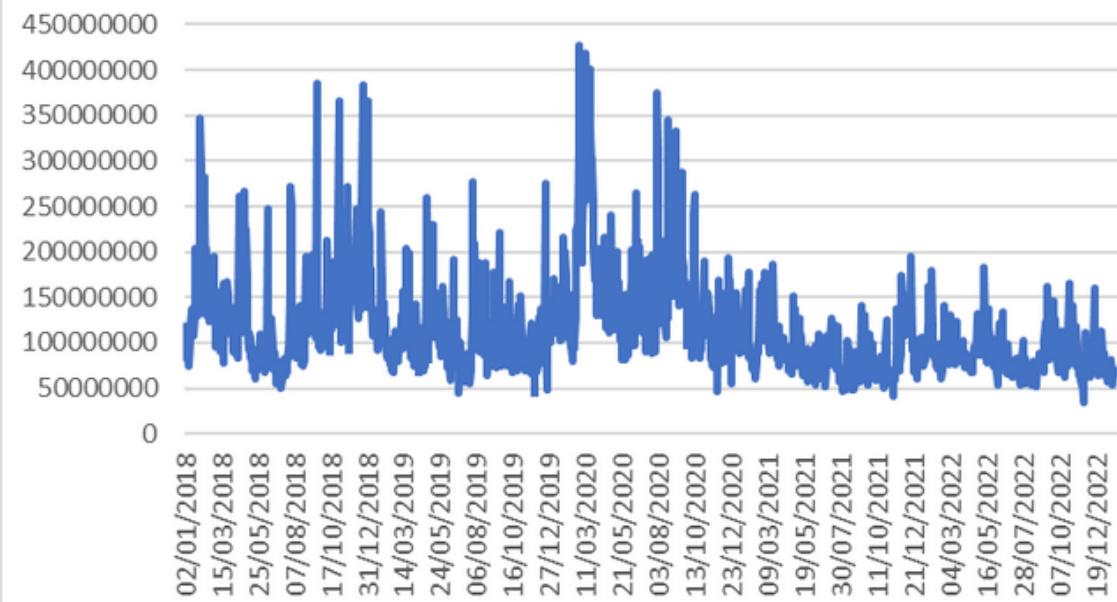
Microsoft Volume over Time



Tesla Volume over Time



Apple Volume over Time



VOLUME ANALYSIS

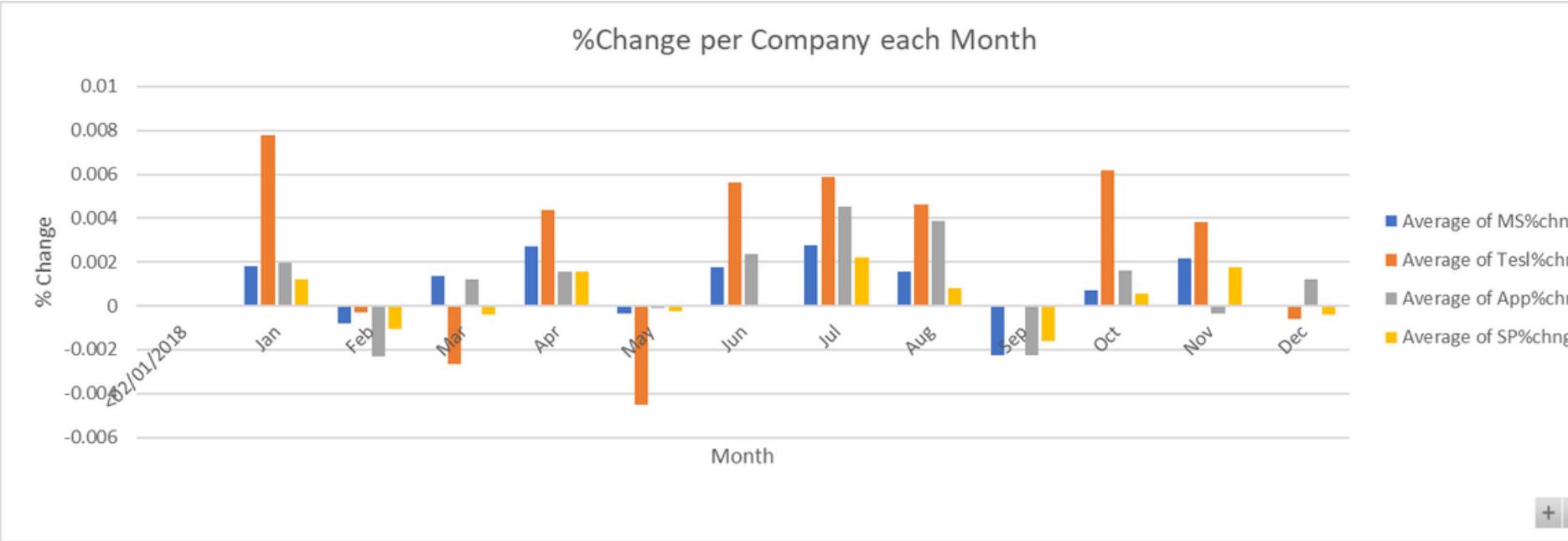
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YEARLY CLOSING PRICES PER COMPANY



- Analyzing the yearly variation of %change within the company each year and the closing prices each year.
- In 2018, Tesla and Microsoft features small positive percentage changes in value and this continued until 2022, when all companies and the S&P500 took a hit.
- Tesla showed a sharp increase from 2019 to 2020, however the %change featured another sharp increase from 2022- 2023.
- Apple and S&P 500 saw their biggest percentage increases from 2022 to 2023.
- Microsoft Percentage Changes are much less drastic emphasising their stability.
- Closing Prices peaked in 2021 for Microsoft, 2022 for Tesla and Microsoft.
- All closing prices dropped from 2022 to 2023.
- The lowest closing prices were seen in 2018 for all stocks but 2019 for Tesla.
- Stock values for Microsoft and Apple correlate better with the Stock Market Index.

MONTHLY CLOSING PRICES PER COMPANY



- Looking at the statistics monthly, we can see that there is an average deviation in stock values over time.
- Tesla seems to take hits predominantly in March and May, indicating it does not perform as well during summer months, with a large increase in January and October.
- Most of the time when S&P 500 has a percentage decrease, so does Apple, Microsoft, however Tesla's changes are more unpredictable.



TIME- SERIES ANALYSIS

- Analysing the variation over time, we can see Tesla peaked around 2021/ 2022, and generally had a lower stock value from 2018 - 2021 than the others.
- A good time to invest would have been at 2020, before prices shot up.
- There are hardly any differences between closing and opening prices over time.
- Microsoft had the highest closing prices consistently until Tesla had a boom. Apple's prices never reached Microsoft stock prices.
- Microsoft Stock prices are slowly decreasing since last year, whereas Apples are increasing.



BETA COMPARISION

- **Microsoft** has the lowest Beta value, which indicates the stock is less risky but it will give a smaller return value
- **Tesla** has the higher Beta value; this stock is a riskier investment but can offer greater returns if sold and brought at the right time.

Company	Beta Value
Tesla	1.83
Apple	1.34
Microsoft	1.22

CONCLUSIONS

From our regression analyses, we conclude that:

- The regression model for the Tesla Stock has the highest stock exchange coefficient, highest standard error lowest R² value and smallest gap between corresponding t-stat/ F-stat and p-values. This suggests that the linear relationship is moderate and there is a weaker correlation between the S&P 500 and Tesla stock exchange alone, so a better model would be used to forecast this stock exchange. Other factors also have an effect on Tesla, and it is the more riskier stock investment due to its volatility.
- Microsoft is the best investment long-term, Tesla is the best short - term

Microsoft:

- Steady growth, less volatility
- Best long-term investment
- Correlates the best with S&P 500
- Currently decreasing in value

Apple:

- Good investment; currently increasing in price but at a steady rate
- Less fluctuations, similar to Microsoft in terms of stability but lower value

Tesla:

- Higher risk, higher reward stock
- High growth, lots of fluctuations, higher market sensitivity
- Currently decreasing in value