OESON Learning Data Science: Stock Return Analysis

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Prompt

Assess the financial risk of a stock in a share market

The three stocks are Microsoft (MSFT), Tesla (TSLA), and Apple (AAPL)

The stocks are held in comparison to the change in the share market

The share market is S&P 500 (S&P)

Compare how the different stocks have performed in the time period of 2018-2023

The data has been pulled from Yahoo Finance

Input Data

Date	Open	High	Low	Close	Adj Close	Volume	%change
1/2/2018	86.13	86.31	85.5	85.95	80.94038	22483800	
1/3/2018	86.06	86.51	85.97	86.35	81.31709	26061400	-0.08127
1/4/2018	86.59	87.66	86.57	87.11	82.03278	21912000	0.006158
1/5/2018	87.66	88.41	87.43	88.19	83.04984	23407100	0.012357
1/8/2018	88.2	88.58	87.6	88.28	83.13459	22113000	0.00616
1/9/2018	88.65	88.73	87.86	88.22	83.07809	19484300	0.005102
1/10/2018	87.86	88.19	87.41	87.82	82.70139	18652200	-0.00891
1/11/2018	88.13	88.13	87.24	88.08	82.94626	17808900	0.003073
1/12/2018	88.67	89.78	88.45	89.6	84.37765	24271500	0.006127
1/16/2018	90.1	90.79	88.01	88.35	83.20052	36599700	0.016127
1/17/2018	89.08	90.28	88.75	90.14	84.88617	25621200	-0.01132
1/18/2018	89.8	90.67	89.66	90.1	84.8485	24159700	0.008083
1/19/2018	90.14	90.61	89.66	90	84.75432	36875000	0.003786
1/22/2018	90	91.62	89.74	91.61	86.27049	23601600	-0.00155
1/23/2018	91.9	92.3	91.54	91.9	86.5436	23412800	0.021111
1/24/2018	92.55	93.43	91.58	91.82	86.46826	33277500	0.007073
1/25/2018	92.47	93.24	91.93	92.33	86.94854	26383200	-0.00086

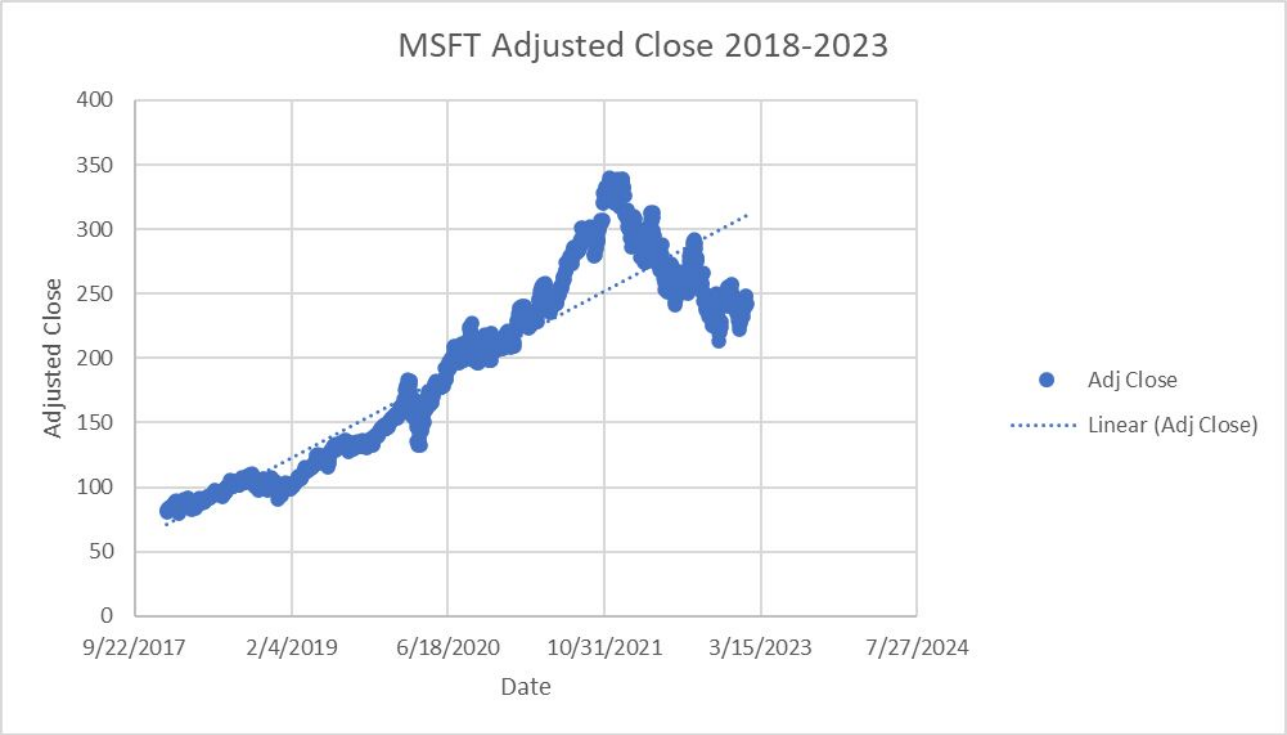
An example of the daily values of stock MSFT

Values included are the Open Price, High Price, Low Price, Close Price, Adjusted Close Price, Volume, and the Percent Change in value from the previous day

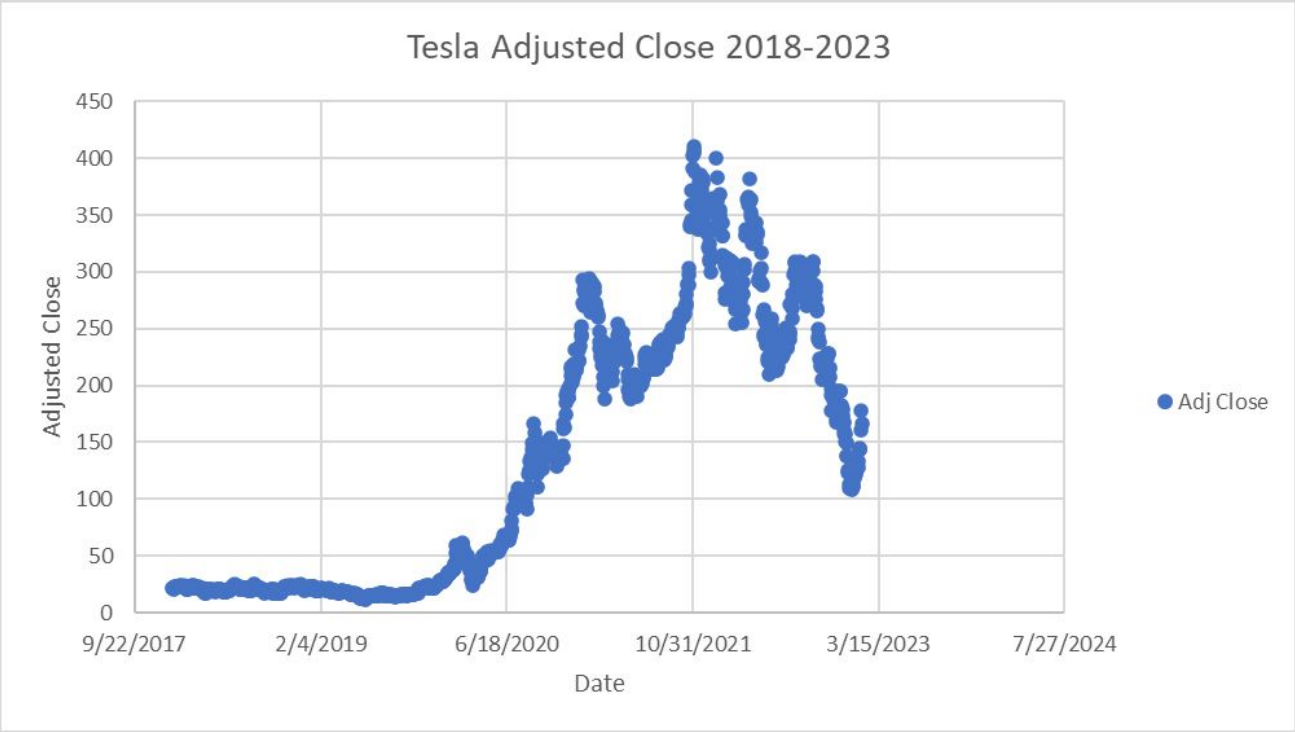
MSFT Adjusted Close Over Time

The graph shows the Adjusted Close of MSFT over the time period

It illustrates the daily, weekly, monthly, and yearly progression in the rise and fall of the value, the price per share in dollars



Tesla Adjusted Close Over Time



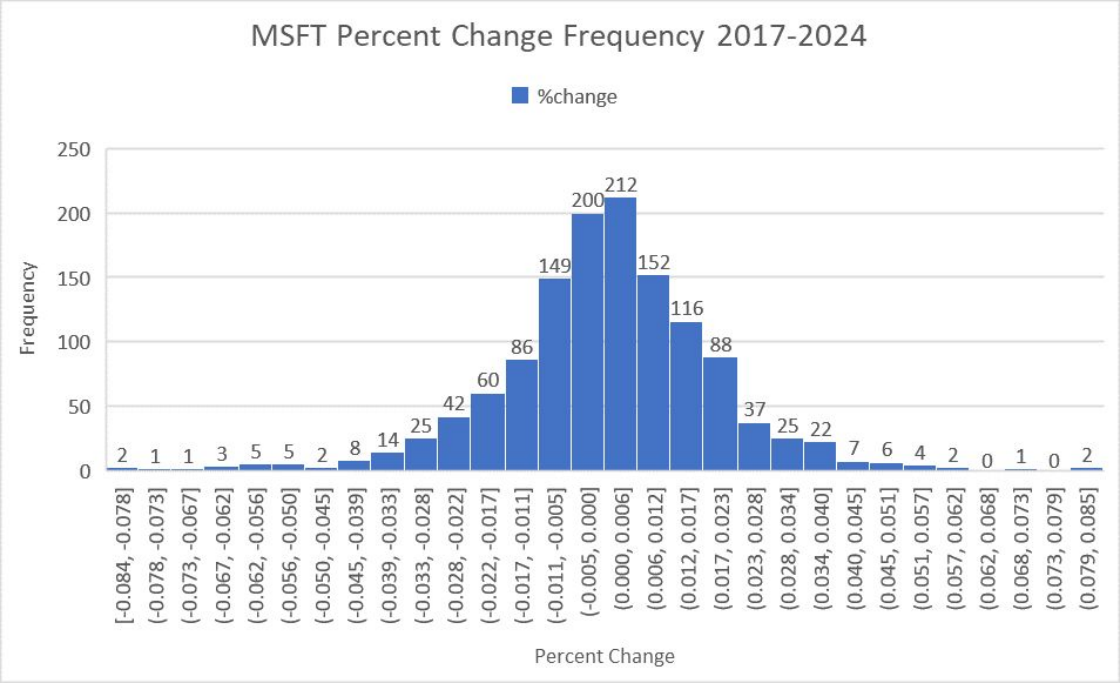
Apple Adjusted Close Over Time

Histograms of Daily Percent Change

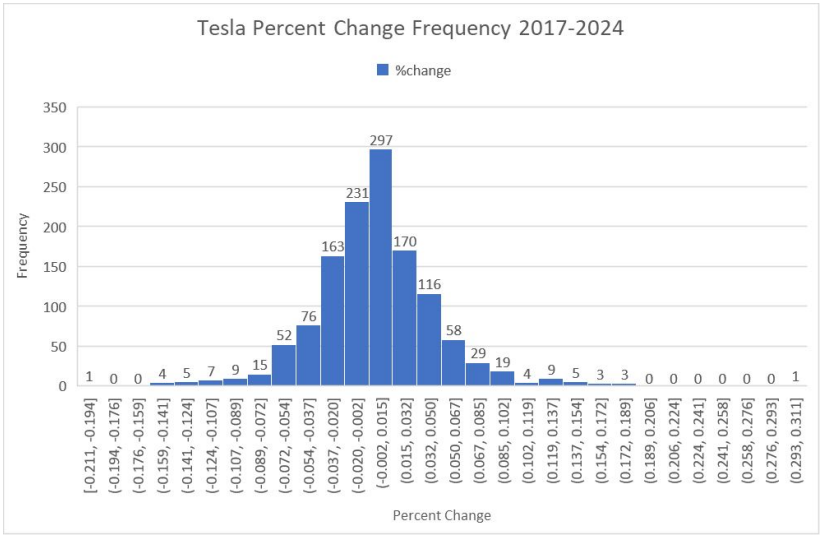
The histogram of the daily percent change visualizes the distribution of the daily returns

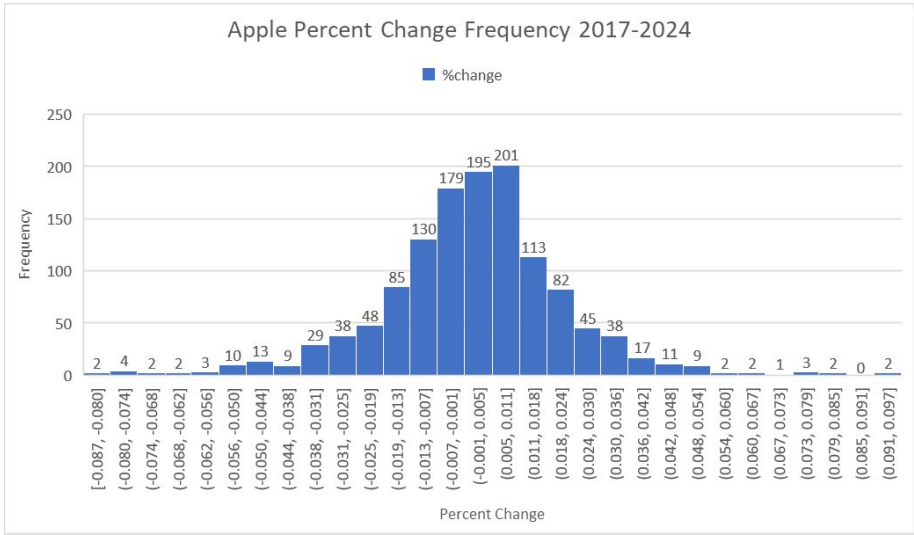
This shows us how often the stock is increasing in value and how often the stock is decreasing in value

This includes small and large changes in value



Histograms of Daily Percent Change (continued)





Descriptive Statistics of Percent Change

%change	
Mean	0.000916952
Standard Error	0.000508263
Median	0.001226943
Mode	#N/A
Standard Deviation	0.018162839
Sample Variance	0.000329889
Kurtosis	2.532941148
Skewness	-0.270746699
Range	0.168714945
Minimum	-0.084074871
Maximum	0.084640074
Sum	1.17094737
Count	1277

Microsoft

Measuring the descriptive statistics of the percent change value gives us useful information about a stock's history of gains and losses

For example, in MSFT

The average return (percent change) each day was 0.0009%. The median was 0.0012%. The standard deviation was 0.0181%. The kurtosis was 2.5329, meaning the data is platykurtic (low in outliers). The skew is -0.2708, meaning it has a negative skew.

There are more instances of small gains occuring, but with potential for infrequent large losses.

Descriptive Statistics of Percent Change (continued)

%change	
Mean	0.002625015
Standard Error	0.00122056
Median	0.001981709
Mode	0
Standard Deviation	0.043616865
Sample Variance	0.001902431
Kurtosis	4.115033068
Skewness	0.413470908
Range	0.521556883
Minimum	-0.210924421
Maximum	0.310632462
Sum	3.352144439
Count	1277

Tesla

The average return (percent change) on the Tesla stock each day was 0.0026%. The median was 0.0019%. The standard deviation was 0.04361%. The kurtosis was 4.1150, meaning that the data is leptokurtic (high in outliers). The skew is 0.4134, meaning it has a positive skew. There are more instances of small losses occurring, but with potential for infrequent large gains.

The average return (percent change) on Apple stock each day was 0.0012%. The median was 0.0020%. The standard deviation was 0.0207%. The kurtosis was 2.48, meaning the data is platykurtic (low in outliers). The skew was -0.1513, meaning it has a negative skew. There are more instances of small gains occuring, but with potential for infrequent large losses.

Apple

%change	
Mean	0.001175
Standard Error	0.00057922
Median	0.0019927
Mode	#N/A
Standard Deviation	0.02069837
Sample Variance	0.00042842
Kurtosis	2.48063018
Skewness	-0.1512673
Range	0.18385772
Minimum	-0.0866021
Maximum	0.09725566
Sum	1.50047399
Count	1277

Regression

A stock's returns regressed against the return of the broader market (S&P500) generates the Beta of a stock

The Beta is the relative risk of the stock in relation to the market

Stocks with higher Beta values are more risky and therefore higher returns can be expected

The regression of the daily returns of a stock against the market returns shows the relationship between the two: how much the daily return of the stock is dependent on the independent market return

The regression produces a positive or negative line to show the relationship of the return value of a stock and the return value of the market S&P 500

A positive trending line means the two values increase and decrease together

A negative trending line means that as the independent value increases, the dependent value decreases

The formula of this line is: $y = mx + b$, where "m" is the Beta value

Regression MSFT and S&P

SUMMARY OUTPUT: MSFT and S&P Percent Change								
Regression Statistics				y = 1.21x + .00067				
Multiple R	0.776762							
R Square	0.603359							
Adjusted R	0.603048							
Standard E	0.011351							
Observatic	1277							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regressior	1	0.2499	0.2499	1939.496	2.7E-258			
Residual	1275	0.164281	0.000129					
Total	1276	0.414181						
	Coefficients	*andard Erı*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.000669	0.000318	2.106468	0.035359	4.6E-05	0.001293	4.6E-05	0.001293
	1.213895	0.027564	44.03971	2.7E-258	1.15982	1.26797	1.15982	1.26797

The Regression Analysis here shows the relationship of MSFT to S&P 500

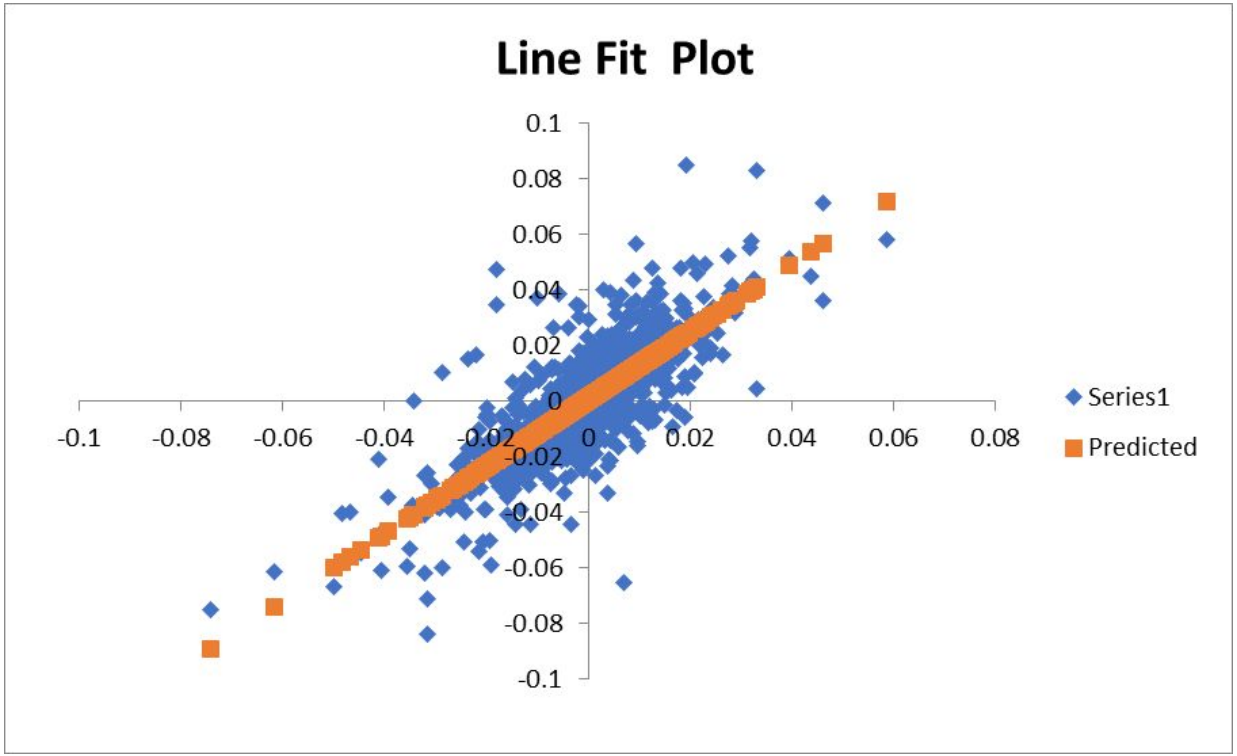
The R square value shows how much the change in stock value is explained and dependent on the change in market value

60% of the change in MSFT depends on change in S&P

The Beta is the slope coefficient of the line (shown in next slide)

The slope coefficient here is 1.21, showing that for every 1 point change in S&P, there is a 1.21 point change in MSFT

Regression MSFT and S&P (continued)



The line on this graph is the “Line of Best Fit”, which best expresses the relationship between the data points

It shows the trend between the change in value of MSFT in relation to the change in value of S&P 500

The equation of the line is y = 1.21x + .00067

The positive trend of the line means that as S&P increases or decreases, so does MSFT

Regression Tesla and S&P

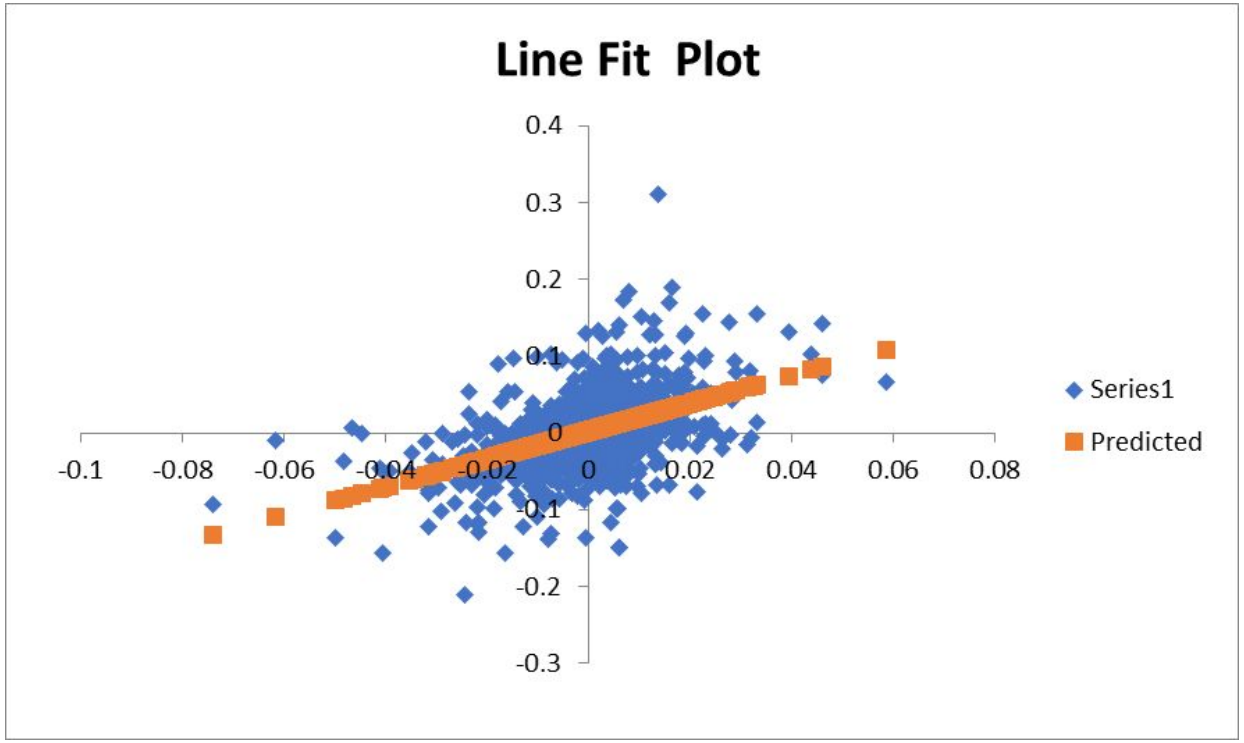
The Regression Analysis here shows the relationship of Tesla to S&P 500

23% of the change in Tesla depends on change in S&P

The slope coefficient here is 1.82, showing that for every 1 point change in S&P, there is a 1.82 point change in Tesla

SUMMARY OUTPUT: Tesla and S&P Percent Change								
Regression Statistics				y = 1.82x + 0.00216				
Multiple R	0.480471							
R Square	0.230852							
Adjusted R S	0.230249							
Standard Err	0.038267							
Observation	1277							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regression	1	0.560394	0.560394	382.6783	9.95E-75			
Residual	1275	1.867108	0.001464					
Total	1276	2.427502						
	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.00216	0.001071	2.016354	0.043972	5.84E-05	0.004261	5.84E-05	0.004261
	1.817793	0.092924	19.56217	9.95E-75	1.635493	2.000094	1.635493	2.000094

Regression Tesla and S&P (continued)



The line on this graph shows the trend between the change in value of Tesla in relation to the change in value of S&P 500

The equation of the line is y = 1.82x + .00216

The positive trend of the line means that as S&P increases or decreases, so does Tesla

Regression Apple and S&P

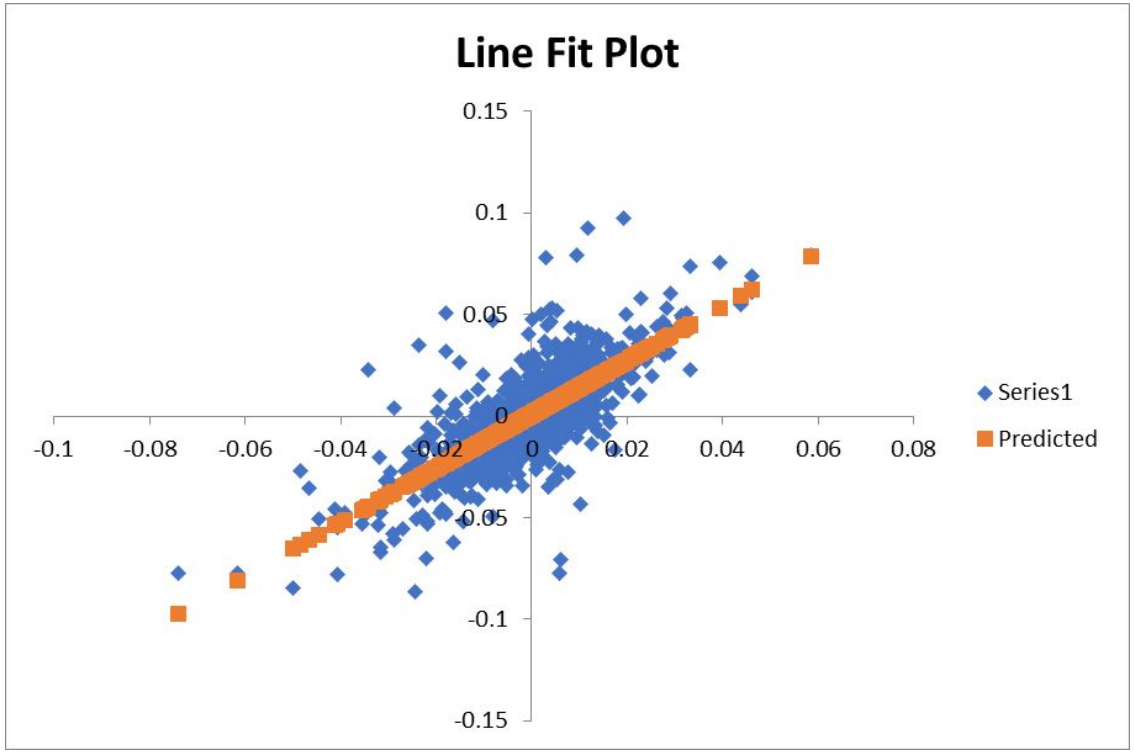
SUMMARY OUTPUT: Apple and S&P Percent Change								
Regression Statistics				y = 1.33x + 0.0008				
Multiple R	0.740343							
R Square	0.548108							
Adjusted R	0.547754							
Standard E	0.01392							
Observatic	1277							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regressior	1	0.299633	0.299633	1546.471	3.7E-222			
Residual	1275	0.247034	0.000194					
Total	1276	0.546667						
	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.000835	0.00039	2.142642	0.032331	7.04E-05	0.001599	7.04E-05	0.001599
	1.329207	0.0338	39.3252	3.7E-222	1.262896	1.395517	1.262896	1.395517

The Regression Analysis here shows the relationship of Apple to S&P 500

54% of the change in Apple depends on change in S&P

The slope coefficient here is 1.33, showing that for every 1 point change in S&P, there is a 1.33 point change in Apple

Regression Apple and S&P (continued)



The line on this graph shows the trend between the change in value of Apple in relation to the change in value of S&P 500

The equation of the line is $y = 1.33x + .0008$

The positive trend of the line means that as S&P increases or decreases, so does Apple

Final Analysis

After gathering and visualizing the data, we can see that each stock is growing over time

However:

60% of the changes in returns of Microsoft relate to changes in the market S&P 500

23% of the changes in returns of Tesla relate to changes in the market S&P 500

54% of the changes in returns of Apple relate to changes in the market S&P 500

And

The Beta of Microsoft is 1.21

The Beta of Tesla is 1.82

The Beta of Apple is 1.33

And

In Microsoft, there are more instances of small gains occurring, but with potential for infrequent large losses

In Tesla, there are more instances of small losses occurring, but with potential for infrequent large gains

In Apple, there are more instances of small gains occurring, but with potential for infrequent large losses

Final Analysis (continued)

In summary, while each stock is growing over time:

The riskiest stock is Tesla, as it has the highest Beta of 1.82 and its daily return values relate to the daily market return values only 23% of the time over the period 2018-2023

The higher Beta yields higher potential returns, however

Microsoft and Apple are lower risk, with Betas of 1.22 and 1.33, respectively

Each daily stock return value relates more closely to each daily market return value for the time period of 2018-2023, with Microsoft at 60% of values and Apple at 54% of values